Nortel

Optical Metro 5100/5200

Testing and Equalization Procedures

Standard   Release 8.0   Issue 1   April 2005

What's inside...

Test procedures
Equalizing amplified systems

NORTEL

Contents

About this document

This document describes the recommended testing and equalization procedures for Nortel Optical Metro 5100/5200.

This document contains the following information:

- test procedures for components and connectivity
- equalization procedures for amplified networks

Audience for this document

This document is intended for the following audience:

- provisioners
- 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 Nortel Technical Publications* (NTP) consist of descriptive information and procedures.

Descriptive information
These NTPs provide detailed 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

Planning a Network	Installing, Commissioning and Testing a Network	Managing, Provisioning and Testing a Network	Maintaining and Troubleshooting a Network
About the NTP Library (323-1701-090)	Installing Optical Metro 5200 Shelves and Components, Part 1 (323-1701-201)	Provisioning and Operating Procedures Part 1 (323-1701-310)	Trouble Clearing and Alarm Reference Guide, Part 1 (323-1701-542)
Network Planning and Link Engineering Part 1 (323-1701-110)	Installing Optical Metro 5200 Shelves and Components, Part 2 (323-1701-201)	Provisioning and Operating Procedures Part 2 (323-1701-310)	Trouble Clearing and Alarm Reference Guide, Part 2 (323-1701-542)
Network Planning and Link Engineering Part 2 (323-1701-110)	Installing Optical Metro 5100 Shelves and Components, Part 1 (323-1701-210)	Customer Acceptance Testing Procedures (323-1701-330)	Trouble Clearing and Alarm Reference Guide, Part 3 (323-1701-542)
Network Planning and Link Engineering Part 3 (323-1701-110)	Installing Optical Metro 5100 Shelves and Components, Part 2 (323-1701-210)	TL1 Interface, Part 1 (323-1701-190)	Trouble Clearing and Alarm Reference Guide, Part 4 (323-1701-542)
Software and User Interface (323-1701-101)	Commissioning Procedures (323-1701-220)	TL1 Interface, Part 2 (323-1701-190)	Maintenance and Replacement Procedures (323-1701-546)
Hardware Description Part 1 (323-1701-102)	Connection Procedures Part 1 (323-1701-221)	TL1 Interface, Part 3 (323-1701-190)	
Hardware Description Part 2 (323-1701-102)	Connection Procedures Part 2 (323-1701-221)	TL1 Interface, Part 4 (323-1701-190)	
Technical Specifications (323-1701-180)	Testing and Equalization Procedures (323-1701-222)		

Technical assistance service telephone numbers

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

Technical Assistance Service	
For service-affecting problems: For 24-hour emergency recovery or software upgrade support, that is, for: • 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	**North America:** 1-800-4NORTEL (1-800-466-7835) **International:** 001-919-992-8300
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.	**North America:** 1-800-4NORTEL (1-800-466-7835) ***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. **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.
Global software upgrade support:	**North America:** 1-800-4NORTEL (1-800-466-7835) **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.

Test procedures

Use the procedures in this chapter to test system components, component specifications, component connectivity, and intershelf connections at the shelf, site, and system levels.

If you discover a problem with any of the tests in this chapter, refer to "Installation troubleshooting procedures" in the *Trouble Clearing and Alarm Reference Guide,* 323-1701-542, Part 1.

Requirements

Table 1-1 lists the tools and materials required for procedures in this chapter.

Table 1-1
Tools and materials required for test procedures

Item	Quantity	Supplied
Antistatic wrist strap	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Optical power meter (OPM) with an SC connector	1	no
Optical patch cords	as required	
Optical test set	1	no
Attenuator or patch cord with mini-VOA	1	no

Before you begin

Many of the test procedures in this document are performed during system installation and commissioning, and are included in the appropriate NTPs. The test procedures are also presented separately in this document, since you may need to run them after system installation—for example, during a system hardware upgrade or during a troubleshooting procedure.

> **CAUTION**
> **Risk of loss of traffic**
> Most of these procedures involve disconnecting fibers, which will disrupt traffic on an In-Service system. Ensure that your traffic is protected when applicable (if may be necessary to use external equipment for protection).

Precautions

General safety notices

> **DANGER**
> **Risk of personal injury**
> Use of controls, adjustments, or procedures other than those described in this documentation can result in exposure to hazardous invisible radiation.

> **CAUTION**
> **Risk of equipment damage**
> Only qualified personnel should install Optical Metro 5100/5200 equipment.

> **CAUTION**
> **Risk of equipment damage**
> Before attempting any of the following tests, make sure that you completely read and understand the procedure that you are about to perform.

> **CAUTION**
> **Risk of equipment damage**
> Do not use the RJ45 panel connectors (10Base-T 1X and 10Base-T 2X) as telephone jacks.

Laser safety notices

> **CAUTION**
> **Risk of personal injury**
> Do not look into the end of connectors on fiber-optic cables or into connectors on the faceplates of installed circuit cards. The light source used in fiber-optic devices can damage your eyes.

> **CAUTION**
> **Risk of personal injury**
> Infrared laser light is not visible and can burn your skin. The lasers used in this equipment give off infrared light. You cannot see or feel the effect of receiving the light on your skin.

Laser safety considerations

> **CAUTION**
> **Invisible laser radiation**
> The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

Observe the following precautions to ensure safe operation and site compliance with EN60825-1 and EN60825-2

- Do not look at the OMX, ECT, PBE, or OFA optical fibers without visual aids. There is a label warning of invisible laser radiation on all OMXs, ECTs, PBEs, and OFAs.

- The mechanical characteristics of the optical fiber connecting the OMX, ECT, or PBE and the optical fiber distribution panel must comply with IEC794-2.

- Follow sound cable management practises to avoid applied stress or cut optical fibers. Do not use cable ties to secure optical fibers to the system rack.

- The optical fiber patch panel must carry a class 3A warning label, and must require the use of a tool to access the optical fiber connections. In addition, attach a laser safety tag to all optical fibers that connect to client subtending equipment. For more information on laser safety tags, refer to the "Labeling" section in the "Observing safety guidelines" chapter in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Component handling precautions

Handling circuit packs

⚠	**CAUTION** **Risk of equipment damage** Make sure you know how to handle electronic components correctly before you begin installation procedures. Incorrect handling can cause damage to static-sensitive components.

To avoid possible damage to circuit packs by electrostatic discharge (ESD), follow these precautions.

- Always plug the wrist strap cable into the ESD jack in the shelf maintenance panel before you put on the wrist strap.

- Always wear grounded antistatic wrist straps when handling circuit packs.

- Keep circuit packs in their antistatic bags until you are ready to install them.

- Remove circuit packs from their antistatic bags and install them directly into the shelf. Do not pass circuit packs to another person.

- If you need to put a circuit pack down, put the pack back into its antistatic bag first.

- Handle circuit packs by their edges only. Do not touch the electronic components or any exposed printed circuitry.

- Limit your movement during installation to reduce the build up of static electricity.

Handling fiber-optic cable

⚠	**DANGER** **Risk of personal injury** Do not look into the end of fiber-optic cable. The light source used in fiber-optic cables can damage your eyes.

⚠	**CAUTION** **Risk of equipment damage** Make sure you know how to handle fiber-optic cable correctly. Incorrect handling can cause damage to the glass optical fiber. Do not compress fiber-optic cable. Do not place fiber-optic cable in a tray or drawer with electrical cable.

Although the glass optical path of fiber-optic cable is protected with reinforcing material and plastic insulation, follow these precautions to avoid damaging the glass optical fiber.

- Do not kink, knot, or vigorously flex the cable.
- Do not bend the cable to less than a 40 mm (1.5-inch) radius.
- Do not stand on fiber-optic cable; keep the cable off the floor.
- Do not pull excessively on any fiber-optic cable.
- Do not allow any static load on any section of the cable.
- Put protective caps on fiber-optic connectors that are not in use.
- Store available fiber-optic patch cords in a cabinet, on a cable rack, or flat on a shelf.
- Do not use cable ties to secure optical fiber to racks or other equipment.
- Clean all connectors and cables before making optical connections. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Overstressing fiber-optic cable might not result in immediate failure of the cable but frequent overstressing can cause progressive degeneration of the cable.

If you suspect damage to a fiber-optic cable, either through known mishandling or by indication of an abnormally high error rate in one direction, reverse the cable pairs. If the high error rate appears in the other direction, replace the cable.

Procedure list

Table 1-2 lists the procedures in this chapter.

Table 1-2
Procedures in this chapter

Procedure 1-1
Testing the shelf lamps

Follow this procedure to check that the indicator lamps on the maintenance panel and shelves are working correctly.

This procedure tests all indicator lamps on the shelf except the 10Base-T and power lamps.

Expected results

When you do a shelf lamp test, any visual alarm indicators connected to the maintenance panel will light, along with all the LEDs on the circuit packs. The audible alarm will not sound.

If you discover a problem with any of the shelf lamps during this test, refer to "Troubleshooting the Optical Metro 5100/5200" in the *Trouble Clearing and Alarm Reference Guide*, 323-1701-542.

Action

Step	Action	
1	**If**	**Then**
	you want to test the shelf lamps using System Manager	follow step 2 through step 9.
	you want to test the shelf lamps by using the alarm cut-off (ACO) button on the shelf	follow step 10 through step 14.

Testing the shelf lamps using System Manager

2	Log in to the System Manager.
3	Select the Configuration tab.
4	Select the Surveillance tab.
5	Under the External Manager section, select the shelf on which you want to perform the test.
6	Under the Actions section, click the **Lamp Test** button.
	A dialog box appears, asking if you want to proceed with the lamp test.
7	Click **Yes**.

