

Nortel

Optical Metro 5100/5200

Technical Specifications

Standard Release 8.0 Issue 1 April 2005

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5100/5200 shelves

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About this document

This document provides the technical specifications of the equipment supported by Release 8.0 of the Nortel Optical Metro 5100/5200 (identified prior to Release 7.0 as Nortel Networks OPTera Metro 5000-series Multiservice Platform).

This document provides information about the specifications for Nortel Optical Metro 5100/5200 hardware.

This document contains the following information:

- specifications for hardware components
- specifications for circuit packs
- specifications for protection switching
- compatibility requirements
- system performance specifications
- standards and regulations
- examples of power consumption in Optical Metro 5100/5200 shelves

Audience for this document

The audience for this document includes the following:

- strategic and current planners
- commissioning personnel
- installers
- transmission standards engineers
- field maintenance engineers
- system line-up and testing (SLAT) personnel
- maintenance technicians
- network administrators

Optical Metro 5100/5200 library

The Optical Metro 5100/5200 library consists of the *Nortel Optical Metro 5100/5200 Technical Publications*, NT0H65AM.

Technical Publications

The *Optical Metro 5100/5200 Technical Publications* (NTP) consist of descriptive information and procedures.

Descriptive information

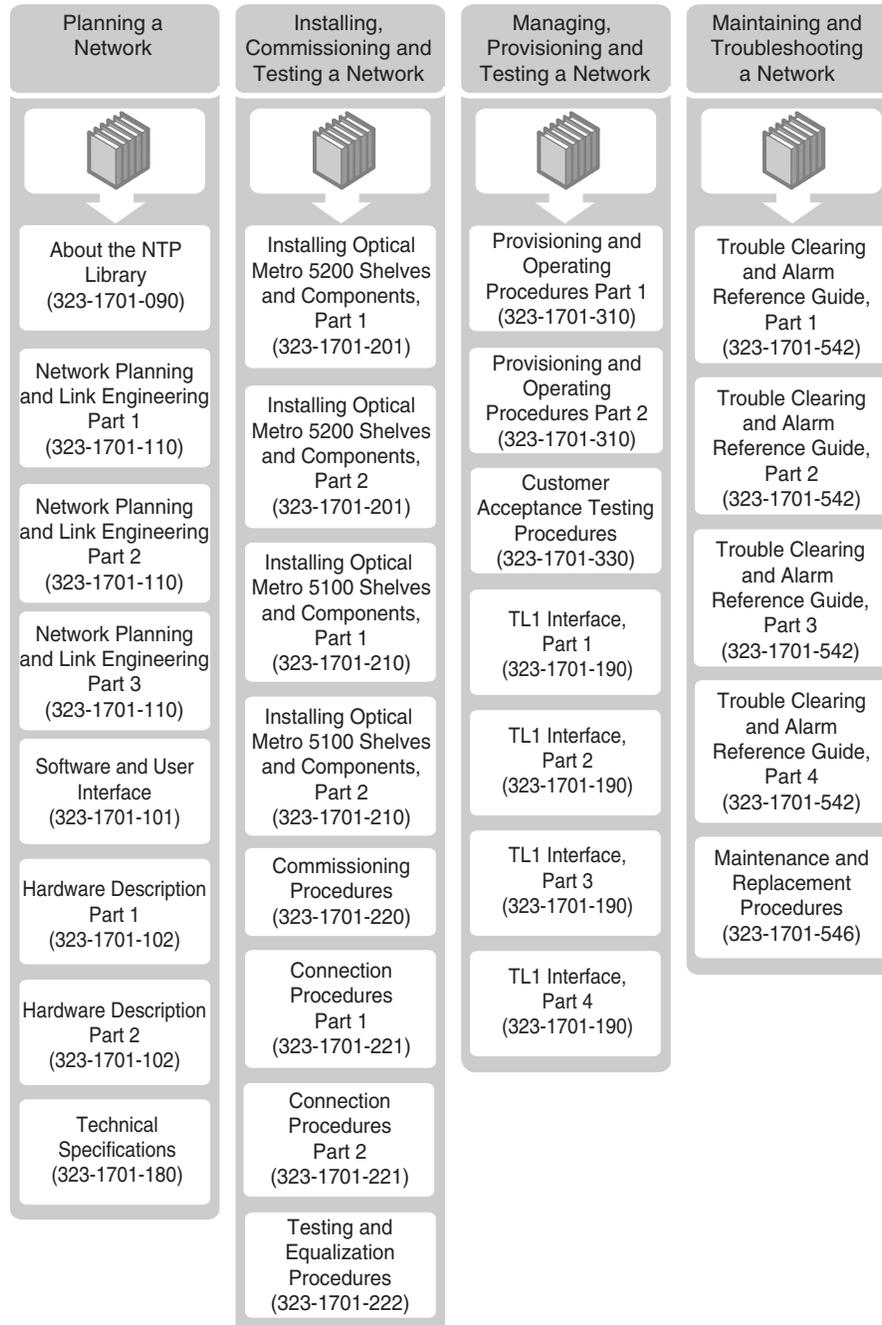
These NTPs provide detailed descriptive information about the Optical Metro 5100/5200, including system software and hardware descriptions, technical specifications, ordering information, and TL1 user information.

Procedures

These NTPs contain all procedures required to install, provision, and maintain the Optical Metro 5100/5200.

The following roadmap lists the documents in the Optical Metro 5100/5200 library.

OM2805p



Technical assistance service telephone numbers

For technical support and information from Nortel Networks, refer to the following table.

Technical Assistance Service	
<p>For service-affecting problems: For 24-hour emergency recovery or software upgrade support, that is, for:</p> <ul style="list-style-type: none"> • restoration of service for equipment that has been carrying traffic and is out of service • issues that prevent traffic protection switching • issues that prevent completion of software upgrades 	<p>North America: 1-800-4NORTEL (1-800-466-7835)</p> <p>International: 001-919-992-8300</p>
<p>For non-service-affecting problems: For 24-hour support on issues requiring immediate support or for 14-hour support (8 a.m. to 10 p.m. EST) on upgrade notification and non-urgent issues.</p>	<p>North America: 1-800-4NORTEL (1-800-466-7835)</p> <p>Note: You require an express routing code (ERC). To determine the ERC, see our corporate Web site at www.nortel.com. Click on the Express Routing Codes link.</p> <p>International: Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortel.com. Click on the Contact Us link.</p>
<p>Global software upgrade support:</p>	<p>North America: 1-800-4NORTEL (1-800-466-7835)</p> <p>International: Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortel.com. Click on the Contact Us link.</p>

Hardware specifications

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Environment specifications



CAUTION

Risk of equipment damage

Do not expose the unit to direct sunlight. Direct sunlight on the unit can cause temperatures to exceed the defined limits and result in incorrect operation, or damage to the unit.



CAUTION

Risk of equipment damage

This equipment is designed for operation inside buildings only. Install the unit in a dry area with enough air circulation to maintain the ambient environment within the defined limits.



CAUTION

Risk of equipment damage

Do not limit air flow by covering the air inlets on the enclosure, or temperatures inside the unit can exceed the defined limits and result in incorrect operation, or damage to the unit.

Table 1-1 lists the environment specifications for Optical Metro 5100/5200 products.

Table 1-1
Environment specifications for the Optical Metro 5100/5200 products

Specification	Value
Temperature limits <ul style="list-style-type: none"> • Operating • Maximum rate of change • Shipping and storage 	<ul style="list-style-type: none"> • 0 to 55°C (32 to 131°F) • 8.3°C (46.94 °F) per hour • -40 to 66°C (-40 to 150°F)
Relative humidity (non-condensing) limits: operating and storage	5 to 95%
Thermal loading	3 444 W/m ²
Floor loading	732 kg/m ² (150 lbs/ft ²)
Operating altitude	-60 to 1800 meters (-197 to 5900 ft) above sea level
Earthquake	Up to and including zone 4
Dust conditions	A maximum of 100,000 dust particles 0.5 microns/ft ³ (MIL-STD-801D)

Optical Metro 5200 shelf general specifications

Table 1-2 lists the general specifications for Optical Metro 5200 shelves.

Table 1-2
Optical Metro 5200 shelf general specifications

Specification	Value
Dimensions	
Height <ul style="list-style-type: none"> • Standard 12U • Variants 11U 	<ul style="list-style-type: none"> • 533 mm (21 in.) • 489 mm (19.25 in.)
Width (see Note 1) setback length from front to mounting flange: <ul style="list-style-type: none"> • 35.6 mm (1.4 in.) • 127 mm (5.0 in.) • 152.4 mm (6.0 in.) • 165.1 mm (6.5 in.) 	<ul style="list-style-type: none"> • 447.6 mm (17.62 in.) • 447.6 mm (17.62 in.) • 437.1 mm (17.21 in.) • 447.6 mm (17.62 in.)
Depth	301 mm (11.85 in.)
Weight	
Minimum (empty shelf) <ul style="list-style-type: none"> • Standard 12U • Variants 11U 	<ul style="list-style-type: none"> • 27 kg (60 lb.) • 23 kg (50 lb.)
Maximum (full shelf) <ul style="list-style-type: none"> • Standard 12U • Variants 11U 	<ul style="list-style-type: none"> • 43 kg (94 lb.) • 34 kg (75 lb.)
Power requirements	
<ul style="list-style-type: none"> • Typical • Minimum • Maximum 	<ul style="list-style-type: none"> • -48 V dc • -40 V dc • -60 V dc
Power consumption (see Note 2)	
Maintenance panel and cooling unit <ul style="list-style-type: none"> • Typical • Maximum 	<ul style="list-style-type: none"> • 40 W • 90 W
SP circuit pack <ul style="list-style-type: none"> • Typical • Maximum 	<ul style="list-style-type: none"> • 10 W • 12 W

Table 1-2 (continued)
Optical Metro 5200 shelf general specifications

Specification	Value
OCM 1.25 Gbit/s circuit pack <ul style="list-style-type: none"> • Typical • Maximum 	(for two OCMs) <ul style="list-style-type: none"> • 23 W • 27 W
Power consumption (cont'd)	
OCM 2.5 Gbit/s circuit pack <ul style="list-style-type: none"> • Typical • Maximum 	(for two OCMs) <ul style="list-style-type: none"> • 25 W • 35 W
Power dissipation	
Full shelf <ul style="list-style-type: none"> • Typical • Maximum 	 <ul style="list-style-type: none"> • 534 W • 732 W
Breaker rating	20 A
Wire gauges	
dc power supply from 3U APRS <ul style="list-style-type: none"> • Minimum • Recommended 	 <ul style="list-style-type: none"> • 10 AWG • 10 AWG
Telemetry alarm connection	24 AWG
Ground wire	10 AWG
<p>Note 1: The width specified is with the mounting brackets installed.</p> <p>Note 2: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity)</p>	

Optical Metro 5100 shelf general specifications

Table 1-3 lists the general specifications for the Optical Metro 5100 shelf.

Table 1-3
Optical Metro 5100 shelf general specifications

Specification	Value
Dimensions	
Height	176 mm (6.92 in.)
Width (see Note 1) setback length from front to mounting flange:	
• 35.6 mm (1.4 in.)	• 448.8 mm (17.67 in.)
• 127 mm (5.0 in.)	• 448.8 mm (17.67 in.)
• 152.4 mm (6.0 in.)	• 438.4 mm (17.26 in.)
• 165.1 mm (6.5 in.)	• 448.8 mm (17.67 in.)
Depth	297 mm (11.7 in.)
Weight	
• Minimum (empty)	• 14.5 kg (32 lb.)
• Maximum (full)	• 16.5 kg (36.2 lb.)
Power requirements	
• Typical	• -48 V dc
• Minimum	• -40 V dc
• Maximum	• -60 V dc
Power consumption (see Note 2)	
Maintenance panel and cooling unit	
• Typical	• 11 W
• Maximum	• 22 W
Power dissipation	
Full shelf	
• Typical	• 140 W
• Maximum	• 191 W
Breaker rating	7.5 A

Table 1-3 (continued)
Optical Metro 5100 shelf general specifications

Specification	Value
Wire gauges	
dc power supply wire from 3U APRS • Minimum • Recommended	• 10 AWG • 10 AWG
dc power supply wire from 1U APRS • Minimum • Recommended	• 14 AWG • 14 AWG
Telemetry alarm connection	24 AWG
Ground wire	10 AWG
Breaker Interface Panel wire • Recommended • Maximum	• 14 AWG • 10 AWG
<p>Note 1: The width specified is with the mounting brackets installed.</p> <p>Note 2: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).</p>	

NEBS Extension Shelf specifications

The NEBS Extension Shelf must be used in applications which require that the Optical Metro 5200 shelf comply with NEBS flame spread requirements. Use the NEBS Extension Shelf kit in conjunction with the following Optical Metro 5200 shelf types:

- Optical Metro 5200 shelf assembly (standard 12U high)
- Optical Metro 5200 shelf assembly (modified for OMX variants, 11U high)

Note: The NEBS Extension Shelf kit is not required for the Optical Metro 5200 shelf assembly (modified for OMX variants, 11U high) Enhanced or the Optical Metro 5100 shelf assembly (standard 4U high) since these shelf types meet NEBS flame spread requirements without the NEBS Extension Shelf kit.

Table 1-4 lists the specifications for the NEBS Extension Shelf.

Table 1-4
NEBS Extension Shelf specifications

Specification	Value or range
Physical dimensions	
• Height	• 43 mm (1.70 in.) (1 U rack space)
• Width	• 445 mm (17.5 in.)
• Depth	• 279 mm (11 in.)

Port specifications

Table 1-5 lists the specifications for ports and cables on the Optical Metro 5100/5200 maintenance panel.

Table 1-5
Port and cable specifications for the maintenance panel

Specification	Value or range
Ethernet ports with integral green Link and Data indicator lamps	<ul style="list-style-type: none">• 10Base-T 1X• 10Base-T 2X
RS-232 ports	<ul style="list-style-type: none">• RS232 V24 1 (DTE)• RS232 V24 2 (DCE)

The RS232 V24 1 (DTE) is a panel mounted female 25-pin D-subminiature port that connects to a modem (DCE) with a straight-through RS232 cable (male/male). The link speed for this port is 120 kbit/s.

The RS232 V24 2 (DCE) port is not supported.



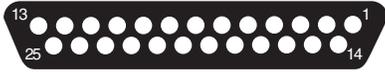
CAUTION

Risk of equipment damage

The cable must have a right angle connector to connect to the maintenance panel.

Table 1-6 lists the pinout for the RS232 V24 1 (DTE) port on the maintenance panel.

Table 1-6
RS232 V24 1 (DTE) pinout

DB25 port	Pin	Signal
	1	Shield
	2	TXD
	3	RXD
	4	RTS
	5	CTS
	6	DSR
	7	Ground
	8	DCD
	15	TX CLK
	17	RX CLK
	20	DTR
	Note: There are no connections to the remaining pins.	

The RS232 V24 2 (DCE) is a 9-pin female D-subminiature connector that connects to a computer (serial port) with a straight-through RS232 cable (male/female). The link speed for this port is 120 kbit/s.

Table 1-7 lists the connector pinout for the RS232 V24 2 (DCE) port on the maintenance panel.

Note: This port is not supported.

Table 1-7
RS232 V24 (DCE) pinout

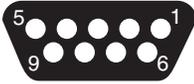
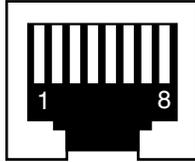
DB9 port	Pin	Signal
	1	DTR (out)
	2	TXD (out)
	3	RXD (in)
	4	DCD (in)
	5	Ground
	6	DTR (out)
	7	CTS (in)
	8	RTS (out)
	9	no connection

Table 1-8 lists the pinout for the 10Base-T 1X and 10Base-T 2X ports on the maintenance panel.

Table 1-8
10Base-T 1X and 2X pinout

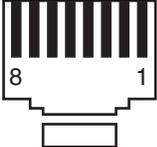
RJ45 port	Pin	Signal
	1	RXD+
	2	RXD-
	3	TXD+
	4	no connection
	5	no connection
	6	TXD-
	7	no connection
	8	no connection

Cable pinouts and specifications

The maximum cable length for a shielded straight-through Ethernet cable is 100 m (300 ft). Use a shielded straight-through Ethernet cable to connect the shelf to a PC.

Table 1-9 lists the pinout for the RJ45 connectors on a shielded straight-through Ethernet cable.

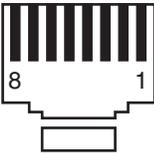
Table 1-9
Straight-through Ethernet cable/RJ45 connector pinout

Straight-through Ethernet cable RJ45 connector	Pin (End 1)	Signal	Pin (End 2)
	1	RXD+	1
	2	RXD-	2
	3	TXD+	3
	4	no connection	4
	5	no connection	5
	6	TXD-	6
	7	no connection	7
	8	no connection	8

Use a shielded Ethernet cross-over cable to connect the 10Base-T 1X or 10Base-T 2X port on the maintenance panel to the Ethernet hub.

Table 1-10 lists the connector pinout for the RJ45 connectors on a cross-over Ethernet cable.

Table 1-10
Cross-over Ethernet cable/ RJ45 connector pinout

Cross-over Ethernet cable RJ45 connector	Pin (End 1)	Signal	Pin (End 2)
	1	RXD+	3
	2	RXD-	6
	3	TXD+	1
	4	no connection	no connection
	5	no connection	no connection
	6	TXD-	2
	7	no connection	no connection
	8	no connection	no connection

Cable sizes: AWG standard sizes and metric equivalents

Table 1-11 lists the American Wire Gauge (AWG) standard cable sizes, the metric equivalent, and the closest equivalent ETSI standard size.

Table 1-11
AWG cables sizes and metric equivalents

AWG standard size	Metric equivalent (mm ²)	ETSI standard (mm ²)
24	0.22	0.2
22	0.325	0.35
20	0.52	0.5
18	0.82	0.75
16	1.3	1.5
14	2.1	2.5
12	3.3	4.0
10	5.27	6.0
8	8.35	10
6	13.3	16
4	21.2	25
2	33.6	35

Table 1-11 (continued)
AWG cables sizes and metric equivalents

AWG standard size	Metric equivalent (mm²)	ETSI standard (mm²)
1/0	53.4	50
2/0	67.5	70
3/0	85	95
4/0	107.2	120
250MCM	107.2	120 / 150

Central office alarm and telemetry interface

This connector enables you to connect the Optical Metro 5100/5200 alarms to external alarm devices. In an Optical Metro 5200 shelf, the card is located in the left side of the maintenance panel. In an Optical Metro 5100 shelf, the card is part of shelf's maintenance panel card.

The Optical Metro 5100 shelf has 8 inputs and is a 36-pin connector, whereas the Optical Metro 5200 shelf has 4 inputs and is a 32-pin connector.

[Table 1-12](#) lists the specifications for the central office (CO) and telemetry connector.

Table 1-12
Connector specifications

Specification		Value
Wire gauge		24 AWG
Central Office alarms and Telemetry Outputs	Total number of central office alarm relays	3 visual, 3 audible (minor, major, critical central office visual alarm relays and minor, major, critical central office audible alarm relays)
	Central office alarm relay type	NO, NC, and COM for each Note: NO=normally open; NC=normally closed; COM=common
	Total number of telemetry output relays	4
	Telemetry output relay type	1 as NO, NC, and COM; 3 as NO and COM Note: NO=normally open; NC=normally closed; COM=common
	Surge Voltage	2500 V (withstand)
	Breakdown Voltage	1500 V
	Nominal Switch Capacity	2A/30 V dc, 0.5A/125 V ac
	Maximum Switch Power	60 W, 62.5 VA
	Maximum Switch Voltage	220 V dc, 125 V ac
	Maximum Switch Current	2 A

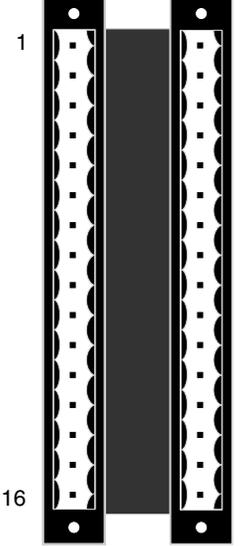
Table 1-12 (continued)
Connector specifications

Specification		Value
Telemetry Inputs	Total number of telemetry inputs	4 (Optical Metro 5200 shelf)
		8 (Optical Metro 5100 shelf)
	Type	non-isolated, hi-impedance TTL logic input with input protection
	'ON' State Voltage	< 0.8 V; <1.5 kilohms to Telemetry Return (GND)
	'OFF' State Voltage	> 2.0 V; > 7 kilohms to Telemetry Return (GND)
	Maximum Voltage	5.5 V
	Minimum Voltage	- 0.7 V

Optical Metro 5200 telemetry connections

Table 1-13 lists the signal assignments for the telemetry connector pins.

Table 1-13
Connector pin signal assignments for the Optical Metro 5200

P	Signal	Connector	P	Signal
1	CO Visual Critical (common)		17	CO Audible Minor (common)
2	CO Visual Critical (norm. open)		18	CO Audible Minor (norm. open)
3	CO Visual Critical (normally closed)		19	CO Audible Minor (norm. closed)
4	CO Visual Major (common)		20	Telemetry Output 1 (common)
5	CO Visual Major (norm. open)		21	Telemetry Output 1 (norm. open)
6	CO Visual Major (norm. closed)		22	Telemetry Output 1 (norm. closed)
7	CO Visual Minor (common)		23	Telemetry Output 2 (common)
8	CO Visual Minor (norm. open)		24	Telemetry Output 2 (norm. open)
9	CO Visual Minor (norm. closed)		25	Telemetry Output 3 (common)
10	CO Audible Critical (common)		26	Telemetry Output 3 (norm. open)
11	CO Audible Critical (norm. open)		27	Telemetry Output 4 (common)
12	CO Audible Critical (norm. closed)		28	Telemetry Output 4 (norm. open)
13	CO Audible Major (common)		29	Telemetry Input 1
14	CO Audible Major (norm. open)		30	Telemetry Input 2
15	CO Audible Major (norm. closed)		31	Telemetry Input 3
16	Telemetry Input Return		32	Telemetry Input 4

Optical Metro 5100 telemetry connections

Figure 1-1 lists the signal assignments for the telemetry connector pins.

Figure 1-1
Telemetry connector for the Optical Metro 5100

OM1055t

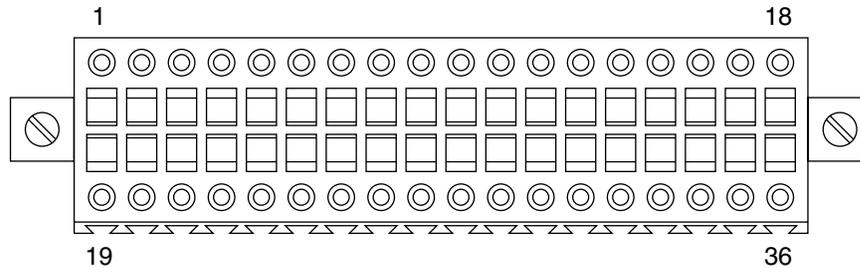


Table 1-14 lists the signal assignments of the telemetry connector pins for the Optical Metro 5100 shelf.

Table 1-14
Telemetry connector pin signal assignments for the Optical Metro 5100

Pin	Signal	Pin	Signal
1	CO Visual Critical (common)	19	CO Audible Minor (norm. closed)
2	CO Visual Critical (norm. open)	20	Telemetry Output 1 (common)
3	CO Visual Critical (norm. closed)	21	Telemetry Output 1(norm. open)
4	CO Visual Major (common)	22	Telemetry Output 1 (norm. closed)
5	CO Visual Major (norm. open)	23	Telemetry Output 2 (common)
6	CO Visual Major (norm. closed)	24	Telemetry Output 2 (norm. open)
7	CO Visual Minor (common)	25	Telemetry Output 3 (common)
8	CO Visual Minor (norm. open)	26	Telemetry Output 3 (norm. open)
9	CO Visual Minor (norm. closed)	27	Telemetry Output 4 (common)
10	CO Audible Critical (common)	28	Telemetry Output 4(norm. open)
11	CO Audible Critical (norm. open)	29	Telemetry Input 1
12	CO Audible Critical (norm. closed)	30	Telemetry Input 2
13	CO Audible Major (common)	31	Telemetry Input 3
14	CO Audible Major (norm. open)	32	Telemetry Input 4
15	CO Audible Major (norm. closed)	33	Telemetry Input 5

Table 1-14 (continued)
Telemetry connector pin signal assignments for the Optical Metro 5100

Pin	Signal	Pin	Signal
16	Telemetry Input Return	34	Telemetry Input 6
17	CO Audible Minor (common)	35	Telemetry Input 7
18	CO Audible Minor (norm. open)	36	Telemetry Input 8

Loss specifications

Any passive component that the optical signal passes through reduces the power level. This includes optical connectors, splices, the fiber plant as well as the components in the Optical Metro 5100/5200 system. Link engineering has to take into account all of these losses when calculating the power budget. This section details the components in the Optical Metro 5100/5200 system that introduce loss. All loss figures quoted include connector losses.

OMX specifications

- OMX (Standard) DWDM and OMX 4CH + Fiber Manager DWDM—see [Table 1-15 on page 1-18](#)
- OMX 4CH DWDM Enhanced—see [Table 1-16 on page 1-19](#)
- OMX 16CH DWDM—see [Table 1-17 on page 1-20](#)
- OMX 1CH CWDM—see [Table 1-18 on page 1-21](#)
- OMX 4CH CWDM—see [Table 1-19 on page 1-22](#)
- OMX 4CH CWDM with dual taps—see [Table 1-20 on page 1-22](#)
- OMX 4CH or 8CH ITU CWDM—see [Table 1-21 on page 1-24](#)
- OMX 1CH or 4CH OADM ITU CWDM—see [Table 1-22 on page 1-25](#)

Table 1-15
OMX (Standard) DWDM and OMX 4CH + Fiber Manager DWDM specifications

Characteristic		Value or range
Maximum total input power		17 dBm
Minimum return loss		40.0 dB
Passband		Center wavelength ± 0.25 nm (for center wavelengths, see Table 2-25 on page 2-76)
Minimum Band isolation	Drop	20 dB
	Thru Out	12 dB

Table 1-15 (continued)
OMX (Standard) DWDM and OMX 4CH + Fiber Manager DWDM specifications

Characteristic		Value or range			
Insertion loss		OMX (Standard)		OMX 4CH + Fiber Manager	
		Maximum	Typical	Maximum	Typical
	Add path	4.2 dB	3.0 dB	4.5 dB	3.2 dB
	Drop path	4.6 dB	3.3 dB	4.9 dB	3.5 dB
	Pass-through	1.2 dB	0.7 dB	1.2 dB	0.7 dB
Physical Dimension	Height	40 mm (1.58 in.)		43 mm (1.70 in.) (1 U rack space)	
	Width	178 mm (7 in.)		443 mm (17.44 in.) (see Note)	
	Depth	279 mm (11 in.)		279 mm (11 in.)	
Note: The width specified is with the mounting brackets installed.					

Table 1-16
OMX 4CH DWDM Enhanced specifications

Characteristic		Value or range	
Maximum total input power		17 dBm	
Minimum return loss		45.0 dB	
Passband		Center wavelength ± 0.25 nm (for center wavelengths, see Table 2-25 on page 2-76)	
Minimum Band isolation	Drop	35 dB	
	Thru Out	20 dB	
Insertion loss		Maximum	Typical
		Add path	2.8 dB
	Drop path	3.1 dB	2.4 dB
	Pass-through	1.0 dB	0.7 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)	
	Width (see Note)	443 mm (17.44 in.)	
	Depth	279 mm (11 in.)	
Note: The width specified is with the mounting brackets installed.			

Table 1-17
OMX 16CH DWDM specifications

Characteristic		Value or range			
Maximum total input power		21 dBm			
Minimum return loss		40 dB			
Passband		Center wavelength ± 0.25 nm (for center wavelengths, see Table 2-25 on page 2-76)			
Minimum isolation	Channel Add and Drop	30 dB			
	L-band THRU In and Out	18 dB			
Insertion loss		C-band OMX 16CH DWDM		L-band OMX 16CH DWDM	
		Maximum	Typical	Maximum	Typical
	Add path	4.5 dB	3.9 dB	4.1 dB	3.5 dB
	Drop path	4.5 dB	3.9 dB	4.1 dB	3.5 dB
	L-band upgrade: OTS IN to L OUT L IN to OTS OUT	1.1 dB	0.8 dB	Not applicable	Not applicable
	Add and Drop (16 channel C- or L-band only, end-to-end)	6.9 dB	5.7 dB	6.0 dB	5.0 dB
	Add and Drop (32 channel C- and L-band, end-to-end)	6.9 dB	5.7 dB	8.2 dB	6.6 dB
Physical Dimension	Height	88 mm (3.48 in.) (2 U rack space)			
	Width (see Note)	<ul style="list-style-type: none"> • 448.8 mm (17.67 in.) with a setback from front to mounting flange equal to 35.6 mm (1.4 in.), 127 mm (5.0 in.) or 152.4 mm (6.0 in.) • 437.1 mm (17.21 in.) with a setback from front to mounting flange equal to 165.1 mm (6.5 in.) 			
	Depth	279 mm (11 in.)			
Note: The width specified is with the mounting brackets installed.					

Table 1-18
OMX 1CH CWDM specifications

Characteristic		Value or range	
Maximum total input power		21 dBm	
Minimum return loss		40 dB	
Passband		Center wavelength ± 2.68 nm (for center wavelengths, see Table 2-27 on page 2-77)	
Minimum isolation	Drop	25 dB	
	Thru Out	25 dB	
Insertion loss		Maximum	Typical
	Add path	1.5 dB	1.0 dB
	Drop path	1.5 dB	1.0 dB
	Thru In - OTS Out	1.2 dB	0.8 dB
	OTS In - Thru Out	1.6 dB	1.2 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)	
	Width (see Note)	443 mm (17.44 in.)	
	Depth	279 mm (11 in.)	
Note: The width specified is with the mounting brackets installed.			

Table 1-19
OMX 4CH CWDM specifications

Characteristic		Value or range	
Maximum total input power		21 dBm	
Minimum return loss		45 dB	
Passband		Center wavelength ± 2.68 nm (for center wavelengths, see Table 2-27 on page 2-77)	
Minimum Band isolation	Drop	25 dB	
	Thru Out	20 dB	
Insertion loss		Maximum	Typical
	Add/Drop	2.7 dB	2.0 dB
	Thru in - OTS Out	2.2 dB	1.5 dB
	OTS In - Thru out	2.5 dB	1.8 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)	
	Width (see Note)	443 mm (17.44 in.)	
	Depth	279 mm (11 in.)	
Note: The width specified is with the mounting brackets installed.			

Table 1-20
OMX 4CH CWDM with dual taps specifications

Characteristic		Value or range	
Maximum total input power		21 dBm	
Minimum return loss		40 dB	
Passband		Center wavelength ± 2.68 nm (for center wavelengths, see Table 2-27 on page 2-77)	
Minimum Band isolation	Channel	35 dB	
	Thru Out	30 dB	
	Thru In	15 dB	

Table 1-20 (continued)
OMX 4CH CWDM with dual taps specifications

Characteristic		Value or range	
		Maximum	Typical
Insertion loss			
	Add/Drop	2.6 dB	1.8 dB
	Thru in - OTS Out	2.1 dB	1.5 dB
	OTS In - Thru out	2.4 dB	1.8 dB
Tap loss			
	OTS In	15.6 dB	14.4 dB
	OTS Out	19 dB	17.7 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)	
	Width (see Note)	443 mm (17.44 in.)	
	Depth	279 mm (11 in.)	
Note: The width specified is with the mounting brackets installed.			

Table 1-21
OMX 4CH or 8CH ITU CWDM specifications

Characteristic		Value or range			
Maximum total input power		21 dBm			
Minimum return loss		45 dB			
Center wavelengths (see Note 1)		1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611 nm			
Passband		Center wavelength ± 6.5 nm			
Minimum isolation	Drop	30 dB			
Insertion loss		OMX 4CH ITU CWDM		OMX 8CH ITU CWDM	
		Maximum	Typical	Maximum	Typical
	Add	2.1 dB	1.1 dB	3.7 dB	1.9 dB
	Drop	2.4 dB	1.2 dB	3.9 dB	2.2 dB
	Add and Drop (end-to-end)	3.7 dB	2.0 dB	5.3 dB	2.9 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		43 mm (1.70 in.) (1 U rack space)	
	Width (see Note 2)	443 mm (17.44 in.)		443 mm (17.44 in.)	
	Depth	279 mm (11 in.)		279 mm (11 in.)	
<p>Note 1: Some Optical Metro 5100/5200 ITU CWDM hardware introduced before the ITU CWDM standard (G.695) was finalized will have labels with a center wavelength that differs by 1 nm with respect to the finalized ITU CWDM standard (G.695). For example, for the 1471 nm wavelength, the label will show 1470 nm. However, there is no wavelength incompatibility since the passbands are the same. For example, the pre-finalized ITU CWDM standard 1470 nm channel specified a range of -5.5 to $+7.5$ nm, that is, a passband of 1464.5 to 1477.5 nm. The finalized ITU CWDM standard 1471 nm channel specifies a range of ± 6.5 nm, that is, the passband is still 1464.5 to 1477.5 nm. The only difference is one of labeling.</p> <p>Note 2: The width specified is with the mounting brackets installed.</p>					

Table 1-22
OMX 1CH or 4CH OADM ITU CWDM specifications

Characteristic		Value or range			
Maximum total input power		21 dBm			
Minimum return loss		40 dB			
Center wavelengths (see Note 1)		1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611 nm			
Passband		Center wavelength \pm 6.5 nm			
Minimum isolation	Drop	35 dB			
	Thru Out	30 dB			
Insertion loss		OMX 1CH OADM ITU CWDM		OMX 4CH OADM ITU CWDM	
		Maximum	Typical	Maximum	Typical
	Add	1.2 dB	0.8 dB	2.0 dB	1.4 dB
	Drop	1.2 dB	0.8 dB	2.3 dB	1.7 dB
	Add and Drop (end-to-end)	2.4 dB	1.6 dB	3.6 dB	2.5 dB
	Thru in - OTS Out	1.0 dB	0.5 dB	1.8 dB	1.1 dB
	OTS In - Thru out	1.2 dB	0.8 dB	1.3 dB	0.8 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		43 mm (1.70 in.) (1 U rack space)	
	Width (see Note 2)	443 mm (17.44 in.)		443 mm (17.44 in.)	
	Depth	279 mm (11 in.)		279 mm (11 in.)	
<p>Note 1: Some Optical Metro 5100/5200 ITU CWDM hardware introduced before the ITU CWDM standard (G.695) was finalized will have labels with a center wavelength that differs by 1 nm with respect to the finalized ITU CWDM standard (G.695). For example, for the 1471 nm wavelength, the label will show 1470 nm. However, there is no wavelength incompatibility since the passbands are the same. For example, the pre-finalized ITU CWDM standard 1470 nm channel specified a range of -5.5 to $+7.5$ nm, that is, a passband of 1464.5 to 1477.5 nm. The finalized ITU CWDM standard 1471 nm channel specifies a range of ± 6.5 nm, that is, the passband is still 1464.5 to 1477.5 nm. The only difference is one of labeling.</p> <p>Note 2: The width specified is with the mounting brackets installed.</p>					

OSC tray specifications

Table 1-23 lists the specifications for the OSC trays.

Table 1-23
OSC tray specifications

Characteristic		Value or range					
Maximum total input power		21 dBm					
Wavelength (Thru)		1528 nm to 1615 nm					
Wavelength (OSC)		1500 nm to 1520 nm					
Minimum isolation		OSC tray without tap		OSC tray with tap		OSC tray with dual taps	
	OSC Drop	25 dB		25 dB		30 dB	
	Thru In	12 dB		12 dB		15 dB	
	Thru Out	12 dB		12 dB		30 dB	
Insertion loss		Maximum	Typical	Maximum	Typical	Maximum	Typical
	OSC Drop	1.6 dB	1.4 dB	1.6 dB	1.4 dB	1.7 dB	1.4 dB
	OSC Add	1.6 dB	1.4 dB	1.6 dB	1.4 dB	1.7 dB	1.3 dB
	Thru Out	1.2 dB	1.0 dB	1.8 dB	1.6 dB	1.9 dB	1.5 dB
	Thru In	1.2 dB	1.0 dB	1.2 dB	1.0 dB	1.5 dB	1.1 dB
						Minimum	Maximum
Tap loss	OTS IN port	Not applicable		Not applicable		13.6 dB	15.6 dB
	OTS OUT port	Not applicable		Not applicable		16.2 dB	19.0 dB
	THRU OUT port	Not applicable		approx. 4% of the signal power or 14.0 dB less than the signal power of the THRU OUT port		Not applicable	
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		43 mm (1.70 in.) (1 U rack space)		43 mm (1.70 in.) (1 U rack space)	
	Width (see Note)	443 mm (17.44 in.)		443 mm (17.44 in.)		443 mm (17.44 in.)	
	Depth	279 mm (11 in.)		279 mm (11 in.)		279 mm (11 in.)	
Note: The width specified is with the mounting brackets installed.							

C&L Splitter/Coupler specifications

Table 1-24 lists the specifications for a C&L Splitter/Coupler.

Table 1-24
C&L Splitter/Coupler specifications

Characteristic		Value or range		
Maximum total input power		21 dBm		
Wavelength	C-band	1528.52 nm to 1562.48 nm		
	L-band	1570.17 nm to 1605.99 nm		
Minimum return loss		40 dB		
Minimum isolation	C&L Drop	38 dB		
Insertion loss		Maximum	Typical	
		Splitter: C-band	1.4 dB	1.0 dB
		Splitter: L-band	1.8 dB	1.2 dB
		Coupler: C-band	1.9 dB	1.4 dB
		Coupler: L-band	1.6 dB	1.1 dB
Tap loss		approx. 1.8% of the signal power or 17.4 dB less than the signal power		
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		
	Width (see Note)	443 mm (17.44 in.)		
	Depth	279 mm (11 in.)		
Note: The width specified is with the mounting brackets installed.				

1310 nm Splitter/Coupler specifications

Table 1-25 lists the specifications for a 1310 nm Splitter/Coupler.