—continued—

Procedure 1-1 (continued)
Testing the shelf lamps

Step	Action
8	Observe the alarm indicator lamps on the maintenance panel, as shown in Figure 1-1 or Figure 1-2 on page 1-9.
	There are indicator lamps for critical, major, and minor alarms. The Critical and Major lamps are red. The Minor and ACO lamps are yellow.
9	Observe the indicator lamps on the circuit packs in the shelf.
	All indicator lamps on all circuit packs are lit. Indicator lamps will stay lit for approximately five seconds. If the lamps on a circuit pack do not light, replace the circuit pack.

Test the shelf lamps using the alarm cut-off (ACO) button

Step	Action
10	Make sure the power switches on the maintenance panel are on.
	Power indicator lamps are green.
11	Press and hold the ACO button for at least five seconds (until all the LEDs on the shelf illuminate) and keep it pressed.
12	Observe the alarm indicator lamps on the maintenance panel, as shown in Figure 1-1 or Figure 1-2 on page 1-9.
	There are indicator lamps for critical, major, and minor alarms. The Critical and Major lamps are red. The Minor and ACO lamps are yellow.
13	Observe the indicator lamps on the circuit packs in the shelf.
	All indicator lamps on all circuit packs are lit. If the lamps on a circuit pack do not light, replace the circuit pack.
14	Release the ACO button.

—**continued**—

Procedure 1-1 (continued)
Testing the shelf lamps

Figure 1-1
Monitoring indicator lamps on the Optical Metro 5200 maintenance panel

OM0147p
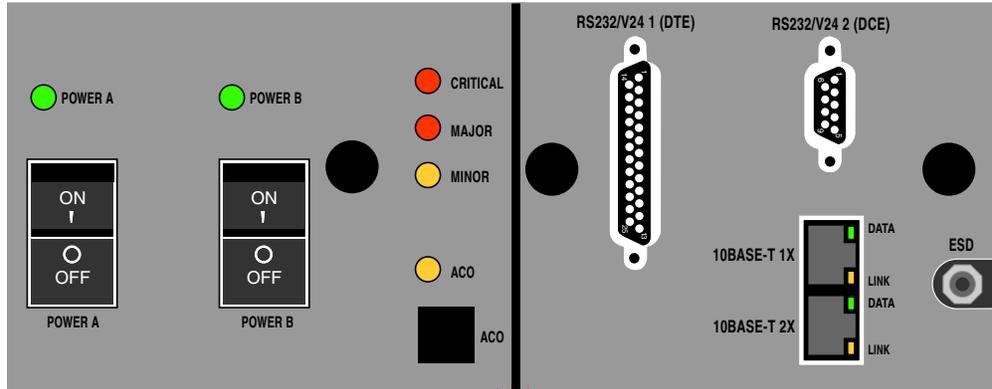
Figure 1-2
Monitoring indicator lamps on the Optical Metro 5100 maintenance panel

OM0975t

Power module   Maintenance
                                panel card

—end—

Procedure 1-2
Testing an Optical Metro 5100/5200 WDM OMX

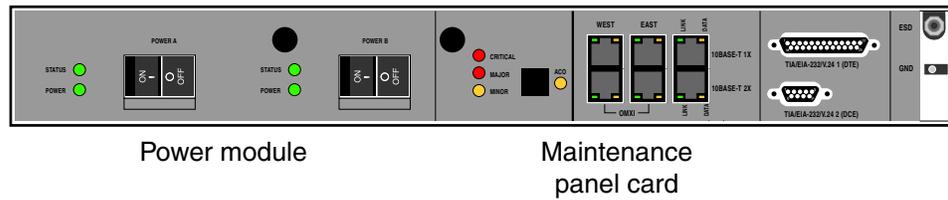Use this procedure to test the optical signal through a WDM OMX. A successful test indicates:

- optical transmit power is correct on the OCLD, OTR or Muxponder
- signal continuity from the output of the OCLD, OTR or Muxponder through to the output of the OMX
- signal continuity from the input of the OMX to the input of the OCLD, OTR or Muxponder
- the correct signal strength through the OMX
- correct fiber connections from the OCLD, OTR or Muxponder to the OMX

Requirements

Before you do this test, make sure that you have:

- powered on the shelf (see *Commissioning Procedures*, 323-1701-220)
- a minimum shelf configuration of one SP, one OCLD, OTR or Muxponder, one OMX, and the shelf database cards (OCMs in slots 9 and 10 for the Optical Metro 5200, and any circuit pack in slot 1 to 4, or 6 for the Optical Metro 5100).

  Note: Other circuit packs may be present and fibered in the shelf, but they must not be seated.

- turned off Automatic Laser Shutdown (ALS) (see Procedure 1-43 "Enabling or disabling automatic laser shutdown", in *Provisioning and Operating Procedures*, 323-1701-310).

  Note: The default setting for ALS is off.

- the OCLD, OTR or Muxponder line-side facilities in the In-service state
- no pads in place at the OMX Band Drop port or at the OMX Band Add port for DWDM OMX (Standard).
- no pads in place at the OMX Band RX port or at the OMX Band TX port for DWDM OMX 4CH + Fiber Manager or DWDM OMX Enhanced
- no pads in place at the CH Drop ports or at the CH Add ports for DWDM OMX 16CH.
- performed Procedure 1-1 "Testing the shelf lamps"

—**continued**—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Table 1-3 lists the tools and materials required for testing the signal through a WDM OMX.

Table 1-3
Tools and materials required for the WDM OMX signal continuity test

Item	Quantity	Supplied
Antistatic strap	1	no
Optical power meter (OPM) with an SC connector	1	no
Optical power meter (OPM) with an FC connector if OCLDs with FC connectors are connected to the OMX under test	1	no
Optical power meter (OPM) with an LC connector if OCLDs with LC connectors or OTRs/Muxponders are connected to the OMX under test	1	no
Optical fiber cleaning kit	1	no
Optical patch cord with SC connectors	1	no
Optical patch cord with an FC connector at one end and an SC connector at other end if OCLDs with FC connectors are connected to the OMX under test	1	no
Optical patch cord with an LC connector at one end and an SC connector at other end if OCLDs, OTRs or Muxponders with LC connectors are connected to the OMX under test	1	no
Fiber inspection scope	1	no

—continued—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Precautions

	CAUTION
	Invisible laser radiation
	The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

	CAUTION
	Risk of network reliability
	Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Expected results

The optical transmit power is correct on the OCLD, OTR or Muxponder, the signal continuity from the output of the OCLD, OTR or Muxponder through to the output of the OMX is correct, and the signal strength through the OMX is correct.

Action

Step	Action
1	Make sure that all OCLDs, OTRs or Muxponders are fibered correctly to their associated OMXs. Refer to Procedure 3-19, "Connecting an OMX to OCLD circuit packs" or Procedure 3-20, "Connecting an OMX to Muxponder (MOTR) circuit packs" in *Connection Procedures*, 323-1701-221.

—continued—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action	
2	**If** you are testing the	**Then** go to
	DWDM OMX 4CH + Fiber Manager	step 3
	DWDM OMX 4CH Enhanced	step 3
	DWDM OMX (Standard)	step 3
	DWDM OMX 16CH C-band	step 6
	DWDM OMX 16CH L-band	step 9
	OMX 4CH CWDM	step 3
	OMX 1CH CWDM	step 3
	OMX 4CH OADM ITU CWDM	step 3
	OMX 1CH OADM ITU CWDM	step 3
	OMX 4CH ITU CWDM	step 9
	OMX 8CH ITU CWDM	step 9

3	Locate the OMX under test, open it, and locate the OTS OUT, OTS IN, THRU OUT and THRU IN connectors. For information on the various OMX types, see "OMX modules" in *Hardware Description*, 323-1701-102.
4	Make sure that any fibers connected to the OTS OUT, OTS IN, THRU OUT and THRU IN connectors of the OMX under test are labelled. Disconnect the fibers connected to the OTS OUT, OTS IN, THRU OUT, and THRU IN connectors of the OMX under test.
5	Go to step 11.
6	Locate the OMX under test, open it, and locate the OTS OUT, OTS IN, L OUT and L IN connectors. For information on the various OMX types, see "OMX modules" in *Hardware Description*, 323-1701-102.
7	Make sure that any fibers connected to the OTS OUT, OTS IN, L OUT and L IN connectors of the OMX under test are labelled. Disconnect the fibers connected to the OTS OUT, OTS IN, L OUT, and L IN connectors of the OMX under test.
8	Go to step 11
9	Locate the OMX under test, open it, and locate the OTS OUT and OTS IN connectors. For information on the various OMX types, see "OMX modules" in *Hardware Description*, 323-1701-102.
10	Make sure that any fibers connected to the OTS OUT and OTS IN connectors of the OMX under test are labelled. Disconnect the fibers connected to the OTS OUT and OTS IN connectors of the OMX under test.
11	Identify all the OCLD, OTR or Muxponder circuit packs connected to the OMX under test and unseat each from the shelf.

—**continued**—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action
12	Identify the first OCLD, OTR or Muxponder circuit pack to test and disconnect the fiber from the OCLD RX port, OTR line-side Rx port or Muxponder line-side Rx port.
13	Set the optical power meter (OPM) to 1550 nm and connect it to the fiber that was disconnected in step 12.
14	Seat the OCLD, OTR or Muxponder circuit pack into the shelf.
15	Connect a patch cord that is known to be error-free between the OMX OTS OUT connector and the OTS IN connector.
16	Using the OPM, record the power reading out from the fiber that normally connects to the OCLD RX port, OTR line-side RX port or Muxponder line-side RX port. See Table 1-4 for the minimum acceptable levels.