Table 1-25
1310 nm Splitter/Coupler specifications

Characteristic		Value or range
Maximum total input power		21 dBm
Wavelength (1310 nm)		1260–1360 nm
Wavelength (Thru)		1460–1620 nm
Minimum return loss		40 dB
Minimum isolation	1310 nm Drop	30 dB
	Thru Out	30 dB
Maximum insertion loss	1310 nm Add	1.1 dB
	1310 nm Drop	1.1 dB
	Thru Out	1.3 dB
	Thru In	0.9 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)
	Width (see Note)	443 mm (17.44 in.)
	Depth	279 mm (11 in.)
Note: The width specified is with the mounting brackets installed.		

DSCM specifications

Table 1-26 lists the specifications for the DSCM.

Table 1-26
DSCM specifications

Characteristic		Value or range	
		C-band	L-band
Maximum total input power		24 dBm	24 dBm
Minimum return loss		45 dB	45 dB
Wavelength range		1528 nm to 1565 nm	1570 nm to 1605 nm
Maximum insertion loss		see Table 1-27	see Table 1-28
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)	
	Width (see Note)	443 mm (17.44 in.)	
	Depth	279 mm (11 in.)	
Note: The width specified is with the mounting brackets installed.			

Table 1-27
C-band DSCM loss specifications

DSCM Description	Maximum Insertion Loss (dB)
Type 1 DSCM-10	2.6
Type 1 DSCM-20	3.2
Type 1 DSCM-30	3.8
Type 1 DSCM-40	4.4
Type 1 DSCM-50	5.0
Type 1 DSCM-60	5.7
Type 1 DSCM-70	6.3
Type 1 DSCM-80	6.9
Type 1 DSCM-90	7.5
Type 1 DSCM-100	8.1
Type 1 DSCM-110	9.8

Table 1-27 (continued)
C-band DSCM loss specifications

DSCM Description	Maximum Insertion Loss (dB)
Type 1 DSCM-120	10.4
Type 1 DSCM-130	11.2
Type 1 DSCM-140	11.8

Table 1-28
L-band DSCM loss specifications

DSCM Description	Maximum Insertion Loss (dB)
Type 1 DSCM-10	2.9
Type 1 DSCM-20	3.7
Type 1 DSCM-30	4.5
Type 1 DSCM-40	5.3
Type 1 DSCM-50	6.1
Type 1 DSCM-60	6.9
Type 1 DSCM-70	7.3
Type 1 DSCM-80	7.8
Type 1 DSCM-90	8.3
Type 1 DSCM-100	8.8
Type 1 DSCM-110	10.3
Type 1 DSCM-120	10.4
Type 1 DSCM-130	11.2
Type 1 DSCM-140	11.6

ECT specifications

Table 1-29 lists the specifications for the ECT.

Table 1-29
ECT specifications

Characteristic	Value or range								
Maximum total input power	21 dBm								
Attenuation	Up to 35 dB								
Minimum Return Loss	40 dB								
Optical Tap	Approximately 1.8% of the signal power or 17.4 dB less than the signal power								
Insertion loss	C-band equalizer with splitter/coupler		L-band equalizer with splitter/coupler		C-band and L-band equalizer with splitter/coupler		C-band and L-band splitter/coupler with VOA		
	Max.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	
	Splitter and demultiplexer: C-band	4.6 dB	3.4 dB	2.2 dB	1.7 dB	6.5 dB	4.9 dB	3.5 dB	2.2 dB
	Splitter and demultiplexer: L-band	2.2 dB	1.7 dB	4.6 dB	3.4 dB	4.6 dB	3.4 dB	3.9 dB	2.4 dB
	Coupler and multiplexer: C-band	1.9 dB	1.4 dB	1.9 dB	1.4 dB	1.9 dB	1.4 dB	1.9 dB	1.4 dB
	Coupler and multiplexer: L-band	1.6 dB	1.1 dB	1.6 dB	1.1 dB	1.6 dB	1.1 dB	1.6 dB	1.1 dB
Physical Dimension	Height	40 mm (1.58 in.)							
	Width	356 mm (14 in.)							
	Depth	279 mm (11 in.)							

Discrete VOA specifications

Table 1-30 lists the specifications for the Discrete VOA.

Table 1-30
Discrete VOA specifications

Characteristic		Value or range
Wavelength		1525 nm to 1610 nm
Attenuation		0.0 dB to 35 dB
Insertion loss (with VOA set to minimum attenuation)		1.8 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)
	Width (see Note)	443 mm (17.44 in.)
	Depth	279 mm (11 in.)
Note: The width specified is with the mounting brackets installed.		

PBE specifications

Table 1-31 lists the specifications for the PBE.

Table 1-31
PBE specifications

Characteristic		Value or range					
Maximum total input power		21 dBm					
Minimum return loss		40 dB					
Attenuation for each band		Up to 30 dB					
Insertion loss		C-band PBE		L-band PBE		C-band and L-band PBE	
		Max.	Typ.	Max.	Typ.	Max.	Typ.
	C-band	4.6 dB	3.4 dB	—	—	4.6 dB	3.4 dB
	L-band	—	—	4.6 dB	3.4 dB	4.6 dB	3.4 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)					
	Width (see Note)	443 mm (17.44 in.)					
	Depth	279 mm (11 in.)					
Note: The width specified is with the mounting brackets installed.							

Transponder Protection Tray specifications

Table 1-32 lists the specifications for the single-mode and multimode Transponder Protection Trays.

Table 1-32
Transponder Protection Tray specifications

Characteristic		Value or range		
Maximum total input power		21 dB		
Minimum return loss		45 dB		
		4CH or 2CH single-mode		4CH or 2CH Multimode
Wavelength		1260 nm to 1360 nm	1528 nm to 1607 nm	770 nm to 860 nm
Maximum Insertion Loss	Splitter	4.0 dB	6.0 dB	5.8 dB
	Combiner	4.0 dB	6.0 dB	5.8 dB
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		43 mm (1.70 in.) (1 U rack space)
	Width (see Note)	443 mm (17.44 in.)		443 mm (17.44 in.)
	Depth	279 mm (11 in.)		279 mm (11 in.)
Note: The width specified is with the mounting brackets installed.				

Optical Trunk Switch specifications

Table 1-33 lists the Optical Trunk Switch specifications.

Table 1-33
Optical Trunk Switch specifications

Characteristic		Value or range		
		Minimum	Maximum	Typical
Power consumption (see Note 1)		—	7 W	—
Voltage		−40 V dc	−60 V dc	−48 V dc
Pilot tone laser launch power (at 1550 nm)		−3.5 dBm	−0.5 dBm	—
Operating optical power range (all optical ports)		−30 dBm	+24 dBm	—
		Value or range		
Wavelength		1260–1360 nm and 1460–1620 nm		
Minimum return loss		40 dB		
Maximum Insertion loss	End-to-End 1528–1607 nm	4.0 dB		
	End-to-End 1260–1360 nm and 1460–1620 nm	5.0 dB		
Switching Time (End-to-End Bidirectional)		100 ms (see Note 2)		
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		
	Width	445 mm (17.5 in.)		
	Depth	305 mm (12 in.) including bulkheads		
<p>Note 1: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).</p> <p>Note 2: To ensure this specification is met on the OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced, OCI SRM GbE, Muxponder 10 Gbit/s circuit packs, set the AOC holdoff time to 500 ms.</p>				

Enhanced Trunk Switch specifications

Table 1-34 lists the Enhanced Trunk Switch specifications.

Table 1-34
Enhanced Trunk Switch specifications

Characteristic		Value or range		
		Minimum	Maximum	Typical
Power consumption (see Note 1)	Fan module	—	6.72 W	—
	ETS Comms	—	7 W	5 W
	ETS Switch	—	2 W	—
Voltage		-40 V dc	-57 V dc	-48 V dc
Power cable required for making power connection		18 AWG (0.8 mm ²)	12 AWG (3 mm ²)	—
Ground wire (via 2 hole lug) Use stranded copper wire		10 AWG (5 mm ²)	10 AWG (5 mm ²)	—
		Value or range		
Fiber type		Single mode fiber		
Wavelength		1260 nm to 1360 nm and 1460 nm to 1630 nm		
Minimum return loss	Switch section	40 dB		
	Coupler section	40 dB		
Maximum Insertion loss	Switch section	2.1 dB		
	Coupler section	4.3 dB		
	End-to-End	6.4 dB		

Table 1-34 (continued)
Enhanced Trunk Switch specifications

Characteristic		Value or range		
		Minimum	Maximum	Typical
Absolute Switching Mode (see Note 2 and Note 3)	Absolute switching limit threshold (ASLTH) (see Note 4)	-35.0 dBm	-35.0 dBm	—
	Absolute switching limit threshold (ASLTH) accuracy	—	±2.0 dB	—
	Received power level (operating)	—	19 dBm	—
	Received power level (without damage)	—	19 dBm	—

Table 1-34 (continued)
Enhanced Trunk Switch specifications

Characteristic		Value or range		
Window Switching Mode (see Note 2 and Note 3)	Reference power level (RPL) Default: -29.0 dBm	-29.0 dBm	-6.0 dBm	—
	RPL accuracy	—	±2.0 dB	—
	Upper window switching range (UWSR) (see Note 5) Default: 6.0 dBm	6.0 dB	29.0 dB	—
	Lower window switching range (LWSR) (see Note 5) Default: 6.0 dBm	6.0 dB	29.0 dB	—
	Upper window switching limit threshold (UWSLTH) UWSLTH = RPL + UWSR	—	0.0 dBm	—
	Lower window switching limit threshold (LWSLTH) LWSLTH = RPL - LWSR	-35.0 dBm	—	—
	Received power level (operating) (see Note 6)	—	0.0 dBm	—
	Received power level (without damage)	—	19 dBm	—
Switching Time	component level	15 ms		
	system level	50 ms		
Auto-switch-back hysteresis		2.0 dB		
Switch-back hold time		3 s		
Received power monitor accuracy		±2.0 dB (Received power range -35.0 dBm to 0.0 dBm)		

Table 1-34 (continued)
Enhanced Trunk Switch specifications

Characteristic		Value or range
Alarm relay signals		Dry contact: critical, major and minor alarms. Relay open under normal operation. Relay closed when power is off or alarm is active. See Table 1-35 on page 1-39 for DB-25 connector pinout
Craft Interface		<ul style="list-style-type: none"> • Supports TL1 command interface through a DB-9 front panel connector: 9600 bps, no parity, no flow control, 8 data bits, 1 stop bit, no start bit. See Table 1-36 on page 1-39 for DB-9 RS-232 pin assignment. • Supports TL1 command interface through an Ethernet RJ-45 connector on the rear of the ETS shelf. Nortel Networks recommends using a shielded CAT 5 cable for the Ethernet connections.
Fuses		2 A
Physical Dimension	Height	44.5 mm (1.75 in.) (1 U rack space)
	Width (see Note 7)	<ul style="list-style-type: none"> • 442.7 mm (17.43 in.) with a setback from front to mounting flange equal to 35.6 mm (1.4 in.), 127 mm (5.0 in.) or 165.1 mm (6.5 in.) • 431.8 mm (17 in.) with a setback from front to mounting flange equal to 152.4 mm (6.0 in.)
	Depth	300 mm (11.8 in.) excluding connectors
<p>Note 1: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).</p> <p>Note 2: See Hardware Description, 323-1701-102 for detailed information about this mode of operation.</p> <p>Note 3: All dBm power levels referenced are aggregate power levels.</p> <p>Note 4: This value cannot be provisioned.</p> <p>Note 5: Can be provisioned in 1 dB increments.</p> <p>Note 6: Captured RPL at the moment the link is setup should not exceed -6 dBm.</p> <p>Note 7: The width specified is with the mounting brackets installed.</p>		

Enhanced Trunk Switch alarm connections

Hard-wired alarm connections can be made through the standard DB-25 connector, located on the rear of the ETS. Follow the pin assignment for the connector listed in [Table 1-35](#).

Since the Fan alarms, Power Fail alarms and the ETS Switch alarms are reported through the ETS Comms, Nortel Networks recommends to use only three of the alarms listed in [Table 1-35](#). These are:

- Critical Alarm
- Slot A Major Alarm
- Slot A Minor Alarm

The alarm log, available through the TL1 interface, can be used to determine the alarm details.

Table 1-35
ETS Central Office Alarm DB-25 connector pinout

Pin	Signal	Pin	Signal
2	Critical Alarm	15	Critical Alarm Return
3	Slot A Major Alarm	16	Slot A Major Alarm Return
4	Slot A Minor Alarm	17	Slot A Minor Alarm Return
5	Power A Fail Alarm	18	Power A Fail Alarm Return
6	Power B Fail Alarm	19	Power B Fail Alarm Return
7	Fan 1 Alarm	20	Fan 1 Alarm Return
8	Fan 2 Alarm	21	Fan 2 Alarm Return
12	Slot B Major Alarm	24	Slot B Major Alarm Return
13	Slot B Minor Alarm	25	Slot B Minor Alarm Return
Note: The ETS Comms is in slot A (left side of the ETS shelf) and the ETS Switch is in slot B.			

Enhanced Trunk Switch DB-9 RS-232 pin assignments

[Table 1-36](#) details the DB-9 RS-232 pin assignments.

Table 1-36
ETS DB-9 RS-232 pin assignments

Pin	Signal
2	RD (Receive data)
3	TD (Transmit data)
5	Ground

Ethernet hub specifications

Table 1-37 lists the specifications for the Ethernet hub.

Table 1-37
Ethernet hub specifications

Characteristic		Value or range		
		Minimum	Maximum	Typical
Power consumption (see Note)		—	20 W	10 W
Voltage		−40 V dc	−60 V dc	−48 V dc
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		
	Width	445 mm (17.5 in.)		
	Depth	279 mm (11 in.)		
Note: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).				

Equipment Inventory Unit specifications

Table 1-38 lists the specifications for the Equipment Inventory Unit.

Table 1-38
Equipment Inventory Unit specifications

Characteristic		Value or range		
		Minimum	Maximum	Typical
Power consumption (see Note 1)		—	7 W	5 W
Voltage		−36 V dc	−70 V dc	−48 V dc
Breaker rating		1.0 A		
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)		
	Width (see Note 2)	448.8 mm (17.67 in.)		
	Depth	279 mm (11 in.)		
Note 1: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).				
Note 2: The width specified is with the mounting brackets installed.				

Mode-conditioning plug specifications

Table 1-39 lists the specifications for the mode-conditioning plugs.

Table 1-39
Mode-conditioning plug specifications

Characteristic	Value or range			
	50 μm mode-conditioning plug		62.5 μm mode-conditioning plug	
Label color (see Note)	Purple		Orange	
	Minimum	Maximum	Minimum	Maximum
Operating wavelength range	1260 nm	1360 nm	1260 nm	1360 nm
Input power range	—	20 dBm	—	20 dBm
Insertion loss	—	1.0 dB	—	1.0 dB
Coupled Power Ratio	12 dB	20 dB	28 dB	40 dB
Optical center offset between SMF and MMF	10 μm	16 μm	17 μm	23 μm
Optical return loss	26 dB	—	26 dB	—

Note: The label color is used to help easily identify whether the mode-conditioning plug is a 50 μm version or a 62.5 μm version. This information is also labelled on the mode-conditioning plug.

Patch panel

Table 1-40 lists the specifications for the patch panel.

Table 1-40
Patch panel specifications

Characteristic		Value or range	
		Patch panel 16 port	Patch panel 20 port
Connectors inside patch panel		16 SC female—SC female bulkheads	20 SC female-SC female bulkheads
Physical Dimension	Height	43 mm (1.70 in.) (1 U rack space)	43 mm (1.70 in.) (1 U rack space)
	Width (see Note)	443 mm (17.44 in.)	443 mm (17.44 in.)
	Depth	279 mm (11 in.)	279 mm (11 in.)

Note: The width specified is with the mounting brackets installed.

Rectifier specifications

3U APRS

Table 1-41 lists the specifications for the 3U APRS rectifier.

Table 1-41
3U APRS rectifier specifications

Specification	Value
Dimensions	
Height	132 mm (5.2 in.) (3 U)
Width	483 mm (19 in.)
Depth	381 mm (15 in.)
Weight	
Rectifier unit	4 kg (9 lbs)
Chassis with two rectifier units installed	17 kg (37 lbs)
Connectors	
Input and output connectors	<ul style="list-style-type: none"> • Internal Elcon Lower Drawer Connector provides hot plug operation. • Screw terminals provide external connections for dc power output and power alarms.
Power input (per rectifier unit)	
Voltage range	90 to 264 V ac
Frequency range	47 to 63 Hz
Current at full load	<ul style="list-style-type: none"> • Maximum input current: 17A RMS • Inrush current: 25 A averaged over 1/2 cycles • Input leakage: current to ground: 2.5 mA • Power factor: 0.99 at full load • Harmonic current: <5% • Efficiency: typically 77%
Hold-up time	Minimum of 86 Watts-second available upon loss of input
Fusing	Internal fuse in the input line
Power output (per rectifier unit)	
Voltage	-48 V dc
Output voltage adjustment range	±10% of nominal output voltage

Table 1-41 (continued)
3U APRS rectifier specifications

Specification	Value
Polarity	<ul style="list-style-type: none"> • Output is fully isolated and regulated • Voltage can be referenced plus or minus as required
Current	<ul style="list-style-type: none"> • 35 Amps 208/220/240 V ac input • 23 Amps 110 V ac input
Line static regulation	±0.25% over full line range
Voltage stability	±0.1% after 30 minutes warm-up for a 24 hour period
Temperature coefficient	±0.02%/ °C from 0°C to 50°C
Peak-to-peak ripple and noise	Differential: 1% or 500 mV; (20 Hz to 20 MHz bandwidth) Common mode: less than 1.5 V peak-to-peak
Minimum load	No minimum load is required.
Power on delay	1 s maximum from application of an alternating current line (when greater than or equal to 110 V ac)
Overvoltage protection	The standard OVP setting is 125% ±5% of nominal. OVP shutdown is latched until the alternating current input line is removed for 5 seconds then reapplied.
Overcurrent protection	Constant current limiting set at 105% of rated output.
Environmental specifications	
Overtemperature protection	Automatically shuts down and latches the unit. (After cool down, power must be recycled to restart the unit.)
Audible noise	60 dBA maximum at 1 m
MTBF	Designed to 250,000 hours
Temperature: operating	0°C to 55°C at full load
Temperature: storage	-55°C to +85°C
Humidity	20% to 95% non-condensing
Altitude: operating	Up to 2440 m (8000 ft)
Altitude: non-operating	Up to 9150 m (30 000 ft)
Vibration: operating	From 5 to 27 Hz, 0.02 in double amplitude; from 27 to 500 Hz, 0.75 G, 3 axes, 5 min per octave sweep, dwell 1 min at resonance
Vibration: non-operating	From 5 to 17 Hz, 0.01 in double amplitude, from 17 to 500 Hz, 1.5 G peak, 3 axes, 5 min per octave sweep; dwell 0 min at resonance

Table 1-41 (continued)
3U APRS rectifier specifications

Specification	Value
Shock: operating	5 G, half sine, 11 ms, 3 axes
Shock: non-operating	15 G, half sine, 11ms, 3 axes
Cooling	<ul style="list-style-type: none"> • Forced air, internal fan • Air flow exits at connector end (back of chassis)
EMI	<ul style="list-style-type: none"> • Conducted: VDE0871, Level A, 150 kHz to 30 MHz • Radiated: VDE 0871, Level B
Safety	<ul style="list-style-type: none"> • UL1950 • CSA22.2 No. 950 • TUV (EN60-950)

1U APRS

[Table 1-42](#) lists the specifications for the 1U APRS rectifier.

Table 1-42
1U APRS rectifier specifications

Specification	Value
Physical dimensions	
Height	43 mm (1.7 in.) (1U)
Width	445 mm (17.5 in.)
Depth	241 mm (9.5 in.)
Weight	
Rectifier module	2 kg (4.5 lbs.)
Chassis with two modules installed	6.5 kg (14 lbs.)
Connectors	
AC power source	IEC 60320–C14 (male)
DC output power	2-pin terminal block
Telemetry alarms	6-pin MOLEX 2.54 mm pitch SL wire-to-board Shrouded header (maximum 1 A)
Power input (per rectifier module)	
Voltage range	90 to 264 V ac
Frequency range	45 to 65 Hz

Table 1-42 (continued)
1U APRS rectifier specifications

Specification	Value
Current at full load <ul style="list-style-type: none"> • Maximum ac steady-state input current • Inrush current • Input leakage: current to ground • Harmonic current 	<ul style="list-style-type: none"> • 3 A at 90 VAC (low-line) • 10 A • < 3.5 mA • < 6%
Hold-up time	2.1 Watt-seconds
Overvoltage protection (ac input): disc varistor	275 V RMS
Power output (per rectifier module)	
Voltage	-48 V dc \pm 2 V
Current (maximum)	4.2 A
Peak-to-peak ripple and noise (maximum)	500 mV (20 kHz to 20 MHz bandwidth)
Overvoltage protection (dc output); protection circuit	V out between 55 V and 63 V. The unit is latched until the user recycles the ac to reset.
Environmental	
Audible noise <ul style="list-style-type: none"> • one module • two modules 	dBA at 1 m <ul style="list-style-type: none"> • 48 dBA • 57 dBA
Mean-time-between-failure (MTBF)	Module MTBF of 151,000 hours per MIL-HDBK-217-FN2, Ground Benign, 40 ⁰ C.
Safety (regulatory approvals)	<ul style="list-style-type: none"> • IEC 60950 Third edition • CSA C22.2 60950 • EN 60950 (Min. Amd 4) • AS/NZ 3260 (Min. Amd 4)

Dual filter drawer

A dual filter drawer is a 1U high, rack-mounted component, for holding two filter trays (such as C/L Splitter/Coupler trays, or two OSC trays).

[Table 1-43](#) lists the dual filter drawer dimensions.

Table 1-43
Physical dimensions of a dual filter drawer

Specification	Value or range
Physical dimensions	
• Height	• 43 mm (1.70 in.) (1 U rack space)
• Width (see Note)	• 443 mm (17.44 in.)
• Depth	• 279 mm (11 in.)
Note: The width specified is with the mounting brackets installed.	

Circuit pack specifications

In this chapter

- [OCM circuit pack on page 2-1](#)
- [SP circuit pack on page 2-1](#)
- [OCI circuit pack on page 2-2](#)
- [OCLD circuit pack on page 2-70](#)
- [OTR circuit pack on page 2-78](#)
- [Muxponder circuit pack on page 2-116](#)
- [OFA circuit pack on page 2-126](#)
- [APBE circuit pack on page 2-131](#)
- [OSC circuit pack on page 2-134](#)
- [Filler cards on page 2-135](#)
- [Gigabit Ethernet frame length specifications on page 2-135](#)
- [Latency specifications on page 2-137](#)
- [Fibre Channel extended reach distances on page 2-146](#)

Note: All supported wavelengths listed in this chapter were measured in a vacuum.

OCM circuit pack

Every Optical Metro 5200 shelf requires two OCM circuit packs. Refer to [Table 1-2](#) in the “Hardware specifications” chapter of this book for OCM power consumption specifications.

SP circuit pack

Every Optical Metro 5100/5200 shelf requires an SP circuit pack. Refer to [Table 1-2](#) in the “Hardware specifications” chapter of this book for SP power consumption specifications.

OCI circuit pack

- [Technical specifications on page 2-2](#)
- [Supported optical protocols on page 2-13](#)
- [OCI/OCLD pairing per protocol and supported PMs for each pairing on page 2-39](#)
- [Optical power threshold values on page 2-66](#)

Technical specifications

[Table 2-1](#) lists specifications for the OCI circuit packs. [Table 2-2 on page 2-7](#) lists specifications for the SRM OCI circuit packs.

Table 2-1
Specifications for OCI circuit packs

Characteristic		Value or range	
Power consumption (see Note 1)		Typical	Maximum
	OCI 622 Mbit/s 1310 nm	18 W	19 W
	OCI 1.25 Gbit/s 1310 nm	18 W	19 W
	OCI 1.25 Gbit/s 850 nm	18 W	19 W
	OCI ISC 1310 nm	18 W	19 W
	OCI GbE 1310 nm	18 W	19 W
	OCI GbE 850 nm	18 W	19 W
	OCI OC-48 STM-16 1310 nm	20 W	24 W
	OCI SONET/SDH 1310 nm	18 W	19 W
OCI SONET/SDH IR 1310 nm	18 W	19 W	
Bit rates		Minimum	Maximum
	OCI 622 Mbit/s 1310 nm	51.84 Mbit/s	622.08 Mbit/s
	OCI 1.25 Gbit/s 1310 nm	16 Mbit/s (See Note 2)	1.25 Gbit/s
	OCI 1.25 Gbit/s 850 nm	1.0625 Gbit/s	1.25 Gbit/s
	OCI ISC 1310 nm	1.0625 Gbit/s	1.0625 Gbit/s
	OCI GbE 1310 nm	1.25 Gbit/s	1.25 Gbit/s
	OCI GbE 850 nm	1.25 Gbit/s	1.25 Gbit/s
	OCI OC-48 STM-16 1310 nm	2.48832 Gbit/s	2.48832 Gbit/s
	OCI SONET/SDH 1310 nm	155.52 Mbit/s	2.48832 Gbit/s
OCI SONET/SDH IR 1310 nm	155.52 Mbit/s	2.48832 Gbit/s	

Table 2-1 (continued)
Specifications for OCI circuit packs

Characteristic	Value or range		
	Minimum	Maximum	
Tx power	OCI 622 Mbit/s 1310 nm	-15.0 dBm	-8.0 dBm
	OCI 1.25 Gbit/s 1310 nm	-11.5 dBm	-3.0 dBm
	OCI 1.25 Gbit/s 850 nm	-9.5 dBm	-4.0 dBm
	OCI ISC 1310 nm	-9.0 dBm	-3.0 dBm
	OCI GbE 1310 nm	-11.0 dBm	-3.0 dBm
	OCI GbE 850 nm	-9.5 dBm	-5.0 dBm
	OCI OC-48 STM-16 1310 nm	-1.0 dBm	0.0 dBm
	OCI SONET/SDH 1310 nm	-10.0 dBm	-3.0 dBm
	OCI SONET/SDH IR 1310 nm (See Note 3)	-5.0 dBm	0.0 dBm
Rx power (see Note 6 and Note 7)	OCI 622 Mbit/s 1310 nm	-28.0 dBm BER=10 ⁻¹⁰ (See Note 4)	-7.0 dBm BER=10 ⁻¹⁰
	OCI 1.25 Gbit/s 1310 nm	-20.0 dBm BER=10 ⁻¹⁰	-3.0 dBm BER=10 ⁻¹⁰
	OCI 1.25 Gbit/s 850 nm	-17.0 dBm BER=10 ⁻¹²	0.0 dBm BER=10 ⁻¹²
	OCI ISC 1310 nm	-19.5 dBm BER=10 ⁻¹²	-3.0 dBm BER=10 ⁻¹²
	OCI GbE 1310 nm	-19.0 dBm BER=10 ⁻¹²	-3.0 dBm BER=10 ⁻¹²
	OCI GbE 850 nm	-17.0 dBm BER=10 ⁻¹²	0.0 dBm BER=10 ⁻¹²
	OCI OC-48 STM-16 1310 nm	-18.0 dBm BER=10 ⁻¹⁰	1.0 dBm BER=10 ⁻¹⁰
	OCI SONET/SDH 1310 nm	-18.0 dBm BER=10 ⁻¹⁰ for 2.48832 Gbit/s rate	-3.0 dBm BER=10 ⁻¹⁰ for 2.48832 Gbit/s rate
		-23.0 dBm BER=10 ⁻¹⁰ for 155.52 Mbit/s and 622.08 Mbit/s rates	-8.0 dBm BER=10 ⁻¹⁰ for 155.52 Mbit/s and 622.08 Mbit/s rate
	OCI SONET/SDH IR 1310 nm	-18.0 dBm BER=10 ⁻¹⁰ for 2.48832 Gbit/s rate	0.0 dBm BER=10 ⁻¹⁰
-23.0 dBm BER=10 ⁻¹⁰ for 155.52 Mbit/s and 622.08 Mbit/s rates (See Note 5)			

2-4 Circuit pack specifications

Table 2-1 (continued)
Specifications for OCI circuit packs

Characteristic	Value or range		
Rx Wavelength	Minimum	Maximum	
	OCI 622 Mbit/s 1310 nm	1270 nm	1355 nm
	OCI 1.25 Gbit/s 1310 nm	1270 nm	1355 nm
	OCI 1.25 Gbit/s 850 nm	770 nm	860 nm
	OCI ISC 1310 nm	1270 nm	1355 nm
	OCI GbE 1310 nm	1270 nm	1355 nm
	OCI GbE 850 nm	770 nm	860 nm
	OCI OC-48 STM-16 1310 nm	1250 nm	1605 nm
	OCI SONET/SDH 1310 nm	1260 nm	1360 nm
OCI SONET/SDH IR 1310 nm	1261 nm	1360 nm	
Tx Wavelength	Minimum	Maximum	
	OCI 622 Mbit/s 1310 nm	1274 nm	1356 nm
	OCI 1.25 Gbit/s 1310 nm	1285 nm	1343 nm
	OCI 1.25 Gbit/s 850 nm	830 nm	860 nm
	OCI ISC 1310 nm	1270 nm	1355 nm
	OCI GbE 1310 nm	1270 nm	1355 nm
	OCI GbE 850 nm	820 nm	860 nm
	OCI OC-48 STM-16 1310 nm	1300 nm	1320 nm
	OCI SONET/SDH 1310 nm	1266 nm	1360 nm
OCI SONET/SDH IR 1310 nm	1261 nm	1360 nm	

Table 2-1 (continued)
Specifications for OCI circuit packs

Characteristic	Value or range		
	TX	RX	
Optical power monitor accuracy (See Note 8)	OCI 622 Mbit/s 1310 nm	not supported	not supported
	OCI 1.25 Gbit/s 1310 nm	not supported	not supported
	OCI 1.25 Gbit/s 850 nm	not supported	not supported
	OCI ISC 1310 nm	not supported	not supported
	OCI GbE 1310 nm	± 2.0 dB	± 3.0 dB, -3 dBm to -6 dBm ± 2.0 dB, -6 dBm to -19 dBm (See Note 9)
	OCI GbE 850 nm	not supported	± 2.0 dB, -12 dBm to -17 dBm (See Note 9)
	OCI OC-48 STM-16 1310 nm	± 1.0 dB	± 1.0 dB, $+1$ dBm to -18 dBm (See Note 9)
	OCI SONET/SDH 1310 nm	± 0.5 dB	± 1.0 dB, -3 dBm to -18 dBm ± 2.0 dB, -18 dBm to -25 dBm (See Note 9)
	OCI SONET/SDH IR 1310 nm	± 2.0 dB	± 1.0 dB, 0 dBm to -18 dBm ± 3.0 dB, -18 dBm to -25 dBm (See Note 9)

Table 2-1 (continued)
Specifications for OCI circuit packs

Characteristic	Value or range	
Applicable optical fiber types supported	OCI 622 Mbit/s 1310 nm	SM
	OCI 1.25 Gbit/s 1310 nm	Protocol dependent, see Table 2-3 on page 2-14
	OCI 1.25 Gbit/s 850 nm	50/62.5 μm MM
	OCI ISC 1310 nm	SM
	OCI GbE 1310 nm	SM
	OCI GbE 850 nm	50/62.5 μm MM
	OCI OC-48 STM-16 1310 nm	SM
	OCI SONET/SDH 1310 nm	SM
	OCI SONET/SDH IR 1310 nm	SM

Note 1: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).

Note 2: ETR/CLO at 8 Mbit/s Manchester encoded (16 Mbit/s) is supported outside nominal range of bit rates for Optical Metro 5200 because of the nature of the traffic type.

Note 3: Although the OCI SONET/SDH IR has the IR tag in its names, it only supports the IR power specification requirements when configured to carry OC-48/STS-16 signals. The OC-3/OC-12 IR power specification requirements are not met when configured to carry OC-3/STM-1 or OC-12/STM-4 signals. The OCI 622 Mbit/s can be used in order to meet the OC-3/OC-12 IR power specification requirements. The SRM OCI can be used to meet the OC-3 IR power specification requirements. The SONET/SDH SRM OCI can be used to meet the OC-12 IR power specification requirements.

Note 4: A minimum Rx sensitivity of -28 dBm can only be achieved when using single mode (SM) fiber or a correctly deployed mode-conditioning plug with multi-mode fiber.

Note 5: Although the OCI SONET/SDH IR has the IR tag in its names, it only supports the IR power specification requirements when configured to carry OC-48/STS-16 signals. The OC-3/OC-12 IR power specification requirements are not met when configured to carry OC-3/STM-1 or OC-12/STM-4 signals. The OCI 622 Mbit/s can be used in order to meet the OC-3/OC-12 IR power specification requirements. The SRM OCI can be used to meet the OC-3 IR power specification requirements. The SONET/SDH SRM OCI can be used to meet the OC-12 IR power specification requirements.

Note 6: In most cases on OCI circuit packs that support equipment PMs (that is, optical power monitoring), traffic continuity at high and low input power is determined by the Receive Power High Fail Threshold and Receive Power Low Fail Threshold rather than by the minimum overload and minimum sensitivity. For threshold values, see [Table 2-22 on page 2-67](#).

Note 7: The Rx minimum sensitivity specifications are back-to-back and include no path power penalties.

Note 8: External power meters may differ System Manager by up to ± 2.0 dB.

Note 9: The Rx power monitor is only accurate in the stated range.

Table 2-2
Specifications for OCI SRM circuit packs

Characteristic	Value or range		
	Typical	Maximum	
Power consumption (see Note 1)	OCI SRM 1310 nm	28 W	30 W
	OCI SRM 1310 nm LC	28 W	30 W
	OCI SRM SONET/SDH 1310 nm	32 W	35 W
	OCI SRM ESCON 1310 nm	24 W	29 W
	OCI SRM GbE/FC 1310 nm	36 W	43.3 W
	OCI SRM GbE/FC 850 nm	36 W	43.3 W
	OCI SRM GbE/FC Enhanced 1310 nm	37 W	45.0 W
	OCI SRM GbE/FC Enhanced 850 nm	37 W	45.0 W
	OCI SRM GbE 1310 nm	27 W	31.4 W
	OCI SRM GbE 850 nm	27 W	31.4 W
	OCI SRM SONET/SDH LTE	20 W	27 W
	Bit rates	OCI SRM 1310 nm	51.84 Mbit/s
OCI SRM 1310 nm LC		51.84 Mbit/s	270 Mbit/s
OCI SRM SONET/SDH 1310 nm		622.08 Mbit/s	622.08 Mbit/s
OCI SRM ESCON 1310 nm		200 Mbit/s	200 Mbit/s
OCI SRM GbE/FC 1310 nm		1.0625 Gbit/s	1.25 Gbit/s
OCI SRM GbE/FC 850 nm		1.0625 Gbit/s	1.25 Gbit/s
OCI SRM GbE/FC Enhanced 1310 nm		1.0625 Gbit/s	1.25 Gbit/s
OCI SRM GbE/FC Enhanced 850 nm		1.0625 Gbit/s	1.25 Gbit/s
OCI SRM GbE 1310 nm		1.25 Gbit/s	1.25 Gbit/s
OCI SRM GbE 850 nm		1.25 Gbit/s	1.25 Gbit/s
OCI SRM SONET/SDH LTE		155.52 Mbit/s	622.08 Mbit/s

2-8 Circuit pack specifications

Table 2-2 (continued)
Specifications for OCI SRM circuit packs

Characteristic	Value or range		
	Minimum (per port)	Maximum (per port)	
Tx power	OCI SRM 1310 nm	-15.0 dBm	-8.0 dBm
	OCI SRM 1310 nm LC	-15.0 dBm	-8.0 dBm (see Note 2)
	OCI SRM SONET/SDH 1310 nm	-15.0 dBm	-8.0 dBm
	OCI SRM ESCON 1310 nm (see Note 3)	-20.5 dBm	-14.5 dBm
	OCI SRM GbE/FC 1310 nm	-9.5 dBm with SM fiber	-3.0 dBm
		-11.5 dBm with MM fiber	
	OCI SRM GbE/FC 850 nm	-9.5 dBm	-1.5 dBm
	OCI SRM GbE/FC Enhanced 1310 nm	-9.5 dBm with SM fiber	-3.0 dBm
		-11.5 dBm with MM fiber	
	OCI SRM GbE/FC Enhanced 850 nm	-9.5 dBm	-1.5 dBm
	OCI SRM GbE 1310 nm	-11.0 dBm with SM fiber	-3.0 dBm
		-11.5 dBm with MM fiber	
	OCI SRM GbE 850 nm	-9.5 dBm	-1.5 dBm
	OCI SRM SONET/SDH LTE	-15 dBm	-8 dBm (see Note 2)

Table 2-2 (continued)
Specifications for OCI SRM circuit packs

Characteristic	Value or range	
	Minimum Sensitivity	Minimum Overload
Rx power (see Note 5)		
OCI SRM 1310 nm	-28.0 dBm BER=10 ⁻¹⁰ (See Note 4)	-8.0 dBm BER=10 ⁻¹⁰
OCI SRM 1310 nm LC	-28.0 dBm BER=10 ⁻¹⁰ (See Note 4)	-8.0 dBm BER=10 ⁻¹⁰
OCI SRM SONET/SDH 1310 nm	-28.0 dBm BER=10 ⁻¹⁰	-8.0 dBm BER=10 ⁻¹⁰
OCI SRM ESCON 1310 nm	-29.0 dBm BER=10 ⁻¹⁵	-14.5 dBm BER=10 ⁻¹⁵
OCI SRM GbE/FC 1310 nm	-19.0 dBm BER=10 ⁻¹²	-3.0 dBm BER=10 ⁻¹²
OCI SRM GbE/FC 850 nm	-17.0 dBm BER=10 ⁻¹²	0.0 dBm BER=10 ⁻¹²
OCI SRM GbE/FC Enhanced 1310 nm	-19.0 dBm BER=10 ⁻¹²	-3.0 dBm BER=10 ⁻¹²
OCI SRM GbE/FC Enhanced 850 nm	-17.0 dBm BER=10 ⁻¹²	0.0 dBm BER=10 ⁻¹²
OCI SRM GbE 1310 nm	-19.0 dBm BER=10 ⁻¹²	-3.0 dBm BER=10 ⁻¹²
OCI SRM GbE 850 nm	-17.0 dBm BER=10 ⁻¹²	0.0 dBm BER=10 ⁻¹²
OCI SRM SONET/SDH LTE	-28.0 dBm BER=10 ⁻¹⁰	-8.0 dBm BER=10 ⁻¹⁰

Table 2-2 (continued)
Specifications for OCI SRM circuit packs

Characteristic	Value or range	
	Minimum	Maximum
Rx Wavelength		
OCI SRM 1310 nm	1270 nm	1380 nm
OCI SRM 1310 nm LC	1270 nm	1380 nm
OCI SRM SONET/SDH 1310 nm	1270 nm	1380 nm
OCI SRM ESCON 1310 nm	1280 nm	1380 nm
OCI SRM GbE/FC 1310 nm	1270 nm	1355 nm
OCI SRM GbE/FC 850 nm	770 nm	860 nm
OCI SRM GbE/FC Enhanced 1310 nm	1270 nm	1355 nm
OCI SRM GbE/FC Enhanced 850 nm	770 nm	860 nm
OCI SRM GbE 1310 nm	1270 nm	1355 nm
OCI SRM GbE 850 nm	770 nm	860 nm
OCI SRM SONET/SDH LTE	1270 nm	1570 nm
Tx Wavelength		
OCI SRM 1310 nm	1274 nm	1356 nm
OCI SRM 1310 nm LC	1274 nm	1356 nm
OCI SRM SONET/SDH 1310 nm	1274 nm	1356 nm
OCI SRM ESCON 1310 nm	1285 nm	1355 nm
OCI SRM GbE/FC 1310 nm	1270 nm	1355 nm
OCI SRM GbE/FC 850 nm	770 nm	860 nm
OCI SRM GbE/FC Enhanced 1310 nm	1270 nm	1355 nm
OCI SRM GbE/FC Enhanced 850 nm	770 nm	860 nm
OCI SRM GbE 1310 nm	1270 nm	1355 nm
OCI SRM GbE 850 nm	770 nm	860 nm
OCI SRM SONET/SDH LTE	1270 nm	1360 nm

Table 2-2 (continued)
Specifications for OCI SRM circuit packs

Characteristic	Value or range		
	TX	RX	
Optical power monitor accuracy	OCI SRM 1310 nm	not supported	not supported
	OCI SRM 1310 nm LC	not supported	not supported
	OCI SRM SONET/SDH 1310 nm	not supported	not supported
	OCI SRM ESCON 1310 nm	not supported	not supported
	OCI SRM GbE/FC 1310 nm	not supported	not supported
	OCI SRM GbE/FC 850 nm	not supported	not supported
	OCI SRM GbE/FC Enhanced 1310 nm	not supported	not supported
	OCI SRM GbE/FC Enhanced 850 nm	not supported	not supported
	OCI SRM GbE 1310 nm	not supported	not supported
	OCI SRM GbE 850 nm	not supported	not supported
	OCI SRM SONET/SDH LTE	not supported	not supported

Table 2-2 (continued)
Specifications for OCI SRM circuit packs

Characteristic	Value or range
Applicable optical fiber types supported	
OCI SRM 1310 nm	Protocol dependent, see Table 2-12 on page 2-28
OCI SRM 1310 nm LC	Protocol dependent, see Table 2-12 on page 2-28
OCI SRM SONET/SDH 1310 nm	SM
OCI SRM ESCON 1310 nm	50/62.5 μ m MM
OCI SRM GbE/FC 1310 nm	Protocol dependent, see Table 2-15 on page 2-34
OCI SRM GbE/FC 850 nm	50/62.5 μ m MM
OCI SRM GbE/FC Enhanced 1310 nm	Protocol dependent, see Table 2-15 on page 2-34
OCI SRM GbE/FC Enhanced 850 nm	50/62.5 μ m MM
OCI SRM GbE 1310 nm	Protocol dependent, see Table 2-17 on page 2-35
OCI SRM GbE 850 nm	50/62.5 μ m MM
OCI SRM SONET/SDH LTE	Protocol dependent, see Table 2-19 on page 2-36
<p>Note 1: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).</p> <p>Note 2: The maximum Tx power of -8 dBm only applies if the patch cord connected at the faceplate connector is a single mode patch cord. The maximum Tx power can be higher than -8 dBm if the patch cord connected at the faceplate connector is a multi-mode patch cord.</p> <p>Note 3: This applies when using a 62.5 μm MMF patch cord.</p> <p>Note 4: A minimum Rx sensitivity of -28 dBm can only be achieved when using single mode (SM) fiber or a correctly deployed mode-conditioning plug with multi-mode fiber.</p> <p>Note 5: The Rx minimum sensitivity specifications are back-to-back and include no path power penalties.</p>	

Supported optical protocols

- OCI 1.25 Gbit/s 1310 nm (see [Table 2-3 on page 2-14](#))
- OCI 622 Mbit/s 1310 nm (see [Table 2-4 on page 2-19](#))
- OCI OC-48/STM-16 1310 nm (see [Table 2-5 on page 2-22](#))
- OCI SONET/SDH 1310 nm (see [Table 2-6 on page 2-23](#))
- OCI SONET/SDH IR 1310 nm (see [Table 2-7 on page 2-25](#))
- OCI 1.25 Gbit/s 850 nm (see [Table 2-8 on page 2-26](#))
- OCI ISC 1310 nm (see [Table 2-9 on page 2-27](#))
- OCI GbE 1310 nm (see [Table 2-10 on page 2-27](#))
- OCI GbE 850 nm (see [Table 2-11 on page 2-28](#))
- OCI SRM 1310 nm (see [Table 2-12 on page 2-28](#))
- OCI SRM 1310 nm LC (see [Table 2-12 on page 2-28](#))
- OCI SRM SONET/SDH 1310 nm (see [Table 2-13 on page 2-33](#))
- OCI SRM ESCON (see [Table 2-14 on page 2-33](#))
- OCI SRM GbE/FC 1310 nm (see [Table 2-15 on page 2-34](#))
- OCI SRM GbE/FC Enhanced 1310 nm (see [Table 2-15 on page 2-34](#))
- OCI SRM GbE/FC 850 nm (see [Table 2-16 on page 2-34](#))
- OCI SRM GbE/FC Enhanced 850 nm (see [Table 2-16 on page 2-34](#))
- OCI SRM GbE 1310 nm (see [Table 2-17 on page 2-35](#))
- OCI SRM GbE 850 nm (see [Table 2-18 on page 2-36](#))
- OCI SRM SONET/SDH LTE (see [Table 2-19 on page 2-36](#))

Notes about the Protocol tables

- For SONET/SDH protocols, any payload mapping is supported. For example, for the OC-48 SONET protocol, the payload mapping can be STS-1, STS-3C, STS-12C, STS-48C. For example, for the STM-16 SDH protocol, the payload mapping can be AU-3, AU-4, AU-4-4C, AU-4-16C.
- The attenuator and reach values refer to the client-side of the network.
- Since various fiber losses exist, the tables list both a maximum allowed loss and a maximum distance. The maximum distance is calculated from the maximum loss based on the allowed fiber loss for a given protocol.
- In most cases, a link budget does not apply to multimode fiber. If power and sensitivity values of the circuit pack meet a given standard specification, then the distance in that standard is considered to be the maximum possible distance.
- If further distance is possible with the circuit pack than that specified by a standard, then the distance specified in the standard is stated as the maximum possible distance.

2-14 Circuit pack specifications

- The BER for a given link is based upon the value stated in the appropriate standard.
- The attenuator values apply to the Optical Metro 5100/5200 Tx and Rx only, and are required for minimum overload protection when the subtending equipment is co-located with the Optical Metro 5100/5200 equipment. The attenuator value can be traded off for fiber loss as long as the input power to the receiver meets the minimum overload specification.
- The attenuator values provided are minimum values. For example, if the table indicates that a 7 dB pad is needed, an 8 dB pad can be used.
- In most cases, the attenuator does not limit the reach. However, there are certain cases where the attenuator will limit the reach. In this case, the reach specified is with the attenuator removed.

Table 2-3
Protocols supported by OCI 1.25 Gbit/s 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Async FOTS Nortel FMT-150		150 Mbit/s	Asynch FOTS 150M	(see Note 8)		SM	(see Note 8)
Async FOTS Nortel FD-565		570 Mbit/s	Asynch FOTS 565M	(see Note 8)		SM	(see Note 8)
ATM	OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-3 (IR)	155.52 Mbit/s	OC-3 (STM-1)	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	11	0	50 μ m or 62.5 μ m MM 500 MHz*km	30 m, BER= 10^{-10} (see Note 9)

Table 2-3 (continued)
Protocols supported by OCI 1.25 Gbit/s 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
D1 Video (See Note 10)	Internal Connection	270 Mbit/s	SDI Video (SMPTE 297M)	5	0	MM	2 km, BER= 10^{-12} (see Note 12)
	Short Haul Trunk Line	270 Mbit/s	SDI Video (SMPTE 297M)	5	0	SM	5.4 km, BER= 10^{-12}
	Long Haul Trunk Line	270 Mbit/s	SDI Video (SMPTE 297M)	5	0	SM	5.4 km, BER= 10^{-12}
ETR/CLO (See Note 11)		16 Mbit/s	ETR	12	0	62.5 μ m MM	500 m (see Note 12)
			CLO				
Fast Ethernet 100Base-FX		125 Mbit/s	Fast Ethernet	12	7	SM	8 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 2
				7	0		15 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 1
				11	0	62.5 μ m MM 500 MHz*km	30 m (see Note 6)
FDDI (Note: only unprotected channel assignments supported)		125 Mbit/s	FDDI	12	7	SM	8 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 2
				7	0		15 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 1
				11	0	62.5 μ m MM 500 MHz*km	30 m (see Note 7)

Table 2-3 (continued)
Protocols supported by OCI 1.25 Gbit/s 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach		
				Tx	Rx				
Fibre Channel	FC 12-F6-LE-I	133 Mbit/s	FC-12	11	0	62.5 µm MM	30 m (see Note 3)		
	FC 25-SM-LL-L	266 Mbit/s	FC-25	0	0	SM	8 dB, BER= 10^{-12} 10 km (see Note 2)		
	FC 25-SM-LL-I	266 Mbit/s	FC-25	0	0	SM	5 dB, BER= 10^{-12} 2 km (see Note 2)		
	FC 25-M6-LE-I	266 Mbit/s	FC-25	11	0	62.5 µm MM 500 MHz*km	5 dB, BER= 10^{-12} 1.5 km (see Note 12)		
	FC 50-SM-LL-L	531 Mbit/s	FC-50	0	0	SM	8 dB, BER= 10^{-12} 10 km (see Note 2)		
	FC 100-SM-LC-L	1062 Mbit/s	FC-100	0	0	SM	10 km, BER= 10^{-12}		
FICON		1062 Mbit/s	FICON	0	0	SM	10 km, BER= 10^{-12}		
Gigabit Ethernet 1000Base-LX		1250 Mbit/s	Gigabit Ethernet	0	0	SM	5 km, BER= 10^{-12}		
						50 µm MM 400 MHz*km	550 m, BER= 10^{-12} (see Note 12)		
						50 µm MM 500 MHz*km			
						62.5 µm MM 550 MHz*km			
IBM ESCON		200 Mbit/s	ESCON/SBC ON	0	0	SM	9.5 dB, BER= 10^{-15} 19 km (see Note 2)		
						12	0	62.5 µm MM 500 MHz*km	30 m (see Note 5)
								50 µm MM 800 MHz*km	

Table 2-3 (continued)
Protocols supported by OCI 1.25 Gbit/s 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH	STM-1 (I-1)	155.52 Mbit/s	STM-1	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	STM-1 (S-1.1)	155.52 Mbit/s	STM-1	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	STM-4 (I-4)	622.08 Mbit/s	STM-4	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	STM-4 (S-4.1)	622.08 Mbit/s	STM-4	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
SONET	OC-1 (SR-1)	51.84 Mbit/s	OC-1	11	0	SM	30 m (see Note 4)
	OC-3 (SR-1)	155.52 Mbit/s	OC-3	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-3 (IR-1)	155.52 Mbit/s	OC-3	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-12 (SR-1)	622.08 Mbit/s	OC-12	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-12 (IR-1)	622.08 Mbit/s	OC-12	5	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
SRM-125 (See Note 13)		1250 Mbit/s	SRM-125	0	0	SM	7.5 dB, BER= 10^{-10} 13 km (see Note 1)
<p>Note 1: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.</p> <p>Note 2: The distance is estimated using the assumption of 0.5 dB/km installed fiber loss including splices and cable margins.</p> <p>Note 3: The FC 12-F6-LE-I transmitter power range is -14 dBm to -22 dBm (ANSI FC-PH). Only FC-12 equipment with an output power greater than -19 dBm (including connector losses) is supported (Sensitivity of the 1.25G OCI 1310 nm, 10^{-12}).</p>							

Table 2-3 (continued)
Protocols supported by OCI 1.25 Gbit/s 1310 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
<p>Note 4: The OC-1 transmitter power range is –14 dBm to –23 dBm (Telcordia GR-253-CORE). Only OC-1 equipment with an output power greater than –20 dBm (including connector losses) is supported (Sensitivity of the 1.25G OCI 1310 nm, 10^{-10}).</p>						
<p>Note 5: The IBM ESCON/SBCON transmitter power range is –15 dBm to –20.5 dBm. Only ESCON/SBCON equipment with an output power greater than –17.5 dBm (including connector losses) is supported (Sensitivity of the 1.25G OCI 1310 nm, 10^{-15}).</p>						
<p>Note 6: The Fast Ethernet 100Base-FX transmitter power range is –14 dBm to –20 dBm. Only Fast Ethernet 100Base-FX equipment with an output power greater than –19 dBm is supported (Sensitivity of the 1.25G OCI 1310 nm, 10^{-12}).</p>						
<p>Note 7: The FDDI transmitter power range is –14 dBm to –20 dBm. Only FDDI equipment with an output power greater than –19 dBm (including connector losses) is supported (Sensitivity of the 1.25G OCI 1310 nm, 10^{-12}).</p>						
<p>Note 8: Contact Nortel Networks to obtain this information.</p>						
<p>Note 9: The multimode 622M ATM transmitter power range for 50um fiber is –14 dBm to –24 dBm (ATM Forum Document af-phy-0046.000). Only ATM equipment with an output power greater than –20dBm is supported (Sensitivity of the 1.25G OCI 1310 nm, 10^{-10}). Distances greater than 30 m are supported provided that the Rx power level into the OCI 1.25 Gbit/s 1310 nm is –20 dBm or higher.</p>						
<p>Note 10: D1 Video is a serial digital video signal that is based on SMPTE 259M and CCIR #601, transmitted at 270 Mbit/s. Some D1 Video signals (as defined by SMPTE 259M) and test patterns may not be carried error-free by Optical Metro 5100/5200. In addition, some test patterns (for example, Matrix SDI) may not be carried error-free. This is a well-known limitation with the scrambling algorithm used by SMPTE and relates to the long time constants introduced by the scrambling algorithm itself. It is usually overcome by the D1 Video equipment vendors, which are using a second level of scrambling proprietary to the vendor. No standards exist at this time for the second level of scrambling.</p>						
<p>Note 11: Optical Metro 5100/5200 supports ETR/CLO at 8 Mbit/s Manchester encoded (16 Mbit/s), which is outside the nominal range of bit rates. Because of the nature of the traffic type, there is no protected connection for ETR/CLO.</p>						
<p>Note 12: A mode-conditioning patch cord or plug is required to guarantee error-free performance if the subtending equipment is not collocated with the Optical Metro 5100/5200. Collocated means less than 30 m (100 ft.) away.</p>						
<p>Note 13: This protocol is used when implementing interoperable topologies with OCI SRM circuit packs. See “Implementing interoperable topologies with OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs” in <i>Network Planning and Link Engineering</i>, 323-1701-110.</p>						

Table 2-4
Protocols supported by OCI 622 Mbit/s 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Async FOTS Nortel FMT-150		150 Mbit/s	Asynch FOTS 150M	(see Note 3)		SM	(see Note 3)
Async FOTS Nortel FD-565		570 Mbit/s	Asynch FOTS 565M	(see Note 3)		SM	(see Note 3)
ATM	OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-3 (IR)	155.52 Mbit/s	OC-3 (STM-1)	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
	OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
D1 Video (See Note 4)	Short Haul Trunk Line	270 Mbit/s	SDI Video (SMPTE 297M)	0	0	SM	15 km, BER= 10^{-12}
	Long Haul Trunk Line	270 Mbit/s	SDI Video (SMPTE 297M)	2	0	SM	20 km, BER= 10^{-12}

Table 2-4 (continued)
Protocols supported by OCI 622 Mbit/s 1310 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
Fast Ethernet 100Base-FX	125 Mbit/s	Fast Ethernet	6	0	SM	7 dB, BER= 10^{-12} 14 km (see Note 2) for Category 1 to OCI, OCI to Category 1
			7	7		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 2
			7	7		7 dB, BER= 10^{-12} 14 km (see Note 2) for Category 1 to OCI, OCI to Category 2
			6	3		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 1
FDDI (Note: only unprotected channel assignments supported)	125 Mbit/s	FDDI	6	0	SM	7 dB, BER= 10^{-12} 14 km (see Note 2) for Category 1 to OCI, OCI to Category 1
			7	7		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 2
			7	7		7 dB, BER= 10^{-12} 14 km (see Note 2) for Category 1 to OCI, OCI to Category 2
			6	3		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 1

Table 2-4 (continued)
Protocols supported by OCI 622 Mbit/s 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Fibre Channel	FC 25-SM-LL-L	266 Mbit/s	FC-25	0	4	SM	8 dB, BER= 10^{-12} 10 km (see Note 2)
	FC 25-SM-LL-I	266 Mbit/s	FC-25	0	4	SM	3 dB, BER= 10^{-12} 2 km (see Note 2)
	FC 50-SM-LL-L	531 Mbit/s	FC-50	0	4	SM	8 dB, BER= 10^{-12} 10 km (see Note 2)
IBM ESCON		200 Mbit/s	ESCON/SBC ON	0	3	SM	13 dB, BER= 10^{-15} 20 km (see Note 2)
SDH	STM-1 (I-1)	155.52 Mbit/s	STM-1	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-1 (S-1.1)	155.52 Mbit/s	STM-1	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
	STM-4 (I-4)	622.08 Mbit/s	STM-4	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-4 (S-4.1)	622.08 Mbit/s	STM-4	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
SONET	OC-1 (SR-1)	51.84 Mbit/s	OC-1	6	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 1)
	OC-3 (SR-1)	155.52 Mbit/s	OC-3	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-3 (IR-1)	155.52 Mbit/s	OC-3	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
	OC-12 (SR-1)	622.08 Mbit/s	OC-12	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (IR-1)	622.08 Mbit/s	OC-12	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)

Table 2-4 (continued)
Protocols supported by OCI 622 Mbit/s 1310 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
<p>Note 1: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.</p> <p>Note 2: The distance is estimated using the assumption of 0.5 dB/km installed fiber loss including splices and cable margins.</p> <p>Note 3: Contact Nortel Networks to obtain this information.</p> <p>Note 4: D1 Video is a serial digital video signal that is based on SMPTE 259M and CCIR #601, transmitted at 270 Mbit/s. Some D1 Video signals (as defined by SMPTE 259M) and test patterns may not be carried error-free by Optical Metro 5100/5200. In addition, some test patterns (for example, Matrix SDI) may not be carried error-free. This is a well-known limitation with the scrambling algorithm used by SMPTE and relates to the long time constants introduced by the scrambling algorithm itself. It is usually overcome by the D1 Video equipment vendors, which are using a second level of scrambling proprietary to the vendor. No standards exist at this time for the second level of scrambling.</p>						

Table 2-5
Protocols supported by OCI OC-48/STM-16 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ATM	OC-48 (SR)	2488.32 Mbit/s	OC-48 (STM-16)	3	0	SM	7 dB, BER= 10^{-10} 12 km (see Note)
	OC-48 (IR)	2488.32 Mbit/s	OC-48 (STM-16)	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note)
SDH	STM-16 (I-16)	2488.32 Mbit/s	STM-16	3	0	SM	7 dB, BER= 10^{-10} 12 km (see Note)
	STM-16 (S-16.1)	2488.32 Mbit/s	STM-16	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note)
SONET	OC-48 (SR-1)	2488.32 Mbit/s	OC-48	3	0	SM	7 dB, BER= 10^{-10} 12 km (see Note)
	OC-48 (IR-1)	2488.32 Mbit/s	OC-48	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note)
<p>Note: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.</p>							

Table 2-6
Protocols supported by OCI SONET/SDH 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ATM	OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-3 (IR)	155.52 Mbit/s	OC-3 (STM-1)	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (SR)	2488.32 Mbit/s	OC-48 (STM-16)	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (IR)	2488.32 Mbit/s	OC-48 (STM-16)	0	3	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
ESRM-250 (See Note 2)		2488.32 Mbit/s	ESRM-250	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)

Table 2-6 (continued)
Protocols supported by OCI SONET/SDH 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH	STM-1 (I-1)	155.52 Mbit/s	STM-1	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-1 (S-1.1)	155.52 Mbit/s	STM-1	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-4 (I-4)	622.08 Mbit/s	STM-4	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-4 (S-4.1)	622.08 Mbit/s	STM-4	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-16 (I-16)	2488.32 Mbit/s	STM-16	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-16 (S-16.1)	2488.32 Mbit/s	STM-16	0	3	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
SONET	OC-3 (SR-1)	155.52 Mbit/s	OC-3	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-3 (IR-1)	155.52 Mbit/s	OC-3	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (SR-1)	622.08 Mbit/s	OC-12	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (IR-1)	622.08 Mbit/s	OC-12	5	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (SR-1)	2488.32 Mbit/s	OC-48	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (IR-1)	2488.32 Mbit/s	OC-48	0	3	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)

Note 1: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 2: This protocol is used when implementing interoperable topologies with OCI SRM ESCON circuit packs. See "Implementing interoperable topologies with OCI SRM ESCON circuit packs" in *Network Planning and Link Engineering*, 323-1701-110.

Table 2-7
Protocols supported by OCI SONET/SDH IR 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ATM	OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-3 (IR)	155.52 Mbit/s	OC-3 (STM-1)	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (SR)	2488.32 Mbit/s	OC-48 (STM-16)	3	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (IR)	2488.32 Mbit/s	OC-48 (STM-16)	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
ESRM-250 (See Note 2)		2488.32 Mbit/s	ESRM-250	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
SDH	STM-1 (I-1)	155.52 Mbit/s	STM-1	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-1 (S-1.1)	155.52 Mbit/s	STM-1	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-4 (I-4)	622.08 Mbit/s	STM-4	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-4 (S-4.1)	622.08 Mbit/s	STM-4	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-16 (I-16)	2488.32 Mbit/s	STM-16	3	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-16 (S-16.1)	2488.32 Mbit/s	STM-16	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)

Table 2-7 (continued)
Protocols supported by OCI SONET/SDH IR 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SONET	OC-3 (SR-1)	155.52 Mbit/s	OC-3	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-3 (IR-1)	155.52 Mbit/s	OC-3	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (SR-1)	622.08 Mbit/s	OC-12	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (IR-1)	622.08 Mbit/s	OC-12	8	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (SR-1)	2488.32 Mbit/s	OC-48	3	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-48 (IR-1)	2488.32 Mbit/s	OC-48	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)

Note 1: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 2: This protocol is used when implementing interoperable topologies with OCI SRM ESCON circuit packs. See "Implementing interoperable topologies with OCI SRM ESCON circuit packs" in *Network Planning and Link Engineering*, 323-1701-110.

Table 2-8
Protocols supported by OCI 1.25 Gbit/s 850 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Fibre Channel	FC 100-M5-SN-I	1062 Mbit/s	FC-100	0	0	50 μ m MM 500 MHz*km	500 m, BER= 10^{-12}
	FC 100-M6-SN-I	1062 Mbit/s	FC-100	0	0	62.5 μ m MM 200 MHz*km	300 m, BER= 10^{-12}
FICON		1062 Mbit/s	FICON	0	0	50 μ m MM 500 MHz*km	500 m, BER= 10^{-12}
						62.5 μ m MM 200 MHz*km	300 m, BER= 10^{-12}

Table 2-8 (continued)
Protocols supported by OCI 1.25 Gbit/s 850 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
Gigabit Ethernet 1000Base-SX	1250 Mbit/s	Gigabit Ethernet	0	0	50 μ m MM 400 MHz*km	500 m, BER= 10^{-12}
					50 μ m MM 500 MHz*km	550 m, BER= 10^{-12}
					62.5 μ m MM 160 MHz*km	220 m, BER= 10^{-12}
					62.5 μ m MM 200 MHz*km	275 m, BER= 10^{-12}

Table 2-9
Protocols supported by OCI ISC 1310 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
ISC	1062 Mbit/s	ISC	0	0	SM	10 km, BER= 10^{-12}

Table 2-10
Protocols supported by OCI GbE 1310 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
Gigabit Ethernet 1000Base-LX	1250 Mbit/s	Gigabit Ethernet	0	0	SM	5 km, BER= 10^{-12}

Table 2-11
Protocols supported by OCI GbE 850 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
Gigabit Ethernet 1000Base-SX	1250 Mbit/s	Gigabit Ethernet	0	0	50 μm MM 400 MHz*km	500 m, BER=10 ⁻¹²
					50 μm MM 500 MHz*km	550 m, BER=10 ⁻¹²
					62.5 μm MM 160 MHz*km	220 m, BER=10 ⁻¹²
					62.5 μm MM 200 MHz*km	275 m, BER=10 ⁻¹²

Table 2-12
Protocols supported by OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach	
			Tx	Rx			
Async FOTS Nortel FMT-150	150 Mbit/s	Asynch FOTS 150M	(see Note 1)		SM	(see Note 1)	
ATM	OC-1 (SR)	51.84 Mbit/s	OC-1	7	0	62.5 μm MM	500 m (see Note 2 and Note 3)
	OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	0	0	SM	7 dB, BER=10 ⁻¹⁰ 12 km (see Note 5)
	OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	6	0	62.5 μm MM 500 MHz*km	2 km, BER=10 ⁻¹⁰ (see Note 2 and Note 3)
	OC-3 (IR)	155.52 Mbit/s	OC-3 (STM-1)	0	0	SM	12 dB, BER=10 ⁻¹⁰ 21 km (see Note 5)

Table 2-12 (continued)
Protocols supported by OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
D1 Video (See Note 6)	Internal Connection	270 Mbit/s	SDI Video (SMPTE 297M)	0	0	MM	2 km, BER= 10^{-12} (see Note 2 and Note 3)
	Short Haul Trunk Line	270 Mbit/s	SDI Video (SMPTE 297M)	0	0	SM	15 km, BER= 10^{-12}
	Long Haul Trunk Line	270 Mbit/s	SDI Video (SMPTE 297M)	2	0	SM	20 km, BER= 10^{-12}
DVB-ASI		270 Mbit/s	DVB-ASI	6	0	62.5 μ m MM 500 MHz*km	1.5 km, BER= 10^{-13} (see Note 2 and Note 3)
Fast Ethernet 100Base-FX		125 Mbit/s	Fast Ethernet	7	0	SM	7 dB, BER= 10^{-12} 14 km (see Note 7) for Category 1 to OCI, OCI to Category 1
				7	8		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 2
				6	0		7 dB, BER= 10^{-12} 14 km (see Note 7) for Category 1 to OCI, OCI to Category 2
				6	8		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 1
				6	0	62.5 μ m MM 500 MHz*km	7 dB, BER= 10^{-12} 2 km (see Note 2 , Note 3 and Note 8)

Table 2-12 (continued)

Protocols supported by OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
FDDI	125 Mbit/s	FDDI	7	0	SM	7 dB, BER= 10^{-12} 14 km (see Note 7) for Category 1 to OCI, OCI to Category 1
			7	8		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 2
			6	0		7 dB, BER= 10^{-12} 14 km (see Note 7) for Category 1 to OCI, OCI to Category 2
			6	8		23 dB, BER= 10^{-12} for Category 2 to OCI, OCI to Category 1
			6	0	62.5 μ m MM 500 MHz*km	7 dB, BER= 10^{-12} 2 km (see Note 2 , Note 3 and Note 8)

Table 2-12 (continued)
Protocols supported by OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Fibre Channel	FC 12-F6-LE-I	133 Mbit/s	FC-12	6	0	62.5 µm MM 500 MHz*km	5 dB, BER=10 ⁻¹² 1.5 km (see Note 2 and Note 3)
	FC 25-SM-LL-L	266 Mbit/s	FC-25	0	5	SM	14 dB, BER=10 ⁻¹² 10 km (see Note 7)
	FC 25-SM-LL-I	266 Mbit/s	FC-25	0	5	SM	3 dB, BER=10 ⁻¹² 2 km (see Note 7)
	FC 25-M6-LE-I	266 Mbit/s	FC-25	6	0	62.5 µm MM 500 MHz*km	6 dB, BER=10 ⁻¹² 1.5 km (see Note 2 and Note 3)
GLink		196.608 Mbit/s	GLink	(see Note 4)		SM	(see Note 4)
IBM ESCON		200 Mbit/s	ESCON/SBC ON	0	4	SM	13 dB, BER=10 ⁻¹⁵ 20 km (see Note 7)
				7	0	62.5 µm MM 500 MHz*km	5 dB, BER=10 ⁻¹⁵ 2 km (see Note 2 and Note 3)
						62.5 µm MM 800 MHz*km	5 dB, BER=10 ⁻¹⁵ 3 km (see Note 2 and Note 3)
						50 µm MM 800 MHz*km	5 dB, BER=10 ⁻¹⁵ 3 km (see Note 2 and Note 3)

Table 2-12 (continued)
Protocols supported by OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH	STM-1 (I-1)	155.52 Mbit/s	STM-1	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 5)
	STM-1 (S-1.1)	155.52 Mbit/s	STM-1	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 5)
SONET	OC-1 (SR-1)	51.84 Mbit/s	OC-1	6	0	SM	4 dB, BER= 10^{-10} 7 km (see Note 5)
	OC-3 (SR-1)	155.52 Mbit/s	OC-3	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 5)
	OC-3 (IR-1)	155.52 Mbit/s	OC-3	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 5)

Note 1: Contact Nortel Networks to obtain this information.

Note 2: A mode-conditioning patch cord or plug is required to guarantee error-free performance if the subtending equipment is not collocated with the Optical Metro 5100/5200. Collocated means less than 30 m (100 ft.) away.

Note 3: When using the OCI SRM 1310 nm LC circuit pack, more attenuation than that indicated in the "Attenuator value for colocation" column may be required if the patch cord connected at the faceplate connector is a multi-mode patch cord. This does not apply if the patch cord connected at the faceplate connector is the NT0H4385 patch cord or any other single mode patch cord.

Note 4: Not provided since this depends on the physical layer specifications of the subtending Glink equipment. Refer to [Table 2-2 on page 2-7](#) for the OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit pack specifications. Contact Nortel Networks if assistance is required.

Note 5: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 6: D1 Video is a serial digital video signal that is based on SMPTE 259M and CCIR #601, transmitted at 270 Mbit/s.

Some D1 Video signals (as defined by SMPTE 259M) and test patterns may not be carried error-free by Optical Metro 5100/5200. In addition, some test patterns (for example, Matrix SDI) may not be carried error-free. This is a well-known limitation with the scrambling algorithm used by SMPTE and relates to the long time constants introduced by the scrambling algorithm itself. It is usually overcome by the D1 Video equipment vendors, which are using a second level of scrambling proprietary to the vendor. No standards exist at this time for the second level of scrambling.

Note 7: The distance is estimated using the assumption of 0.5 dB/km installed fiber loss including splices and cable margins.

Note 8: The distance is estimated using the assumption of 1.5 dB/km installed fiber loss including splices and cable margins.

Table 2-13
Protocols supported by OCI SRM SONET/SDH 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ATM	OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 2)
	OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 2)
SDH	STM-4 (I-4)	622.08 Mbit/s	STM-4	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 2)
	STM-4 (S-4.1)	622.08 Mbit/s	STM-4	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 2)
SONET	OC-12 (SR-1)	622.08 Mbit/s	OC-12	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 2)
	OC-12 (IR-1)	622.08 Mbit/s	OC-12	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 2)

Note 1: If you use a SONET/SDH SRM OCI circuit pack, make sure that the four OC-12/STM-4 source signals come from a single SONET/SDH transport product that can be configured for either BITS synchronization or line timing. You cannot connect the OC-12/STM-4 signals to a SONET/SDH SRM OCI from a source that cannot function as a SONET/SDH transport product. The four OC-12/STM-4 source traffic signals that connect to the SONET/SDH SRM OCI must be synchronized to a single internal clock source.

Note 2: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Table 2-14
Protocols supported by OCI SRM ESCON circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
IBM ESCON		200 Mbit/s	ESCON/SBC ON	0	0	50 μ m MM 800 MHz*km	8 dB, BER= 10^{-15} 3 km
						62.5 μ m MM 500 MHz*km	8 dB, BER= 10^{-15} 2 km
						62.5 μ m MM 800 MHz*km	8 dB, BER= 10^{-15} 3 km

Table 2-15

Protocols supported by OCI SRM GbE/FC 1310 nm and OCI SRM GbE/FC Enhanced 1310 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Fibre Channel	FC 100-SM-LC-L	1.0625 Gbit/s	FC-100	0	0	SM	10 km, BER= 10^{-12}
FICON		1.0625 Gbit/s	FICON	0	0	SM	10 km, BER= 10^{-12}
Gigabit Ethernet 1000Base-LX		1.25 Gbit/s	Gigabit Ethernet	0	0	SM	5 km, BER= 10^{-12}
						50 μ m MM 400 MHz*km	550 m, BER= 10^{-12} (see Note)
						50 μ m MM 500 MHz*km	
						62.5 μ m MM 500 MHz*km	

Note: A mode-conditioning patch cord or plug is required to guarantee error-free performance if the subtending equipment is not collocated with the Optical Metro 5100/5200. Collocated means less than 30 m (100 ft.) away.

Table 2-16

Protocols supported by OCI SRM GbE/FC 850 nm and OCI SRM GbE/FC Enhanced 850 nm circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Fibre Channel	FC 100-M5-SN-I	1.0625 Gbit/s	FC-100	0	0	50 μ m MM 500 MHz*km	500 m, BER= 10^{-12}
	FC 100-M6-SN-I	1.0625 Gbit/s	FC-100	0	0	62.5 μ m MM 200 MHz*km	300 m, BER= 10^{-12}
FICON		1.0625 Gbit/s	FICON	0	0	50 μ m MM 500 MHz*km	500 m, BER= 10^{-12}
						62.5 μ m MM 200 MHz*km	300 m, BER= 10^{-12}

Table 2-16 (continued)

Protocols supported by OCI SRM GbE/FC 850 nm and OCI SRM GbE/FC Enhanced 850 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
Gigabit Ethernet 1000Base-SX	1250 Mbit/s	Gigabit Ethernet	0	0	50 μm MM 400 MHz*km	500 m, BER= 10^{-12}
					50 μm MM 500 MHz*km	550 m, BER= 10^{-12}
					62.5 μm MM 160 MHz*km	220 m, BER= 10^{-12}
					62.5 μm MM 200 MHz*km	275 m, BER= 10^{-12}

Table 2-17

Protocols supported by OCI SRM GbE 1310 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
Gigabit Ethernet 1000Base-LX	1.25 Gbit/s	Gigabit Ethernet	0	0	SM	5 km, BER= 10^{-12}
					50 μm MM 400 MHz*km	550 m, BER= 10^{-12} (see Note)
					50 μm MM 500 MHz*km	
					62.5 μm MM 500 MHz*km	

Note: A mode-conditioning patch cord or plug is required to guarantee error-free performance if the subtending equipment is not collocated with the Optical Metro 5100/5200. Collocated means less than 30 m (100 ft.) away.

Table 2-18
Protocols supported by OCI SRM GbE 850 nm circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
			Tx	Rx		
Gigabit Ethernet 1000Base-SX	1250 Mbit/s	Gigabit Ethernet	0	0	50 μ m MM 400 MHz*km	500 m, BER= 10^{-12}
					50 μ m MM 500 MHz*km	550 m, BER= 10^{-12}
					62.5 μ m MM 160 MHz*km	220 m, BER= 10^{-12}
					62.5 μ m MM 200 MHz*km	275 m, BER= 10^{-12}

Table 2-19
Protocols supported by OCI SRM SONET/SDH LTE circuit packs

Protocol	Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach	
			Tx	Rx			
ATM	OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
				6	0	62.5 μ m MM 500 MHz*km	2 km, BER= 10^{-10} (see Note 2 and Note 3)
	OC-3 (IR)	155.52 Mbit/s	OC-3 (STM-1)	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
				OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	0
	6	0	62.5 μ m MM 500 MHz*km				500 m, BER= 10^{-10} (see Note 2 and Note 3)
	6	0	50 μ m MM 500 MHz*km				500 m, BER= 10^{-10} (see Note 2 and Note 3)
OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)	

Table 2-19 (continued)
Protocols supported by OCI SRM SONET/SDH LTE circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH	STM-1 (I-1)	155.52 Mbit/s	STM-1	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-1 (S-1.1)	155.52 Mbit/s	STM-1	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
	STM-1 (S-1.2)	155.52 Mbit/s	STM-1	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 4)
	STM-4 (I-4)	622.08 Mbit/s	STM-4	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	STM-4 (S-4.1)	622.08 Mbit/s	STM-4	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
	STM-4 (S-4.2)	622.08 Mbit/s	STM-4	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 4)

Table 2-19 (continued)
Protocols supported by OCI SRM SONET/SDH LTE circuit packs

Protocol		Bit rate	System Manager menu item	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SONET	OC-3 (SR-1)	155.52 Mbit/s	OC-3	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-3 (IR-1)	155.52 Mbit/s	OC-3	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
	OC-3 (IR-2)	155.52 Mbit/s	OC-3	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 4)
	OC-12 (SR-1)	622.08 Mbit/s	OC-12	0	0	SM	7 dB, BER= 10^{-10} 12 km (see Note 1)
	OC-12 (IR-1)	622.08 Mbit/s	OC-12	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 1)
	OC-12 (IR-2)	622.08 Mbit/s	OC-12	0	0	SM	12 dB, BER= 10^{-10} 21 km (see Note 4)

Note 1: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 2: A mode-conditioning patch cord or plug is required to guarantee error-free performance if the subtending equipment is not collocated with the Optical Metro 5100/5200. Colocated means less than 30 m (100 ft.) away.