Note: Before taking a reading, ensure that the OCLD, OTR or Muxponder faceplate green Status is lit.

—**continued**—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	**Action**

Table 1-4
Minimum acceptable optical power level

Type of OMX	Type of OCLD/OTR				
	OCLD 1.25 Gbit/s	**OCLD 2.5 Gbit/s**	**OCLD/OTR 2.5 Gbit/s Flex**	**OTR 10 Gbit/s**	**OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC**
DWDM OMX 4CH + Fiber Manager	-6.2 dBm	-3.2 dBm	-3.3 dBm	-7.9 dBm	-3.5 dBm
DWDM OMX 4CH Enhanced	-4.1 dBm	-1.1 dBm	-1.3 dBm	-5.9 dBm	-1.5 dBm
DWDM OMX (Standard)	-5.9 dBm	-2.9 dBm	-3.0 dBm	-7.6 dBm	-3.2 dBm
DWDM OMX 16CH C-band	not applicable	not applicable	-4.1 dBm	not applicable	-4.3 dBm
DWDM OMX 16CH L-band	not applicable	not applicable	-3.2 dBm	not applicable	-3.4 dBm
OMX 4CH CWDM	-3.1 dBm	-0.1 dBm	-0.3 dBm	not applicable	-0.5 dBm
OMX 1CH CWDM	-1.8 dBm	1.2 dBm	0.9 dBm	not applicable	0.7 dBm
OMX 4CH ITU CWDM	not applicable	not applicable	-0.9 dBm	not applicable	-1.1 dBm
OMX 8CH ITU CWDM	not applicable	not applicable	-2.5 dBm	not applicable	-2.7 dBm
OMX 1CH OADM ITU CWDM	not applicable	not applicable	0.4 dBm	not applicable	0.2 dBm
OMX 4CH OADM ITU CWDM	not applicable	not applicable	-0.8 dBm	not applicable	-1.0 dBm

—continued—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action

17	**If** the OPM power reading	**Then** go to
	meets the minimum acceptable power level	step 39
	does not meet the minimum acceptable power level	step 18

18	Check the fibering and cleanliness of all connectors (using a fiber inspection scope and optical fiber cleaning kit). For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201. For a list of connectors to check, see Table 1-5.

Table 1-5
Connectors to check

Type of component	Connector
DWDM OMX (Standard)	OTS OUT, OTS IN, Band Drop, Band Add
DWDM OMX 4CH + Fiber Manager	OTS OUT, OTS IN, Band RX, Band TX, CH Add, CH Drop
DWDM OMX 4CH Enhanced	OTS OUT, OTS IN, Band RX, Band TX, CH Add, CH Drop
DWDM OMX 16CH	OTS OUT, OTS IN, CH Add, CH Drop
OMX 4CH CWDM	OTS OUT, OTS IN, Band Drop, Band Add
OMX 1CH CWDM	
OMX 4CH ITU CWDM	OTS OUT, OTS IN, <Wavelength nm> Drop, <Wavelength nm> Add
OMX 8CH ITU CWDM	
OMX 1CH OADM ITU CWDM	OTS OUT, OTS IN, <Wavelength nm> Drop, <Wavelength nm> Add
OMX 4CH OADM ITU CWDM	
OCLD	TX, RX
OTR or Muxponder	line-side TX, line-side RX

19	With the OPM, record the power reading again. See Table 1-4 for the minimum acceptable levels.

—**continued**—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action	
20	**If** the OPM power reading	**Then** go to
	meets the minimum acceptable power level	step 39
	does not meet the minimum acceptable power level	step 21
21	**If** you have	**Then** go to
	an OMX (Standard)	step 35
	any OMX other than an OMX (Standard)	step 22

22 Unhook the fiber from the Channel Add port of the OMX (or the Band Add port for the CWDM OMX or the <Wavelength nm> Add port for the ITU CWDM OMX), and attach the OPM to the end of the fiber. Take a reading at the end of the fiber coming from the OCLD, OTR or Muxponder. Refer to the "Circuit pack specifications" chapter in *Technical Specifications*, 323-1701-180, and record the minimum Tx power level for the OCLD, OTR or Muxponder circuit pack.

23	**If** the OPM power reading	**Then** go to
	meets the minimum acceptable power level	step 24
	does not meet the minimum acceptable power level	step 31

24 Reconnect the fiber (the one that was disconnected in step 22) to the Channel Add port of the OMX (or the Band Add port for the CWDM OMX or the <Wavelength nm> Add port for the ITU CWDM OMX).

25 Disconnect the fiber connected to the Channel Drop port of the OMX (or the Band Drop port for the CWDM OMX or the <Wavelength nm> Drop port for the ITU CWDM OMX).

26 Connect a patch cord that is known to be error-free to the Channel Drop port of the OMX (or the Band Drop port for the CWDM OMX or the <Wavelength nm> Drop port for the ITU CWDM OMX). Take a reading at the end of the fiber coming from the OMX Channel Drop port (or the Band Drop port for the CWDM OMX or the <Wavelength nm> Drop port for the ITU CWDM OMX). See Table 1-4 for the minimum acceptable levels.

27	**If** the OPM power reading	**Then** go to
	meets the minimum acceptable power level	step 30
	does not meet the minimum acceptable power level	step 28

28 Reconnect the original fiber (the one that was disconnected in step 26) to the Channel Drop port of the OMX (or the Band Drop port for the CWDM OMX or the <Wavelength nm> Drop port for the ITU CWDM OMX) and the other end to the OPM.

—continued—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action
29	Replace the OMX, making sure to reconnect the fibers at their correct locations. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. Go to step 16.
30	Replace the original patch cord between the RX port of the circuit pack and the Channel Drop port of the OMX (or the Band Drop port for the CWDM OMX or the <Wavelength nm> Drop port for the ITU CWDM OMX) but do not connect the patch cord to the RX port of the circuit pack. Go to step 16.
31	Take a reading coming from the OCLD TX port, OTR line-side TX port or Muxponder line-side TX port with a patch cord that is known to be error-free. See the "Circuit pack specifications" chapter in *Technical Specifications*, 323-1701-180, and record the minimum Tx power level for the OCLD, OTR or Muxponder circuit pack.

32	**If**	**Then** go to
	the reading is within the acceptable power levels	step 33
	If the reading is not within the minimum acceptable power levels	step 34

33	Replace the original patch cord between the circuit pack and the OMX. Go to step 16.
34	Replace the circuit pack, making sure to reconnect the patch cord to the TX port, but do not connect the patch cord to the RX port of the circuit pack. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. Go to step 16.
35	Take a reading coming from the OCLD TX port, OTR line-side TX port or Muxponder line-side TX port with a patch cord that is known to be error-free. See the "Circuit pack specifications" chapter in *Technical Specifications*, 323-1701-180, and record the minimum Tx power level for the OCLD, OTR or Muxponder circuit pack.

36	**If**	**Then** go to
	the reading is within the acceptable power levels	step 37
	If the reading is not within the minimum acceptable power levels	step 38

37	Replace the OMX making sure to reconnect the fibers at their correct locations. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. Go to step 16.

—**continued**—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action
38	Replace the circuit pack, making sure to reconnect the patch cord to the TX port, but do not connect the patch cord to the RX port of the circuit pack. See the chapter "Replacing circuit packs" in *Maintenance and Replacement Procedures*, 323-1701-546. Go to step 16.
39	Unhook the OPM.
40	Unseat the OCLD, OTR or Muxponder circuit pack.
41	Reconnect the fiber to the OCLD RX port, OTR line-side RX port or Muxponder line-side RX port.
42	Determine if there are other OCLD, OTR or Muxponder circuit packs connected to the OMX under test.

If there are	**Then** go to
other OCLD, OTR or Muxponder circuit packs connected to the OMX under test	step 43
no other OCLD, OTR or Muxponder circuit packs connected to the OMX under test	step 46

Step	Action
43	Identify the next OCLD, OTR or Muxponder circuit pack to test and disconnect the fiber from the OCLD RX port, OTR line-side RX port or Muxponder line-side RX port.
44	Set the optical power meter (OPM) to 1550 nm and connect it to the fiber that was disconnected in step 43.
45	Seat the OCLD, OTR or Muxponder circuit pack into the shelf. Go to step 16.
46	Disconnect the patch cord from the OMX OTS IN connector and OTS OUT connector.
47	Reinsert all OCLDs, OTRs or Muxponders connected to the OMX under test.

—**continued**—

Procedure 1-2 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action	
48	**If** you are testing the	**Then** go to
	DWDM OMX 4CH + Fiber Manager	step 49
	DWDM OMX 4CH Enhanced	step 49
	DWDM OMX (Standard)	step 49
	DWDM OMX 16CH C-band	step 51
	DWDM OMX 16CH L-band	step 53
	OMX 4CH CWDM	step 49
	OMX 1CH CWDM	step 49
	OMX 4CH OADM ITU CWDM	step 49
	OMX 1CH OADM ITU CWDM	step 49
	OMX 4CH ITU CWDM	step 53
	OMX 8CH ITU CWDM	step 53
49	Reconnect fibers to the OTS OUT, OTS IN, THRU OUT and THRU IN connectors if any were disconnected in step 4.	
50	Go to step 54.	
51	Reconnect fibers to the OTS OUT, OTS IN, L OUT and L IN connectors if any were disconnected in step 7.	
52	Go to step 54.	
53	Reconnect fibers to the OTS OUT and OTS IN connectors if any were disconnected in step 10.	
54	Repeat the procedure for all OMXs.	