Note 3: More attenuation than that indicated in the “Attenuator value for colocation” column may be required if the patch cord connected at the faceplate connector is a multi-mode patch cord.

Note 4: For these protocols, the OCI SRM SONET/SDH LTE will receive 1550 nm signals but will only transmit at 1310 nm. You must ensure that the subtending equipment can receive a 1310 nm signal. The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and connectors for the 1310 nm link and 0.275 dB/km installed fiber loss including splices and connectors for the 1550 nm link.

OCI/OCLD pairing per protocol and supported PMs for each pairing

Table 2-20 lists the OCI and OCLD pairing required to support each protocol and the supported PMs for each pairing.

Table 2-20
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
Async FOTS Nortel FMT-150		150 Mbit/s	SM	Asynch FOTS 150M	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
Async FOTS Nortel FD-565		570 Mbit/s	SM	Asynch FOTS 565M	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
ATM	OC-1 (SR)	51.84 Mbit/s	MM (62.5 μm)	OC-1	<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
ATM (cont'd)	OC-3 (SR)	155 Mbit/s	SM	OC-3 (STM-1)	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
					<ul style="list-style-type: none"> OCI SONET/SDH 1310 nm OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD		
OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)					

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
ATM (cont'd)	OC-3 (SR)	155 Mbit/s	MM (62.5 μm)	OC-3 (STM-1)	• OCI SRM 1310 nm	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					• OCI SRM 1310 nm LC	2.5G Flex OCLD, 2.5G Uni OCLD		
					OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)
	OC-3 (IR)	155 Mbit/s	SM	OC-3 (STM-1)	• OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					• OCI 622 Mbit/s 1310 nm	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					• OCI SRM 1310 nm	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					• OCI SRM 1310 nm LC	2.5G Flex OCLD, 2.5G Uni OCLD		
					• OCI SONET/SDH 1310 nm	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
					• OCI SONET/SDH IR 1310 nm	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	
					OCI SRM SONET/SDH LTE	2.5G Flex OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
ATM (cont'd)	OC-12 (SR)	622.08 Mbit/s	SM	OC-12 (STM-4)	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> • OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	
			OCI SRM SONET/SDH 1310 nm (See Note 3)	2.5G OCLD	SONET/SDH on SRM OCI and SFC on OCLD	Yes on OCLD (None on OCI)		
				2.5G Flex OCLD, 2.5G Uni OCLD				
			OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)		
			MM (62.5 and 50 μm)	OC-12 (STM-4)				OCI SRM SONET/SDH LTE
OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD						Yes on OCLD (None on OCI)
		2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI					

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
ATM (cont'd)	OC-12 (IR)	622.08 Mbit/s	SM	OC-12 (STM-4)	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> • OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	
					OCI SRM SONET/SDH 1310 nm (See Note 3)	2.5G OCLD	SONET/SDH on SRM OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)					

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)	
ATM (cont'd)	OC-48 (SR)	2488.32 Mbit/s	SM	OC-48 (STM-16)	OCI OC-48/STM-16 1310 nm	2.5G OCLD	SFC on OCI and OCLD	Yes on OCI and OCLD	
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI		
					• OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD		Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD		
	OC-48 (IR)	2488.32 Mbit/s	SM	OC-48 (STM-16)	OCI OC-48/STM-16 1310 nm	2.5G OCLD	SFC on OCI and OCLD	Yes on OCI and OCLD	
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI		
					• OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD		Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
D1 Video Short Haul Trunk Line Long Haul Trunk Line (See Note 4)	270 Mbit/s	SM	SDI Video (SMPTE 297M)	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
				<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
D1 Video Internal Connection (See Note 4)	270 Mbit/s	MM	SDI Video (SMPTE 297M)	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
				<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
DVB-ASI	270 Mbit/s	MM	DVB-ASI	<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
ESRM-250 (See Note 8)	2488.32 Mbit/s	SM	ESRM-250	<ul style="list-style-type: none"> OCI SONET/SDH 1310 nm OCI SONET/SDH IR 1310 nm 	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
					2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)		
ETR/CLO (See Note 5)	16 Mbit/s	MM (62.5 μm)	ETR/CLO	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)		
					2.5G Flex OCLD, 2.5G Uni OCLD				
Fast Ethernet 100Base-FX	125 Mbit/s	SM	Fast Ethernet	• OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)		
					2.5G Flex OCLD, 2.5G Uni OCLD				
				• OCI SRM 1310 nm • OCI SRM 1310 nm LC	1.25G OCLD			Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD				
		MM (62.5 μm)	Fast Ethernet	• OCI SRM 1310 nm • OCI SRM 1310 nm LC	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)		
					2.5G Flex OCLD, 2.5G Uni OCLD				
				OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)		
					2.5G Flex OCLD, 2.5G Uni OCLD				

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
FDDI (Note: Only unprotected channel assignments supported with the OCI 1.25 Gbit/s 1310 nm and the OCI 622 Mbit/s 1310 nm. Both unprotected and protected channel assignments supported with the OCI SRM 1310 nm and the OCI SRM 1310 nm LC).	125 Mbit/s	SM	FDDI	• OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
				• OCI 622 Mbit/s 1310 nm	2.5G Flex OCLD, 2.5G Uni OCLD		
				• OCI SRM 1310 nm	1.25G OCLD		
		• OCI SRM 1310 nm LC	2.5G Flex OCLD, 2.5G Uni OCLD				
		MM (62.5 μm)	FDDI	• OCI SRM 1310 nm	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
				• OCI SRM 1310 nm LC	2.5G Flex OCLD, 2.5G Uni OCLD		
OCI 1.25 Gbit/s 1310 nm	1.25G OCLD			SFC on OCI and OCLD	Yes on OCLD (None on OCI)		
	2.5G Flex OCLD, 2.5G Uni OCLD						
Fibre Channel FC 12-F6-LE-I	133 Mbit/s	MM (62.5 μm)	FC-12	• OCI SRM 1310 nm	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
				• OCI SRM 1310 nm LC	2.5G Flex OCLD, 2.5G Uni OCLD		
				OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
Fibre Channel FC 25-SM-LL-I FC 25-SM-LL-L	266 Mbit/s	SM	FC-25	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
				<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
Fibre Channel FC 25-M6-LE-I	266 Mbit/s	MM (62.5 μ m)	FC-25	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
				<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
Fibre Channel FC 50-SM-LL-L	531 Mbit/s	SM	FC-50	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
Fibre Channel FC 100-SM-LC-L	1062 Mbit/s	SM	FC-100	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				<ul style="list-style-type: none"> • OCI SRM GbE/FC 1310 nm • OCI SRM GbE/FC Enhanced 1310 nm 	2.5G Flex OCLD, 2.5G Uni OCLD	<ul style="list-style-type: none"> • SONET/ SDH on OCLD, 8B10BWAN and SONET/ SDH on OCI • LAN/WAN OMs on OCI 	Yes on OCLD (None on OCI)
Fibre Channel FC 100-M5-SN-I FC 100-M6-SN-I	1062 Mbit/s	MM (50/ 62.5 µm)	FC-100	OCI 1.25 Gbit/s 850 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				<ul style="list-style-type: none"> • OCI SRM GbE/FC 850 nm • OCI SRM GbE/FC Enhanced 850 nm 	2.5G Flex OCLD, 2.5G Uni OCLD	<ul style="list-style-type: none"> • SONET/ SDH on OCLD, 8B10BWAN and SONET/ SDH on OCI • LAN/WAN OMs on OCI 	Yes on OCLD (None on OCI)

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
FICON	1062 Mbit/s	SM	FICON	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				<ul style="list-style-type: none"> • OCI SRM GbE/FC 1310 nm • OCI SRM GbE/FC Enhanced 1310 nm 	2.5G Flex OCLD, 2.5G Uni OCLD	<ul style="list-style-type: none"> • SONET/SDH on OCLD, 8B10BWAN and SONET/SDH on OCI • LAN/WAN OMs on OCI 	Yes on OCLD (None on OCI)
	1062 Mbit/s	MM (50/62.5 μm)	FICON	OCI 1.25 Gbit/s 850 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				<ul style="list-style-type: none"> • OCI SRM GbE/FC 850 nm • OCI SRM GbE/FC Enhanced 850 nm 	2.5G Flex OCLD, 2.5G Uni OCLD	<ul style="list-style-type: none"> • SONET/SDH on OCLD, 8B10BWAN and SONET/SDH on OCI • LAN/WAN OMs on OCI 	Yes on OCLD (None on OCI)

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
Gigabit Ethernet 1000Base-LX	1250 Mbit/s	SM	Gigabit Ethernet	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				OCI GbE 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCI and OCLD
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				<ul style="list-style-type: none"> • OCI SRM GbE/FC 1310 nm • OCI SRM GbE/FC Enhanced 1310 nm • OCI SRM GbE 1310 nm 	2.5G Flex OCLD, 2.5G Uni OCLD	<ul style="list-style-type: none"> • SONET/SDH on OCLD, GigE and SONET/SDH on OCI • LAN/WAN OMs on OCI 	Yes on OCLD (None on OCI)
Gigabit Ethernet 1000Base-LX (See Note 6)	1250 Mbit/s	MM (50/62.5 μm)	Gigabit Ethernet	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				<ul style="list-style-type: none"> • OCI SRM GbE/FC 1310 nm • OCI SRM GbE/FC Enhanced 1310 nm • OCI SRM GbE 1310 nm 	2.5G Flex OCLD, 2.5G Uni OCLD	<ul style="list-style-type: none"> • SONET/SDH on OCLD, GigE and SONET/SDH on OCI • LAN/WAN OMs on OCI 	Yes on OCLD (None on OCI)

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
Gigabit Ethernet 1000Base-SX	1250 Mbit/s	MM (50/62.5 μm)	Gigabit Ethernet	OCI 1.25 Gbit/s 850 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				OCI GbE 850 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCI (Rx only) and OCLD
					2.5G Flex OCLD, 2.5G Uni OCLD	8B/10B on OCLD and SFC on OCI	
				<ul style="list-style-type: none"> • OCI SRM GbE/FC 850 nm • OCI SRM GbE/FC Enhanced 850 nm • OCI SRM GbE 850 nm 	2.5G Flex OCLD, 2.5G Uni OCLD	<ul style="list-style-type: none"> • SONET/SDH on OCLD, GigE and SONET/SDH on OCI • LAN/WAN OMs on OCI 	Yes on OCLD (None on OCI)
GLink	196.608 Mbit/s	SM	GLink	<ul style="list-style-type: none"> • OCI SRM 1310 nm • OCI SRM 1310 nm LC 	2.5G Flex OCLD, 2.5G Uni OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
IBM ESCON	200 Mbit/s	SM	ESCON/S BCON	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
				<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
		MM (50/62.5 μm)	ESCON/S BCON	<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
				OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		
				OCI SRM ESCON	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD, 8B/10B and SONET/SDH on OCI	Yes on OCLD (None on OCI)
ISC	1062 Mbit/s	SM	ISC	OCI ISC 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					2.5G Flex OCLD, 2.5G Uni OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SDH	STM-1 (I-1)	155.52 Mbit/s	SM	STM-1	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> OCI SRM 1310 nm OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
					<ul style="list-style-type: none"> OCI SONET/SDH 1310 nm OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD		
OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)					

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SDH (cont'd)	STM-1 (S-1.1)	155.52 Mbit/s	SM	STM-1	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> • OCI SRM 1310 nm • OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
<ul style="list-style-type: none"> • OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD					
	2.5G Flex OCLD, 2.5G Uni OCLD			SONET/SDH on OCI and OCLD				
	STM-1 (S-1.1 and S-1.2)	155.52 Mbit/s	SM	STM-1	OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SDH (cont'd)	STM-4 (I-4)	622.08 Mbit/s	SM	STM-4	<ul style="list-style-type: none"> OCI 1.25 Gbit/s 1310 nm OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> OCI SONET/SDH 1310 nm OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	
					OCI SRM SONET/SDH 1310 nm (See Note 3)	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)					

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SDH (cont'd)	STM-4 (S-4.1)	622.08 Mbit/s	SM	STM-4	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> • OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	
	OCI SRM SONET/SDH 1310 nm (See Note 3)	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCLD (None on OCI)				
	2.5G Flex OCLD, 2.5G Uni OCLD							
	STM-4 (S-4.1 and S-4.2)	622.08 Mbit/s	SM	STM-4	OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCLD (None on OCI)

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)	
SDH (cont'd)	STM-16 (I-16)	2488.32 Mbit/s	SM	STM-16	OCI OC-48/STM-16 1310 nm	2.5G OCLD	SFC on OCI and OCLD	Yes on OCI and OCLD	
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI		
					• OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD		Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD		
	STM-16 (S-16.1)	2488.32 Mbit/s	SM	STM-16	OCI OC-48/STM-16 1310 nm	2.5G OCLD	SFC on OCI and OCLD	Yes on OCI and OCLD	
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI		
					• OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD		Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SONET	OC-1 (SR-1)	51.84 Mbit/s	SM	OC-1	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm • OCI SRM 1310 nm • OCI SRM 1310 nm LC 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
						1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SONET (con't)	OC-3 (SR-1)	155.52 Mbit/s	SM	OC-3	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> • OCI SRM 1310 nm • OCI SRM 1310 nm LC 	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
					<ul style="list-style-type: none"> • OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD		
OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCI and OCLD					

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SONET (con't)	OC-3 (IR-1)	155.52 Mbit/s	SM	OC-3	• OCI 1.25 Gbit/s 1310 nm	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
					• OCI 622 Mbit/s 1310 nm	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					• OCI SRM 1310 nm	1.25G OCLD	Agile and SFC on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
					• OCI SRM 1310 nm LC	2.5G Flex OCLD, 2.5G Uni OCLD		
• OCI SONET/SDH 1310 nm	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD					
• OCI SONET/SDH IR 1310 nm	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD						
	OC-3 (IR-1 and IR-2)	155.52 Mbit/s	SM	OC-3	OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCI and OCLD

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SONET (cont'd)	OC-12 (SR-1)	622.08 Mbit/s	SM	OC-12	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> • OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	
					OCI SRM SONET/SDH 1310 nm (See Note 3)	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD		
OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCI and OCLD					

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SONET (cont'd)	OC-12 (IR-1)	622.08 Mbit/s	SM	OC-12	<ul style="list-style-type: none"> • OCI 1.25 Gbit/s 1310 nm • OCI 622 Mbit/s 1310 nm 	1.25G OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI	
					<ul style="list-style-type: none"> • OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm 	1.25G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	
	OCI SRM SONET/SDH 1310 nm (See Note 3)	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCLD (None on OCI)				
	2.5G Flex OCLD, 2.5G Uni OCLD							
	OC-12 (IR-1 and IR-2)	622.08 Mbit/s	SM	OC-12	OCI SRM SONET/SDH LTE	2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD	Yes on OCI and OCLD

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol		Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)	
SONET (cont'd)	OC-48 (SR-1)	2488.32 Mbit/s	SM	OC-48	OCI OC-48/STM-16 1310 nm	2.5G OCLD	SFC on OCI and OCLD	Yes on OCI and OCLD	
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI		
					• OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD		Yes on OCI and OCLD
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD		
	OC-48 (IR-1)	2488.32 Mbit/s	SM	OC-48	OCI OC-48/STM-16 1310 nm	2.5G OCLD	SFC on OCI and OCLD	Yes on OCI and OCLD	
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCLD and SFC on OCI		
					• OCI SONET/SDH 1310 nm • OCI SONET/SDH IR 1310 nm	2.5G OCLD	SONET/SDH on OCI and SFC on OCLD	Yes on OCI and OCLD	
						2.5G Flex OCLD, 2.5G Uni OCLD	SONET/SDH on OCI and OCLD		

Table 2-20 (continued)
OCI/OCLD protocols, circuit pack compatibility, and supported PMs

Protocol	Bit rate	Fiber type	System Manager menu item	OCI circuit packs	OCLD circuit packs	Facility PMs (see Note 1 and Note 2)	Equipment PMs (see Note 1 and Note 2)
SRM-125 (See Note 7)	1250 Mbit/s	SM	SRM-125	OCI 1.25 Gbit/s 1310 nm	1.25G OCLD 2.5G Flex OCLD, 2.5G Uni OCLD	SFC on OCI and OCLD	Yes on OCLD (None on OCI)

Note 1: PMs that are indicated as available on OCI refer to the client side. PMs that are indicated as available on OCLD refer to the line side.

Note 2: For a description of available performance parameters see “[Performance monitoring description](#)” in *Software and User Interface 323-1701-101*.

Note 3: If you use a SONET/SDH SRM OCI circuit pack, make sure that the four OC-12/STM-4 source signals come from a single SONET/SDH transport product that can be configured for either BITS synchronization or line timing. You cannot connect the OC-12/STM-4 signals to a SONET/SDH SRM OCI from a source that cannot function as a SONET/SDH transport product. The four OC-12/STM-4 source traffic signals that connect to the SONET/SDH SRM OCI must be synchronized to a single internal clock source.

Note 4: D1 Video is a serial digital video signal that is based on SMPTE 259M and CCIR #601, transmitted at 270 Mbit/s.

Some D1 Video signals (as defined by SMPTE 259M) and test patterns may not be carried error-free by Optical Metro 5100/5200. In addition, some test patterns (for example, Matrix SDI) may not be carried error-free. This is a well-known limitation with the scrambling algorithm used by SMPTE and relates to the long time constants introduced by the scrambling algorithm itself. It is usually overcome by the D1 Video equipment vendors, which are using a second level of scrambling proprietary to the vendor. No standards exist at this time for the second level of scrambling.

Note 5: Optical Metro 5100/5200 supports ETR/CLO at 8 Mbit/s Manchester encoded (16 Mbit/s), which is outside the nominal range of bit rates. Because of the nature of the traffic type, there is no protected connection for ETR/CLO.

Note 6: Mode conditioning patchcord is required to guarantee error-free performance when using multimode fiber.

Note 7: This protocol is used when implementing interoperable topologies with OCI SRM circuit packs. See “[Implementing interoperable topologies with OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs](#)” in *Network Planning and Link Engineering, 323-1701-110*.

Note 8: This protocol is used when implementing interoperable topologies with OCI SRM ESCON circuit packs. See “[Implementing interoperable topologies with OCI SRM ESCON circuit packs](#)” in *Network Planning and Link Engineering, 323-1701-110*.

Optical power threshold values

Table 2-21 lists the alarms raised by a circuit pack when an optical power threshold is crossed.

Table 2-21
Mapping of optical power thresholds to alarms

Threshold	Alarm raised when Degrade Threshold is crossed	Alarm raised when Fail Threshold is crossed (see Note)	Alarm raised when Default User Threshold is crossed
Rx Power High	High Optical Power warning	High Optical Power	TCA - Optical Power Rx High
Rx Power Low	Low Optical Power warning	Loss of Signal	TCA - Optical Power Rx Low
Tx Power High	Transceiver Degrade	Circuit Pack Fail	TCA - Optical Power Rx High
Tx Power Low	Transceiver Degrade	Circuit Pack Fail	TCA - Optical Power Rx Low

Note: Traffic continuity is lost when the Fail Threshold is crossed.

Table 2-22 lists the optical power threshold values for OCI circuit packs that support optical power monitoring. If the value is within the ranges listed in the table, a threshold crossing alarm is raised. For a list of alarms raised when optical power thresholds are crossed, see Table 2-21.

The following circuit packs do not support optical power level performance monitoring:

- OCI 622 Mbit/s 1310 nm
- OCI 1.25 Gbit/s 1310 nm
- OCI ISC 1310 nm
- OCI SRM 1310 nm
- OCI SRM 1310 nm LC
- OCI SRM SONET/SDH 1310 nm
- OCI SRM ESCON 1310 nm
- OCI SRM GbE/FC 1310 nm
- OCI SRM GbE/FC 850 nm
- OCI SRM GbE/FC Enhanced 1310 nm
- OCI SRM GbE/FC Enhanced 850 nm
- OCI SRM GbE 1310 nm
- OCI SRM GbE 850 nm

- OCI SRM SONET/SDH LTE

Table 2-22
OCI optical power threshold values for alarming

OCI Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
OCI OC-48/STM-16 (See Note)	Rx Power High	-0.50	0.00	1.00	-0.50
	Rx Power Low	-18.00	-18.50	-19.00	-17.50
	Tx Power High	0.40	0.50	0.60	0.40
	Tx Power Low	-0.40	-0.50	-0.60	-0.40
OCI GbE 1310 nm	Rx Power High	not supported	not supported	not supported	not supported
	Rx Power Low (NT0H20CN Hardware Version 03 and lower)	-16.50	-17.00	-18.50	-16.00
	Rx Power Low (NT0H20CN Hardware Version 04 and higher)	-18.00	-18.50	-19.50	-17.50
	Tx Power High	not supported	not supported	not supported	not supported
	Tx Power Low	not supported	not supported	not supported	not supported
OCI GbE 850 nm	Rx Power High	not supported	not supported	not supported	not supported
	Rx Power Low	-18.00	-18.50	-19.50	-18.00
	Tx Power High	not supported	not supported	not supported	not supported
	Tx Power Low	not supported	not supported	not supported	not supported

Table 2-22 (continued)
OCI optical power threshold values for alarming

OCI Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
OCI SONET/SDH IR provisioned to carry OC-3/STM-1 (See Note)	Rx Power High (NT0H10HK Hardware Version 04 and lower)	-0.50	0.00	0.30	-0.50
	Rx Power High (NT0H10HK Hardware Version 05 and higher)	-0.50	0.00	1.00	-1.00
	Rx Power Low	-22.50	-23.00	-24.00	-22.00
	Tx Power High	0.40	0.50	1.50	-0.50
	Tx Power Low	-5.40	-5.50	-6.50	-5.00
OCI SONET/SDH IR provisioned to carry OC-12/STM-4 (See Note)	Rx Power High (NT0H10HK Hardware Version 04 and lower)	-0.50	0.00	0.30	-0.50
	Rx Power High (NT0H10HK Hardware Version 05 and higher)	-0.50	0.00	1.00	-1.00
	Rx Power Low	-22.50	-23.00	-24.00	-22.00
	Tx Power High	0.40	0.50	1.50	-0.50
	Tx Power Low	-5.40	- 5.50	-6.50	-5.00

Table 2-22 (continued)
OCI optical power threshold values for alarming

OCI Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
OCI SONET/SDH IR provisioned to carry OC-48/STM-16 (See Note)	Rx Power High (NT0H10HK Hardware Version 04 and lower)	-0.50	0.00	0.30	-0.50
	Rx Power High (NT0H10HK Hardware Version 05 and higher)	-0.50	0.00	1.00	-1.00
	Rx Power Low	-19.50	-20.00	-21.00	-19.00
	Tx Power High	0.40	0.50	1.50	-0.50
	Tx Power Low	-5.40	-5.50	-6.50	-5.00
OCI SONET/SDH provisioned to carry OC-3/STM-1 (See Note)	Rx Power High	-8.00	-7.50	-6.50	-8.50
	Rx Power Low	-23.00	-23.50	-24.50	-22.50
	Tx Power High	-2.60	-2.50	-1.50	-3.50
	Tx Power Low	-10.40	-10.50	-11.50	-9.50
OCI SONET/SDH provisioned to carry OC-12/STM-4 (See Note)	Rx Power High	-8.00	-7.50	-6.50	-8.50
	Rx Power Low	-23.00	-23.50	-24.50	-22.50
	Tx Power High	-2.60	-2.50	-1.50	-3.50
	Tx Power Low	-10.40	-10.50	-11.50	-9.50
OCI SONET/SDH provisioned to carry OC-48/STM-16 (See Note)	Rx Power High	-3.00	-2.50	-1.50	-3.50
	Rx Power Low	-18.00	-18.50	-19.50	-17.50
	Tx Power High	-2.60	-2.50	-1.50	-3.50
	Tx Power Low	-10.40	-10.50	-11.50	-9.50
Note: For power monitor accuracy, see Table 2-1 on page 2-2 .					

OCLD circuit pack

- [Technical specifications on page 2-70](#)
- [Optical power threshold values on page 2-75](#)
- [Center wavelength frequencies on page 2-76](#)



CAUTION

Risk of equipment damage

Damage to the receiver (Rx) of the Flex OCLD circuit pack can occur. Under no circumstances should the transmitter (Tx) be loop-backed directly to the receiver (Rx).

Technical specifications

[Table 2-23](#) lists the OCLD circuit pack specifications.

Table 2-23
OCLD circuit pack specifications

Characteristic	Value or range	
	Typical	Maximum
Power consumption		
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 1.25 Gbit/s CWDM OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s CWDM	21 W	28 W
OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Flex 100 GHz OCLD 2.5 Gbit/s Flex CWDM OCLD 2.5 Gbit/s Flex ITU CWDM OCLD 2.5 Gbit/s Universal	16 W	22 W
Bit rates	Minimum	Maximum
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 1.25 Gbit/s CWDM	16 Mbit/s (See Note 1)	1.25 Gbit/s
OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s CWDM	2.48832 Gbit/s	2.48832 Gbit/s

Table 2-23 (continued)
OCLD circuit pack specifications

Characteristic	Value or range			
	OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Flex 100 GHz OCLD 2.5 Gbit/s Flex CWDM OCLD 2.5 Gbit/s Flex ITU CWDM OCLD 2.5 Gbit/s Universal	16 Mbit/s (See Note 1)	2.48832 Gbit/s	
Tx power	Typical	Minimum	Maximum	
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 1.25 Gbit/s CWDM	0.5 dBm	0.0 dBm	1.0 dBm	
OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s CWDM	3.5 dBm	3.0 dBm	4.0 dBm	
OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Flex 100 GHz OCLD 2.5 Gbit/s Flex CWDM OCLD 2.5 Gbit/s Flex ITU CWDM OCLD 2.5 Gbit/s Universal	3.5 dBm	2.8 dBm	4.2 dBm	
Rx power (see Note 2 and Note 4)	Minimum Sensitivity at BER = 10⁻¹²		Minimum Overload at BER = 10⁻¹²	Damage Level
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 1.25 Gbit/s CWDM	-29.7 dBm		-3.0 dBm	+3.5 dBm
OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s CWDM	-25.8 dBm		-3.0 dBm	+3.5 dBm
OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Flex 100 GHz OCLD 2.5 Gbit/s Flex CWDM OCLD 2.5 Gbit/s Flex ITU CWDM OCLD 2.5 Gbit/s Universal	-27.5 dBm		-5.0 dBm (see Note 3)	-2.0 dBm

Table 2-23 (continued)
OCLD circuit pack specifications

Characteristic	Value or range	
	Minimum	Maximum
Rx wavelength		
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 1.25 Gbit/s CWDM OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s CWDM OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Flex 100 GHz OCLD 2.5 Gbit/s Flex CWDM OCLD 2.5 Gbit/s Universal	1500 nm	1610 nm
OCLD 2.5 Gbit/s Flex ITU CWDM	1464.5 nm	1617.5 nm
Tx Center wavelength		
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Universal	see Table 2-25 on page 2-76	
OCLD 2.5 Gbit/s Flex 100 GHz	see Table 2-26 on page 2-76	
OCLD 1.25 Gbit/s CWDM OCLD 2.5 Gbit/s CWDM OCLD 2.5 Gbit/s Flex CWDM	see Table 2-27 on page 2-77	
OCLD 2.5 Gbit/s Flex ITU CWDM	see Table 2-28 on page 2-77	

Table 2-23 (continued)
OCLD circuit pack specifications

Characteristic	Value or range
Tx wavelength tolerance	
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Universal	± 0.25 nm
OCLD 2.5 Gbit/s Flex 100 GHz	± 0.08 nm
OCLD 1.25 Gbit/s CWDM OCLD 2.5 Gbit/s CWDM OCLD 2.5 Gbit/s Flex CWDM	± 0.25 nm
OCLD 2.5 Gbit/s Flex ITU CWDM	± 6.5 nm
Dispersion reach limit (NDSF)	
OCLD 1.25 Gbit/s OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Flex	110 km
OCLD 2.5 Gbit/s Flex 100 GHz	200 km
OCLD 1.25 Gbit/s Extended Reach OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s Flex Extended Reach	175 km
OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Universal	350 km for C-band and 200 km for L-band
OCLD 1.25 Gbit/s CWDM OCLD 2.5 Gbit/s CWDM OCLD 2.5 Gbit/s Flex CWDM OCLD 2.5 Gbit/s Flex ITU CWDM	80 km

Table 2-23 (continued)
OCLD circuit pack specifications

Characteristic	Value or range	
	TX	RX
Optical power monitor accuracy (See Note 5)		
OCLD 1.25 Gbit/s OCLD 1.25 Gbit/s Extended Reach OCLD 1.25 Gbit/s CWDM OCLD 2.5 Gbit/s OCLD 2.5 Gbit/s Extended Reach OCLD 2.5 Gbit/s CWDM OCLD 2.5 Gbit/s Flex OCLD 2.5 Gbit/s Flex Extended Reach OCLD 2.5 Gbit/s Flex Extended Metro OCLD 2.5 Gbit/s Flex 100 GHz OCLD 2.5 Gbit/s Flex CWDM OCLD 2.5 Gbit/s Flex ITU CWDM OCLD 2.5 Gbit/s Universal	± 1.2 dB	± 1.5 dB
<p>Note 1: ETR/CLO at 8 Mbit/s Manchester encoded (16 Mbit/s) is supported outside nominal range of bit rates for Optical Metro 5100/5200 because of the nature of the traffic type.</p> <p>Note 2: Rx overload and Rx sensitivity specifications are back-to-back and include no path penalties. The Network Modeling Tool (NMT) should be used to account for path penalties. If NMT is not used to design the network:</p> <ul style="list-style-type: none"> • For Rx sensitivity path penalties, see “Link engineering rules” in <i>Network Planning and Link Engineering</i>, 323-1701-110. • For OCLD 2.5 Gbit/s Flex 100 GHz circuit packs, use the Common Photonic Layer Optical Modeler tool. <p>Note 3: A 3 dB path penalty must be added to the Rx minimum overload, resulting in a value of –8 dBm.</p> <p>Note 4: In most cases, traffic continuity at high and low input power is determined by the Receive Power High Fail Threshold and Receive Power Low Fail Threshold rather than by the minimum overload and minimum sensitivity. For threshold values, see Table 2-24 on page 2-75.</p> <p>Note 5: External power meters may differ from System Manager by up to ± 2.0 dB.</p>		

Optical power threshold values

Table 2-24 lists the optical power threshold values for OCLD circuit packs. If the value is within the ranges listed in the table, a threshold crossing alarm is raised. For a list of alarms raised when optical power thresholds are crossed, see Table 2-21.

Table 2-24
OCLD optical power threshold values for alarming

OCLD Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
1.25 Gbit/s (See Note 1 and Note 2)	Rx Power High	-4.00	-3.50	-2.50	-4.00
	Rx Power Low	-28.50	-29.00	-29.50	-28.00
	Tx Power High	0.90	1.00	1.10	0.90
	Tx Power Low	0.10	0.00	-0.10	0.10
2.5 Gbit/s (See Note 1 and Note 2)	Rx Power High	-4.00	-3.50	-2.50	-4.00
	Rx Power Low	-24.90	-25.40	-25.90	-24.40
	Tx Power High	3.90	4.00	4.10	3.90
	Tx Power Low	3.10	3.00	2.90	3.10
2.5 Gbit/s Flex and 2.5 Gbit/s Universal (See Note 1 and Note 2)	Rx Power High	-6.00	-5.50	-4.50	-6.50
	Rx Power Low	-27.00	-27.50	-28.50	-26.50
	Tx Power High	3.80	3.90	4.10	3.70
	Tx Power Low	3.10	3.00	2.90	3.10
Note 1: There is no Fail alarm for Tx power low.					
Note 2: For power monitor accuracy, see Table 2-23 on page 2-70.					

Center wavelength frequencies

Table 2-25 lists the 200 GHz DWDM center wavelengths.

Table 2-25
200 GHz DWDM center wavelengths

Band	Center wavelength			
	Channel 1	Channel 2	Channel 3	Channel 4
1	1528.77 nm	1533.47 nm	1530.33 nm	1531.90 nm
2	1538.19 nm	1542.94 nm	1539.77 nm	1541.35 nm
3	1547.72 nm	1552.52 nm	1549.32 nm	1550.92 nm
4	1557.36 nm	1562.23 nm	1558.98 nm	1560.61 nm
5	1570.42 nm	1575.37 nm	1572.06 nm	1573.71 nm
6	1580.35 nm	1585.36 nm	1582.02 nm	1583.69 nm
7	1590.41 nm	1595.49 nm	1592.10 nm	1593.80 nm
8	1600.60 nm	1605.73 nm	1602.31 nm	1604.02 nm

Table 2-26 lists the 100 GHz DWDM center wavelengths.

Note: 100 GHz circuit packs cannot be connected to Optical Metro 5100/5200 OMXs, only to Common Photonic Layer equipment.

Table 2-26
100 GHz DWDM center wavelengths

Band/Group	Center wavelength			
	Channel 1	Channel 2	Channel 3	Channel 4
1	1530.33 nm	1531.12 nm	1531.90 nm	1532.68 nm
2	1534.25 nm	1535.04 nm	1535.82 nm	1536.61 nm
3	1538.19 nm	1538.98 nm	1539.77 nm	1540.56 nm
4	1542.14 nm	1542.94 nm	1543.73 nm	1544.53 nm
5	1546.12 nm	1546.92 nm	1547.72 nm	1548.52 nm
6	1550.12 nm	1550.92 nm	1551.72 nm	1552.52 nm
7	1554.13 nm	1554.94 nm	1555.75 nm	1556.56 nm
8	1558.17 nm	1558.98 nm	1559.79 nm	1560.61 nm
9	1562.23 nm	1563.05 nm	1563.86 nm	1564.68 nm

Table 2-27 lists the CWDM center wavelengths.

Table 2-27
CWDM center wavelengths

Band	Wavelength
1	1533.47 nm
2	1539.77 nm
3	1550.92 nm
4	1558.98 nm
5	1575.37 nm
6	1580.35 nm
7	1590.41 nm
8	1604.02 nm

Table 2-28 lists the ITU CWDM center wavelengths.

Table 2-28
ITU CWDM center wavelengths

Product engineering code for 2.5 Gbit/s Flex ITU CWDM	Product engineering code for ITU CWDM 2.5 Gbit/s Flex OTR 1310 nm	Product engineering code for ITU CWDM 2.5 Gbit/s Flex OTR 850 nm	Wavelength (see Note)
NTPM04AA	NTPM17AA	NTPM17BA	1511 nm
NTPM04AB	NTPM17AB	NTPM17BB	1531 nm
NTPM04AC	NTPM17AC	NTPM17BC	1551 nm
NTPM04AD	NTPM17AD	NTPM17BD	1571 nm
NTPM04AE	NTPM17AE	NTPM17BE	1471 nm
NTPM04AF	NTPM17AF	NTPM17BF	1491 nm
NTPM04AG	NTPM17AG	NTPM17BG	1591 nm
NTPM04AH	NTPM17AH	NTPM17BH	1611 nm

Note: Some Optical Metro 5100/5200 ITU CWDM hardware introduced before the ITU CWDM standard (G.695) was finalized will have labels with a center wavelength that differs by 1 nm with respect to the finalized ITU CWDM standard (G.695). For example, for the 1471 nm wavelength, the label will show 1470 nm. However, there is no wavelength incompatibility since the passbands are the same. For example, the pre-finalized ITU CWDM standard 1470 nm channel specified a range of -5.5 to +7.5 nm, that is, a passband of 1464.5 to 1477.5 nm. The finalized ITU CWDM standard 1471 nm channel specifies a range of ± 6.5 nm, that is, the passband is still 1464.5 to 1477.5 nm. The only difference is one of labeling.

OTR circuit pack

- [Power consumption values on page 2-78](#)
- [Technical specifications—client side on page 2-79](#)
- [Technical specifications—line side on page 2-84](#)
- [Supported optical protocols on page 2-89](#)
- [Supported PMs for each protocol on page 2-111](#)
- [Optical power threshold values on page 2-114](#)

Power consumption values

[Table 2-29](#) lists the power consumption of the OTR circuit packs.

Table 2-29
OTR circuit pack power consumption

Characteristic	Value or range	
	Typical	Maximum
Power consumption (see Note)		
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM	16 W	22 W
OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Universal 850 nm	17 W	23 W
OTR 10 Gbit/s	35 W	45 W
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	40 W	45 W
Note: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).		

Technical specifications—client side

Table 2-30 lists the specifications for the client-side interfaces of the different types of supported OTR circuit packs.

**CAUTION****Risk of equipment damage**

Damage to the client-side receiver (Rx) of the 10G OTR and the 10G OTR Enhanced circuit packs can occur. Under no circumstances should the transmitter (Tx) be loop-backed directly to the receiver (Rx).

Table 2-30
Specifications for OTR circuit packs—client side

Characteristic	Value or range	
	Minimum	Maximum
Bit rates		
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm CWDM	622.08 Mbit/s	2.48832 Gbit/s
OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	155.52 Mbit/s	2.48832 Gbit/s
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	1.0625 Gbit/s	2.125 Gbit/s
OTR 10 Gbit/s	9.95328 Gbit/s	9.95328 Gbit/s
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	9.95328 Gbit/s	10.3125 Gbit/s

Table 2-30 (continued)
Specifications for OTR circuit packs—client side

Characteristic	Value or range		
	Typical	Minimum	Maximum
Tx power			
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	—	–5.0 dBm	0.0 dBm
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	—	–9.5 dBm	–1.5 dBm
OTR 10 Gbit/s (see Note 1 and Note 2)	5.0 dBm	4.5 dBm	5.5 dBm
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	—	1.0 dBm	5.0 dBm
Rx power (see Note 4 and Note 5)	Minimum Sensitivity	Minimum Overload	Damage Level
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	–18.0 dBm BER=10 ^{–10}	0.0 dBm BER=10 ^{–10}	+3.0 dBm
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	–17.0 dBm or –15.0 dBm BER=10 ^{–12} (see Note 3)	0.0 dBm BER=10 ^{–12}	+3.0 dBm
OTR 10 Gbit/s	–11.0 dBm BER=10 ^{–12}	–1.5 dBm BER=10 ^{–12}	+4.77 dBm
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	–15.0 dBm BER=10 ^{–12}	–1.0 dBm BER=10 ^{–12}	+3.0 dBm

Table 2-30 (continued)
Specifications for OTR circuit packs—client side

Characteristic	Value or range	
	Minimum	Maximum
Rx wavelength		
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	1260 nm	1570 nm
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	770 nm	860 nm
OTR 10 Gbit/s	1290 nm	1320 nm
	1525 nm	1610 nm
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	1260 nm	1565 nm
Tx wavelength	Minimum	Maximum
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	1260 nm	1360 nm
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	830 nm	860 nm
OTR 10 Gbit/s	1290 nm	1320 nm
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	1290 nm	1330 nm

Table 2-30 (continued)
Specifications for OTR circuit packs—client side

Characteristic	Value or range	
	TX	RX
Optical power monitor accuracy (See Note 6) OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	± 1.8 dB	± 1.6 dB, -5 dBm to -18 dBm (See Note 7)
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	not supported	not supported
OTR 10 Gbit/s	± 1.2 dB	± 1.5 dB
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	± 1.9 dB	± 1.8 dB

Table 2-30 (continued)
Specifications for OTR circuit packs—client side

Characteristic	Value or range
Applicable optical fiber types supported	Value or range
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	Protocol dependent, see Table 2-34 on page 2-94 and Table 2-35 on page 2-101
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	50/62.5 μ m MM
OTR 10 Gbit/s OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	SM
<p>Note 1: When performing link engineering between the OTR 10 Gbit/s and other SONET/SDH subtending equipment which is not an Optical Metro 5100/5200 OTR 10 Gbit/s, you must de-rate the link by 0.91 dB as a result of the OTR 10 Gbit/s Extinction Ratio of 6.0 dB.</p> <p>Note 2: When performing link engineering between the OTR 10 Gbit/s and other subtending equipment supporting the 10G Clear Channel protocol which is not an Optical Metro 5100/5200 OTR 10 Gbit/s, you must de-rate the link by 1.35 dB as a result of the OTR 10 Gbit/s Extinction Ratio of 6.0 dB.</p> <p>Note 3: -17 dBm for FC-100, FICON, and Gigabit Ethernet, -15 dBm for FC-200 and FICON Express. FC-100 and FC-200 standards do not specify a sensitivity requirement (quoted values are calculated using Optical Modulation Amplitude specifications).</p> <p>Note 4: In most cases on OTR circuit packs that support equipment PMs (that is, optical power monitoring) on the client-side, traffic continuity at high and low input power is determined by the Receive Power High Fail Threshold and Receive Power Low Fail Threshold rather than by the minimum overload and minimum sensitivity. For threshold values, see Table 2-41 on page 2-114.</p> <p>Note 5: The Rx minimum sensitivity specifications are back-to-back and include no path power penalties.</p> <p>Note 6: External power meters may differ from System Manager by up to ± 2.0 dB.</p> <p>Note 7: The Rx power monitor is only accurate in the stated range.</p>	

Technical specifications—line side

Table 2-31 lists the specifications for the line-side interfaces of the different types of supported OTR circuit packs.

	<p>CAUTION Risk of equipment damage Damage to the line-side receiver (Rx) of the 2.5G OTR or 10G OTR Enhanced circuit pack can occur. Under no circumstances should the transmitter (Tx) be loop-backed directly to the receiver (Rx).</p>
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Table 2-31
Specifications for OTR circuit packs—line side

Characteristic	Value or range	
	Minimum	Maximum
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm CWDM	622.08 Mbit/s	2.48832 Gbit/s
OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	155.52 Mbit/s	2.48832 Gbit/s
OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	1.0625 Gbit/s	2.125 Gbit/s
OTR 10 Gbit/s	10.6642 Gbit/s	10.6642 Gbit/s
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	10.709225 Gbit/s	10.733408 Gbit/s

Table 2-31 (continued)
Specifications for OTR circuit packs—line side

Characteristic	Value or range			
	Typical	Minimum	Maximum	
Tx power				
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm	3.5 dBm	2.8 dBm	4.2 dBm	
OTR 10 Gbit/s	-1.0 dBm	-3.0 dBm	0.0 dBm	
OTR 10 Gbit/s Enhanced	3.3 dBm	2.6 dBm	4.0 dBm	
OTR 10 Gbit/s Enhanced 100 GHz	3.4 dBm	2.6 dBm	4.0 dBm	
Rx power (see Note 1 and Note 3)		Minimum Sensitivity	Minimum Overload	Damage Level
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 850 nm		-27.5 dBm BER=10 ⁻¹²	-5.0 dBm BER=10 ⁻¹² (see Note 2)	-2.0 dBm
OTR 10 Gbit/s		-24.0 dBm BER=10 ⁻¹⁵	-5.0 dBm BER=10 ⁻¹⁵	0 dBm
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz		-25.0 dBm BER=10 ⁻¹²	-5.0 dBm BER=10 ⁻¹²	-2.0 dBm

Table 2-31 (continued)
Specifications for OTR circuit packs—line side

Characteristic	Value or range	
	Minimum	Maximum
Rx wavelength		
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Universal 850 nm	1500 nm	1610 nm
OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM	1464.5 nm	1617.5 nm
OTR 10 Gbit/s	1500 nm	1605 nm
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	1528.773 nm	1605.744 nm
Tx Center wavelength		
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Universal 850 nm	see Table 2-25 on page 2-76	
OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm 100 GHz	see Table 2-26 on page 2-76	
OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 850 nm CWDM	see Table 2-27 on page 2-77	
OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM	see Table 2-28 on page 2-77	
OTR 10 Gbit/s OTR 10 Gbit/s Enhanced	see Table 2-25 on page 2-76	
OTR 10 Gbit/s Enhanced 100 GHz	see Table 2-26 on page 2-76	

Table 2-31 (continued)
Specifications for OTR circuit packs—line side

Characteristic	Value or range
Tx wavelength tolerance	
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Universal 850 nm	± 0.25 nm
OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm 100 GHz	± 0.08 nm
OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 850 nm CWDM	± 0.25 nm
OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM	± 6.5 nm
OTR 10 Gbit/s	+0.2/-0.05 nm
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	± 0.05 nm
Dispersion reach limit (NDSF)	Value or range
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 850 nm	110 km
OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm 100 GHz	200 km
OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Reach	175 km
OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Universal 850 nm	350 km for C-band and 200 km for L-band
OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM	80 km
OTR 10 Gbit/s	60 km
OTR 10 Gbit/s Enhanced	typically 110 km for C-band and 95 km for L-band (2000 ps/nm. See Note 4)

Table 2-31 (continued)
Specifications for OTR circuit packs—line side

Characteristic	Value or range	
OTR 10 Gbit/s Enhanced 100 GHz	typically 110 km (2000 ps/nm. See Note 4)	
Optical power monitor accuracy (See Note 5)	TX	RX
OTR 2.5 Gbit/s Flex 1310 nm OTR 2.5 Gbit/s Flex 1310 nm Extended Reach OTR 2.5 Gbit/s Flex 1310 nm Extended Metro OTR 2.5 Gbit/s Flex 1310 nm 100 GHz OTR 2.5 Gbit/s Flex 1310 nm CWDM OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm OTR 2.5 Gbit/s Flex 850 nm OTR 2.5 Gbit/s Flex 850 nm Extended Reach OTR 2.5 Gbit/s Flex 850 nm Extended Metro OTR 2.5 Gbit/s Flex 850 nm 100 GHz OTR 2.5 Gbit/s Flex 850 nm CWDM OTR 2.5 Gbit/s Flex 850 nm ITU CWDM OTR 2.5 Gbit/s Universal 1310 nm	± 1.2 dB	± 1.5 dB
OTR 10 Gbit/s	± 1.2 dB	± 1.5 dB
OTR 10 Gbit/s Enhanced OTR 10 Gbit/s Enhanced 100 GHz	± 1.0 dB	± 1.5 dB
<p>Note 1: Rx overload and Rx sensitivity specifications are back-to-back and include no path penalties. The Network Modeling Tool (NMT) should be used to account for path penalties. If NMT is not used to design the network:</p> <ul style="list-style-type: none"> • For Rx sensitivity path penalties, see “Link engineering rules” in <i>Network Planning and Link Engineering</i>, 323-1701-110. • For OTR 2.5 Gbit/s Flex 1310 nm 100 GHz, OTR 2.5 Gbit/s Flex 850 nm 100 GHz, and OTR 10 Gbit/s Enhanced 100 GHz circuit packs, use the CPL Optical Modeler tool. <p>Note 2: A 3 dB path penalty must be added to the Rx minimum overload, resulting in a value of –8 dBm.</p> <p>Note 3: In most cases, traffic continuity at high and low input power is determined by the Receive Power High Fail Threshold and Receive Power Low Fail Threshold rather than by the minimum overload and minimum sensitivity. For threshold values, see Table 2-41 on page 2-114.</p> <p>Note 4: In some applications, it may be possible to exceed the dispersion limits specified on NDSF fiber. To ensure that the dispersion limit of the circuit pack is not exceeded, it is necessary to check that either:</p> <ul style="list-style-type: none"> • The total measured dispersion of the fiber, from the TX (add) through all spans to the RX (drop), is less than 2000 ps/nm • If the characteristic dispersion per unit length (ps/nm/km) of the fiber is known, then the maximum reach can be calculated using the 2000 ps/nm dispersion limit (for example, the maximum reach over 17 ps/nm/km dispersion fiber is 2000/17 = 117 km) <p>It is important to perform this check at the longest wavelength to be deployed, as dispersion is wavelength dependent.</p> <p>Note 5: External power meters may differ from System Manager by up to ± 2.0 dB.</p>		

Supported optical protocols

- OTR 10 Gbit/s (see [Table 2-32 on page 2-90](#))
- OTR 10 Gbit/s Enhanced (see [Table 2-33 on page 2-92](#))
- OTR 2.5 Gbit/s Flex 1310 nm DWDM, CWDM (see [Table 2-34 on page 2-94](#))
- OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM, and 100 GHz (see [Table 2-35 on page 2-101](#))
- OTR 2.5 Gbit/s Universal 850 nm and OTR 2.5 Gbit/s Flex 850 nm DWDM, CWDM, ITU, and 100 GHz (see [Table 2-36 on page 2-109](#))

Notes about the Protocol tables

- For SONET/SDH protocols, any payload mapping is supported. For example, for the OC-192 SONET protocol, the payload mapping can be STS-1, STS-3C, STS-12C, STS-48C, STS-192C. For example, for the STM-64 SDH protocol, the payload mapping can be AU-3, AU-4, AU-4-4C, AU-4-16C, AU-4-64C.
- The attenuator and reach values refer to the client-side of the network.
- Since various fiber losses exist, the tables list both a maximum allowed loss and a maximum distance. The maximum distance is calculated from the maximum loss based on the allowed fiber loss for a given protocol.
- In most cases, a link budget does not apply to multimode fiber. If power and sensitivity values of the circuit pack meet a given standard specification, then the distance in that standard is considered to be the maximum possible distance.
- If further distance is possible with the circuit pack than that specified by a standard, then the distance specified in the standard is stated as the maximum possible distance.
- The BER for a given link is based upon the value stated in the appropriate standard.
- The attenuator values apply to the Optical Metro 5100/5200 Tx and Rx only, and are required for minimum overload protection when the subtending equipment is co-located with the Optical Metro 5100/5200 equipment. The attenuator value can be traded off for fiber loss as long as the input power to the receiver meets the minimum overload specification.
- The attenuator values provided are minimum values. For example, if the table indicates that a 7 dB pad is needed, an 8 dB pad can be used.
- In most cases, the attenuator does not limit the reach. However, there are certain cases where the attenuator will limit the reach. In this case, the reach specified is with the attenuator removed.

Table 2-32
Protocols supported by OTR 10 Gbit/s circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SONET OC-192 (SR-1) 1310 nm	9953.28 Mbit/s	OC-192	Protected	4	0	SM	30 m, BER= 10^{-12} (see Note 2)
			Unprotected	7	1		4 dB, BER= 10^{-12} 7 km (see Note 3)
SONET OC-192 (SR-2) 1550 nm (See Note 7)	9953.28 Mbit/s	OC-192	Protected	—	—	SM	Not supported (See Note 1)
			Unprotected	7	1		4.4 dB, BER= 10^{-12} 16 km (see Note 4)
SONET OC-192 (IR-1) 1310 nm	9953.28 Mbit/s	OC-192	Protected	4	4	SM	7 dB, BER= 10^{-12} 12 km (see Note 3)
			Unprotected	7	7		11 dB, BER= 10^{-12} 17 km (see Note 3)
SONET OC-192 (IR-2) 1550 nm (See Note 7)	9953.28 Mbit/s	OC-192	Protected	4	1	SM	4.4 dB, BER= 10^{-12} 16 km (see Note 4)
			Unprotected	7	4		10 dB, BER= 10^{-12} 17 km (see Note 4)
SDH STM-64 (I-64.1) 1310 nm	9953.28 Mbit/s	STM-64	Protected	4	0	SM	30 m, BER= 10^{-12} (see Note 2)
			Unprotected	7	1		4 dB, BER= 10^{-12} 7 km (see Note 3)
SDH STM-64 (I-64.2) 1550 nm (See Note 7)	9953.28 Mbit/s	STM-64	Protected	—	—	SM	Not supported (See Note 1)
			Unprotected	7	1		4.4 dB, BER= 10^{-12} 16 km (see Note 4)
SDH STM-64 (S-64.1) 1310 nm	9953.28 Mbit/s	STM-64	Protected	4	4	SM	7 dB, BER= 10^{-12} 12 km (see Note 3)
			Unprotected	7	7		11 dB, BER= 10^{-12} 17 km (see Note 3)

Table 2-32 (continued)
Protocols supported by OTR 10 Gbit/s circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH STM-64 (S-64.2) 1550 nm (See Note 7)	9953.28 Mbit/s	STM-64	Protected	4	1	SM	4.4 dB, BER= 10^{-12} 16 km (see Note 4)
			Unprotected	7	4		10 dB, BER= 10^{-12} 17 km (see Note 4)
10GbE WAN IEEE 10GBase-LW 1310 nm	9953.28 Mbit/s	10G Ethernet WAN	Protected	3	0	SM	30 m, BER= 10^{-12} (see Note 2)
			Unprotected	5	2		4 dB, BER= 10^{-12} 8 km (see Note 5)
10GbE WAN IEEE 10GBase-EW 1550 nm (See Note 7)	9953.28 Mbit/s	10G Ethernet WAN	Protected	4	3	SM	1.63 dB, BER= 10^{-12} 5 km (see Note 6)
			Unprotected	7	6		7.63 dB, BER= 10^{-12} 17 km (see Note 6)
10G Clear Channel	9953.28 Mbit/s	10G Clear Channel	Protected	3	0	SM	4 dB, BER= 10^{-12} 13 km (see Note 6)
			Unprotected	6	1		10 dB, BER= 10^{-12} 17 km (see Note 6)

Note 1: Using protocol transmitter specifications and OTR protection scheme optical losses, it is impossible to guarantee an error-free client-side link.

Note 2: Only co-location is supported for this protocol and configuration.

Note 3: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 4: The distance is estimated using the assumption of 0.275 dB/km installed fiber loss including splices and cable margins for 1550 nm systems.

Note 5: The distance is estimated using the assumption of 0.5 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 6: The distance is estimated using the assumption of 0.3 dB/km installed fiber loss including splices and cable margins for 1550 nm systems.

Note 7: For these protocols, the OTR will receive the 1550 nm signal, but will transmit only at 1310 nm. Please refer to Table 2-30. You must ensure that your client-side equipment can receive 1310 nm signals.

Table 2-33
Protocols supported by OTR 10 Gbit/s Enhanced circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SONET OC-192 (SR-1) 1310 nm	9953.28 Mbit/s	OC-192	Protected	4	0	SM	4 dB, BER= 10^{-12} 7 km (See Note 2)
			Unprotected	6	0		4 dB, BER= 10^{-12} 7 km (See Note 2)
SONET OC-192 (SR-2) 1550 nm (See Note 1)	9953.28 Mbit/s	OC-192	Protected	4	0	SM	2.9 dB, BER= 10^{-12} 10 km (see Note 3)
			Unprotected	6	0		7 dB, BER= 10^{-12} 12 km (see Note 2)
SONET OC-192 (IR-1) 1310 nm	9953.28 Mbit/s	OC-192	Protected	4	4	SM	7 dB, BER= 10^{-12} 12 km (see Note 2)
			Unprotected	6	6		11 dB, BER= 10^{-12} 20 km (see Note 2)
SONET OC-192 (IR-2) 1550 nm (See Note 1)	9953.28 Mbit/s	OC-192	Protected	4	4	SM	1310 nm link: 8.1 dB, BER= 10^{-12} 14 km 1550 nm link: 6.9 dB, BER= 10^{-12} 25 km (see Note 6)
			Unprotected	6	3		11 dB, BER= 10^{-12} 20 km (see Note 2)
SDH STM-64 (I-64.1) 1310 nm	9953.28 Mbit/s	STM-64	Protected	4	0	SM	4 dB, BER= 10^{-12} 7 km (see Note 2)
			Unprotected	6	0		4 dB, BER= 10^{-12} 7 km (see Note 2)
SDH STM-64 (I-64.2) 1550 nm (See Note 1)	9953.28 Mbit/s	STM-64	Protected	4	0	SM	2.9 dB, BER= 10^{-12} 10 km (see Note 3)
			Unprotected	6	0		7 dB, BER= 10^{-12} 12 km (see Note 2)

Table 2-33 (continued)
Protocols supported by OTR 10 Gbit/s Enhanced circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH STM-64 (S-64.1) 1310 nm	9953.28 Mbit/s	STM-64	Protected	4	4	SM	7 dB, BER= 10^{-12} 12 km (see Note 2)
			Unprotected	6	6		11 dB, BER= 10^{-12} 20 km (see Note 2)
SDH STM-64 (S-64.2) 1550 nm (See Note 1)	9953.28 Mbit/s	STM-64	Protected	4	1	SM	1310 nm link: 8.1 dB, BER= 10^{-12} 14 km 1550 nm link: 6.9 dB, BER= 10^{-12} 25 km (see Note 6)
			Unprotected	6	3		11 dB, BER= 10^{-12} 20 km (see Note 2)
10GbE WAN IEEE 10GBase-LW 1310 nm	9953.28 Mbit/s	10G Ethernet WAN	Protected	4	0	SM	4 dB, BER= 10^{-12} 5 km (see Note 4)
			Unprotected	6	2		6.2 dB, BER= 10^{-12} 10 km (see Note 4)
10GbE WAN IEEE 10GBase-EW 1550 nm (See Note 1)	9953.28 Mbit/s	10G Ethernet WAN	Protected	4	3	SM	6.1 dB, BER= 10^{-12} 13 km (see Note 5)
			Unprotected	6	5		11 dB, BER= 10^{-12} 22 km (see Note 4)
10GbE LAN IEEE 10GBase-LR 1310 nm	10.3125 Gbit/s	10G Ethernet LAN	Protected	4	0	SM	4 dB, BER= 10^{-12} 5 km (see Note 4)
			Unprotected	6	2		6.2 dB, BER= 10^{-12} 10 km (see Note 4)
10GbE LAN IEEE 10GBase-ER 1550 nm (See Note 1)	10.3125 Gbit/s	10G Ethernet LAN	Protected	4	3	SM	6.1 dB, BER= 10^{-12} 13 km (see Note 5)
			Unprotected	6	5		11 dB, BER= 10^{-12} 22 km (see Note 4)

Table 2-33 (continued)
Protocols supported by OTR 10 Gbit/s Enhanced circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
10G Clear Channel	9953.28 Mbit/s	10G Clear Channel	Protected	3	4	SM	7.9 dB, BER= 10^{-10} 19 km (see Note 5)
			Unprotected	5	6		14 dB, BER= 10^{-10} 30 km (see Note 5)
<p>Note 1: For these protocols, the OTR will receive the 1550 nm signal, but will transmit only at 1310 nm. Please refer to Table 2-30. You must ensure that your client-side equipment can receive 1310 nm signals.</p> <p>Note 2: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss according to Telcordia GR-253-CORE and ITU-T G.691.</p> <p>Note 3: The distance is estimated using the assumption of 0.275 dB/km installed fiber loss according to Telcordia GR-253-CORE and ITU-T G.691.</p> <p>Note 4: The distance is estimated using the assumption of 0.4 dB/km installed fiber loss for the 1310 nm link and 2 dB for connector losses according to IEEE 802.3ae Draft 5.</p> <p>Note 5: The distance is estimated using the assumption of 0.3 dB/km installed fiber loss for the 1550 nm link and 2 dB for connector losses according to IEEE 802.3ae Draft 5.</p> <p>Note 6: In a protected link, the 1550 nm link supports the least loss however, due to differences in the fiber loss between 1310 nm and 1550 nm, the minimum reach is determined by the 1310 nm link.</p>							

Table 2-34
Protocols supported by OTR 2.5 Gbit/s Flex 1310 nm (DWDM and CWDM) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ATM OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
ATM OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)

Table 2-34 (continued)
Protocols supported by OTR 2.5 Gbit/s Flex 1310 nm (DWDM and CWDM) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ATM OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	Protected	—	—	50 μ m or 62.5 μ m MM	Not supported (See Note 5)
			Unprotected	14	0	500 MHz*km	30 m, BER= 10^{-10} (see Note 6 and Note 7)
DMIF (10 km)	960 Mbit/s	DMIF	Protected	1	0	SM	1.5 dB, BER= 10^{-15} 3 km (see Note 8)
			Unprotected	3	0		5.5 dB, BER= 10^{-15} 11 km (see Note 8)
DMIF (20 km)	960 Mbit/s	DMIF	Protected	1	0	SM	3.5 dB, BER= 10^{-15} 7 km (see Note 8)
			Unprotected	3	0		7.5 dB, BER= 10^{-15} 15 km (see Note 8)
DV6000	2.38 Gbit/s	DV6000	Protected	1	0	SM	15 km, BER= 10^{-12}
			Unprotected	3	2		15 km, BER= 10^{-12}
ESRM-250	2488.32 Mbit/s	ESRM-250	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
Fibre Channel FC 100-SM-LC-L	1.062 Gbit/s	FC-100	Protected	1	0	SM	7 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
Fibre Channel FC 200-SM-LC-L	2.125 Gbit/s	FC-200	Protected	1	0	SM	2.6 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
FICON	1.0625 Gbit/s	FICON	Protected	1	0	SM	7 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
FICON Express	2.125 Gbit/s	FICON Express	Protected	1	0	SM	2.6 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
Gigabit Ethernet 1000Base-LX	1.25 Gbit/s	Gigabit Ethernet	Protected	1	0	SM	4 km, BER= 10^{-12}
			Unprotected	3	0		5 km, BER= 10^{-12}

Table 2-34 (continued)
Protocols supported by OTR 2.5 Gbit/s Flex 1310 nm (DWDM and CWDM) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
HDTV	1.483/ 1.4835 Gbit/s	HDTV29Hz	Protected	1	0	SM	2 km, BER= 10^{-12}
			Unprotected	3	0		2 km, BER= 10^{-12}
HDTV	1.485/ 1.4835 Gbit/s	HDTV30Hz	Protected	1	0	SM	2 km, BER= 10^{-12}
			Unprotected	3	0		2 km, BER= 10^{-12}
ISC-3 Peer-mode	2.125 Gbit/s	ISC-3	Protected	1	0	SM	8 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
Orion	1080 Mbit/s	Orion	Protected	0	0	SM	6 dB, BER= 10^{-12} 12 km (see Note 8)
			Unprotected	1	0		10 dB, BER= 10^{-12} 20 km (see Note 8)
SONET OC-12 (SR-1) 1310 nm	622.08 Mbit/s	OC-12	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SONET OC-12 (IR-1) 1310 nm	622.08 Mbit/s	OC-12	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SONET OC-12 (IR-2) 1550 nm (See Note 3)	622.08 Mbit/s	OC-12	Protected	—	—	SM	Not supported (See Note 5)
			Unprotected	8	0		2 dB, BER= 10^{-10} 7 km (see Note 2)
SONET OC-48 (SR-1) 1310 nm	2.48832 Gbit/s	OC-48	Protected	0	0	SM	3 dB, BER= 10^{-10} 5 km (see Note 1)
			Unprotected	3	0		7 dB, BER= 10^{-10} 12 km (see Note 1)
SONET OC-48 (IR-1) 1310 nm	2.48832 Gbit/s	OC-48	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)

Table 2-34 (continued)
Protocols supported by OTR 2.5 Gbit/s Flex 1310 nm (DWDM and CWDM) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SONET OC-48 (IR-2) 1550 nm (See Note 3)	2.48832 Gbit/s	OC-48	Protected	0	0	SM	6 dB, BER= 10^{-10} 10 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
SDH STM-4 (I-4) 1310 nm	622.08 Mbit/s	STM-4	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SDH STM-4 (S-4.1) 1310 nm	622.08 Mbit/s	STM-4	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SDH STM-4 (S-4.2) 1550 nm (See Note 3)	622.08 Mbit/s	STM-4	Protected	—	—	SM	Not supported (See Note 5)
			Unprotected	8	0		2 dB, BER= 10^{-10} 7 km (see Note 2)
SDH STM-4 (L-4.2) 1550 nm (See Note 3)	622.08 Mbit/s	STM-4	Protected	6	0	SM	8 dB, BER= 10^{-10} 29 km (see Note 2)
			Unprotected	8	2		1310 nm link: 22 dB, BER= 10^{-10} 40 km 1550 nm link: 14 dB, BER= 10^{-10} 50 km (see Note 4)

Table 2-34 (continued)
Protocols supported by OTR 2.5 Gbit/s Flex 1310 nm (DWDM and CWDM) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH STM-4 (L-4.3) 1550 nm (See Note 3)	622.08 Mbit/s	STM-4	Protected	6	0	SM	8 dB, BER= 10^{-10} 29 km (see Note 2)
			Unprotected	8	2		1310 nm link: 22 dB, BER= 10^{-10} 40 km 1550 nm link: 14 dB, BER= 10^{-10} 50 km (see Note 4)
SDH STM-16 (I-16) 1310 nm	2.48832 Gbit/s	STM-16	Protected	0	0	SM	3 dB, BER= 10^{-10} 5 km (see Note 1)
			Unprotected	3	0		7 dB, BER= 10^{-10} 12 km (see Note 1)
SDH STM-16 (S-16.1) 1310 nm	2.48832 Gbit/s	STM-16	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
SDH STM-16 (S-16.2) 1550 nm (See Note 3)	2.48832 Gbit/s	STM-16	Protected	0	0	SM	6 dB, BER= 10^{-10} 10 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)

Table 2-34 (continued)

Protocols supported by OTR 2.5 Gbit/s Flex 1310 nm (DWDM and CWDM) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH STM-16 (L-16.2) 1550 nm (See Note 3)	2.48832 Gbit/s	STM-16	Protected	7	1	SM	1310 nm link: 15 dB, BER= 10^{-10} 27 km 1550 nm link: 8 dB, BER= 10^{-10} 29 km (see Note 4)
			Unprotected	9	3		1310 nm link: 21 dB, BER= 10^{-10} 38 km 1550 nm link: 14 dB, BER= 10^{-10} 50 km (see Note 4)
SDH STM-16 (L-16.3) 1550 nm (See Note 3)	2.48832 Gbit/s	STM-16	Protected	7	1	SM	1310 nm link: 15 dB, BER= 10^{-10} 27 km 1550 nm link: 9 dB, BER= 10^{-10} 32 km (see Note 4)
			Unprotected	9	3		1310 nm link: 21 dB, BER= 10^{-10} 38 km 1550 nm link: 15 dB, BER= 10^{-10} 54 km (see Note 4)

Table 2-34 (continued)

Protocols supported by OTR 2.5 Gbit/s Flex 1310 nm (DWDM and CWDM) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SRM-125	1250 Mbit/s	SRM-125	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)

Note 1: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 2: The distance is estimated using the assumption of 0.275 dB/km installed fiber loss including splices and cable margins for 1550 nm systems.

Note 3: For these protocols, the OTR will receive the 1550 nm signal, but will transmit only at 1310 nm. Please refer to [Table 2-30](#). You must ensure that your client-side equipment can receive 1310 nm signals.

Note 4: The 1550 nm link supports the least loss however, due to differences in the fiber loss between 1310 nm and 1550 nm, the minimum reach is determined by the 1310 nm link.

Note 5: Using protocol transmitter specifications and OTR protection scheme optical losses, it is impossible to guarantee an error-free client-side link.

Note 6: The multimode 622M ATM transmitter power range for 62.5um fiber is -14 dBm to -20 dBm (ATM Forum Document af-phy-0046.000). Only ATM equipment with an output power greater than -18 dBm is supported (Sensitivity of the 2.5G Flex OTR 1310 nm, 10^{-10}). Distances greater than 30 m are supported provided that the Rx power level into the OTR 2.5 Gbit/s 1310 nm is -18 dBm or higher.

Note 7: The multimode 622M ATM transmitter power range for 50um fiber is -14 dBm to -24 dBm (ATM Forum Document af-phy-0046.000). Only ATM equipment with an output power greater than -18 dBm is supported (Sensitivity of the 2.5G Flex OTR 1310 nm, 10^{-10}). Distances greater than 30 m are supported provided that the Rx power level into the OTR 2.5 Gbit/s 1310 nm is -18 dBm or higher.

Note 8: The distance is estimated using the assumption of 0.5 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 9: The OC-12 SR and IR and STM-4 I-4 and S-4 transmitter power range is -8 dBm to -15 dBm. The transponder protection tray has a maximum insertion loss of 4 dB. Only OC-12/STM-4 equipment with an output power greater than -14 dBm (including connector losses) is supported (Sensitivity of the 2.5G Flex OTR 1310 nm, 10^{-10}).

Table 2-35

Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ATM OC-3 (SR)	155.52 Mbit/s	OC-3 (STM-1)	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
ATM OC-3 (IR)	155.52 Mbit/s	OC-3 (STM-1)	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
ATM OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
ATM OC-12 (IR)	622.08 Mbit/s	OC-12 (STM-4)	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
ATM OC-12 (SR)	622.08 Mbit/s	OC-12 (STM-4)	Protected	—	—	50 μ m or 62.5 μ m MM	Not supported (See Note 5)
			Unprotected	14	0	500 MHz*km	30 m, BER= 10^{-10} (see Note 6 and Note 7)
DMIF (10 km)	960 Mbit/s	DMIF	Protected	1	0	SM	1.5 dB, BER= 10^{-15} 3 km (see Note 8)
			Unprotected	3	0		5.5 dB, BER= 10^{-15} 11 km (see Note 8)
DMIF (20 km)	960 Mbit/s	DMIF	Protected	1	0	SM	3.5 dB, BER= 10^{-15} 7 km (see Note 8)
			Unprotected	3	0		7.5 dB, BER= 10^{-15} 15 km (see Note 8)
DV6000	2.38 Gbit/s	DV6000	Protected	1	0	SM	15 km, BER= 10^{-12}
			Unprotected	3	2		15 km, BER= 10^{-12}

Table 2-35 (continued)

Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
ESRM-250	2488.32 Mbit/s	ESRM-250	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
Fibre Channel FC 100-SM-LC-L	1.062 Gbit/s	FC-100	Protected	1	0	SM	7 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
Fibre Channel FC 200-SM-LC-L	2.125 Gbit/s	FC-200	Protected	1	0	SM	2.6 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
FICON	1.0625 Gbit/s	FICON	Protected	1	0	SM	7 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
FICON Express	2.125 Gbit/s	FICON Express	Protected	1	0	SM	2.6 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
Gigabit Ethernet 1000Base-LX	1.25 Gbit/s	Gigabit Ethernet	Protected	1	0	SM	4 km, BER= 10^{-12}
			Unprotected	3	0		5 km, BER= 10^{-12}
HDTV	1.483/ 1.4835 Gbit/s	HDTV29Hz	Protected	1	0	SM	2 km, BER= 10^{-12}
			Unprotected	3	0		2 km, BER= 10^{-12}
HDTV	1.485/ 1.4835 Gbit/s	HDTV30Hz	Protected	1	0	SM	2 km, BER= 10^{-12}
			Unprotected	3	0		2 km, BER= 10^{-12}
ISC-3 Peer-mode	2.125 Gbit/s	ISC-3	Protected	1	0	SM	8 km, BER= 10^{-12}
			Unprotected	3	0		10 km, BER= 10^{-12}
Orion	1080 Mbit/s	Orion	Protected	0	0	SM	6 dB, BER= 10^{-12} 12 km (see Note 8)
			Unprotected	1	0		10 dB, BER= 10^{-12} 20 km (see Note 8)

Table 2-35 (continued)

Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SONET OC-3 (SR-1) 1310 nm	155.52 Mbit/s	OC-3	Protected	6	0	SM	0 dB, BER=10 ⁻¹⁰ 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER=10 ⁻¹⁰ 3 km (see Note 1)
SONET OC-3 (IR-1) 1310 nm	155.52 Mbit/s	OC-3	Protected	6	0	SM	0 dB, BER=10 ⁻¹⁰ 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER=10 ⁻¹⁰ 3 km (see Note 1)
SONET OC-3 (IR-2) 1550 nm (See Note 3)	155.52 Mbit/s	OC-3	Protected	—	—	SM	Not supported (See Note 5)
			Unprotected	8	0		2 dB, BER=10 ⁻¹⁰ 7 km (see Note 2)
SONET OC-12 (SR-1) 1310 nm	622.08 Mbit/s	OC-12	Protected	6	0	SM	0 dB, BER=10 ⁻¹⁰ 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER=10 ⁻¹⁰ 3 km (see Note 1)
SONET OC-12 (IR-1) 1310 nm	622.08 Mbit/s	OC-12	Protected	6	0	SM	0 dB, BER=10 ⁻¹⁰ 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER=10 ⁻¹⁰ 3 km (see Note 1)
SONET OC-12 (IR-2) 1550 nm (See Note 3)	622.08 Mbit/s	OC-12	Protected	—	—	SM	Not supported (See Note 5)
			Unprotected	8	0		2 dB, BER=10 ⁻¹⁰ 7 km (see Note 2)
SONET OC-48 (SR-1) 1310 nm	2.48832 Gbit/s	OC-48	Protected	0	0	SM	3 dB, BER=10 ⁻¹⁰ 5 km (see Note 1)
			Unprotected	3	0		7 dB, BER=10 ⁻¹⁰ 12 km (see Note 1)

Table 2-35 (continued)

Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SONET OC-48 (IR-1) 1310 nm	2.48832 Gbit/s	OC-48	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
SONET OC-48 (IR-2) 1550 nm (See Note 3)	2.48832 Gbit/s	OC-48	Protected	0	0	SM	6 dB, BER= 10^{-10} 10 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
SDH STM-1 (I-1) 1310 nm	155.52 Mbit/s	STM-1	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SDH STM-1 (S-1.1) 1310 nm	155.52 Mbit/s	STM-1	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SDH STM-1 (S-1.2) 1550 nm (See Note 3)	155.52 Mbit/s	OC-3	Protected	—	—	SM	Not supported (See Note 5)
			Unprotected	8	0		2 dB, BER= 10^{-10} 7 km (see Note 2)
SDH STM-1 (L-1.2) 1550 nm (See Note 3)	155.52 Mbit/s	OC-3	Protected	8	0	SM	6 dB, BER= 10^{-10} 21 km (see Note 2)
			Unprotected	10	0		12 dB, BER= 10^{-10} 43 km (see Note 2)
SDH STM-1 (L-1.3) 1550 nm (See Note 3)	155.52 Mbit/s	OC-3	Protected	8	0	SM	6 dB, BER= 10^{-10} 21 km (see Note 2)
			Unprotected	10	0		12 dB, BER= 10^{-10} 43 km (see Note 2)

Table 2-35 (continued)

Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH STM-4 (I-4) 1310 nm	622.08 Mbit/s	STM-4	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SDH STM-4 (S-4.1) 1310 nm	622.08 Mbit/s	STM-4	Protected	6	0	SM	0 dB, BER= 10^{-10} 30 m (see Note 9)
			Unprotected	8	0		2 dB, BER= 10^{-10} 3 km (see Note 1)
SDH STM-4 (S-4.2) 1550 nm (See Note 3)	622.08 Mbit/s	STM-4	Protected	—	—	SM	Not supported (See Note 5)
			Unprotected	8	0		2 dB, BER= 10^{-10} 7 km (see Note 2)
SDH STM-4 (L-4.2) 1550 nm (See Note 3)	622.08 Mbit/s	STM-4	Protected	6	0	SM	8 dB, BER= 10^{-10} 29 km (see Note 2)
			Unprotected	8	2		1310 nm link: 22 dB, BER= 10^{-10} 40 km 1550 nm link: 14 dB, BER= 10^{-10} 50 km (see Note 4)
SDH STM-4 (L-4.3) 1550 nm (See Note 3)	622.08 Mbit/s	STM-4	Protected	6	0	SM	8 dB, BER= 10^{-10} 29 km (see Note 2)
			Unprotected	8	2		1310 nm link: 22 dB, BER= 10^{-10} 40 km 1550 nm link: 14 dB, BER= 10^{-10} 50 km (see Note 4)

Table 2-35 (continued)

Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH STM-16 (I-16) 1310 nm	2.48832 Gbit/s	STM-16	Protected	0	0	SM	3 dB, BER= 10^{-10} 5 km (see Note 1)
			Unprotected	3	0		7 dB, BER= 10^{-10} 12 km (see Note 1)
SDH STM-16 (S-16.1) 1310 nm	2.48832 Gbit/s	STM-16	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
SDH STM-16 (S-16.2) 1550 nm (See Note 3)	2.48832 Gbit/s	STM-16	Protected	0	0	SM	6 dB, BER= 10^{-10} 10 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)
SDH STM-16 (L-16.2) 1550 nm (See Note 3)	2.48832 Gbit/s	STM-16	Protected	7	1	SM	1310 nm link: 15 dB, BER= 10^{-10} 27 km 1550 nm link: 8 dB, BER= 10^{-10} 29 km (see Note 4)
			Unprotected	9	3		1310 nm link: 21 dB, BER= 10^{-10} 38 km 1550 nm link: 14 dB, BER= 10^{-10} 50 km (see Note 4)

Table 2-35 (continued)

Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SDH STM-16 (L-16.3) 1550 nm (See Note 3)	2.48832 Gbit/s	STM-16	Protected	7	1	SM	1310 nm link: 15 dB, BER= 10^{-10} 27 km 1550 nm link: 9 dB, BER= 10^{-10} 32 km (see Note 4)
			Unprotected	9	3		1310 nm link: 21 dB, BER= 10^{-10} 38 km 1550 nm link: 15 dB, BER= 10^{-10} 54 km (see Note 4)

Table 2-35 (continued)
Protocols supported by OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (ITU CWDM and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
SRM-125	1250 Mbit/s	SRM-125	Protected	0	0	SM	8 dB, BER= 10^{-10} 14 km (see Note 1)
			Unprotected	0	0		12 dB, BER= 10^{-10} 21 km (see Note 1)

Note 1: The distance is estimated using the assumption of 0.55 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 2: The distance is estimated using the assumption of 0.275 dB/km installed fiber loss including splices and cable margins for 1550 nm systems.