—*end*—

Procedure 1-3
Testing the optical continuity through the OMXs at a site

Use this procedure to verify signal continuity through the band filters of the OMX (THRU IN to OTS OUT and OTS IN to THRU OUT) and the patch cords added to interconnect the OMXs. A successful test indicates:

- optical transmit power is correct
- signal continuity from shelf to shelf

This procedure must be performed for both the East-bound and West-bound directions, as well as for both the C and L band shelves in parallel configurations.

> *Note:* This procedure is only required for sites that have OMXs daisy-chained together using the OMX THRU ports.

Requirements

Before you do this test, make sure that you have:

- powered on the shelf (see *Commissioning Procedures*, 323-1701-220)
- a minimum shelf configuration of one SP, one OCLD, OTR or Muxponder, one OMX, and the shelf database cards (OCMs in slots 9 and 10 for the Optical Metro 5200, and any circuit pack in slots 1 to 4, or 6 for the Optical Metro 5100) for each shelf at the site

> *Note:* Other circuit packs may be present and fibered in the shelf, but they must not be seated.

- turned off Automatic Laser Shutdown (ALS) (see Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures*, 323-1701-310)

> *Note:* The default setting for ALS is off.

- no pads in place at the OMX Band Drop port or at the OMX Band Add port for DWDM OMX (Standard)
- no pads in place at the OMX Band RX port or at the OMX Band TX port for DWDM OMX 4CH + Fiber Manager or DWDM OMX Enhanced
- performed Procedure 1-1 and Procedure 1-2

—continued—

Procedure 1-3 (continued)
Testing the optical continuity through the OMXs at a site

Table 1-6 lists the tools and materials required for testing optical continuity.

Table 1-6
Tools and materials required for the optical continuity test

Item	Quantity	Supplied
Antistatic strap	1	no
Optical power meter (OPM) with an SC connector	1	no
Optical power meter (OPM) with an FC connector if OCLDs with FC connectors are connected to the OMX under test	1	no
Optical power meter (OPM) with an LC connector if OCLDs with LC connectors or if OTRs or Muxponders are connected to the OMX under test	1	no
Variable optical attenuator (VOA) with SC-SC connectors	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Optical patch cord	1	no

Precautions

CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of network reliability
Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—

Procedure 1-3 (continued)
Testing the optical continuity through the OMXs at a site

Expected results

The optical transmit power is correct, and there is signal continuity from shelf to shelf.

Action

Step	Action
1	Make sure that all OCLDs, OTRs or Muxponders are fibered correctly to their associated OMXs. Refer to Procedure 3-19, "Connecting an OMX to OCLD circuit packs" or, Procedure 3-20, "Connecting an OMX to Muxponder (MOTR) circuit packs" in *Connection Procedures*, 323-1701-221.
2	Make sure that all OMXs at the site are correctly fibered. Refer to Procedure 3-1, "Connecting multiple OMXs in a series", in *Connection Procedures*, 323-1701-221.

3	**If** the C-band and L-band WDM OMXs are fibered together in	**Then** go to
	sequence (serial configuration)	step 5
	two parallel series (parallel configuration)	step 4

Step	Action
4	Perform the following steps for each series of OMX. That is, first perform the following steps on the C-band OMXs and then on the L-band OMXs.
5	In Table 1-7 on page 1-23:

- record the OMX band order starting with the west-most OMX. See "Guidelines for determining the east-most and west-most OMXs in a series of interconnected OMXs" in *Connection Procedures*, 323-1701-221 as a guide to help you determine the band order.

- when you check off the TX and RX boxes later in this procedure, it is advised to use a pencil since some boxes may need to be unchecked

Table 1-7
West OMX worksheet for testing optical continuity

OMX Band Order	TX	RX
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

—continued—

Procedure 1-3 (continued)
Testing the optical continuity through the OMXs at a site

Step	Action

6 In Table 1-8 on page 1-24:

- record the OMX band order starting with the east-most OMX. See "Guidelines for determining the east-most and west-most OMXs in a series of interconnected OMXs" in *Connection Procedures*, 323-1701-221 as a guide to help you determine the band order.

- when you check off the TX and RX boxes later in this procedure, it is advised to use a pencil since some boxes may need to be unchecked

Table 1-8
East OMX worksheet for testing optical continuity

OMX Band Order	TX	RX
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

7 Make sure that any fibers connected to the OTS OUT port and the OTS IN port of the West OMX of the first band listed in Table 1-7 on page 1-23 are labelled. Disconnect any fibers connected to the OTS OUT port and OTS IN port of the West OMX of the first band listed in Table 1-7 on page 1-23.

8 Make sure that any fibers connected to the OTS OUT port and the OTS IN port of the East OMX of the first band listed in Table 1-8 on page 1-24 are labelled. Disconnect any fibers connected to the OTS OUT port and OTS IN port of the East OMX of the first band listed in Table 1-8 on page 1-24.

Testing the optical continuity through the West OMXs - TX direction

9 Unseat all OCLD, OTR or Muxponder circuit packs connected to the West OMXs listed in Table 1-7 on page 1-23 except one OCLD, OTR or Muxpnder circuit pack connected to the West OMX of the last band listed in Table 1-7 on page 1-23.

—continued—

Procedure 1-3 (continued)
Testing the optical continuity through the OMXs at a site

Step	Action
10	Connect one end of a patch cord (which is known to be error-free) to the OTS OUT port of the West OMX of the first band listed in Table 1-7 on page 1-23 and the other end to the optical power meter (OPM).

If the site is configured as a	**Then** see
standard terminal	Figure 1-3 on page 1-37
stacked terminal	Figure 1-4 on page 1-37
standard OADM	Figure 1-5 on page 1-38

Note 1: If the site is configured as a dual-density or quad-density, use the standard terminal as an example.

Note 2: For more information on site types, see "Preparing to connect optical components" in *Connection Procedures,* 323-1701-221.

Step	Action
11	Set the Optical Power Meter (OPM) to 1550 nm and record the power reading.

If using	**Then** see
OMX (Standard) or OMX 4CH + Fiber Manager	Table 1-9 on page 1-33 for minimum acceptable levels
OMX 4CH Enhanced	Table 1-10 on page 1-33 for minimum acceptable levels
OMX 4CH CWDM	Table 1-11 on page 1-34 for minimum acceptable levels
OMX 1CH CWDM	Table 1-12 on page 1-34 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-13 on page 1-34 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-14 on page 1-35 for minimum acceptable levels

Note: The number of OMXs the signal passes through is determined by the number of bands which have an unchecked box in the TX column in Table 1-7 on page 1-23.

Step		
12	**If**	**Then** go to
	the OPM power reading meets the minimum acceptable power level	step 35
	otherwise	step 13

Step	Action
13	In Table 1-7 on page 1-23, note the first band with an unchecked box in the TX column.
14	In Table 1-7 on page 1-23, check the TX column for the band noted in step 13.

—continued—

Procedure 1-3 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action
15	In Table 1-7 on page 1-23, note the last band with a checked off box in the TX column.

16	**If**	**Then** go to
	the band noted in step 15 is also the last band listed in Table 1-7 on page 1-23	step 28
	otherwise	step 17

17	Disconnect the patch cord connected to the THRU IN port of the West OMX of the band noted in step 15 and connect it to the OPM.

18	Set the Optical Power Meter (OPM) to 1550 nm and record the power reading.

If using	**Then** see
OMX (Standard) or OMX 4CH + Fiber Manager	Table 1-9 on page 1-33 for minimum acceptable levels
OMX 4CH Enhanced	Table 1-10 on page 1-33 for minimum acceptable levels
OMX 4CH CWDM	Table 1-11 on page 1-34 for minimum acceptable levels
OMX 1CH CWDM	Table 1-12 on page 1-34 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-13 on page 1-34 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-14 on page 1-35 for minimum acceptable levels

Note: The number of OMXs the signal passes through is determined by the number of bands which have an unchecked box in the TX column in Table 1-7 on page 1-23.

19	**If**	**Then** go to
	the OPM power reading meets the minimum acceptable power level	step 22
	otherwise	step 20

20	Clean and reconnect the patch cord to the THRU IN port of the West OMX of the band noted in step 15 (that is, the patch cord that was disconnected in step 17).
21	Go to step 13.
22	Clean and reconnect the patch cord to the THRU IN port of the West OMX of the band noted in step 15 (that is, the patch cord that was disconnected in step 17).

—**continued**—

Procedure 1-3 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action

23	**If**	**Then** go to
	the band noted in step 15 is also the first band listed in Table 1-7 on page 1-23	step 32
	otherwise	step 24

24 Disconnect the patch cord that connects to the OTS OUT port of the West OMX of the band noted in step 15.

25 Connect the OPM to the OTS OUT port of the West OMX of the band noted in step 15 with a patch cord that is known to be error-free.

26 Set the Optical Power Meter (OPM) to 1550 nm and record the power reading.

If using	**Then** see
OMX (Standard) or OMX 4CH + Fiber Manager	Table 1-9 on page 1-33 for minimum acceptable levels
OMX 4CH Enhanced	Table 1-10 on page 1-33 for minimum acceptable levels
OMX 4CH CWDM	Table 1-11 on page 1-34 for minimum acceptable levels
OMX 1CH CWDM	Table 1-12 on page 1-34 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-13 on page 1-34 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-14 on page 1-35 for minimum acceptable levels

Note: The number of OMXs the signal passes through is determined by adding one to the number of bands which have an unchecked box in the TX column in Table 1-7 on page 1-23.