Note 3: For these protocols, the OTR will receive the 1550 nm signal, but will transmit only at 1310 nm. Please refer to [Table 2-30](#). You must ensure that your client-side equipment can receive 1310 nm signals.

Note 4: The 1550 nm link supports the least loss however, due to differences in the fiber loss between 1310 nm and 1550 nm, the minimum reach is determined by the 1310 nm link.

Note 5: Using protocol transmitter specifications and OTR protection scheme optical losses, it is impossible to guarantee an error-free client-side link.

Note 6: The multimode 622M ATM transmitter power range for 62.5um fiber is -14 dBm to -20 dBm (ATM Forum Document af-phy-0046.000). Only ATM equipment with an output power greater than -18 dBm is supported (Sensitivity of the 2.5G Flex OTR 1310 nm, 10^{-10}). Distances greater than 30 m are supported provided that the Rx power level into the OTR 2.5 Gbit/s 1310 nm is -18 dBm or higher.

Note 7: The multimode 622M ATM transmitter power range for 50um fiber is -14 dBm to -24 dBm (ATM Forum Document af-phy-0046.000). Only ATM equipment with an output power greater than -18 dBm is supported (Sensitivity of the 2.5G Flex OTR 1310 nm, 10^{-10}). Distances greater than 30 m are supported provided that the Rx power level into the OTR 2.5 Gbit/s 1310 nm is -18 dBm or higher.

Note 8: The distance is estimated using the assumption of 0.5 dB/km installed fiber loss including splices and cable margins for 1310 nm systems.

Note 9: The OC-3/12 SR and IR and STM-1/4 I-4 and S-4 transmitter power range is -8 dBm to -15 dBm. The transponder protection tray has a maximum insertion loss of 4 dB. Only OC-3/12 and STM-1/4 equipment with an output power greater than -14 dBm (including connector losses) is supported (Sensitivity of the 2.5G Flex OTR 1310 nm, 10^{-10}).

Table 2-36

Protocols supported by OTR 2.5 Gbit/s Universal 850 nm and OTR 2.5 Gbit/s Flex 850 nm (DWDM, CWDM, ITU CWDM, and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Fibre Channel FC 100-M6-SN-I	1.0625 Gbit/s	FC-100	Protected or Unprotected	0	0	62.5 μm MM 200 MHz*km	300 m, BER=10 ⁻¹²
Fibre Channel FC 100-M5-SN-I	1.0625 Gbit/s	FC-100	Protected or Unprotected	0	0	50 μm MM 500 MHz*km	500 m, BER=10 ⁻¹²
Fibre Channel FC 200-M6-SN-I	2.125 Gbit/s	FC-200	Protected	0	0	62.5 μm MM 200 MHz*km	30 m, BER=10 ⁻¹²
			Unprotected	0	0	62.5 μm MM 200 MHz*km	150 m, BER=10 ⁻¹²
Fibre Channel FC 200-M5-SN-I	2.125 Gbit/s	FC-200	Protected	0	0	50 μm MM 500 MHz*km	30 m, BER=10 ⁻¹²
			Unprotected	0	0	50 μm MM 500 MHz*km	300 m, BER=10 ⁻¹²
FICON	1.0625 Gbit/s	FICON	Protected or Unprotected	0	0	62.5 μm MM 200 MHz*km	300 m, BER=10 ⁻¹²
						50 μm MM 500 MHz*km	500 m, BER=10 ⁻¹²
FICON Express	2.125 Gbit/s	FICON Express	Protected	0	0	50 μm MM 500 MHz*km	30 m, BER=10 ⁻¹²
						62.5 μm MM 200 MHz*km	30 m, BER=10 ⁻¹²
			Unprotected	0	0	50 μm MM 500 MHz*km	300 m, BER=10 ⁻¹²
						62.5 μm MM 200 MHz*km	150 m, BER=10 ⁻¹²

Table 2-36 (continued)

Protocols supported by OTR 2.5 Gbit/s Universal 850 nm and OTR 2.5 Gbit/s Flex 850 nm (DWDM, CWDM, ITU CWDM, and 100 GHz) circuit packs

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Gigabit Ethernet 1000Base-SX	1.25 Gbit/s	Gigabit Ethernet	Protected or Unprotected	0	0	50 μm MM 400 MHz*km	500 m, BER=10 ⁻¹²
						50 μm MM 500 MHz*km	550 m, BER=10 ⁻¹²
						62.5 μm MM 160 MHz*km	220 m, BER=10 ⁻¹²
						62.5 μm MM 200 MHz*km	275 m, BER=10 ⁻¹²

Supported PMs for each protocol

Table 2-37 lists the 10 Gbit/s OTR supported PMs for each protocol. Table 2-38 lists the 10 Gbit/s Enhanced OTR supported PMs for each protocol. Table 2-39 lists the 2.5 Gbit/s 1310 OTR (DWDM, CWDM and ITU) supported PMs for each protocol. Table 2-40 lists the 2.5 Gbit/s 850 nm Gbit/s OTR (DWDM, CWDM, and ITU) supported PMs for each protocol.

Table 2-37
OTR 10 Gbit/s protocols and supported PMs

Protocol	Facility PMs (see Note)	Equipment PMs (see Note)
SONET OC-192	SONET/SDH on client (None on line)	Yes on client and line
SDH STM-64	SONET/SDH on client (None on line)	Yes on client and line
10GbE WAN IEEE	SONET/SDH on client (None on line)	Yes on client and line
10G Clear Channel	SFC on client and line	Yes on client and line
Note: For a description of available performance parameters see “Performance monitoring description” in <i>Software and User Interface</i> , 323-1701-101.		

Table 2-38
OTR 10 Gbit/s Enhanced protocols and supported PMs

Protocol	Facility PMs (see Note)	Equipment PMs (see Note)
SONET OC-192	SONET/SDH on client DigitalWrapper on line	Yes on client and line
SDH STM-64	SONET/SDH on client DigitalWrapper on line	Yes on client and line
10GbE WAN IEEE	SONET/SDH on client DigitalWrapper on line	Yes on client and line
10GbE LAN IEEE	LanPhy PMs and Ethernet OMs on client DigitalWrapper on line	Yes on client and line
10G Clear Channel	SFC on client DigitalWrapper on line	Yes on client and line
Note: For a description of available performance parameters see “Performance monitoring description” in <i>Software and User Interface</i> , 323-1701-101.		

Table 2-39
OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (DWDM, CWDM, ITU CWDM and 100 GHz) protocols and supported PMs

Protocol	Facility PMs (see Note1)	Equipment PMs (see Note1)
ATM OC-3 (see Note 2)	SONET/SDH on client (None on line)	Yes on client and line
ATM OC-12	SONET/SDH on client (None on line)	Yes on client and line
ATM OC-48	SONET/SDH on client (None on line)	Yes on client and line
DMIF	SFC on client and line	Yes on client and line
DV6000	SFC on client and line	Yes on client and line
ESRM-250	SONET/SDH on client (None on line)	Yes on client and line
FC 100-SM-LC-L	8B/10B on client (None on line)	Yes on client and line
FC 200-SM-LC-L	8B/10B on client (None on line)	Yes on client and line
FICON	8B/10B on client (None on line)	Yes on client and line
FICON Express	8B/10B on client (None on line)	Yes on client and line
Gigabit Ethernet 1000Base-LX	8B/10B on client (None on line)	Yes on client and line
HDTV	SFC on client and line	Yes on client and line
ISC-3 Peer-mode	8B/10B on client (None on line)	Yes on client and line
Orion	SFC on client and line	Yes on client and line
SONET OC-3 (see Note 2)	SONET/SDH on client (None on line)	Yes on client and line
SONET OC-12	SONET/SDH on client (None on line)	Yes on client and line
SONET OC-48	SONET/SDH on client (None on line)	Yes on client and line
SDH STM-1 (see Note 2)	SONET/SDH on client (None on line)	Yes on client and line

Table 2-39 (continued)**OTR 2.5 Gbit/s Universal 1310 nm and OTR 2.5 Gbit/s Flex 1310 nm (DWDM, CWDM, ITU CWDM and 100 GHz) protocols and supported PMs**

Protocol	Facility PMs (see Note1)	Equipment PMs (see Note1)
SDH STM-4	SONET/SDH on client (None on line)	Yes on client and line
SDH STM-16	SONET/SDH on client (None on line)	Yes on client and line
SRM-125	SFC on client and line	Yes on client and line
<p>Note 1: For a description of available performance parameters see “Performance monitoring description” in <i>Software and User Interface</i>, 323-1701-101.</p> <p>Note 2: This protocol supported only on the ITU OTR and Flex OTR 100 GHz circuit packs.</p>		

Table 2-40**OTR 2.5 Gbit/s Universal 850 nm and OTR 2.5 Gbit/s Flex 850 nm (DWDM, CWDM, ITU CWDM and 100 GHz) protocols and supported PMs**

Protocol	Facility PMs (see Note)	Equipment PMs (see Note)
FC 100-M6-SN-I	8B/10B on client (None on line)	Yes on line (None on client)
FC 100-M5-SN-I	8B/10B on client (None on line)	Yes on line (None on client)
FC 200-M6-SN-I	8B/10B on client (None on line)	Yes on line (None on client)
FC 200-M5-SN-I	8B/10B on client (None on line)	Yes on line (None on client)
FICON	8B/10B on client (None on line)	Yes on line (None on client)
FICON Express	8B/10B on client (None on line)	Yes on line (None on client)
Gigabit Ethernet 1000Base-SX	8B/10B on client (None on line)	Yes on line (None on client)
<p>Note: For a description of available performance parameters see “Performance monitoring description” in <i>Software and User Interface</i>, 323-1701-101.</p>		

Optical power threshold values

Table 2-41 lists the optical power threshold values for OTR circuit packs. If the value is within the ranges listed in the table, a threshold crossing alarm is raised. For a list of alarms raised when optical power thresholds are crossed, see Table 2-21.

Table 2-41
OTR optical power threshold values for alarming

OTR Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
10 Gbit/s Enhanced Line-side (see Note 2)	Rx Power High	-5.50	-5.00	-4.00	-6.00
	Rx Power Low	-24.50	-25.00	-26.00	-24.00
	Tx Power High	3.60	3.70	3.80	3.60
	Tx Power Low	2.60	2.50	2.40	2.60
10 Gbit/s Line-side (see Note 2)	Rx Power High	-5.50	-5.00	-4.50	-5.60
	Rx Power Low	-23.00	-23.50	-24.00	-22.90
	Tx Power High	0.50	0.60	1.20	0.00
	Tx Power Low	-3.50	-3.60	-4.20	-3.00
10 Gbit/s Enhanced Client-side (see Note 1)	Rx Power High	-1.50	-1.00	0.00	-2.00
	Rx Power Low	-14.5	-15.00	-16.00	-14.00
	Tx Power High	5.15	5.25	5.50	5.00
	Tx Power Low	0.85	0.75	0.50	1.00
10 Gbit/s Client-side (see Note 1)	Rx Power High	-2.00	-1.50	-1.00	-2.10
	Rx Power Low (NT0H18xx Hardware version 05 and lower)	-10.00	-10.50	-11.00	-9.90
	Rx Power Low (NT0H18xx Hardware version 06 and higher)	-11.50	-12.00	-13.00	-11.00
	Tx Power High	6.00	6.10	6.60	5.50
	Tx Power Low	4.00	3.90	3.40	4.50

Table 2-41 (continued)
OTR optical power threshold values for alarming

OTR Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
2.5 Gbit/s Line-side (see Note 2)	Rx Power High	-6.00	-5.50	-4.50	-6.50
	Rx Power Low	-27.00	-27.50	-28.50	-26.50
	Tx Power High	3.80	3.90	4.10	3.70
	Tx Power Low	3.10	3.00	2.90	3.10
2.5 Gbit/s Client-side (see Note 1 and Note 3)	Rx Power High	-0.50	0.00	1.00	-1.00
	Rx Power Low	-17.50	-18.00	-19.00	-17.00
	Tx Power High	0.90	1.00	2.00	0.00
	Tx Power Low	-5.90	-6.00	-7.00	-5.00

Note 1: For power monitor accuracy, see [Table 2-30 on page 2-79](#).

Note 2: For power monitor accuracy, see [Table 2-31 on page 2-84](#).

Note 3: Optical power thresholds are not supported on the 850 nm versions of the OTR circuit pack.

Muxponder circuit pack

- [Power consumption values on page 2-116](#)
- [Technical specifications—client side on page 2-117](#)
- [Technical specifications—line side on page 2-118](#)
- [Supported optical protocols on page 2-121](#)
- [Supported PMs for each protocol on page 2-124](#)
- [Optical power threshold values on page 2-125](#)

Power consumption values

[Table 2-42](#) lists the power consumption of the Muxponder circuit packs.

Table 2-42
Muxponder circuit pack power consumption

Characteristic	Value or range	
	Typical	Maximum
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC 100 GHz	48 W	68 W
Muxponder 10 Gbit/s GbE/FC VCAT Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	53 W	68 W
Note: Maximum power consumption values are obtained during worst-case operating conditions.		

Technical specifications—client side

Table 2-43 lists the specifications for the client-side interface of the following Muxponder 10 Gbit/s circuit packs:

- Muxponder 10 Gbit/s GbE/FC
- Muxponder 10 Gbit/s GbE/FC VCAT
- Muxponder 10 Gbit/s GbE/FC 100 GHz
- Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz

Table 2-43
Specifications for Muxponder 10 Gbit/s circuit pack—client side

Characteristic	Value or range	
	Minimum	Maximum
Bit rates		
1310 nm SFP (NTTP06CF) 850 nm SFP (NTTP06AF)	1.0625 Gbit/s	2.125 Gbit/s
Rx wavelength		
1310 nm SFP (NTTP06CF)	1270 nm	1355 nm
850 nm SFP (NTTP06AF)	770 nm	860 nm
Tx wavelength		
1310 nm SFP (NTTP06CF)	1270 nm	1355 nm
850 nm SFP (NTTP06AF)	830 nm	860 nm
Tx power		
1310 nm SFP (NTTP06CF)	-9.5 dBm	-3.0 dBm
850 nm SFP (NTTP06AF)	-9.5 dBm	-1.5 dBm
Rx power (see Note 1)	Minimum Sensitivity	Minimum Overload
1310 nm SFP (NTTP06CF)	-20.0 dBm BER=10 ⁻¹² (see Note 2)	-3.0 dBm BER=10 ⁻¹²
850 nm SFP (NTTP06AF)	-17.0 dBm or -15.0 dBm BER=10 ⁻¹² (see Note 3)	0.0 dBm BER=10 ⁻¹²
Optical power monitor accuracy (see Note 4)	TX	RX
1310 nm SFP (NTTP06CF)	± 2.0 dB	± 2.0 dB
850 nm SFP (NTTP06AF)	± 2.0 dB	± 3.0 dB

Table 2-43 (continued)
Specifications for Muxponder 10 Gbit/s circuit pack—client side

Characteristic	Value or range
Applicable optical fiber types supported	
1310 nm SFP (NTTP06CF)	Protocol dependent, see Table 2-46 on page 2-123
850 nm SFP (NTTP06AF)	50/62.5 μ m MM
<p>Note 1: The Rx minimum sensitivity specifications are back-to-back and include no path power penalties.</p> <p>Note 2: FC-100 and FC-200 standards do not specify a sensitivity requirement (quoted values are calculated using Optical Modulation Amplitude specifications).</p> <p>Note 3: -17 dBm for FC-100, FICON, and Gigabit Ethernet, -15 dBm for FC-200 and FICON Express. FC-100 and FC-200 standards do not specify a sensitivity requirement (quoted values are calculated using Optical Modulation Amplitude specifications).</p> <p>Note 4: External power meters may differ from System Manager by up to ± 2.0 dB.</p>	

Technical specifications—line side

[Table 2-44](#) lists the specifications for the line-side interface of the Muxponder circuit packs.

	<p>CAUTION Risk of equipment damage Damage to the line-side receiver (Rx) of the Muxponder 10 Gbit/s circuit pack can occur. Under no circumstances should the transmitter (Tx) be loop-backed directly to the receiver (Rx).</p>
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Table 2-44
Specifications for Muxponder 10 Gbit/s circuit pack—line side

Characteristic	Value or range		
	Minimum	Maximum	
Bit rates			
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	10.709225 Gbit/s	10.709225 Gbit/s	
Tx power	Typical	Minimum	Maximum
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT	3.3 dBm	2.6 dBm	4.0 dBm
Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	3.4 dBm	2.6 dBm	4.0 dBm

Table 2-44 (continued)
Specifications for Muxponder 10 Gbit/s circuit pack—line side

Characteristic	Value or range		
Rx power (see Note 1 and Note 2)	Minimum Sensitivity	Minimum Overload	Damage Level
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	-25.0 dBm BER= 10^{-12}	-5.0 dBm BER= 10^{-12}	-2.0 dBm
Rx wavelength	Minimum	Maximum	
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	1528.773 nm	1605.744 nm	
Tx Center wavelength	Value or range		
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT	see Table 2-25 on page 2-76		
Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	see Table 2-26 on page 2-76		
Tx wavelength tolerance			
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	± 0.05 nm		
Dispersion reach limit (NDSF)			
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT	typically 110 km for C-band and 95 km for L-band (2000 ps/nm. See Note 3)		
Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	typically 110 km (2000 ps/nm. See Note 3)		

Table 2-44 (continued)
Specifications for Muxponder 10 Gbit/s circuit pack—line side

Characteristic	Value or range	
	TX	RX
Optical power monitor accuracy (See Note 4)		
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC VCAT Muxponder 10 Gbit/s GbE/FC 100 GHz Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	± 1.0 dB	± 1.5 dB
<p>Note 1: Rx overload and Rx sensitivity specifications are back-to-back and include no path penalties. The Network Modeling Tool (NMT) should be used to account for path penalties. If NMT is not used to design the network:</p> <ul style="list-style-type: none"> • For Rx sensitivity path penalties, see “Link engineering rules” in <i>Network Planning and Link Engineering</i>, 323-1701-110. • For Muxponder 10 Gbit/s GbE/FC 100 GHz and Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz circuit packs, use the Common Photonic Layer Optical Modeler tool. <p>Note 2: In most cases, traffic continuity at high and low input power is determined by the Receive Power High Fail Threshold and Receive Power Low Fail Threshold rather than by the minimum overload and minimum sensitivity. For threshold values, <i>Technical Specifications</i>, 323-1801-180.</p> <p>Note 3: In some applications, it may be possible to exceed the dispersion limits on NDSF fiber. To ensure that the dispersion limit of the circuit pack is not exceeded, it is necessary to check that either:</p> <ul style="list-style-type: none"> • The total measured dispersion of the fiber, from the TX (add) through all spans to the RX (drop), is less than 2000 ps/nm • If the characteristic dispersion per unit length (ps/nm/km) of the fiber is known, then the maximum reach can be calculated using the 2000 ps/nm dispersion limit (for example, the maximum reach over 17 ps/nm/km dispersion fiber is 2000/17 = 117 km) <p>It is important to perform this check at the longest wavelength to be deployed, as dispersion is wavelength dependent.</p> <p>Note 4: External power meters may differ from System Manager by up to ± 2.0 dB.</p>		

Supported optical protocols

- Muxponder 10 Gbit/s using 850 nm SFP (NTTP06AF) (see [Table 2-45 on page 2-122](#))
- Muxponder 10 Gbit/s using 1310 nm SFP (NTTP06CF) (see [Table 2-46 on page 2-123](#))

Notes about the Protocol tables

- The attenuator and reach values refer to the client-side of the network.
- Since various fiber losses exist, the tables list both a maximum allowed loss and a maximum distance. The maximum distance is calculated from the maximum loss based on the allowed fiber loss for a given protocol.
- In most cases, a link budget does not apply to multimode fiber. If power and sensitivity values of the circuit pack meet a given standard specification, then the distance in that standard is considered to be the maximum possible distance.
- If further distance is possible with the circuit pack than that specified by a standard, then the distance specified in the standard is stated as the maximum possible distance.
- The BER for a given link is based upon the value stated in the appropriate standard.
- The attenuator values apply to the Optical Metro 5100/5200 Tx and Rx only, and are required for minimum overload protection when the subtending equipment is co-located with the Optical Metro 5100/5200 equipment. The attenuator value can be traded off for fiber loss as long as the input power to the receiver meets the minimum overload specification.
- The attenuator values provided are minimum values. For example, if the table indicates that a 7 dB pad is needed, an 8 dB pad can be used.
- In most cases, the attenuator does not limit the reach. However, there are certain cases where the attenuator will limit the reach. In this case, the reach specified is with the attenuator removed.

Table 2-45
Protocols supported by Muxponder 10 Gbit/s circuit packs using 850 nm SFP (NTTP06AF)

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach
				Tx	Rx		
Fibre Channel FC 100-M5-SN-I	1.0625 Gbit/s	FC-100	Protected or Unprotected	0	0	50 µm MM 500 MHz*km	500 m, BER=10 ⁻¹²
Fibre Channel FC 100-M6-SN-I	1.0625 Gbit/s	FC-100	Protected or Unprotected	0	0	62.5 µm MM 200 MHz*km	300 m, BER=10 ⁻¹²
Fibre Channel FC 200-M5-SN-I	2.125 Gbit/s	FC-200	Protected or Unprotected	0	0	50 µm MM 500 MHz*km	300 m, BER=10 ⁻¹²
Fibre Channel FC 200-M6-SN-I	2.125 Gbit/s	FC-200	Protected or Unprotected	0	0	62.5 µm MM 200 MHz*km	150 m, BER=10 ⁻¹²
FICON	1.0625 Gbit/s	FICON	Protected or Unprotected	0	0	50 µm MM 500 MHz*km	500 m, BER=10 ⁻¹²
						62.5 µm MM 200 MHz*km	300 m, BER=10 ⁻¹²
FICON Express	2.125 Gbit/s	FICON Express	Protected or Unprotected	0	0	50 µm MM 500 MHz*km	300 m, BER=10 ⁻¹²
						62.5 µm MM 200 MHz*km	150 m, BER=10 ⁻¹²
Gigabit Ethernet 1000Base-SX	1.25 Gbit/s	Gigabit Ethernet	Protected or Unprotected	0	0	50 µm MM 400 MHz*km	500 m, BER=10 ⁻¹²
						50 µm MM 500 MHz*km	550 m, BER=10 ⁻¹²
						62.5 µm MM 160 MHz*km	220 m, BER=10 ⁻¹²
						62.5 µm MM 200 MHz*km	275 m, BER=10 ⁻¹²

Table 2-46
Protocols supported by Muxponder 10 Gbit/s circuit packs using 1310 nm SFP (NTTP06CF)

Protocol	Bit rate	System Manager menu name	Protection scheme	Attenuator value for colocation		Fiber type	Reach	
				Tx	Rx			
Fibre Channel FC 100-SM-LC-L	1.062 Gbit/s	FC-100	Protected or Unprotected	0	0	SM	10 km, BER= 10^{-12}	
Fibre Channel FC 200-SM-LC-L	2.125 Gbit/s	FC-200	Protected or Unprotected	0	0	SM	10 km, BER= 10^{-12}	
FICON	1.0625 Gbit/s	FICON	Protected or Unprotected	0	0	SM	10 km, BER= 10^{-12}	
FICON Express	2.125 Gbit/s	FICON Express	Protected or Unprotected	0	0	SM	10 km, BER= 10^{-12}	
Gigabit Ethernet 1000Base-LX	1.25 Gbit/s	Gigabit Ethernet	Protected or Unprotected	0	0	SM	5 km, BER= 10^{-12}	
Gigabit Ethernet 1000Base-LX	1.25 Gbit/s	Gigabit Ethernet	Protected or Unprotected	0	0	SM	5 km, BER= 10^{-12}	
						50 μ m MM 400 MHz*km		550 m, BER= 10^{-12} (see Note 1)
						50 μ m MM 500 MHz*km		
Gigabit Ethernet 1000Base-LX10 (see Note 2)	1.25 Gbit/s	Gigabit Ethernet	Protected or Unprotected	0	0	SM	5 km, BER= 10^{-12}	
						50 μ m MM 500 MHz*km		550 m, BER= 10^{-12} (see Note 1)
						62.5 μ m MM 500 MHz*km		

Note 1: A mode-conditioning patch cord or plug is required to guarantee error-free performance if the subtending equipment is not collocated with the Optical Metro 5100/5200. Collocated means less than 30 m (100 ft.) away.

Note 2: Subtending equipment must support 1000BASE-LX10.

Supported PMs for each protocol

Table 2-47 lists the Muxponder 10 Gbit/s supported PMs for each protocol.

Table 2-47
Muxponder 10 Gbit/s protocols and supported PMs

Protocol	Facility PMs (see Note)	Equipment PMs (see Note)
Fibre Channel	8B/10BWAN on client SONET/DigitalWrapper, SDH/DigitalWrapper on line	Yes on client and line
FICON	8B/10BWAN on client SONET/DigitalWrapper, SDH/DigitalWrapper on line	Yes on client and line
FICON Express	8B/10BWAN on client SONET/DigitalWrapper, SDH/DigitalWrapper on line	Yes on client and line
Gigabit Ethernet	GigEWAN on client (GFP-T), GigE on client (GFP-F) SONET/DigitalWrapper, SDH/DigitalWrapper on line	Yes on client and line
Note: For a description of available performance parameters see " Performance monitoring description " in <i>Software and User Interface</i> , 323-1701-101.		

Optical power threshold values

Table 2-48 lists the optical power threshold values for Muxponder 10 Gbit/s circuit packs. If the value is within the ranges listed in the table, a threshold crossing alarm is raised. For a list of alarms raised when optical power thresholds are crossed, see Table 2-21.

Table 2-48
Muxponder 10 Gbit/s optical power threshold values for alarming

Muxponder Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
Muxponder 10 Gbit/s Line-side (see Note)	Rx Power High	-5.50	-5.00	-4.00	-6.00
	Rx Power Low	-24.50	-25.00	-26.00	-24.00
	Tx Power High	3.60	3.70	3.80	3.60
	Tx Power Low	2.60	2.50	2.40	2.60
Muxponder 10 Gbit/s Client-side	Rx Power High	not supported	not supported	not supported	not supported
	Rx Power Low	not supported	not supported	not supported	not supported
	Tx Power High	not supported	not supported	not supported	not supported
	Tx Power Low	not supported	not supported	not supported	not supported
Note: For power monitor accuracy, see Table 2-44 on page 2-118.					

OFA circuit pack

- [Technical specifications on page 2-126](#)
- [Optical power threshold values on page 2-129](#)

Technical specifications

[Table 2-49](#) lists the specifications for OFA circuit packs. [Table 2-50 on page 2-127](#) lists the specifications for Standard OFA and the High Input Power OFA circuit pack.

Table 2-49
OFA VGA circuit pack specifications

Characteristic		Value or range	
Power consumption (see Note 1)		Typical	Maximum
	C-band	25 W	30 W
	L-band	25 W	30 W
		Minimum	Maximum
Average optical gain (see Note 2)		7 dB (see Note 3)	17 dB
Gain stability (see Note 4)		—	± 0.3 dB
Total Rx power (see Note 5)		-28.0 dBm	9.0 dBm
	17 dB gain	-28.0 dBm	-2.0 dBm (see Note 6)
	7 dB gain	-18.0 dBm (see Note 7)	8.0 dBm
Total Tx power		-11.0 dBm	15.1 dBm (see Note 8)
Tx level per channel		—	3.0 dBm (see Note 8)
Rx optical power monitor accuracy		—	± 0.6 dB down to -12 dBm ± 0.7 dB down to -26 dBm ± 0.9 dB down to -32 dBm
Tx optical power monitor accuracy		—	± 0.6 dB up to 17 dBm ± 1.0 dB up to 5 dBm ± 1.5 dB up to -9 dBm

Table 2-49 (continued)
OFA VGA circuit pack specifications

Characteristic		Value or range	
		Minimum	Maximum
Wavelength	C-band	1528.52 nm	1562.48 nm
	L-band	1570.17 nm	1606.98 nm
Noise figure (see Note 9)	C-band	—	6.3 dB
	L-band	—	6.3 dB
<p>Note 1: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).</p> <p>Note 2: Gain is automatically adjusted by software to the value required to achieve the target output power given by the user. Once the target power is achieved, the circuit pack switches into constant gain mode.</p> <p>Note 3: Although the minimum gain quoted is 7 dB, in order to have some margin, the circuit pack gain can go down to 5 dB.</p> <p>Note 4: The gain stability is given relative to the System Manager power reading.</p> <p>Note 5: In most cases, traffic continuity at maximum and minimum input power is determined by the Receive Power High Fail Threshold and Receive Power Low Fail Threshold. For threshold values, see Table 2-51 on page 2-129.</p> <p>Note 6: At high input power, the gain has to be reduced in order to prevent saturation. For each dB of input power greater than -2 dBm, the gain will decrease by one dB to prevent saturation.</p> <p>Note 7: At lower gain setting, the minimum Rx input power has to increase in order to prevent Loss Of Signal. For each dB of gain reduction, the maximum input power has to be increased by one dB.</p> <p>Note 8: Tx power levels are independent of the gain setting of the module. Even though the amplifier can support a total output power of +17 dBm, in order to have margin, System Manager will enforce a maximum aggregate target output power of +15.1 dBm, i.e. +3 dBm/ch if 16 channels are present.</p> <p>Note 9: The quoted noise figure is for a maximum gain of 17 dB. As the gain decreases, the noise figure increases by 1 dB for each dB of gain reduction.</p>			

Table 2-50
Standard OFA and High Input Power OFA circuit pack optical interface specifications

Characteristic		Value or range	
		Typical	Maximum
Power consumption (see Note 1)	Standard OFA: C-band	14 W	22 W
	Standard OFA: L-band	20 W	36 W
	High Input Power OFA: C-band	16 W	29 W
	High Input Power OFA: L-band	26 W	49 W

Table 2-50 (continued)
Standard OFA and High Input Power OFA circuit pack optical interface specifications

Characteristic		Value or range		
		Average	Minimum	Maximum
Optical gain per channel	Standard OFA	23.0 dB	22.0 dB	24.0 dB
	High Input Power OFA	23.0 dB	22.0 dB	24.0 dB
Gain stability	Standard OFA			± 0.5 dB
	High Input Power OFA			± 0.25 dB
Total Tx level	Standard OFA		-6.0 dBm	13.0 dBm
	High Input Power OFA		-6.0 dBm	16.0 dBm
Tx level per channel	Standard OFA	—	—	—
	High Input Power OFA	—	—	4.0 dBm
Total Rx power (see Note 2)	Standard OFA	—	-28.0 dBm	-11.0 dBm
	High Input Power OFA	—	-28.0 dBm	-7.0 dBm (see Note 3)
Rx optical power monitor accuracy	Standard OFA	± 0.5 dB down to -22 dBm ± 1.0 dB down to -31 dBm		
	High Input Power OFA	± 0.25 dB down to -20 dBm ± 0.5 dB down to -25 dBm ± 1.0 dB down to -32 dBm		
Wavelength		Minimum		Maximum
	Standard OFA: C-band	1528.52 nm		1562.48 nm
	High Input Power OFA: C-band			
	Standard OFA: L-band	1570.17 nm		1606.98 nm
High Input Power OFA: L-band				

Table 2-50 (continued)
Standard OFA and High Input Power OFA circuit pack optical interface specifications

Characteristic	Value or range		
	Minimum	Maximum	
Noise figure	Standard OFA: C-band	—	5.5 dB
	High Input Power OFA: C-band	—	5.3 dB
	Standard OFA: L-band	—	6.0 dB
	High Input Power OFA: L-band	—	5.3 dB
<p>Note 1: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity).</p> <p>Note 2: In most cases, traffic continuity at maximum and minimum input power is determined by the Receive Power High Fail Threshold and Receive Power Low Fail Threshold. For threshold values, see Table 2-51 on page 2-129.</p> <p>Note 3: Although the HIP amplifier can accept a maximum input power of -7.0 dBm, it is recommended that you engineer to a maximum input power of -8 dBm, as implemented in the Network Modeling Tool. The -8.0 dBm value includes a 1.0 dB buffer for increased network reliability.</p>			

Optical power threshold values

[Table 2-51](#) lists the optical power threshold values for OFA circuit packs performance monitoring (PM). If the value is within the ranges listed in the table, a threshold crossing alarm is raised. For a list of alarms raised when optical power thresholds are crossed, see [Table 2-21](#).

Table 2-51
OFA optical power threshold values for alarming

OFA Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
Standard OFA	Rx Power High	-10.50	-10.00	-9.00	-11.00
	Rx Power Low	-28.50	-29.00	-30.00	-28.00
	Tx Power High	13.90	14.00	15.00	13.00
	Tx Power Low	-5.90	-6.00	-7.00	-5.00

Table 2-51 (continued)
OFA optical power threshold values for alarming

OFA Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
High Input Power OFA	Rx Power High	-6.50	-6.00	-5.00	-7.00
	Rx Power Low	-28.50	-29.00	-30.00	-28.00
	Tx Power High	17.90	18.00	19.00	17.00
	Tx Power Low	-5.90	-6.00	-7.00	-5.00
OFA VGA	Rx Power High	9.50	10.00	11.00	9.00
	Rx Power Low (see Note)	$-28.50 + (P_{in} - P_{out}) + 17$	$-29.00 + (P_{in} - P_{out}) + 17$	$-31.00 + (P_{in} - P_{out}) + 17$	$-28.00 + (P_{in} - P_{out}) + 17$
	Tx Power High	17.90	18.00	19.00	17.00
	Tx Power Low	-11.90	-12.00	-13.00	-11.00
<p>Note: P_{in} is the input power and P_{out} is the output power in dBm after power adjust (or equalization) successfully completes.</p>					

APBE circuit pack

- [Technical specifications on page 2-131](#)
- [Optical power threshold values on page 2-132](#)

Technical specifications

Table 2-52 lists specifications for the APBE circuit pack.

Table 2-52
APBE circuit pack specifications

Characteristic	Value or Range				
	APBE		APBE Enhanced		
Maximum power consumption	19.5 W		14 W		
Typical power consumption	12.5 W		10 W		
Maximum total input power - for correct operation	14 dBm		14 dBm		
Maximum total input power - damage level	17 dBm		18 dBm		
Minimum return loss	35 dB		35 dB		
Attenuation for each band	0.0dB to 28.0 dB		0.0 dB to 30.0 dB		
Insertion Loss	Maximum	Typical	Maximum	Typical	
	C-band	6.9 dB	5.7 dB	4.6 dB	4.1 dB
	L-band	6.9 dB	5.9 dB	4.6 dB	4.1 dB

Optical power threshold values

Table 2-53 lists the optical power thresholds for the APBE and APBE Enhanced. If the value is within the ranges listed in the table, a threshold crossing alarm is raised. For a list of alarms raised when optical power thresholds are crossed, see Table 2-21.

Table 2-53

APBE Enhanced optical power threshold values for alarming

Facility Type	Threshold	Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
Band - Port 1, Port 2, Port 3, or Port 4	Rx Power High	not supported	not supported	not supported	not supported
	Rx Power Low	-26.50	-27.00	-28.00 (See Note 1)	-25.00 (for degrade) -26.00 (for fail)
	Tx Power High	not supported	not supported	not supported	not supported
	Tx Power Low	-29.90	-30.00	-31.00 (See Note 2)	-28.00 (for degrade) -29.00 (for fail)

Table 2-53 (continued)

APBE Enhanced optical power threshold values for alarming

Facility Type	Threshold		Default User Threshold (dBm)	Degrade Threshold (dBm)	Fail Threshold (dBm)	Clear Threshold (dBm)
Aggregate - Port 5 (Standard OFA)	Rx Power High		not supported	not supported	not supported	not supported
	Rx Power Low		not supported	not supported	(See Note 1)	not supported
	Tx Power High	When associated equipment provisioned as OFA Standard	-10.10	-10.00	-9.00	-10.00
		When associated equipment provisioned as OFA HIP	-6.10	-6.00	-5.00	-6.00
		When associated equipment provisioned as OFA VGA	0.90	1.00	2.00	1.00
		When associated equipment provisioned as DSCM	10.90	11.00	12.00	11.00
	Tx Power Low		not supported	not supported	(See Note 2)	not supported

Note 1: When the receive power of all ports have dropped below their fail thresholds, the Rx Loss of signal alarm is raised against the aggregate port.

Note 2: When the transmit power of all In-Service ports have dropped below their fail thresholds, the Tx Low Optical Power alarm is raised against the aggregate port.

OSC circuit pack

Table 2-54 lists the specifications of the OSC circuit pack.

Table 2-54
OSC circuit pack specifications

Characteristic		Value or range	
		Typical	Maximum
Power consumption (see Note)		10 W	16 W
Bit rate		Minimum	Maximum
		OSC ports	155.52 Mbit/s
WSC ports		125 Mbit/s (Fast Ethernet)	125 Mbit/s (Fast Ethernet)
Wavelength		OSC ports	1510 nm
		WSC ports	1310 nm
Tx power		Minimum	Maximum
		OSC ports	-3.0 dBm
WSC ports		-20.0 dBm	-14.0 dBm
Rx power		Minimum sensitivity	Minimum Overload
		OSC ports	-34.5 dBm
WSC ports		-31.0 dBm	-8.0 dBm
Dispersion reach limit		OSC ports	110 km
		WSC ports	2 km
Supported applicable fiber type		OSC ports	SM fiber
		WSC ports	62.5/125 μ m MM fiber
<p>Note: Maximum power consumption values are obtained during worst-case operating conditions (for example, temperature, humidity)</p>			

Filler cards

For the forced-air cooling to work correctly, all unused slots in the card cage must have filler cards installed. [Table 2-55](#) lists the types of filler cards.

Table 2-55
Types of filler cards

Filler card	Description
OCLD filler card	OCLD filler cards (NT0H52BA) have FC connectors on the faceplate to hold unused pigtails from the OMX (Standard) tray. The OCLD filler card is mandatory if you are using the OMX (Standard) tray. The OCLD filler card may also be used in any shelf if you want to pre-fiber any OMX variant other than the OMX (Standard) tray. Note: Pre-fibering is an optional exercise. It is not mandatory.
LC filler card	LC filler cards (NT0H52DA) have LC connectors on the faceplate to hold unused pigtails from any OMX variant other than the OMX (Standard) tray. The LC filler card is used if you want to pre-fiber any OMX variant other than the OMX (Standard) tray. Note: Pre-fibering is an optional exercise. It is not mandatory.
OFA filler card	The OFA filler card has two SC faceplate connectors that connect to the fiber-optic patch cords from the ECT. The TX and RX ports on the filler card faceplate are looped using an SMF patch cord. The OFA filler card is only required for OPTera Metro 5200 OFA shelves using ECTs.
Blank filler card	The blank filler card does not have faceplate connectors. Install blank filler cards in all other empty slots.

Gigabit Ethernet frame length specifications

The following OCI and OTR circuit packs support any Gigabit Ethernet frame length as these circuit packs do not process the Ethernet frames:

- OCI 622 Mbit/s 1310 nm
- OCI 1.25 Gbit/s 1310 nm
- OCI 1.25 Gbit/s 850 nm
- OCI GbE 1310 nm
- OCI GbE 850 nm
- OCI SRM 1310 nm

- OCI SRM 1310 nm LC
- OTR 2.5 Gbit/s Flex 1310 nm DWDM
- OTR 2.5 Gbit/s Flex 850 nm DWDM
- OTR 2.5 Gbit/s Flex 1310 nm CWDM
- OTR 2.5 Gbit/s Flex 850 nm CWDM
- OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM
- OTR 2.5 Gbit/s Flex 850 nm ITU CWDM
- OTR 2.5 Gbit/s Flex 1310 nm 100 GHz
- OTR 2.5 Gbit/s Flex 850 nm 100 GHz
- OTR 2.5 Gbit/s Universal 1310 nm
- OTR 2.5 Gbit/s Universal 850 nm
- OTR 10 Gbit/s in 10G Ethernet WAN mode
- OTR 10 Gbit/s Enhanced in 10G Ethernet WAN mode or in 10G Ethernet LAN mode

Note: In 10G Ethernet LAN mode, OM counters (FrTooShorts and FrTooLongs) flag frames to be too short or too long based on the standard Ethernet frame size specified by 802.3 (64Bytes and 1522Bytes).

The following OCI circuit packs support frame lengths defined by the Maximum Transmission Unit (MTU) parameter which is provisionable to be either 1600 or 9600:

- OCI SRM GbE/FC 1310 nm
- OCI SRM GbE/FC 850 nm
- OCI SRM GbE/FC Enhanced 1310 nm
- OCI SRM GbE/FC Enhanced 850 nm
- OCI SRM GbE 1310 nm
- OCI SRM GbE 850 nm

For Muxponder circuit packs:

- When using GFP-T, the Maximum Transmission Unit (MTU) value cannot be set. The circuit pack passes frames with any frame size. However, a frame size greater than 9600 bytes is considered a FrameTooLong and increments the FrameTooLong Ethernet OM counter.
- When using GFP-F, the supported frame length is defined by the MTU parameter which is provisionable to either 1600 or 9600.

Latency specifications

- Latency is quoted based on the type of client interface (that is, type of OCI/SRM/OTR pack). Not for OCLD, OCM, OMX etc.
- Latency quoted is end-to-end and includes the effect of all Optical Metro 5100/5200 circuit packs in the path (OCLD, OCM, etc.).
- Latency does not include delay due to speed of light in fiber (5 μ s/km).
- The typical latency for an OCLD to OCLD passthrough (bridge or regen) channel assignment is 0.1 μ s.

Constant latency circuit packs

The circuit packs listed in [Table 2-56](#) have constant latency.

Table 2-56
Constant latency circuit pack specifications

Circuit pack	Typical Latency (μ s)
OCI 622 Mbit/s 1310 nm	0.1
OCI 1.25 Gbit/s 1310 nm	0.1
OCI 1.25 Gbit/s 850 nm	0.1
OCI OC-48/STM-16 1310 nm	0.1
OCI ISC 1310 nm	0.1
OCI GbE 1310 nm	0.1
OCI GbE 850 nm	0.1
OCI SONET/SDH 1310 nm	0.1
OCI SONET/SDH IR 1310 nm	0.1
OCI SRM SONET/SDH 1310 nm	4.0
OCI SRM ESCON 1310 nm	3.0
OCI SRM SONET/SDH LTE	5.0
OTR 2.5 Gbit/s Flex 1310 nm	0.1
OTR 2.5 Gbit/s Flex 850 nm	0.1
OTR 2.5 Gbit/s Universal 1310 nm	0.1
OTR 2.5 Gbit/s Universal 850 nm	0.1
OTR 2.5 Gbit/s Flex 1310 nm CWDM	0.1
OTR 2.5 Gbit/s Flex 850 nm CWDM	0.1

Table 2-56 (continued)
Constant latency circuit pack specifications

Circuit pack		Typical Latency (µs)
OTR 2.5 Gbit/s Flex 1310 nm ITU CWDM		0.1
OTR 2.5 Gbit/s Flex 850 nm ITU CWDM		0.1
OTR 2.5 Gbit/s Flex 1310 nm 100 GHz		0.1
OTR 2.5 Gbit/s Flex 850 nm 100 GHz		0.1
OTR 10 Gbit/s DWDM		4.0
OTR 10 Gbit/s Enhanced DWDM	OC-192, STM-64, 10G Ethernet WAN, 10G Clear Channel	12.0
	10G Ethernet LAN	70.0

OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced and OCI SRM GbE circuit pack latency specifications

[Table 2-57](#) specifies the typical latency for the OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced and the OCI SRM GbE circuit packs for each mode of operation.

Table 2-57
OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced and OCI SRM GbE latency

Circuit pack type	Protocol	Configuration	Typical Latency (µs)
OCI SRM GbE/FC	FC-100 FICON	Full Rate	39
	GbE	PAUSE Disabled	14.4 + 0.018 x frame length (bytes). See Table 2-58 .
	GbE	PAUSE Enabled	Variable

Table 2-57
OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced and OCI SRM GbE latency

Circuit pack type	Protocol	Configuration	Typical Latency (μ s)
OCI SRM GbE/FC Enhanced	FC-100 FICON	Subrate Disabled, Extended Reach Disabled	39
	FC-100 FICON	Subrate Enabled, Extended Reach Enabled	See Figure 2-1 on page 2-140
	GbE	PAUSE Disabled	$14.4 + 0.018 \times$ frame length (bytes). See Table 2-58 .
	GbE	PAUSE Enabled	Variable
OCI SRM GbE	GbE	PAUSE Disabled	$14.4 + 0.018 \times$ frame length (bytes). See Table 2-58 .
	GbE	PAUSE Enabled	Variable

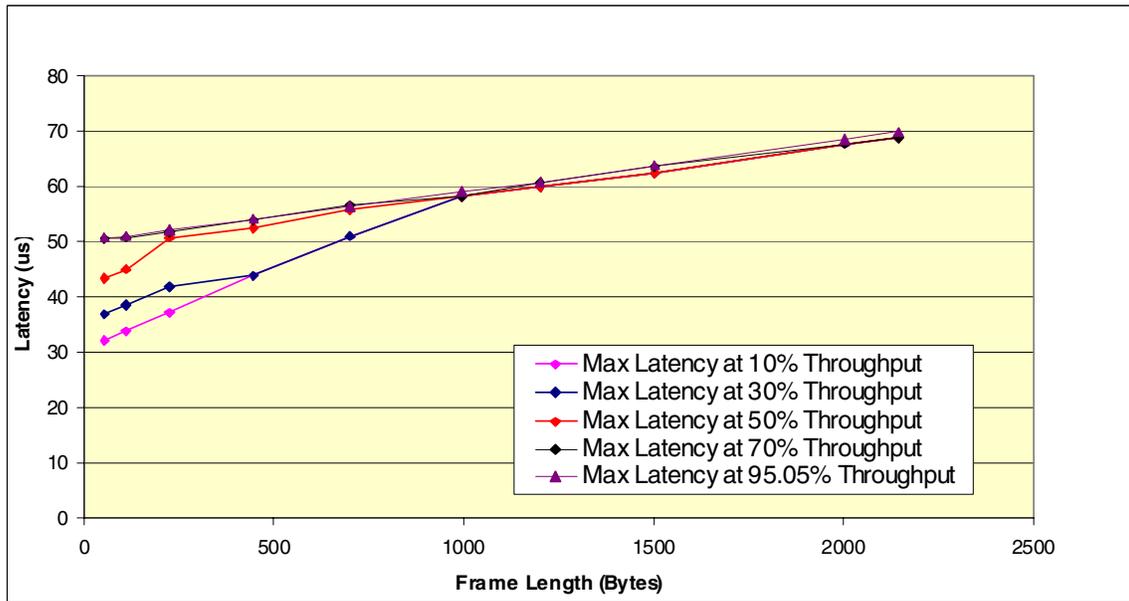
[Table 2-58](#) displays the Gigabit Ethernet latency specifications for the OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced and OCI SRM GbE circuit packs based on some approximate minimum, maximum and jumbo frame sizes.

Table 2-58
Gigabit Ethernet latency specifications for the OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced and OCI SRM GbE circuit packs based on frame size

Gigabit Ethernet packet size	Typical Latency (μ s)
72 bytes (approx. minimum frame size)	15.7
1500 bytes (approx. maximum frame size)	41.4
9000 bytes (jumbo frame size)	176.0

Latency for the OCI SRM GbE/FC Enhanced circuit pack when configured for FC-100 and FICON with subrate enabled and extended reach enabled is dependent on both client data throughput and frame length. [Figure 2-1](#) describes the relationship between latency, frame length and throughput with no backpressure (that is, WAN bandwidth greater than LAN bandwidth). Note that if LAN throughput approaches 100%, latency may be significantly higher due to the use of approximately 7 ms of egress buffering.

Figure 2-1
Latency vs. frame length for various LAN throughputs, WAN bandwidth set to STS-24C



OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit pack latency specifications

The OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit pack has bit-rate dependent latency which can be calculated using the following formula:

$$\text{Latency } (\mu\text{s}) = 0.243 + 572 \div \text{bit rate (Mbit/s)}$$

[Table 2-59](#) displays the latency for all provisionable protocols supported on the OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit pack.

Table 2-59
OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit pack latency specifications

Protocol	Latency (μs)
OC-1	11.3
FDDI	4.8
Fast Ethernet	4.8
FC-12 (133M)	4.5
Asynch FOTS 150M	4.1
OC-3	3.9
STM-1	3.9
ESCON (SBCON)	3.1
FC-25 (266M)	2.4
D1 Video	2.4

Muxponder 10 Gbit/s GbE/FC circuit pack latency specifications

The latency specifications for the Muxponder 10 Gbit/s circuit pack are from the local client port to the remote client port with negligible fiber (less than 3 ft) on the DWDM line side.

If additional fiber is used on the line side, add fiber latency to the Muxponder latency according to the following formula:

$$\text{Fiber latency } (\mu\text{s}) = 4.84 \times \text{Fiber length (km)}$$

The Muxponder typical latency specifications are detailed in [Table 2-60](#).

Table 2-60
Muxponder 10 Gbit/s circuit pack latency

Circuit pack type	Protocol	Configuration	Typical Latency (μs)
Muxponder 10 Gbit/s GbE/FC Muxponder 10 Gbit/s GbE/FC 100 GHz	GbE	GFP-T, C-cat	17 (see Note 1, 2, 4)
	FC-100 FICON	GFP-T, C-cat	17 (see Note 1, 3, 4)
	FC-200 FICON Express	GFP-T, C-cat	16 (see Note 1, 3, 4)

Table 2-60 (continued)
Muxponder 10 Gbit/s circuit pack latency

Circuit pack type	Protocol	Configuration	Typical Latency (μ s)
Muxponder 10 Gbit/s GbE/FC VCAT Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	GbE	GFP-T, C-cat	19 (see Note 1, 2, 4)
		GFP-T, V-cat	67 (see Note 1, 2, 4)
		GFP-F, C-cat, STS-24c/VC-4-8c, PAUSE Disabled	13 + 0.014 x frame length (bytes)
		GFP-F, C-cat, STS-48c/VC-4-16c, PAUSE Disabled	13 + 0.011 x frame length (bytes)
		GFP-F, C-cat, PAUSE Enabled	Variable
		GFP-F, V-cat, PAUSE Disabled	60 + 0.016 x frame length (bytes)
		GFP-F, V-cat, PAUSE Enabled	Variable
	FC-100 FICON	GFP-T, C-cat	20 (see Note 1, 3, 4)
		GFP-T, V-cat	68 (see Note 1, 3, 4)
	FC-200 FICON Express	GFP-T, C-cat	16 (see Note 1, 3, 4)
GFP-T, V-cat		68 (see Note 1, 3, 4)	

Note 1: This latency value is independent of packet size and is derived using 100% throughput.

Note 2: The maximum Gigabit Ethernet packet jitter (latency variation at different throughput rates) is $\pm 1.0 \mu$ s. For GFP-F, V-cat the latency can be as much as 10 μ s lower at throughputs less than 100%.

Note 3: The maximum FC-100/FICON and FC-200/FICON Express packet jitter (latency variation at different throughput rates) is $\pm 1.0 \mu$ s.

Note 4: The latency through a protected Muxponder path is typically 1.0 μ s higher than that of a working Muxponder path for all client traffic types. Packet jitter is the same on the protection and working paths.

DSCM latency specifications

Table 2-61 and Table 2-62 display the typical latency through DSCMs.

Table 2-61
C-band DSCM latency specifications

DSCM Description	Latency (μs)
Type 1 DSCM-10	6.4
Type 1 DSCM-20	12.9
Type 1 DSCM-30	19.3
Type 1 DSCM-40	25.7
Type 1 DSCM-50	32.1
Type 1 DSCM-60	38.5
Type 1 DSCM-70	44.9
Type 1 DSCM-80	51.4
Type 1 DSCM-90	57.8
Type 1 DSCM-100	64.2
Type 1 DSCM-110	70.6
Type 1 DSCM-120	77.0
Type 1 DSCM-130	89.6
Type 1 DSCM-140	92.7

Table 2-62
L-band DSCM latency specifications

DSCM Description	Latency (μs)
Type 1 DSCM-10	10.7
Type 1 DSCM-20	16.0
Type 1 DSCM-30	26.7
Type 1 DSCM-40	37.3
Type 1 DSCM-50	48.0
Type 1 DSCM-60	53.3
Type 1 DSCM-70	64.0
Type 1 DSCM-80	74.7
Type 1 DSCM-90	63.3

Table 2-62
L-band DSCM latency specifications

DSCM Description	Latency (μs)
Type 1 DSCM-100	70.4
Type 1 DSCM-110	77.4
Type 1 DSCM-120	85.3
Type 1 DSCM-130	90.1
Type 1 DSCM-140	92.5

Fibre Channel extended reach distances

Fibre Channel extended reach avoids inherent throughput degradation due to FC R_RDY protocol for distances up to 987 kilometers (km) at full rate or about 5900 km at sub-rate (STS3c). Using FC at sub-rate provides the benefit of extending the reach beyond 900 km while utilizing 100% of the available WAN bandwidth. [Table 2-63 on page 2-146](#) lists sample distances based on the available WAN bandwidth.

Note: Fibre Channel Extended Reach is only supported on OCI SRM GbE/FC Enhanced circuit packs.

Table 2-63
Fibre Channel extended reach sample distances

Path configuration	Round Trip Delay (μ s) See Note 1 :	Equivalent Distance (km) See Note 2 :
STS-3c-6v	9870	987
STS-3c-5v	11820	1182
STS-3c-4v	14770	1477
STS-3c-3v	19690	1969
STS-3c-2v	29540	2954
STS-3c-1v	59080	5908
STS-48c	9870	987
STS-24c	9870	987
STS-12c	14770	1477
<p>Note 1: When measuring round trip delay using Procedure 3-18 “Measuring round trip delay on a client-side port” in <i>Provisioning and Operating Procedures</i>, 323-1701-310, please be aware that round trip latency measurement (RTDELAY) returns the network latency to an accuracy of ± 1 ms.</p> <p>Note 2: These approximations assume no network propagation delays, and a 5 microsecond per kilometer fiber propagation delay.</p>		

Compatibility requirements

In this chapter

- [Channel assignment compatibility on page 3-1](#)
- [Line-side circuit pack compatibility on page 3-6](#)
- [Client-side circuit pack compatibility on page 3-11](#)

Channel assignment compatibility

- [OCI to OCLD circuit packs \(see Table 3-1 on page 3-2\)](#)
- [OCLD to OCLD circuit packs \(see Table 3-2 on page 3-3\)](#)
- [2.5 Gbit/s OTR to 2.5 Gbit/s OTR circuit packs \(see Table 3-3 on page 3-4\)](#)
- [10 Gbit/s OTR to 10 Gbit/s OTR circuit packs \(see Table 3-4 on page 3-5\)](#)
- [Muxponder to Muxponder circuit packs \(see Table 3-5 on page 3-5\)](#)

[Table 3-1](#) indicates which OCI- OCLD pairs are compatible when both have at least one common supporting protocol. For a list of OCI-OCLD pairing based on protocol, see [Table 2-20 on page 2-39](#).

3-2 Compatibility requirements

Table 3-1
Channel assignment compatibility matrix (OCI to OCLD)

	<ul style="list-style-type: none"> • OCLD 1.25 Gbit/s • OCLD 1.25 Gbit/s CWDM • OCLD 1.25 Gbit/s ER 	<ul style="list-style-type: none"> • OCLD 2.5 Gbit/s • OCLD 2.5 Gbit/s CWDM • OCLD 2.5 Gbit/s ER 	<ul style="list-style-type: none"> • OCLD 2.5 Gbit/s Flex • OCLD 2.5 Gbit/s Flex ER • OCLD 2.5 Gbit/s Flex EM • OCLD 2.5 Gbit/s Universal • OCLD 2.5 Gbit/s Flex 100 GHz • OCLD 2.5 Gbit/s Flex CWDM • OCLD 2.5 Gbit/s Flex ITU CWDM
OCI 622 Mbit 1310 nm	C	x	C
OCI 1.25 Gbit/s 850 nm	C	x	C
OCI 1.25 Gbit/s 1310 nm	C	x	C
OCI OC-48/STM-16 1310 nm	x	C	C
OCI ISC 1310 nm	C	x	C
OCI GbE 1310 nm	C	x	C
OCI GbE 850 nm	C	x	C
OCI SONET/SDH 1310 nm	C	C	C
OCI SONET/SDH IR 1310 nm	C	C	C
OCI SRM 1310 nm	C	x	C
OCI SRM 1310 nm LC	C	x	C
OCI SRM SONET/SDH 1310 nm	x	C	C
OCI SRM ESCON 1310 nm	x	x	C
OCI SRM GbE/FC Enhanced 850 nm	x	x	C
OCI SRM GbE/FC 850 nm	x	x	C
OCI SRM GbE/FC Enhanced 1310 nm	x	x	C
OCI SRM GbE/FC 1310 nm	x	x	C
OCI SRM GbE 850 nm	x	x	C
OCI SRM GbE 1310 nm	x	x	C
OCI SRM SONET/SDH LTE	x	x	C
Legend: C = compatible x = not compatible			

Table 3-2 indicates which OCLD circuit packs are compatible with each other, in a protected or passthrough (bridge or regen) channel assignment.

Table 3-2
Channel assignment compatibility matrix (OCLD to OCLD)

		OCLD 1.25 Gbit/s circuit packs	OCLD 2.5 Gbit/s circuit packs				
		• any type	• Fixed • Fixed CWDM • Fixed ER	• Flex • Flex ER • Flex EM • Universal	Flex 100 GHz	Flex CWDM	Flex ITU CWDM
OCLD 1.25 Gbit/s circuit packs	• any type	p, r, b	x	x	x	x	x
	• Fixed • Fixed CWDM • Fixed ER	x	p, r, b	p, r	b	b	b
OCLD 2.5 Gbit/s circuit packs	• Flex • Flex ER • Flex EM • Universal	x	p, r	p, r, b	b	b	b
	Flex 100 GHz	x	b	b	p, r, b	b	b
	Flex CWDM	x	b	b	b	p, r, b	b
	Flex ITU CWDM	x	b	b	b	b	p, r, b
Legend: p = protected channel assignment r = passthrough channel assignment (regen) b = passthrough channel assignment (bridge) x = not compatible							

3-4 Compatibility requirements

Table 3-3 indicates which 2.5 Gbit/s OTR circuit packs are compatible with each other in a protected channel assignment.

Table 3-3
Channel assignment compatibility matrix (2.5 Gbit/s OTR to 2.5 Gbit/s OTR)

		OTR 2.5 Gbit/s 1310 nm circuit packs				OTR 2.5 Gbit/s 850 nm circuit packs			
		• Flex • Flex ER • Flex EM • Universal	Flex 100 GHz	Flex CWDM	Flex ITU CWDM	• Flex • Flex ER • Flex EM • Universal	Flex 100 GHz	Flex CWDM	Flex ITU CWDM
OTR 2.5 Gbit/s 1310 nm circuit packs	• Flex • Flex ER • Flex EM • Universal	C	x	x	x	x	x	x	x
	Flex 100 GHz	x	C	x	x	x	x	x	x
	Flex CWDM	x	x	C	x	x	x	x	x
	Flex ITU CWDM	x	x	x	C	x	x	x	x
OTR 2.5 Gbit/s 850 nm circuit packs	• Flex • Flex ER • Flex EM • Universal	x	x	x	x	C	x	x	x
	Flex 100 GHz	x	x	x	x	x	C	x	x
	Flex CWDM	x	x	x	x	x	x	C	x
	Flex ITU CWDM	x	x	x	x	x	x	x	C
Legend:									
C = compatible									
x = not compatible									

Table 3-4 indicates which 10 Gbit/s OTR circuit packs are compatible with each other in a protected channel assignment.

Table 3-4
Channel assignment compatibility matrix (10 Gbit/s OTR to 10 Gbit/s OTR)

	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced	OTR 10 Gbit/s Enhanced 100 GHz
OTR 10 Gbit/s	C	x	x
OTR 10 Gbit/s Enhanced	x	C	x
OTR 10 Gbit/s Enhanced 100 GHz	x	x	C
Legend: C = compatible x = not compatible			

Table 3-5 indicates which Muxponder circuit packs are compatible with each other in a protected channel assignment.

Table 3-5
Channel assignment compatibility matrix (Muxponder to Muxponder)

	Muxponder 10 Gbit/s GbE/FC	Muxponder 10 Gbit/s GbE/FC 100 GHz	Muxponder 10 Gbit/s GbE/FC VCAT	Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz
Muxponder 10 Gbit/s GbE/FC	C	x	x	x
Muxponder 10 Gbit/s GbE/FC 100 GHz	x	C	x	x
Muxponder 10 Gbit/s GbE/FC VCAT	x	x	C	x
Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	x	x	x	C
Legend: C = compatible x = not compatible				

Line-side circuit pack compatibility

- OCLD to OCLD circuit packs (see [Table 3-6 on page 3-6](#))
- OCLD to 2.5 Gbit/s OTR circuit packs (see [Table 3-7 on page 3-7](#))
- 2.5 Gbit/s OTR to 2.5 Gbit/s OTR circuit packs (see [Table 3-8 on page 3-8](#))
- 10 Gbit/s OTR to 10 Gbit/s OTR circuit packs (see [Table 3-9 on page 3-9](#))
- Muxponder to Muxponder circuit packs (see [Table 3-10 on page 3-9](#))
- Muxponder to OTR circuit packs (see [Table 3-11 on page 3-10](#))

[Table 3-6](#) indicates which OCLD circuit packs are compatible with each other on the line-side. These two circuit packs form the endpoints of an optical span (Tx to Rx on the line-side).

Table 3-6
Line-side circuit pack compatibility matrix (OCLD to OCLD)

		OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s			
		<ul style="list-style-type: none"> • Fixed • Fixed ER 	<ul style="list-style-type: none"> • Fixed • Fixed ER • Flex • Flex ER • Flex EM • Universal 	Flex 100 GHz	Flex CWDM	Flex ITU CWDM
OCLD 1.25 Gbit/s circuit packs	<ul style="list-style-type: none"> • Fixed • Fixed ER 	C	x	x	x	x
	<ul style="list-style-type: none"> • Fixed • Fixed ER • Flex • Flex ER • Flex EM • Universal 	x	C	x	x	x
OCLD 2.5 Gbit/s circuit packs	Flex 100 GHz	x	x	C	x	x
	Flex CWDM	x	x	x	C	x
	Flex ITU CWDM	x	x	x	x	C
Legend:						
C = compatible						
x = not compatible						

Table 3-7 indicates which OCLD and 2.5 Gbit/s OTR pairs are compatible with each other on the line-side. These two circuit packs form the endpoints of an optical span (Tx to Rx on the line-side).

Table 3-7
Line-side circuit pack compatibility matrix (OCLD to 2.5 Gbit/s OTR)

		OTR 2.5 Gbit/s 1310 nm circuit packs				OTR 2.5 Gbit/s 850 nm circuit packs			
		• Flex • Flex ER • Flex EM • Universal	Flex 100 GHz	Flex CWDM	Flex ITU CWDM	• Flex • Flex ER • Flex EM • Universal	Flex 100 GHz	Flex CWDM	Flex ITU CWDM
OCLD 1.25 Gbit/s circuit packs	Fixed	x	x	x	x	x	x	x	x
	Fixed ER	x	x	x	x	x	x	x	x
OCLD 2.5 Gbit/s circuit packs	Fixed	C	x	x	x	x	x	x	x
	Fixed ER	C	x	x	x	x	x	x	x
	• Flex • Flex ER • Flex EM • Universal	C	x	x	x	C	x	x	x
	Flex 100 GHz	x	C	x	x	x	C	x	x
	Flex CWDM	x	x	C	x	x	x	C	x
	Flex ITU CWDM	x	x	x	C	x	x	x	C
Legend:									
C = compatible									
x = not compatible									

3-8 Compatibility requirements

Table 3-8 indicates which 2.5 Gbit/s OTR circuit packs are compatible with each other on the line-side. These two circuit packs form the endpoints of an optical span (Tx to Rx on the line-side).

Table 3-8
Line-side circuit pack compatibility matrix (2.5 Gbit/s OTR to 2.5 Gbit/s OTR)

		OTR 2.5 Gbit/s circuit packs			
		<ul style="list-style-type: none"> • Flex 1310 nm • Flex 850 nm • Flex ER 1310 nm • Flex ER 850 nm • Flex EM 1310 nm • Flex EM 850 nm • Universal 1310 nm • Universal 850 nm 	<ul style="list-style-type: none"> • Flex 100 GHz 1310 nm • Flex 100 GHz 850 nm 	<ul style="list-style-type: none"> • Flex CWDM 1310 nm • Flex CWDM 850 nm 	<ul style="list-style-type: none"> • Flex ITU CWDM 1310 nm • Flex ITU CWDM 850 nm
OTR 2.5 Gbit/s circuit packs	<ul style="list-style-type: none"> • Flex 1310 nm • Flex 850 nm • Flex ER 1310 nm • Flex ER 850 nm • Flex EM 1310 nm • Flex EM 850 nm • Universal 1310 nm • Universal 850 nm 	C	x	x	x
	<ul style="list-style-type: none"> • Flex 100 GHz 1310 nm • Flex 100 GHz 850 nm 	x	C	x	x
	<ul style="list-style-type: none"> • Flex CWDM 1310 nm • Flex CWDM 850 nm 	x	x	C	x
	<ul style="list-style-type: none"> • Flex ITU CWDM 1310 nm • Flex ITU CWDM 850 nm 	x	x	x	C
Legend: C = compatible x = not compatible					

Table 3-9 indicates which 10 Gbit/s OTR circuit packs are compatible with each other on the line-side. These two circuit packs form the endpoints of an optical span (Tx to Rx on the line-side).

Table 3-9
Line-side circuit pack compatibility matrix (10 Gbit/s OTR to 10 Gbit/s OTR)

	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced	OTR 10 Gbit/s Enhanced 100 GHz
OTR 10 Gbit/s	C	x	x
OTR 10 Gbit/s Enhanced	x	C	x
OTR 10 Gbit/s Enhanced 100 GHz	x	x	C
Legend: C = compatible x = not compatible			

Table 3-10 indicates which Muxponder circuit packs are compatible with each other on the line-side. These two circuit packs form the endpoints of an optical span (Tx to Rx on the line-side).

Table 3-10
Line-side circuit pack compatibility matrix (Muxponder to Muxponder)

	Muxponder 10 Gbit/s GbE/FC	Muxponder 10 Gbit/s GbE/FC 100 GHz	Muxponder 10 Gbit/s GbE/FC VCAT	Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz
Muxponder 10 Gbit/s GbE/FC	C	x	C	x
Muxponder 10 Gbit/s GbE/FC 100 GHz	x	C	x	C
Muxponder 10 Gbit/s GbE/FC VCAT	C	x	C	x
Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	x	C	x	C
Legend: C = compatible x = not compatible				

3-10 Compatibility requirements

Table 3-11 indicates which Muxponder and OTR pairs are compatible with each other on the line-side. These two circuit packs form the endpoints of an optical span (Tx to Rx on the line-side).

Table 3-11
Line-side circuit pack compatibility matrix (Muxponder to OTR)

	<ul style="list-style-type: none"> • OTR 2.5 Gbit/s Flex 1310 nm • OTR 2.5 Gbit/s Flex 850 nm • OTR 2.5 Gbit/s Flex ER 1310 nm • OTR 2.5 Gbit/s Flex ER 850 nm • OTR 2.5 Gbit/s Flex EM 1310 nm • OTR 2.5 Gbit/s Flex EM 850 nm • OTR 2.5 Gbit/s Universal 1310 nm • OTR 2.5 Gbit/s Universal 850 nm • OTR 2.5 Gbit/s Flex 100 GHz 1310 nm • OTR 2.5 Gbit/s Flex 100 GHz 850 nm • OTR 2.5 Gbit/s Flex CWDM 1310 nm • OTR 2.5 Gbit/s Flex CWDM 850 nm • OTR 2.5 Gbit/s Flex ITU CWDM 1310 nm • OTR 2.5 Gbit/s Flex ITU CWDM 850 nm 	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced	OTR 10 Gbit/s Enhanced 100 GHz
Muxponder 10 Gbit/s GbE/FC	x	x	C	x
Muxponder 10 Gbit/s GbE/FC 100 GHz	x	x	x	C
Muxponder 10 Gbit/s GbE/FC VCAT	x	x	C	x
Muxponder 10 Gbit/s GbE/FC VCAT 100 GHz	x	x	x	C
Legend: C = compatible x = not compatible				

Client-side circuit pack compatibility

- OCI to OCI circuit packs (see [Table 3-12 on page 3-12](#))
- OCI to OCI SRM circuit packs (see [Table 3-13 on page 3-13](#))
- OCI SRM to OCI SRM circuit packs (see [Table 3-14 on page 3-14](#))
- OCI SRM to OTR circuit packs (see [Table 3-15 on page 3-15](#))
- OTR to OCI circuit packs (see [Table 3-16 on page 3-16](#))
- 2.5 Gbit/s OTR to 2.5 Gbit/s OTR circuit packs (see [Table 3-17 on page 3-17](#))
- 10 Gbit/s OTR to 10 Gbit/s OTR circuit packs (see [Table 3-18 on page 3-18](#))
- Muxponder to Muxponder circuit packs (see [Table 3-19 on page 3-19](#))
- Muxponder to OCI circuit packs (see [Table 3-20 on page 3-20](#))
- Muxponder to OCI SRM circuit packs (see [Table 3-21 on page 3-21](#))
- Muxponder to OTR circuit packs (see [Table 3-22 on page 3-22](#))

[Table 3-12](#) indicates which OCI circuit packs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

3-12 Compatibility requirements

Table 3-12
Client-side circuit pack compatibility matrix (OCI to OCI)

		OCI circuit packs								
		622 Mbit 1310 nm	1.25 Gbit/s 850 nm	1.25 Gbit/s 1310 nm	OC-48/S TM-16 1310 nm	ISC 1310 nm	GbE 1310 nm	GbE 850 nm	SONET/ SDH 1310 nm	SONET/ SDH IR 1310 nm
OCI circuit packs	622 Mbit 1310 nm	1, 2	x	1, 2	x	x	x	x	1, 2	1, 2
	1.25 Gbit/s 850 nm	x	1, 2	1	x	x	1	1, 2	x	x
	1.25 Gbit/s 1310 nm	1, 2	1	1, 2	x	x	1, 2	1	1, 2	1, 2
	OC-48/STM-16 1310 nm	x	x	x	1	x	x	x	1	1
	ISC 1310 nm	x	x	x	x	1	x	x	x	x
	GbE 1310 nm	x	1	1, 2	x	x	1, 2	1	x	x
	GbE 850 nm	x	1, 2	1	x	x	1	1, 2	x	x
	SONET/SDH 1310 nm	1, 2	x	1, 2	1	x	x	x	1, 2	1, 2
	SONET/SDH IR 1310 nm	1, 2	x	1, 2	1	x	x	x	1, 2	1, 2
<p>Legend: 1—Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network. 2—Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model. x—not compatible</p>										

Table 3-13 indicates which OCI and OCI SRM pairs are compatible with each other within a network, at client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.

Table 3-13
Client-side circuit pack compatibility matrix (OCI to OCI SRM)

		OCI SRM circuit packs				
		<ul style="list-style-type: none"> • OCI SRM 1310 nm • OCI SRM 1310 nm LC 	SONET/SDH 1310 nm	ESCON 1310 nm	<ul style="list-style-type: none"> • GbE/FC Enhanced 850 nm • GbE/FC Enhanced 1310 nm • GbE/FC 850 nm • GbE/FC 1310 nm • GbE 850 nm • GbE 1310 nm 	SONET/SDH LTE
OCI circuit packs	622 Mbit 1310 nm	x	x	x	x	x
	1.25 Gbit/s 850 nm	x	x	x	x	x
	1.25 Gbit/s 1310 nm	C (see Note 1)	x	x	x	x
	OC-48/STM-16 1310 nm	x	x	x	C (see Note 2)	x
	ISC 1310 nm	x	x	x	x	x
	GbE 1310 nm	x	x	x	x	x
	GbE 850 nm	x	x	x	x	x
	SONET/SDH 1310 nm	x	x	C (see Note 3)	C (see Note 2)	C (see Note 4)
	SONET/SDH IR 1310 nm	x	x	C (see Note 3)	C (see Note 2)	C (see Note 4)

Note 1: For more information, see “Implementing interoperable topologies with OCI SRM 1310 nm and OCI SRM 1310 nm LC circuit packs” on page 3-58 in *Network Planning and Link Engineering*, 323-1701-110.

Note 2: For more information, see “Implementing interoperable topologies with OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced or OCI SRM GbE circuit packs” on page 3-55 in NTP 323-1701-110.

Note 3: For more information, see “Implementing interoperable topologies with OCI SRM ESCON circuit packs” on page 3-57 in NTP 323-1701-110.

Note 4: This is permitted provided that the OC-48/STM-16 signal output from the OCI SONET/SDH circuit pack is not fed into a SONET/SDH cloud but back into another Optical Metro 5100/5200 network (for example, between an access ring and a core ring). This OC-48/STM-16 signal will eventually be demultiplexed at another OCI SRM SONET/SDH LTE circuit pack. The OC-48/STM-16 signal from the OCI SRM SONET/SDH LTE circuit pack cannot be fed to a SONET/SDH cloud since some of the overhead bits are used for proprietary reasons and is therefore non-standard compliant.

3-14 Compatibility requirements

Table 3-14 indicates which OCI SRM circuit packs are compatible with each other within a network, at client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.

Table 3-14
Client-side circuit pack compatibility matrix (OCI SRM to OCI SRM)

		OCI SRM circuit packs				
		<ul style="list-style-type: none"> • OCI SRM 1310 nm • OCI SRM 1310 nm LC 	SONET/SDH 1310 nm	ESCON 1310 nm	<ul style="list-style-type: none"> • GbE/FC Enhanced 850 nm • GbE/FC Enhanced 1310 nm • GbE/FC 850 nm • GbE/FC 1310 nm • GbE 850 nm • GbE 1310 nm 	SONET/SDH LTE
OCI SRM circuit packs	<ul style="list-style-type: none"> • OCI SRM 1310 nm • OCI SRM 1310 nm LC 	C	x	x	x	x
	SONET/SDH 1310 nm	x	C	x	x	x
	ESCON 1310 nm	x	x	C	x	x
	<ul style="list-style-type: none"> • GbE/FC Enhanced 850 nm • GbE/FC Enhanced 1310 nm • GbE/FC 850 nm • GbE/FC 1310 nm • GbE 850 nm • GbE 1310 nm 	x	x	x	C	x
	SONET/SDH LTE	x	x	x	x	C
Legend: C = compatible x = not compatible						

Table 3-15 indicates which OCI SRM and OTR pairs are compatible with each other within a network, at client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.