27	**If**	**Then** go to
	the OPM power reading meets the minimum acceptable power level	step 28
	otherwise	step 31

28 Replace the original patch cord that connects the OTS OUT port of the West OMX noted in step 15 to the THRU IN port of the West OMX of the band listed before the West OMX noted in step 15.

29 In Table 1-7 on page 1-23, uncheck all boxes in the TX column.

30 Go to step 10.

—**continued**—

Procedure 1-3 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action
31	Reconnect the patch cord that connects to the OTS OUT port of the West OMX of the band noted in step 15 (that is, the patch cord that was disconnected in step 24).
32	Replace the West OMX of the band noted in step 15.
33	In Table 1-7 on page 1-23, uncheck all boxes in the TX column.
34	Go to step 10.
35	Disconnect the OPM and the patch cord from the OMX.

Testing the optical continuity through the West OMXs - RX direction

36	Connect one end of a variable optical attenuator (VOA) with SC-SC connectors that is known to be error-free to the OTS OUT port of the West OMX of the first band listed in Table 1-7 on page 1-23.
37	Connect the other end of the VOA to the OPM which is set to 1550 nm.
38	Adjust the VOA so that the OPM power reading is -12 dBm.
39	Disconnect the OPM and connect the unconnected end of the VOA to the OTS IN port of the West OMX of the first band listed in Table 1-7 on page 1-23.
40	Locate the OCLD RX port, OTR LINE RX port or Muxponder LINE RX port of the OCLD, OTR or Muxponder circuit pack connected to the West OMX of the last band listed in Table 1-7 on page 1-23.
41	Disconnect the patch cord at the port located in step 40 and connect it to the OPM.

If the site is configured as a	**Then** see
standard terminal	Figure 1-6 on page 1-38
stacked terminal	Figure 1-7 on page 1-39
standard OADM	Figure 1-8 on page 1-39

Note 1: If the site is configured as a dual-density or quad-density, use the standard terminal as an example.

Note 2: For more information on site types, see "Preparing to connect optical components" in *Connection Procedures,* 323-1701-221.

—**continued**—

Procedure 1-3 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action
42	Set the Optical Power Meter (OPM) to 1550 nm and record the power reading.

If using	**Then** see the column with the header "First reading" in
DWDM OMX	Table 1-15 on page 1-35 for minimum acceptable levels
OMX 4CH CWDM	Table 1-16 on page 1-36 for minimum acceptable levels
OMX 1CH CWDM	Table 1-17 on page 1-36 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-18 on page 1-36 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-19 on page 1-36 for minimum acceptable levels

Note: The number of OMXs the signal passes through is determined by the number of bands which have an unchecked box in the RX column in Table 1-7 on page 1-23.

Step	
43	**If** — **Then** go to

If	**Then** go to
the OPM power reading meets the minimum acceptable power level	step 44
otherwise	step 47

Step	Action
44	Disconnect the OPM and reconnect the patch cord to the OCLD RX port, OTR LINE RX port or Muxponder LINE RX port.
45	Remove the VOA.
46	Go to step 73.
47	Disconnect the OPM and reconnect the patch cord to the OCLD RX port, OTR LINE RX port or Muxponder LINE RX port.
48	In Table 1-7 on page 1-23, note the last band with an unchecked box in the RX column.
49	In Table 1-7 on page 1-23, check the RX column for the band noted in step 48.
50	In Table 1-7 on page 1-23, note the first band with a checked off box in the RX column.

—**continued**—

Procedure 1-3 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action	
	Step	**Action**

	If	**Then** go to
51	the band noted in step 50 is also the first band listed in Table 1-7 on page 1-23	step 59
	otherwise	step 52

52 Disconnect the patch cord connected to the OTS IN port of the West OMX of the band noted in step 50 and connect it to the OPM.

53 Set the Optical Power Meter (OPM) to 1550 nm and record the power reading.

If using	**Then** see the column with the header "Other readings" in
DWDM OMX	Table 1-15 on page 1-35 for minimum acceptable levels
OMX 4CH CWDM	Table 1-16 on page 1-36 for minimum acceptable levels
OMX 1CH CWDM	Table 1-17 on page 1-36 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-18 on page 1-36 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-19 on page 1-36 for minimum acceptable levels

Note: The number of OMXs the signal passes through is determined by the number of bands which have an unchecked box in the RX column in Table 1-7 on page 1-23.

	If	**Then** go to
54	the OPM power reading meets the minimum acceptable power level	step 57
	otherwise	step 55

55 Clean and reconnect the patch cord that connects to the OTS IN port of the West OMX of the band noted in step 50 (that is, the patch cord that was disconnected in step 52).

56 Go to step 48.

57 Clean and reconnect the patch cord that connects to the OTS IN port of the West OMX of the band noted in step 50 (that is, the patch cord that was disconnected in step 52).

—**continued**—

Procedure 1-3 (continued)
Testing the optical continuity through the OMXs at a site

Step	Action

58

If	**Then** go to
the band noted in step 50 is also the last band listed in Table 1-7 on page 1-23	step 69
otherwise	step 59

59   Disconnect the patch cord that connects to the THRU OUT port of the West OMX of the band noted in step 50.

60   Connect the OPM to the THRU OUT port of the West OMX of the band noted in step 50 with a patch cord that is known to be error-free.

61   Set the Optical Power Meter (OPM) to 1550 nm and record the power reading.

If using	**Then** see the column with the header "Other readings" in
DWDM OMX	Table 1-15 on page 1-35 for minimum acceptable levels
OMX 4CH CWDM	Table 1-16 on page 1-36 for minimum acceptable levels
OMX 1CH CWDM	Table 1-17 on page 1-36 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-18 on page 1-36 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-19 on page 1-36 for minimum acceptable levels

Note: The number of OMXs the signal passes through is determined by adding one to the number of bands which have an unchecked box in the RX column in Table 1-7 on page 1-23.

62

If	**Then** go to
the OPM power reading meets the minimum acceptable power level	step 63
otherwise	step 67

63   Disconnect the OPM.

64   Replace the original patch cord that connects the THRU OUT port of the West OMX of the band noted in step 50 to the OTS IN port of West OMX of the band listed after the West OMX noted in step 50.

65   In Table 1-7 on page 1-23, uncheck all boxes in the RX column.

66   Go to step 40.

—**continued**—

Procedure 1-3 (continued)
Testing an Optical Metro 5100/5200 WDM OMX

Step	Action
67	Disconnect the OPM.
68	Reconnect the patch cord that connects to the THRU OUT port of the West OMX of the band noted in step 50 (that is, the patch cord that was disconnected in step 59).
69	Replace the West OMX of the band noted in step 50.
70	Remove the VOA.
71	In Table 1-7 on page 1-23, uncheck all boxes in the RX column.
72	Go to step 10.
73	Seat all OCLD, OTR or Muxponder circuit packs connected to the West OMXs listed in Table 1-7 on page 1-23 (the ones which were unseated in step 9).
74	Repeat step 9 to step 73 for the East OMXs. When you repeat these steps, replace West OMX with East OMX and replace Table 1-7 on page 1-23 with Table 1-8 on page 1-24.
75	Reconnect fibers that you disconnected in step 7 and step 8, if any.

—end—

Table 1-9
Minimum acceptable Tx optical power level - DWDM OMXs

Number of OMXs	Type of OCLD/OTR/Muxponder				
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	-3.6 dBm	-0.6 dBm	-0.8 dBm	-5.4 dBm	-1.0 dBm
2	-4.2 dBm	-1.2 dBm	-1.4 dBm	-6.0 dBm	-1.6 dBm
3	-4.8 dBm	-1.8 dBm	-2.0 dBm	-6.6 dBm	-2.2 dBm
4	-5.4 dBm	-2.4 dBm	-2.6 dBm	-7.2 dBm	-2.8 dBm
5	-6.0 dBm	-3.0 dBm	-3.2 dBm	-7.8 dBm	-3.4 dBm
6	-6.6 dBm	-3.6 dBm	-3.8 dBm	-8.4 dBm	-4.0 dBm
7	-7.2 dBm	-4.2 dBm	-4.4 dBm	-9.0 dBm	-4.6 dBm
8	-7.8 dBm	-4.8 dBm	-5.0 dBm	-9.6 dBm	-5.2 dBm

Table 1-10
Minimum acceptable Tx optical power level - DWDM OMX 4CH Enhanced

Number of OMXs	Type of OCLD/OTR/Muxponder				
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	-2.3 dBm	0.7 dBm	0.5 dBm	-4.1 dBm	0.3 dBm
2	-2.9 dBm	0.1 dBm	-0.1 dBm	-4.7 dBm	-0.3 dBm
3	-3.5 dBm	-0.5 dBm	-0.7 dBm	-5.3 dBm	-0.9 dBm
4	-4.1 dBm	-1.1 dBm	-1.4 dBm	-6.0 dBm	-1.5 dBm
5	-4.8 dBm	-1.8 dBm	-2.0 dBm	-6.6 dBm	-2.2 dBm
6	-5.4 dBm	-2.4 dBm	-2.6 dBm	-7.2 dBm	-2.8 dBm
7	-6.0 dBm	-3.0 dBm	-3.2 dBm	-7.8 dBm	-3.4 dBm
8	-6.6 dBm	-3.6 dBm	-3.8 dBm	-8.4 dBm	-4.0 dBm

Table 1-11
Minimum acceptable Tx optical power level - OMX 4CH CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	-2.0 dBm	1.0 dBm	0.7 dBm	0.5 dBm
2	-3.5 dBm	-0.5 dBm	-0.8 dBm	-0.9 dBm

Table 1-12
Minimum acceptable Tx optical power level - OMX 1CH CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	-0.8 dBm	2.2 dBm	1.8 dBm	1.6 dBm
2	-1.6 dBm	1.4 dBm	1.1 dBm	0.9 dBm
3	-2.3 dBm	0.7 dBm	0.4 dBm	0.2 dBm
4	-3.0 dBm	0.0 dBm	-0.3 dBm	-0.4 dBm
5	-3.7 dBm	-0.7 dBm	-0.9 dBm	-1.1 dBm
6	-4.4 dBm	-1.4 dBm	-1.6 dBm	-1.8 dBm
7	-5.1 dBm	-2.1 dBm	-2.3 dBm	-2.5 dBm
8	-5.7 dBm	-2.8 dBm	-3.0 dBm	-3.1 dBm

Table 1-13
Minimum acceptable Tx optical power level - OMX 4CH OADM ITU CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	not applicable	not applicable	0.8 dBm	0.6 dBm
2	not applicable	not applicable	-1.0 dBm	-1.2 dBm

Table 1-14
Minimum acceptable Tx optical power level - OMX 1CH OADM ITU CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	not applicable	not applicable	1.6 dBm	1.4 dBm
2	not applicable	not applicable	0.6 dBm	0.4 dBm
3	not applicable	not applicable	-0.4 dBm	-0.6 dBm
4	not applicable	not applicable	-1.4 dBm	-1.6 dBm
5	not applicable	not applicable	-2.4 dBm	-2.6 dBm
6	not applicable	not applicable	-3.4 dBm	-3.6 dBm
7	not applicable	not applicable	-4.4 dBm	-4.6 dBm
8	not applicable	not applicable	-5.4dBm	-5.6 dBm

Table 1-15
Minimum acceptable Rx optical power level - DWDM OMXs

Number of OMXs	First reading (DWDM OMX Standard and DWDM OMX 4CH + Fiber Manager)	First reading (DWDM OMX 4CH Enhanced)	Other readings
1	-16.3 dBm	-15.1 dBm	-13.0 dBm
2	-16.9 dBm	-15.7 dBm	-13.7 dBm
3	-17.5 dBm	-16.4 dBm	-14.4 dBm
4	-18.1 dBm	-17.0 dBm	-15.1 dBm
5	-18.7 dBm	-17.6 dBm	-15.7 dBm
6	-19.3 dBm	-18.2 dBm	-16.4 dBm
7	-19.9 dBm	-18.8 dBm	-17.0 dBm
8	-20.5 dBm	-19.4 dBm	Not applicable

Table 1-16
Minimum acceptable Rx optical power level - OMX 4CH CWDM

Number of OMXs	First reading	Other readings
1	-14.6 dBm	-14.4 dBm
2	-16.3 dBm	Not applicable

Table 1-17
Minimum acceptable Rx optical power level - OMX 1CH CWDM

Number of OMXs	First reading	Other readings
1	-13.4 dBm	-13.4 dBm
2	-14.5 dBm	-14.6 dBm
3	-15.6 dBm	-15.8 dbm
4	-16.7 dBm	-16.9 dBm
5	-17.8 dBm	-18.0 dbm
6	-18.9 dBm	-19.1 dBm
7	-20.0 dBm	-20.2 dBm
8	-21.1 dBm	Not applicable

Table 1-18
Minimum acceptable Rx optical power level - OMX 4CH OADM ITU CWDM

Number of OMXs	First reading	Other readings
1	-14.5 dBm	-13.5 dBm
2	-15.8 dBm	Not applicable

Table 1-19
Minimum acceptable Rx optical power level - OMX 1CH OADM ITU CWDM

Number of OMXs	First reading	Other readings
1	-13.4 dBm	-13.4 dBm
2	-14.6 dBm	-14.6 dBm
3	-15.8 dBm	-15.8 dBm
4	-17.0 dBm	-17.0 dBm
5	-18.2 dBm	-18.2 dBm

Table 1-19 (continued)
Minimum acceptable Rx optical power level - OMX 1CH OADM ITU CWDM

Number of OMXs	First reading	Other readings
6	-19.4 dBm	-19.4 dBm
7	-20.6 dBm	-20.6 dBm
8	-21.8 dBm	Not applicable

Figure 1-3
OMX continuity tests for standard terminal sites (Tx direction test)

OM2083p
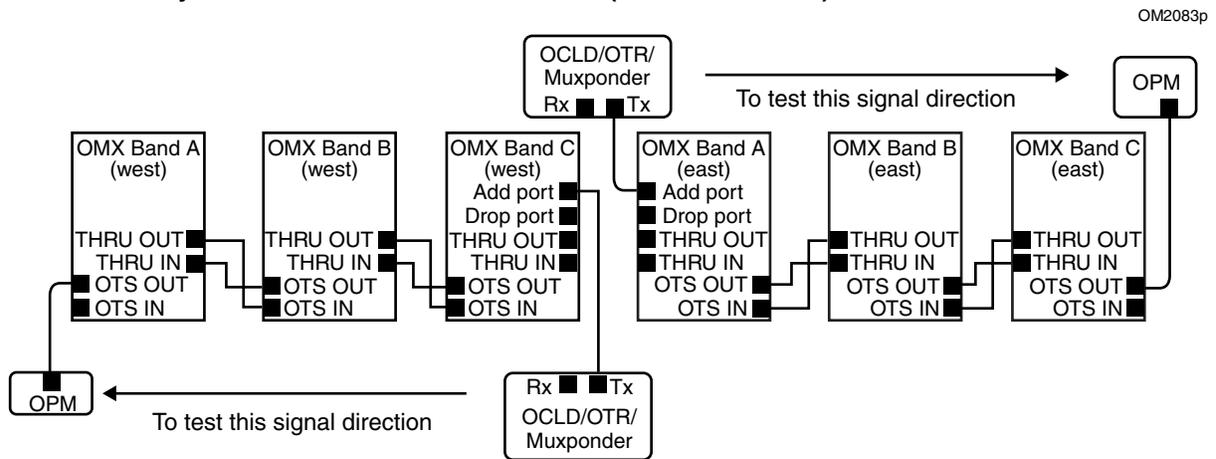
Figure 1-4
OMX continuity tests for stacked terminal sites (Tx direction test)

OM2084p
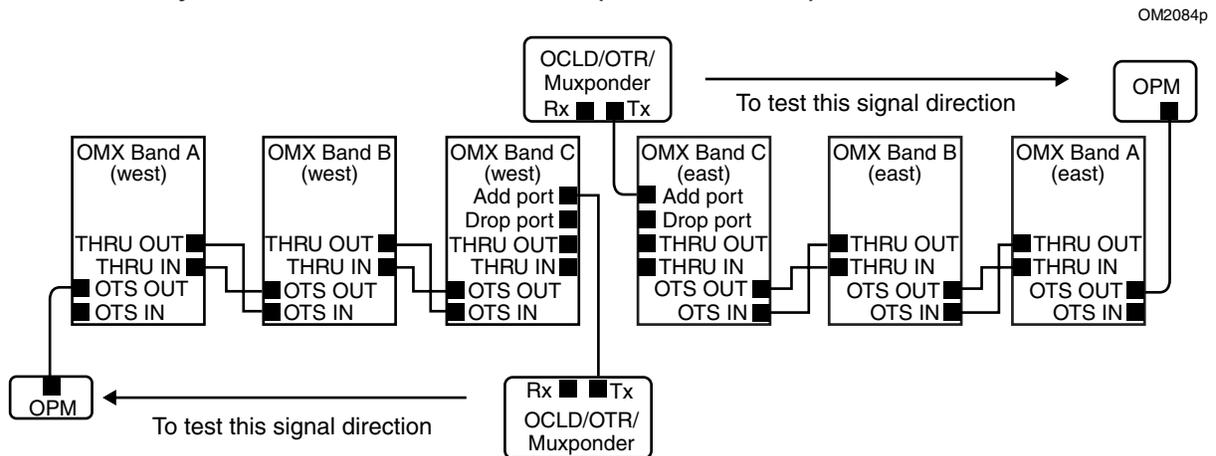
Figure 1-5
OMX continuity tests for standard OADM sites (Tx direction test)
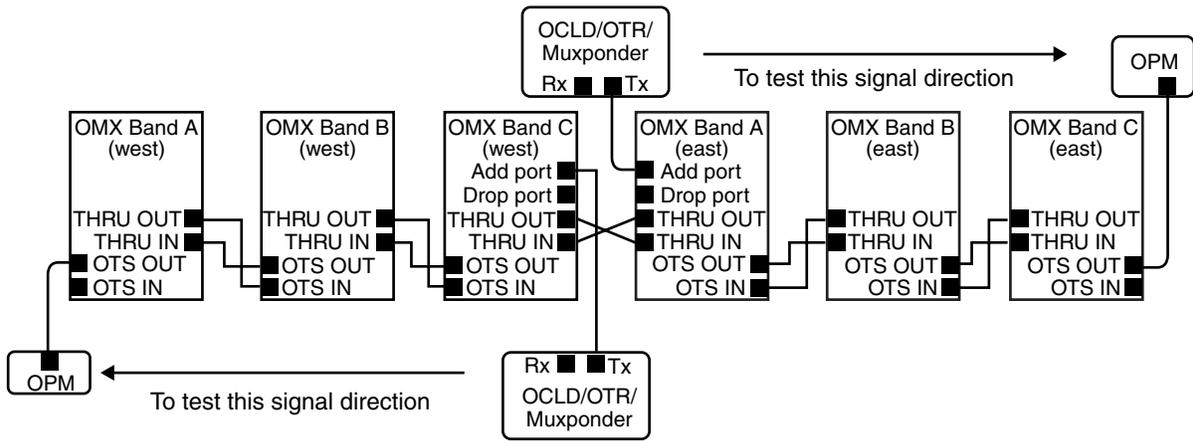
Figure 1-6
OMX continuity tests for standard terminal sites (Rx direction test)
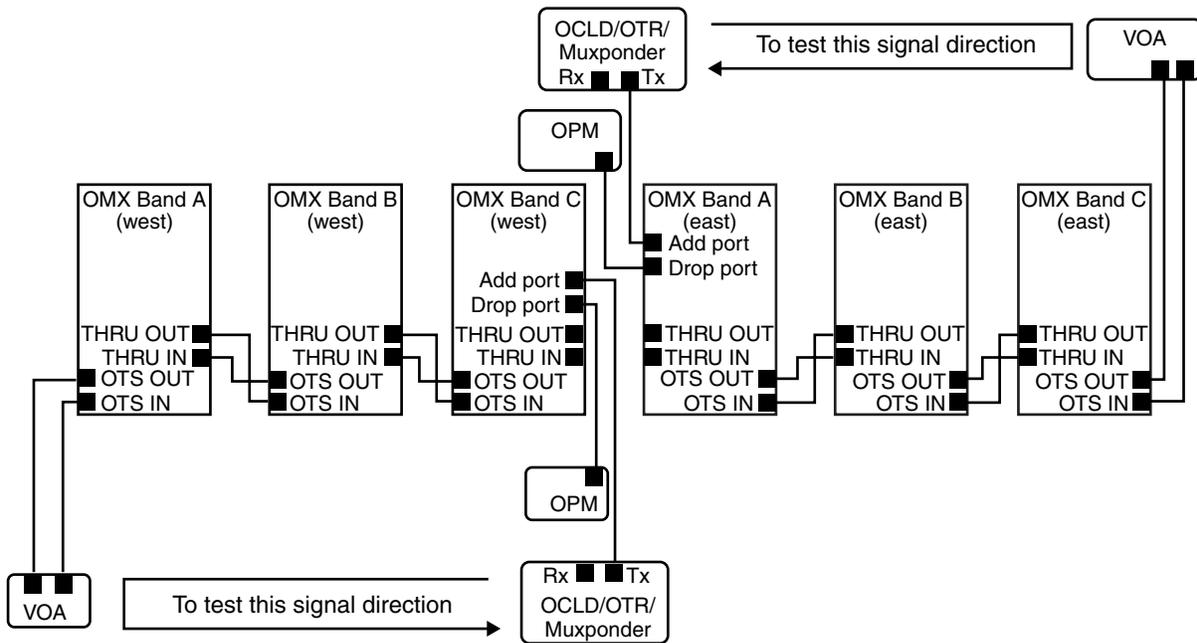
Figure 1-7
OMX continuity tests for stacked terminal sites (Rx direction test)