Table 3-15
Client-side circuit pack compatibility matrix (OCI SRM to OTR)

		OTR 2.5 Gbit/s 1310 nm circuit packs	OTR 2.5 Gbit/s 850 nm circuit packs	OTR 10 Gbit/s circuit packs		
		<ul style="list-style-type: none"> • Flex • Flex ER • Flex EM • Universal • Flex 100 GHz • Flex CWDM • Flex ITU CWDM 	<ul style="list-style-type: none"> • Flex • Flex ER • Flex EM • Universal • Flex 100 GHz • Flex CWDM • Flex ITU CWDM 	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced	OTR 10 Gbit/s Enhanced 100 GHz
OCI SRM circuit packs	OCI SRM 1310 nm	x	x	x	x	x
	OCI SRM 1310 nm LC	x	x	x	x	x
	SONET/SDH 1310 nm	x	x	x	x	x
	ESCON 1310 nm	x	x	x	x	x
	GbE/FC Enhanced 850 nm GbE/FC 850 nm GbE/FC Enhanced 1310 nm GbE/FC 1310 nm GbE 1310 nm GbE 850 nm	C (see Note 1)	x	x	x	x
	SONET/SDH LTE	C (see Note 2)	x	x	x	x
	<p>Legend: C = compatible x = not compatible</p> <p>Note 1: For more information, see “Implementing interoperable topologies with OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced or OCI SRM GbE circuit packs” on page 3-55 in <i>Network Planning and Link Engineering</i>, 323-1701-110.</p> <p>Note 2: This is permitted provided that the OC-48/STM-16 signal output from the OTR 2.5 Gbit/s Flex 1310 nm circuit pack is not fed into a SONET/SDH cloud but back into another Optical Metro 5100/5200 network (for example, between an access ring and a core ring). This OC-48/STM-16 signal will eventually be demultiplexed at another OCI SRM SONET/SDH LTE circuit pack. The OC-48/STM-16 signal from the OCI SRM SONET/SDH LTE circuit pack cannot be fed to a SONET/SDH cloud since some of the overhead bits are used for proprietary reasons and is therefore non-standard compliant.</p>					

3-16 Compatibility requirements

Table 3-16 indicates which OTR and OCI pairs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-16
Client-side circuit pack compatibility matrix (OTR to OCI)

		OCI circuit packs								
		622 Mbit 1310 nm	1.25 Gbit/s 850 nm	1.25 Gbit/s 1310 nm	OC-48/ STM-16 1310 nm	ISC 1310 nm	GbE 1310 nm	GbE 850 nm	SONET/ SDH 1310 nm	SONET/ SDH IR 1310 nm
OTR 2.5 Gbit/s 1310 nm circuit packs	• Flex • Flex ER • Flex EM • Universal • Flex 100 GHz	1, 2	1	1, 2	1	x	1, 2	1	1, 2	1, 2
	• Flex CWDM • Flex ITU CWDM	1, 2	1	1, 2	1	x	1, 2	1	1, 2	1, 2
OTR 2.5 Gbit/s 850 nm circuit packs	• Flex • Flex ER • Flex EM • Universal • Flex 100 GHz	x	1, 2	1	x	x	1	1, 2	x	x
	• Flex CWDM • Flex ITU CWDM	x	1, 2	1	x	x	1	1, 2	x	x
OTR 10 Gbit/s circuit packs	OTR 10 Gbit/s	x	x	x	x	x	x	x	x	x
	OTR 10 Gbit/s Enhanced	x	x	x	x	x	x	x	x	x
	OTR 10 Gbit/s Enhanced 100 GHz	x	x	x	x	x	x	x	x	x
<p>Legend: 1 - Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network. 2 - Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model. x - not compatible</p>										

Table 3-17 indicates which OTR pairs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
- Within a network, at the client-side endpoints through a bridge or inter-connected ring connection.
- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-17
Client-side circuit pack compatibility matrix (2.5 Gbit/s OTR to 2.5 Gbit/s OTR)

		OTR 2.5 Gbit/s 1310 nm circuit packs				OTR 2.5 Gbit/s 850 nm circuit packs			
		• Flex • Flex ER • Flex EM • Universal	Flex 100 GHz	Flex CWDM	Flex ITU CWDM	• Flex • Flex ER • Flex EM • Universal	Flex 100 GHz	Flex CWDM	Flex ITU CWDM
OTR 2.5 Gbit/s 1310 nm circuit packs	• Flex • Flex ER • Flex EM • Universal	1, 2, 3	2, 3	2, 3	2, 3	1, 2	2	2	2
	Flex 100 GHz	2, 3	1, 2, 3	2, 3	2, 3	2	1, 2	2	2
	Flex CWDM	2, 3	2, 3	1, 2, 3	2, 3	2	2	1, 2	2
	Flex ITU CWDM	2, 3	2, 3	2, 3	1, 2, 3	2	2	2	1, 2
OTR 2.5 Gbit/s 850 nm circuit packs	• Flex • Flex ER • Flex EM • Universal	1, 2	2	2	2	1, 2, 3	2, 3	2, 3	2, 3
	Flex 100 GHz	2	1, 2	2	2	2, 3	1, 2, 3	2, 3	2, 3
	Flex CWDM	2	2	1, 2	2	2, 3	2, 3	1, 2, 3	2, 3
	Flex ITU CWDM	2	2	2	1, 2	2, 3	2, 3	2, 3	1, 2, 3

Legend:
 1 - Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
 2 - Within a network, at the client-side endpoints through a bridge or inter-connected ring connection.
 3- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

3-18 Compatibility requirements

Table 3-18 indicates which 10 Gbit/s OTR pairs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-18
Client-side circuit pack compatibility matrix (10 Gbit/s OTR to 10 Gbit/s OTR)

	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced	OTR 10 Gbit/s Enhanced 100 GHz
OTR 10 Gbit/s	1, 2	2	2
OTR 10 Gbit/s Enhanced	2	1, 2	2
OTR 10 Gbit/s Enhanced 100 GHz	2	2	1, 2

Legend:
1 - Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
2 - Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-19 indicates which Muxponder pairs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-19
Client-side circuit pack compatibility matrix (Muxponder to Muxponder)

		Muxponder 10 Gbit/s GbE/FC circuit packs	
		<ul style="list-style-type: none"> • with 1310 nm SFP • 100 GHz with 1310 nm SFP • VCAT 1310 nm SFP • VCAT 100 GHz 1310 nm SFP 	<ul style="list-style-type: none"> • with 850 nm SFP • 100 Ghz with 850 nm SFP • VCAT 850 nm SFP • VCAT 100 GHz 850 nm SFP
Muxponder 10 Gbit/s GbE/FC circuit packs	<ul style="list-style-type: none"> • with 1310 nm SFP • 100 GHz with 1310 nm SFP • VCAT 1310 nm SFP • VCAT 100 GHz 1310 nm SFP 	1, 2	1
	<ul style="list-style-type: none"> • with 850 nm SFP • 100 Ghz with 850 nm SFP • VCAT 850 nm SFP • VCAT 100 GHz 850 nm SFP 	1	1, 2
<p>Legend: 1 - Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network. 2 - Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.</p>			

3-20 Compatibility requirements

Table 3-20 indicates which Muxponder and OCI pairs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-20
Client-side circuit pack compatibility matrix (Muxponder to OCI)

		OCI circuit packs								
		622Mbit 1310 nm	1.25 Gbit/s 850 nm	1.25 Gbit/s 1310 nm	OC-48/S TM-16 1310 nm	ISC 1310 nm	GbE 1310 nm	GbE 850 nm	SONET/ SDH 1310 nm	SONET/ SDH IR 1310 nm
Muxponder 10 Gbit/s GbE/FC circuit packs	<ul style="list-style-type: none"> • with 1310 nm SFP • 100 GHz with 1310 nm SFP • VCAT with 1310 nm SFP • VCAT 100 GHz with 1310 nm SFP 	2	x	2	x	x	2	x	x	x
	<ul style="list-style-type: none"> • with 850 nm SFP • 100 GHz with 850 nm SFP • VCAT with 850 nm SFP • VCAT 100 GHz 850 nm SFP 	x	2	x	x	x	x	2	x	x
<p>Legend:</p> <p>1 - Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.</p> <p>2 - Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.</p> <p>x - not compatible</p>										

Table 3-21 indicates which Muxponder and OCI SRM pairs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-21
Client-side circuit pack compatibility matrix (OCI SRM to Muxponder)

	Muxponder 10 Gbit/s GbE/FC circuit packs	
	<ul style="list-style-type: none"> • with 1310 nm SFP • 100 GHz with 1310 nm SFP • VCAT 1310 nm SFP • VCAT 100 GHz 1310 nm SFP 	<ul style="list-style-type: none"> • with 850 nm SFP • 100 GHz with 850 nm SFP • VCAT 850 nm SFP • VCAT 100 GHz 850 nm SFP
OCI SRM 1310 nm	x	x
OCI SRM 1310 nm LC	x	x
OCI SRM SONET/SDH 1310 nm	x	x
OCI SRM ESCON 1310 nm	x	x
OCI SRM GbE/FC Enhanced 850 nm	x	2
OCI SRM GbE/FC 850 nm	x	2
OCI SRM GbE/FC Enhanced 1310 nm	2	x
OCI SRM GbE/FC 1310 nm	2	x
OCI SRM GbE 850 nm	x	2
OCI SRM GbE 1310 nm	2	x
OCI SRM SONET/SDH LTE	x	x
Legend: 1 - Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network. 2 - Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model. x - not compatible		

Table 3-22 on page 3-22 indicates which Muxponder and OCI SRM pairs are compatible with each other in the following ways:

- Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.

3-22 Compatibility requirements

- Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.

Table 3-22
Client-side circuit pack compatibility matrix (Muxponder to OTR)

		OTR 2.5 Gbit/s 1310 nm circuit packs	OTR 2.5 Gbit/s 850 nm circuit packs	OTR 10 Gbit/s circuit packs		
		<ul style="list-style-type: none"> • Flex • Flex ER • Flex EM • Universal • Flex 100 GHz • Flex CWDM • Flex ITU CWDM 	<ul style="list-style-type: none"> • Flex • Flex ER • Flex EM • Universal • Flex 100 GHz • Flex CWDM • Flex ITU CWDM 	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced	OTR 10 Gbit/s Enhanced 100 GHz
Muxponder 10 Gbit/s GbE/FC circuit packs	with 1310 nm SFP	2	x	x	1 (see Note)	x
	100 GHz with 1310 nm SFP	2	x	x	x	1 (see Note)
	VCAT with 1310 nm SFP	2	x	x	1 (see Note)	x
	VCAT 100 GHz with 1310 nm SFP	2	x	x	x	1 (see Note)
	with 850 nm SFP	x	2	x	1 (see Note)	x
	100 GHz with 850 nm SFP	x	2	x	x	1 (see Note)
	VCAT with 850 nm SFP	x	2	x	1 (see Note)	x
	VCAT 100 GHz with 850 nm SFP	x	2	x	x	1 (see Note)

Legend:
1 - Within a network, at the client-side endpoints. These two circuit packs form the two client-side endpoints of a channel within a single network.
2 - Between cascaded networks. These two circuit packs add/drop a signal between networks in an interop or cascaded network model.
x - not compatible

Note: In regenerator or interoperable configurations. For interoperable configurations, see [“Implementing interoperable topologies with Muxponder 10 Gbit/s GbE/FC circuit packs” on page 3-59](#) in *Network Planning and Link Engineering*, 323-1701-110.

System performance specifications

In this chapter

- [System specifications for the System Manager computer on page 4-1](#)
- [Protection switch times on page 4-3](#)

System specifications for the System Manager computer

The Optical Metro 5100/5200 System Manager is a Web-based graphical user interface (GUI) that allows you to access one or more shelves in an Optical Metro 5100/5200 network. Use the System Manager to provision, monitor, and maintain the network.

For more information about the System Manager, refer to the “[System Manager](#)” chapter in *Software and User Interface*, 323-1701-101.

[Table 4-1](#) lists the minimum platform requirements for the System Manager.

Table 4-1
Minimum platform requirements for the System Manager computer

Component	Solaris 8	Windows 2000/ Windows NT (See Note 1 and Note 4)	Windows XP
Machine type	Ultra 5	Pentium II - 266 MHz (See Note 2)	Pentium III - 500 MHz
RAM	128 Mbyte	Minimum: 64 Mbyte Recommended: 128 Mbyte (See Note 2)	256 Mbyte
Display settings	VGA 800 x 600 pixels true color (32-bit) (See Note 3)	VGA 800 x 600 pixels true color (32-bit) (See Note 3)	VGA 800 x 600 pixels true color (32-bit) (See Note 3)
Software environment	<ul style="list-style-type: none"> • Common Desktop Environment (CDE) and Netscape Communicator 4.76 • Exceed Version 9.0 (See Note 5) 	Internet Explorer 5.5 or Netscape Communicator 4.75/4.76 (See Note 6)	Internet Explorer 6.0

4-2 System performance specifications

Table 4-1 (continued)
Minimum platform requirements for the System Manager computer

Component	Solaris 8	Windows 2000/ Windows NT (See Note 1 and Note 4)	Windows XP
Space available on drive C	310 Mbytes (See Note 7)	300 Mbytes (See Note 7)	300 Mbytes
Virtual memory	256 Mbytes	Double the size of the allocated RAM (128 or 256 Mbytes)	Double the size of the allocated RAM (512 Mbytes)
Environment source	CD-ROM	CD-ROM	CD-ROM
Plug-in	Java plug-in 1.4.1_05	Java plug-in 1.4.1_05	Java plug-in 1.4.1_05
Plug-in source	CD	CD	CD
Plug-in patches	(none)	(none)	(none)
Ethernet adapter	10BASE-T	10BASE-T	10BASE-T
Networking	TCP/IP	TCP/IP	TCP/IP

Note 1: Service Pack 2 or later required for Windows 2000 (Service Pack 3 is recommended if you will be using the “file save” function on the System Manager to save files on a network drive instead of on the System Manager computer local disk). Service Pack 5 or later required for Windows NT.

Note 2: The minimum Windows 2000/NT requirement for managing a ring network with more than 12 shelves is 128 Mbyte of RAM with a Pentium 266 processor. If you want to manage a ring network of more than 12 shelves and run several System Manager sessions at one time, with other applications running in the background, you will need more memory and a faster processor. For example, for a large ring network of 40 shelves, Nortel Networks recommends 256 Mbyte of RAM and a Pentium III 500 MHz (or more) processor.

Note 3: Nortel Networks recommends that you use a setting of 1024 x 768 pixels.

Note 4: When viewing the Nortel Networks Technical Publications (NTPs) on a computer running Windows 2000, it is recommended to close the Bookmarks pane in Adobe Acrobat for clearer viewing.

Note 5: Exceed permits applications that normally are only available on UNIX workstations, to be accessed from Windows-based PCs. This feature supports the ability to launch System Manager using Exceed version 9.0. Although this method of displaying System Manager is functionally operational, it is expected that the display is not as aesthetically pleasing as a standalone System Manager session due to inter-platform font transformations. Some display issues can be reduced if the PC’s video card supports the display of 3D graphics.

Note 6: You can run a maximum of eight System Manager sessions from a single computer, as long as the computer has 64 Mbyte available for each session. However, Nortel Networks recommends that you run no more than five System Manager sessions at a time for best performance. You cannot run the System Manager simultaneously from both types of browsers on a single computer.

Note 7: If proper space is allocated for virtual memory disk caching of RAM, this space can be reduced to 110 Mbyte. Refer to the manual for your operating system to allocate space.

Protection switch times

Protection switching is completed within 50 millisecond (ms) following a 10 ms detect interval for both path protection and equipment protection.

Due to the nature of the Open Fiber Control (OFC) protocol, a link running the ISC protocol may take up to 12 seconds to re-initialize after a protection switch. For the ISC protocol, it is recommended that protection be performed by the subtending equipment. The Optical Metro 5100/5200 can be used to carry the two ISC signals over diverse optical paths using unprotected channel assignments.

Optical Trunk Switch

The maximum switching time for the OTS is 100 ms.

Note: To ensure this specification is met on the OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced, OCI SRM GbE, Muxponder 10 Gbit/s circuit packs, set the AOC holdoff time to 500 ms.

Enhanced Trunk Switch

The maximum switching time for the ETS is 50 ms.

Note: To ensure this specification is met on the OCI SRM GbE/FC, OCI SRM GbE/FC Enhanced, OCI SRM GbE, Muxponder 10 Gbit/s circuit packs, set the AOC holdoff time to 500 ms.

Optical Metro 5100/5200 protection switching activity effect on subtending equipment

Some subtending equipment may be very sensitive to the momentary traffic interruptions associated with a Optical Metro 5100/5200 protection switch event. For example, protocols such as Fibre Channel and Gigabit Ethernet, may declare a link failure after as little as 10 ms of interruption.

As a result, the following conditions may be experienced depending on the subtending equipment configuration:

- the link may reset automatically
- the link may require user intervention for recovery
- a Gigabit Ethernet link with auto-negotiation enabled will come back up only after auto-negotiation restarts and completes
- Layer 2 or 3 traffic protection or re-routing schemes (for example, STP, OSPF)

All of the above conditions can result in a longer than expected momentary traffic interruption as a result of a Optical Metro 5100/5200 protection switch. To minimize this, any available hold-off timers on the subtending equipment can be configured to make it less sensitive to momentary traffic interruptions.

For example, the debounce timer for declaring a link failure can be set on some Gigabit Ethernet equipment to a minimum of 100 ms to allow Optical Metro 5100/5200 protection switching without affecting link status.

Recovery time after power cycling

When an Optical Metro 5100/5200 shelf experiences a power outage, the shelf automatically (with no user intervention) returns to normal operation within 2 minutes after the power has been restored.

Standards and regulations

In this chapter

- [Optical Metro 5100/5200 standards compliance on page 5-1](#)
- [Mandatory regulations on page 5-3](#)
- [Safety approval for direct current systems on page 5-3](#)
- [Equipment interconnection points on page 5-4](#)
- [Laser interface on page 5-4](#)
- [Prevention of access to the user on page 5-4](#)
- [Telecom safety earth on page 5-4](#)
- [EMC compliance on page 5-4](#)
- [Canada on page 5-4](#)
- [United States of America on page 5-6](#)
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- [United Kingdom on page 5-7](#)
- [Norway on page 5-8](#)
- [Sweden on page 5-8](#)
- [Switzerland on page 5-8](#)

Optical Metro 5100/5200 standards compliance

The Optical Metro 5100/5200 conforms to the standards listed in [Table 5-1](#).

Table 5-1
Safety, emissions, immunity, environmental and grounding standards

Standard	Region
Safety	
IEC 950, CSA 950, UL 1950, EN60950, AS/NZ 3260 & CB report	Global
IEC 825 EN 60825 -1 & 2	Global
FDA CDRH 21 CFR 1040	NSA

Table 5-1 (continued)
Safety, emissions, immunity, environmental and grounding standards

Standard	Region
GR-1089-CORE	Telcordia
NRTL/C certified	
EMC	
Emissions: CISPR22, ICES 003, FCC 15, EN55022, AS/NZ3548, VCCI (Japan), BSMI (Taiwan), KMOC (Korea), ETS 300 386-2 (All Class B)	Global
Emissions: GR-1089- CORE (EMC std)	Telcordia
Immunity: EN50082-1 (ESD, RF Immunity, EFT) Commercial	Europe
Immunity: EN50082-2 (ESD, RF Immunity, EFT) Industrial	Europe
Immunity: ETS 300 386-2	Europe
Environmental requirements	
GR-63-CORE (NEBS)	Telcordia
ETS 300 019	ETSI
Grounding	
CSA22.1 1990	Telcordia
UL 1950	Telcordia
Telcordia TR-NWT-000295	Telcordia

Mandatory regulations

General requirements

The following sections outline the mandatory regulations governing the installation and operation of the Optical Metro 5100/5200 shelves. Observe these instructions to make sure regulatory requirements are met.



DANGER

Risk of personal injury

There is a danger of explosion if the battery used in this device is incorrectly replaced. Do not attempt to replace the battery. Return the equipment to Nortel Networks for servicing when you think battery fault is the cause of equipment failure. Where the law prohibits, do not discard the battery or the equipment with battery. Return it to Nortel Networks for proper disposal.

The battery used in this device may present a fire or chemical burn hazard if mishandled. Do not recharge, disassemble, heat above 100°C (212°F), or incinerate.



CAUTION

Risk of equipment damage

This equipment must be grounded.

This unit does not contain any parts that you can service yourself. You risk damaging the equipment if you attempt to service any parts. Refer servicing to qualified personnel.



CAUTION

Risk of equipment damage

To prevent accidental electrical shorting of circuit packs, make sure the circuit packs are aligned correctly between the circuit pack guides before you insert them.

Safety approval for direct current systems

The direct current source for the Optical Metro 5100/5200 shelf must meet the requirements of a SELV source in accordance with CSA C22.2 No. 950. The system is intended for use with a SELV secondary source that is electrically isolated from the alternating current source and that is reliably connected to earth.

Equipment interconnection points

Connect Safety Extra Low Voltage (SELV) circuits on this equipment only to other circuits that comply with the requirements of SELV circuits as defined in CSA C22.2 No 950, UL1950, EN 60950, AS/NZS 3260 and IEC950.

Laser interface

The Optical Metro 5100/5200 shelf uses a fiber-optic communications method and operates up to a Hazard Level of k x 3A. Only qualified service personnel who are thoroughly familiar with laser radiation hazards should install or remove the fiber-optic cables and circuit packs in this system.

Prevention of access to the user

The Optical Metro 5100/5200 system must be accessible only to authorized personnel. Install this equipment in a restricted access location or similar environment to prevent unauthorized access.

Telecom safety earth

Telecom safety earth is referred to as signal ground in this document. The cable used for safety ground must be at least the same size as the supply conductors or be a minimum of 1.5 mm² (whichever is greater), green and yellow in color and of sufficient length to connect the building earth point to the ground lug in the maintenance panel.

EMC compliance

EMC compliance may require the use of ferrite beads, shielded cables, or other special accessories. Where required, you must install these special accessories according to instructions.

To comply with Class B emissions requirements you must install ferrite beads (supplied) around OMX cables, ECT cables, or COTEL interface wires that are connected to the maintenance panel.

Canada

ICES-003

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

The compliance of this product with EMC regulatory standards depends on the use of specific cable constructions. Refer to the cable characteristics table in the manual for the correct cable construction. It your responsibility to procure the appropriate cables.

Industry Canada

Notice

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

For their own protection, users should ensure that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system (if present) are connected together. This precaution can be particularly important in rural areas.



DANGER

Risk of personal injury

Users should not attempt to make electrical ground connections themselves, but should contact the electric inspection authority or an electrician, as appropriate.

Avis

L'étiquette de l'Industrie Canada identifie le matériel homologué. Cette étiquette certifie que le matériel conforme à certaines normes de protection, d'exploitation, et de sécurité de réseaux de télécommunications. Industrie Canada n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunication. Le matériel doit également être installé en suivant une méthode acceptée de raccordement. L'abonné ne doit pas oublier qu'il est possible que la conformité aux conditions énoncées ci-dessus n'empêchent pas la dégradation du service dans certaines situations.

Les réparations de matériel homologué doivent être effectuées par un centre d'entretien canadien autorisé, désigné par le fournisseur. La compagnie de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement.

Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à terre de la source d'énergie électrique, les lignes téléphoniques, et les canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales.



DANGER

L'utilisateur ne doit pas tenter de faire ces raccordements de lui-même; il doit avoir recours à un service d'inspection des installations électriques, ou à un électricien, selon le cas.

United States of America

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Safety approval for direct current systems

The direct current source for the Optical Metro 5100/5200 shelf must meet the requirements of a SELV source in accordance with UL1950. The system is intended for use with an SELV secondary source that is electrically isolated from the alternating current source and that is reliably connected to earth.

Food and drug administration

This product complies with 21 CFR 1040.10 and 1040.11 regulations, which govern the safe use of lasers. Only qualified service personnel, thoroughly familiar with laser radiation hazards, should install or remove the fiber optic cables used in this system. Information regarding the safe use of lasers can be found in ANSI Z 136.1: Safe Use of Lasers and ANSI Z 136.2: Safe Use of Lasers in Optical Fiber Communications Systems. These documents and other instructional material can be obtained from:

Laser Institute of America
13501 Ingenuity Drive, Suite 128
Orlando, FL 32826

CSA NRTL

This equipment is Certified by the Canadian Standards Association (CSA) as meeting the requirements of UL1950, Safety of Information Technology Equipment (or UL1459, Safety of Telephone Equipment). CSA is listed by the American Federal Occupational Safety and Health Administration (OSHA) as equivalent to Underwriters Laboratories (UL) and other American safety testing laboratories under the Nationally Recognized Testing Laboratories (NRTL) program.

Europe**Declaration of conformity**

The Optical Metro 5100/5200 conforms with the essential requirements of Directive 89/336/EEC (EMC Directive, as amended by 92/31/EC and 93/68/EEC) and Directive 73/23/EEC (Low Voltage Directive, as amended by 93/68/EEC) through compliance to the following harmonized standards:

- EN 300 386:2001.
- EN 60950-1:2001
- EN 60825-1:2001
- EN 60825-2:2000

The product bears the CE mark.

A signed Declaration of Conformity is available upon request. Contact your local Nortel Networks representative to obtain a copy.

Safety approval for direct current systems

The direct current source for the Optical Metro 5100/5200 shelf must meet the requirements of a SELV (Safety Extra Low Voltage) source as defined in *EN 60950: Host Apparatus*.

Protective earth

Protective earth is referred to as chassis ground in this document. A green and yellow colored earth wire must be connected from the site equivalent of the ac earth to all shelves in accordance with IEE Wiring Regulations (16th edition). This connection is made through the Maintenance Panel.

United Kingdom**Prevention of access by user**

The apparatus must be accessible only to authorized personnel. Install this apparatus in a locked room or similar environment, such that unauthorized user access is prevented. Failure to prevent such user access will invalidate any approval given to this apparatus.

Norway

Apparatus maa tilkobles jordet stikkontakt. Jordet Stikkontakt skal benyttes naar apparatet tilkobles datanett.

The equipment must be connected to an earthed mains socket-outlet. An earthed mains socket outlet must be used when the equipment is connected to a data network.

Sweden

Apparaten skall anslutas till jordat uttag nar den anslutas till ett natverk.

The product should be connected to a mains socket-outlet with earthing contact.

Switzerland

The mains plug must comply with SEV/ASE 1011.

Appendix—Examples of power consumption in Optical Metro 5100/5200 shelves

In this chapter

- [Examples of Optical Metro 5200 shelf power consumption on page 6-1](#)
- [Examples of Optical Metro 5100 shelf power consumption on page 6-7](#)

Examples of Optical Metro 5200 shelf power consumption

[Table 6-1](#) lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5200 shelf operating with a bit rate up to 1.25 Gbit/s.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-1
Power consumption of a fully loaded Optical Metro 5200 shelf (up to 1.25 Gbit/s)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OCI circuit pack type: • OCI (622 Mbit/s or 1.25 Gbit/s) • OCI SRM 1310 nm • OCI SRM 1310 nm LC	0–8	• 18 W • 28 W • 28 W	• 19 W • 30 W • 30 W	• 144 W • 224 W • 224 W	• 152 W • 240 W • 240 W
OCLD 2.5 Gbit/s Flex circuit pack	0–8	16 W	22 W	128 W	176 W
OCM circuit pack (1.25 Gbit/s) • 1.25 Gbit/s • 2.5 Gbit/s	2	• 23 W • 25 W	• 27 W • 35 W	• 46 W • 50 W	• 54 W • 70 W

6-2 Appendix—Examples of power consumption in Optical Metro 5100/5200 shelves

Table 6-1 (continued)
Power consumption of a fully loaded Optical Metro 5200 shelf (up to 1.25 Gbit/s)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Maintenance panel and cooling unit	1	40 W	90 W	40 W	90 W
Total power consumption when loaded with the circuit packs that draw the most power				462 W	604 W

Table 6-2 lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5200 shelf operating with a bit rate up to 2.5 Gbit/s.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-2
Power consumption of a fully loaded Optical Metro 5200 shelf (up to 2.5 Gbit/s)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OCI circuit pack type	0–8				
• 2.5 Gbit/s		• 20 W	• 24 W	• 160 W	• 192 W
• SONET/SDH OCI		• 18 W	• 19 W	• 144 W	• 152 W
• SONET/SDH SRM OCI		• 32 W	• 35 W	• 256 W	• 280 W
• OCI SRM GbE/FC		• 36 W	• 43.3 W	• 288 W	• 346.4 W
• OCI SRM GbE/FC Enhanced		• 37 W	• 45 W	• 296 W	• 360 W
• OCI SRM GbE		• 27 W	• 31.4 W	• 216 W	• 251.2 W
• OCI SRM ESCON 1310 nm		• 24 W	• 29 W	• 192 W	• 232 W
• OCI SRM SONET/SDH LTE	• 20 W	• 27 W	• 160 W	• 216 W	
OCLD 2.5 Gbit/s circuit pack (Flex or Universal)	0–8	16 W	22 W	128 W	176 W
OTR 2.5 Gbit/s Universal circuit pack	0–16	17 W	23 W	272 W	368 W
OTR 2.5 Gbit/s Flex	0–16	16 W	22 W	256 W	352 W
OCM (circuit pack 2.5 Gbit/s)	2	25 W	35 W	50 W	70 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Maintenance panel and cooling unit	1	40 W	90 W	40 W	90 W
Total power consumption when loaded with the OCI/OCLD circuit packs that draw the most power				534 W	724 W
Total power consumption when loaded with OTR Flex circuit packs				366 W	540 W
Total power consumption when loaded with OTR Universal circuit packs				382 W	556 W

Table 6-3 lists the power consumption of individual shelf components, and the total power consumption of a fully loaded Optical Metro 5200 shelf equipped with OTR 10 Gbit/s, OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC VCAT circuit packs.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-3
Power consumption of a fully loaded Optical Metro 5200 shelf (OTR 10 Gbit/s, OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC VCAT)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OTR circuit pack type • OTR 10 Gbit/s • OTR 10 Gbit/s Enhanced	0–8	• 35 W • 40 W	• 45 W • 45 W	• 280 W • 320 W	• 360 W • 360 W
Muxponder 10 Gbit/s GbE/FC VCAT circuit pack	0–8	53 W	68 W	424 W	544 W
OCM circuit pack (2.5 Gbit/s)	2	25 W	35 W	50 W	70 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Cooling unit and maintenance panel	1	40 W	90 W	40 W	90 W
Total power consumption when loaded with the OTR circuit packs that draw the most power				430 W	548 W
Total power consumption when loaded with Muxponder 10 Gbit/s GbE/FC VCAT circuit packs				534 W	732 W

Table 6-4 lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5200 shelf equipped with optical-fiber amplifier (OFA) circuit packs.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-4
Power consumption of a fully loaded OFA shelf equipped with OFA circuit packs

Component	Quantity for a fully loaded shelf	Power consumption			
		Per component		Per fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OFA circuit pack type: • Standard C-band • Standard L-band	0-4	• 14 W • 20 W	• 22 W • 36 W	• 56 W • 80 W	• 88 W • 144 W
OFA circuit pack type: • High input power C-band • High input power L-band	0-4	• 16 W • 26 W	• 29 W • 49 W	• 64 W • 104 W	• 116 W • 196 W
OFA circuit pack type: • OFA VGA C-band • OFA VGA L-band	0-4	• 25 W • 25 W	• 30 W • 30 W	• 100 W • 100 W	• 120 W • 120 W
OCM circuit pack (2.5 Gbit/s)	2	25 W	35 W	50 W	70 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Cooling unit and maintenance panel	1	40 W	90 W	40 W	90 W
Total power consumption with Standard OFA				190 W	332 W
Total power consumption with High input power OFA				214 W	384 W
Total power consumption with OFA VGA				210 W	308 W

Table 6-5 lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5200 shelf equipped with optical-fiber amplifier (OFA) circuit packs and APBE circuit packs.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-5
Power consumption of a fully loaded OFA shelf equipped with OFA and APBE circuit packs

Component	Quantity for a fully loaded shelf	Power consumption			
		Per component		Per fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OFA circuit pack type: • Standard C-band • Standard L-band	0-3	• 14 W • 20 W	• 22 W • 36 W	• 42 W • 60 W	• 66 W • 108 W
OFA circuit pack type: • High input power C-band • High input power L-band	0-3	• 16 W • 26 W	• 29 W • 49 W	• 48 W • 78 W	• 87 W • 147 W
OFA circuit pack type: • OFA VGA C-band • OFA VGA L-band	0-4	• 25 W • 25 W	• 30 W • 30 W	• 100 W • 100 W	• 120 W • 120 W
APBE circuit pack	0-2	12.5 W	19.5 W	25 W	39 W
APBE Enhanced circuit pack	0-2	10 W	14 W	20 W	28 W
OCM circuit pack (2.5 Gbit/s)	2	25 W	35 W	50 W	70 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Cooling unit and maintenance panel	1	40 W	90 W	40 W	90 W
Total power consumption with Standard OFA and APBE				• 195 W	• 335 W
Total power consumption with Standard OFA and APBE Enhanced				• 190 W	• 324 W
Total power consumption with High input power OFA and APBE				• 213 W	• 374 W
Total power consumption with High input power OFA and APBE Enhanced				• 208 W	• 363 W
Total power consumption with OFA VGA and APBE				• 235 W	• 347 W
Total power consumption with OFA VGA and APBE Enhanced				• 230 W	• 336 W

Examples of Optical Metro 5100 shelf power consumption

Table 6-6 lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5100 shelf operating with a bit rate up to 1.25 Gbit/s.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-6
Power consumption of a fully loaded Optical Metro 5100 shelf (up to 1.25 Gbit/s)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OCI circuit pack type: • OCI (622 Mbit/s or 1.25 Gbit/s) • OCI SRM 1310 nm • OCI SRM 1310 nm LC	0–2	• 18 W • 28 W • 28 W	• 19 W • 30 W • 30 W	• 36 W • 56 W • 56 W	• 38 W • 60 W • 60 W
OCLD 2.5 Gbit/s circuit pack (Flex or Universal)	0–2	16 W	22 W	32 W	44 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Power card	2	1.5 W	2.5 W	3 W	5 W
Maintenance panel and cooling unit	1	11 W	22 W	11 W	22 W
Total power consumption when loaded with circuit packs that draw the most power				122 W	159 W

Table 6-7 lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5100 shelf operating with a bit rate up to 2.5 Gbit/s.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-7
Power consumption of a fully loaded Optical Metro 5100 shelf (up to 2.5 Gbit/s)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OCI circuit pack type:	0-2	• 20 W	• 24 W	• 40 W	• 48 W
• 2.5 Gbit/s		• 18 W	• 19 W	• 36 W	• 38 W
• SONET/SDH OCI		• 32 W	• 35 W	• 64 W	• 70 W
• SONET/SDH SRM		• 37 W	• 45 W	• 74 W	• 90 W
• SONET/SRM GbE/FC Enhanced		• 36 W	• 43.3 W	• 72 W	• 86.6 W
• OCI SRM GbE/FC		• 27 W	• 31.4 W	• 54 W	• 62.8 W
• OCI SRM GbE		• 24 W	• 29 W	• 48 W	• 58 W
• OCI SRM ESCON 1310 nm		• 20 W	• 27 W	• 40 W	• 54 W
• OCI SRM SONET/SDH LTE					
OCLD 2.5 Gbit/s circuit pack (Flex or Universal)	0-2	16 W	22 W	32 W	44 W
OTR 2.5 Gbit/s Flex circuit pack	0-4	16 W	22 W	64 W	88 W
OTR 2.5 Gbit/s Universal circuit pack	0-4	17 W	23 W	68 W	92 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Power card	2	1.5 W	2.5 W	3 W	5 W
Maintenance panel and cooling unit	1	11 W	22 W	11 W	22 W
Total power consumption when loaded with circuit packs that draw the most power				140 W	189 W
Total power consumption when loaded with OTR Flex circuit packs				98 W	143 W
Total power consumption when loaded with OTR Universal circuit packs				102 W	147 W

Table 6-8 lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5100 regenerator shelf.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-8
Power consumption of a fully loaded Optical Metro 5100 regenerator shelf (1.25 or 2.5 Gbit/s)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OCLD 2.5 Gbit/s circuit pack (Flex or Universal)	0–4	16 W	22 W	64 W	88 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Power card	2	1.5 W	2.5 W	3 W	5 W
Maintenance panel and cooling unit	1	11 W	22 W	11 W	22 W
Total power consumption				98 W	143 W

Table 6-9 lists the power consumption of individual shelf components and the total power consumption of a fully loaded Optical Metro 5100 shelf equipped with OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC VCAT circuit packs.

Note: Maximum power consumption values are obtained during worst-case operating conditions.

Table 6-9
Power consumption of a fully loaded Optical Metro 5100 shelf (OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC)

Component	Quantity for a fully loaded shelf	Power consumption			
		For each component		For each fully loaded shelf	
		Typical	Maximum	Typical	Maximum
OTR 10 Gbit/s Enhanced circuit pack	0–2	40 W	45 W	80 W	90 W
Muxponder 10 Gbit/s GbE/FC VCAT circuit pack	0–2	53 W	68 W	106 W	136 W
SP circuit pack	1	10 W	12 W	10 W	12 W
OSC circuit pack	1	10 W	16 W	10 W	16 W
Power card	2	1.5 W	2.5 W	3 W	5 W
Maintenance panel and cooling unit	1	11 W	22 W	11 W	22 W
Total power consumption when loaded with OTR circuit packs				114 W	145 W
Total power consumption when loaded with Muxponder 10 Gbit/s GbE/FC VCAT circuit packs				140 W	191 W

Nortel

Optical Metro 5100/5200

Technical Specifications

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