OM2087p
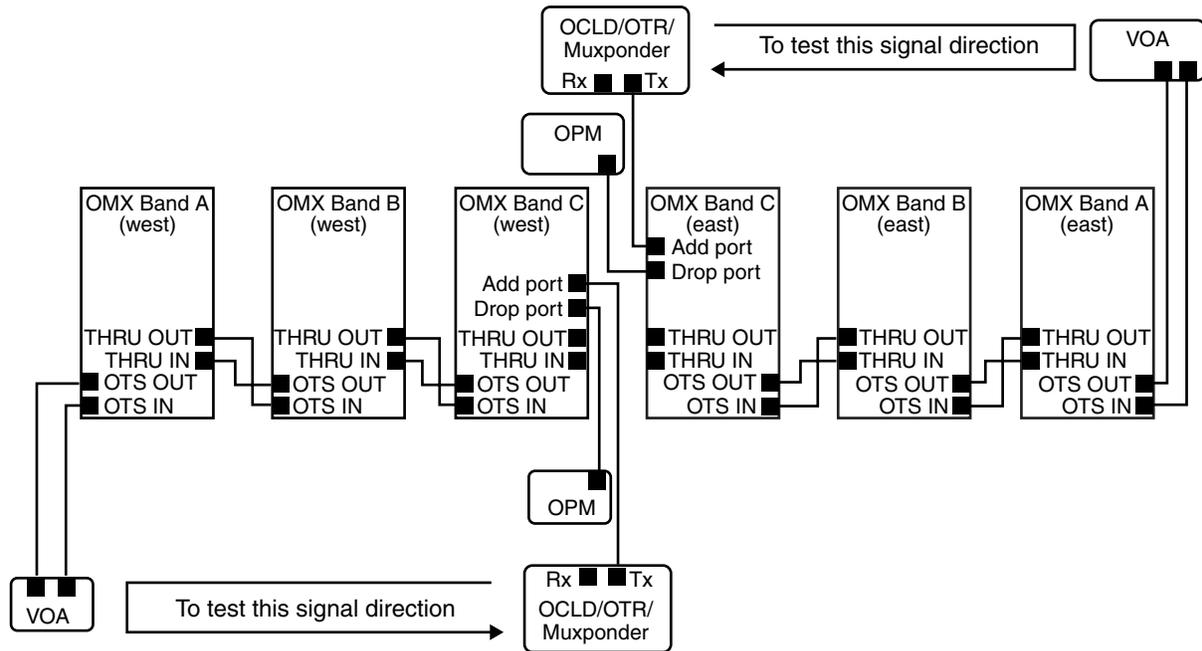
Figure 1-8
OMX continuity tests for standard OADM sites (Rx direction text)

OM2088p
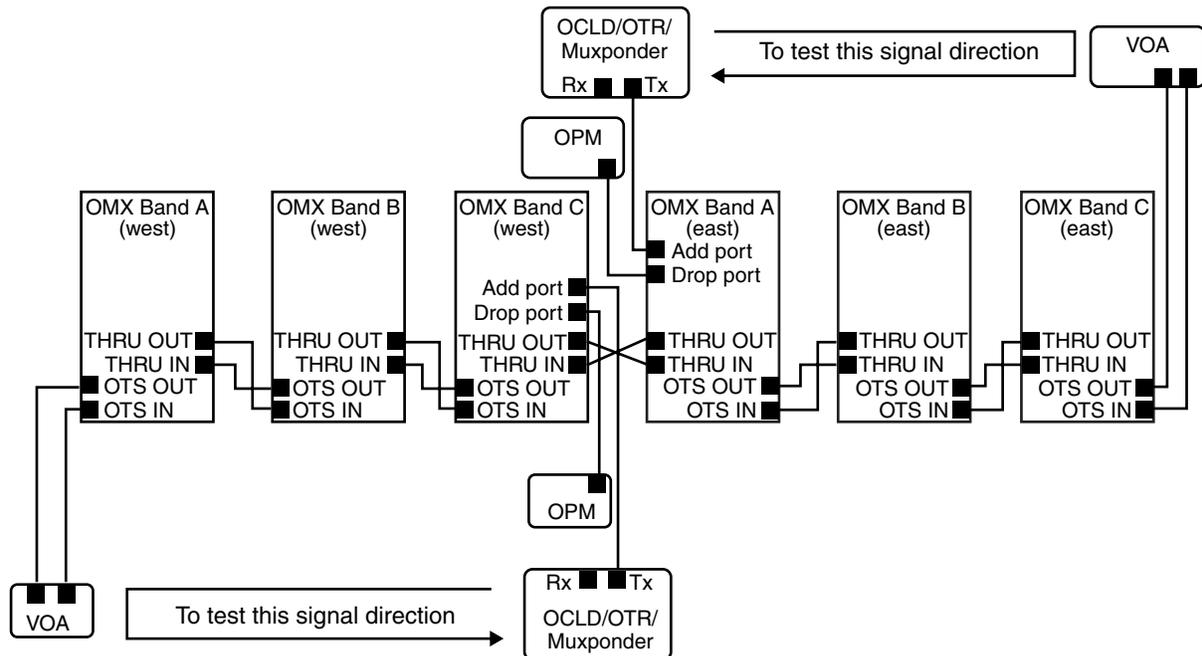
Procedure 1-4
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Use this procedure to verify signal continuity through the band filters of the OMX (THRU IN to OTS OUT and OTS IN to THRU OUT) and the patch cords added to interconnect the OMXs at an OADM site which uses single-shelf wiring. A successful test indicates:

- optical transmit power is correct
- signal continuity from shelf to shelf

This procedure must be performed for both the East-bound and West-bound directions, as well as for both the C and L band shelves in parallel configurations.

Note: This procedure is only required for sites that have OMXs daisy-chained together using the OMX THRU ports.

Requirements

Before you do this test, make sure that you have:

- powered on the shelf (see *Commissioning Procedures*, 323-1701-220)
- a minimum shelf configuration of one SP, one OCLD, OTR or Muxponder, one OMX, and the shelf database cards (OCMs in slots 9 and 10 for the Optical Metro 5200, and any circuit pack in slots 1 to 4, or 6 for the Optical Metro 5100) for each shelf at the site

  Note: Other circuit packs may be present and fibered in the shelf, but they must not be seated.

- turned off Automatic Laser Shutdown (ALS) (see Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures*, 323-1701-310)

  Note: The default setting for ALS is off.

- no pads in place at the OMX Band Drop port or at the OMX Band Add port for DWDM OMX (Standard)
- no pads in place at the OMX Band RX port or at the OMX Band TX port for DWDM OMX 4CH + Fiber Manager or DWDM OMX 4CH Enhanced
- performed Procedure 1-1 and Procedure 1-2

—continued—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Table 1-20 lists the tools and materials required for testing optical continuity.

Table 1-20
Tools and materials required for the optical continuity test

Item	Quantity	Supplied
Antistatic strap	1	no
Optical power meter (OPM) with an SC connector	1	no
Optical power meter (OPM) with an FC connector if OCLDs with FC connectors are connected to the OMX under test	1	no
Optical power meter (OPM) with an LC connector if OCLDs with LC connectors or if OTRs or Muxponders are connected to the OMX under test	1	no
Variable optical attenuator (VOA) with SC-SC connectors	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Optical patch cord	1	no

Precautions

	CAUTION
	Invisible laser radiation
	The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

	CAUTION
	Risk of network reliability
	Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in Installing Optical Metro 5200 Shelves and Components, 323-1701-201.

—continued—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Expected results

The optical transmit power is correct, and there is signal continuity from shelf to shelf.

Action

Step	Action
1	Make sure that all OCLDs, OTRs or Muxponders are fibered correctly to their associated OMXs. Refer to Procedure 3-19, "Connecting an OMX to OCLD circuit packs" or Procedure 3-20, "Connecting an OMX to Muxponder (MOTR) circuit packs" in *Connection Procedures*, 323-1701-221.
2	Make sure that all OMXs at the site are correctly fibered. Refer to Procedure 3-1, "Connecting multiple OMXs in a series", in *Connection Procedures*, 323-1701-221.
3	Make sure that any fibers connected to the OTS OUT connector and the OTS IN connector of the OMX Band 1 (west) are labelled. Disconnect the fibers connected to the OTS OUT connector and OTS IN connector of OMX Band 1 (west) in Figure 1-9 on page 1-55.
4	Make sure that any fibers connected to the OTS OUT connector and the OTS IN connector of the OMX Band 3 (east) are labelled. Disconnect the fibers connected to the OTS OUT connector and OTS IN connector of OMX Band 3 (east) in Figure 1-9 on page 1-55.
5	Make sure that only one OCLD, OTR or Muxponder circuit pack is seated in the appropriate shelf. See Figure 1-9 on page 1-55.

Testing the Tx direction

6	Connect one end of a patch cord (which is known to be error-free) to the OTS OUT port on the OMX and the other end to the optical power meter (OPM). See Figure 1-10 on page 1-56 (First reading) for the correct setup.

—continued—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Step	Action

7   Switch on the OPM and record the power reading.

If using	**Then** see
OMX (Standard) or OMX 4CH + Fiber Manager	Table 1-21 on page 1-49 for minimum acceptable levels
OMX 4CH Enhanced	Table 1-22 on page 1-50 for minimum acceptable levels
OMX 4CH CWDM	Table 1-23 on page 1-50 for minimum acceptable levels
OMX 1CH CWDM	Table 1-24 on page 1-51 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-25 on page 1-51 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-26 on page 1-52 for minimum acceptable levels

Note: See Figure 1-10 on page 1-56 to determine the number of OMXs the signal passes through. For example, for the first reading, the signal passes through five OMXs.

8

If the power reading is	**Then** go to
within acceptable limits	step 18
not within acceptable limits	step 9

9   Disconnect the fiber connected to the THRU IN port (or the OTS IN port) of the current OMX in the signal flow and connect it to the OPM. See Figure 1-10 on page 1-56 (Second reading or Third reading) for the correct setup.

Note: Make sure that you clean and reconnect all patch cords from previous steps. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Step	Action	
10	Switch on the OPM and record the power reading.	

If using	**Then** see
OMX (Standard) or OMX 4CH + Fiber Manager	Table 1-21 on page 1-49 for minimum acceptable levels
OMX 4CH Enhanced	Table 1-22 on page 1-50 for minimum acceptable levels
OMX 4CH CWDM	Table 1-23 on page 1-50 for minimum acceptable levels
OMX 1CH CWDM	Table 1-24 on page 1-51 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-25 on page 1-51 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-26 on page 1-52 for minimum acceptable levels

Note: See Figure 1-10 on page 1-56 to determine the number of OMXs the signal passes through. For example, for the second reading, the signal passes through four OMXs.

Step	Action
11	Clean and reconnect the cable to the THRU IN port (or the OTS IN port) that you disconnected in step 9 of the OMX. See the example in Figure 1-10 on page 1-56. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

12	**If** the power reading is	**Then** go to
	within acceptable limits	step 13
	not within acceptable limits	step 9

Note: If all the OMXs are not within acceptable limits, repeat Procedure 1-2 for the last OMX tested.

13	**If**	**Then** go to
	single-shelf crossover connections are used	step 14
	otherwise	step 15

Note: For more information on single-shelf crossover connections, see Procedure 3-2 "Connecting east and west OMX modules in the same drawer" in *Connection Procedures*, 323-1701-221.

Step	Action
14	Replace the OMX currently being tested. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. Go to step 6.

—continued—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Step	Action
15	Connect the OPM to the THRU OUT port (or the OTS OUT port) of the current OMX with a patch cord that is known to be error-free. See the example in Figure 1-10 on page 1-56.
16	Switch on the OPM and record the power reading.

If using	**Then** see
OMX (Standard) or OMX 4CH + Fiber Manager	Table 1-21 on page 1-49 for minimum acceptable levels
OMX 4CH Enhanced	Table 1-22 on page 1-50 for minimum acceptable levels
OMX 4CH CWDM	Table 1-23 on page 1-50 for minimum acceptable levels
OMX 1CH CWDM	Table 1-24 on page 1-51 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-25 on page 1-51 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-26 on page 1-52 for minimum acceptable levels

Step	
17	**If** the power reading is

If the power reading is	**Then**
within acceptable limits	replace the original patch cord that was connected to the THRU OUT port (or the OTS OUT port) of the current OMX. Then go to step 6.
not within acceptable limits	replace the OMX currently being tested. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. Then go to step 6.

Step	Action
18	Disconnect the OPM and the patch cord from the OMX.

Testing the Rx direction

Step	Action
19	Connect one end of a variable optical attenuator (VOA) with SC-SC connectors that is known to be error-free to the OMX OTS OUT connector. See Figure 1-11 on page 1-57.
20	Connect the other end of the VOA to the OPM.
21	Adjust the VOA so that the OPM power reading is -12 dBm.
22	Disconnect the OPM and connect the unconnected end of the VOA to the OMX OTS IN connector.

—continued—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Step	Action
23	Locate the OCLD RX port, OTR line-side RX port or Muxponder line-side RX port, disconnect the patch cord at this port and connect it to the OPM.

Note: See Figure 1-12 on page 1-58 (First reading) for the correct setup.

Step	Action
24	Switch on the OPM and record the power reading.

If using	Then see the column with the header "First reading" in
DWDM OMX	Table 1-27 on page 1-52 for minimum acceptable levels
OMX 4CH CWDM	Table 1-28 on page 1-53 for minimum acceptable levels
OMX 1CH CWDM	Table 1-29 on page 1-53 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-30 on page 1-53 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-31 on page 1-54 for minimum acceptable levels

Note: See Figure 1-12 on page 1-58 to determine the number of OMXs after the VOA the signal passes through. For example, for the first reading, the signal passes through five OMXs.

Step	If the power reading is	Then go to
25	within acceptable limits	step 26
	not within acceptable limits	step 28

Step	Action
26	Disconnect the OPM and reconnect the patch cord to the OCLD RX port, OTR line-side RX port or Muxponder line-side RX port.
27	Remove the VOA.

Go to step 39.

Step	Action
28	Disconnect the OPM and reconnect the patch cord to the OCLD RX port, OTR line-side RX port or Muxponder line-side RX port.
29	Disconnect the fiber connected to the THRU IN port of the current OMX and connect it to the OPM. See Figure 1-12 on page 1-58 (Second reading) for the correct setup.

—**continued**—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Step	Action
30	Switch on the OPM and record the power reading.

If using	**Then** see the column with the header "Second reading" in
DWDM OMX	Table 1-27 on page 1-52 for minimum acceptable levels
OMX 4CH CWDM	Table 1-28 on page 1-53 for minimum acceptable levels
OMX 1CH CWDM	Table 1-29 on page 1-53 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-30 on page 1-53 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-31 on page 1-54 for minimum acceptable levels

Note: For the second reading in Figure 1-12 on page 1-58, the signal passes through only one OMX after the VOA.

| 31 | Clean and reconnect the cable to the THRU IN port that you disconnected in step 29 of the OMX. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201. |

32	**If** the power reading is	**Then** go to

within acceptable limits	step 33
not within acceptable limits	step 34

| 33 | Replace the current OMX. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. |
| | Go to step 6. |

34	**If**	**Then** go to

single-shelf crossover connections are used	step 35
otherwise	step 36

Note: For more information on single-shelf crossover connections, see Procedure 3-2 "Connecting east and west OMX modules in the same drawer" in Connection Procedures, 323-1701-221 .

| 35 | Replace the previous OMX. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. |
| | Go to step 6. |

—continued—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Step	Action
36	Connect the OPM to the THRU OUT port of the previous OMX with a patch cord that is known to be error-free.
37	Switch on the OPM and record the power reading.

If using	**Then** see the column with the header "Second reading" in
DWDM OMX	Table 1-27 on page 1-52 for minimum acceptable levels
OMX 4CH CWDM	Table 1-28 on page 1-53 for minimum acceptable levels
OMX 1CH CWDM	Table 1-29 on page 1-53 for minimum acceptable levels
OMX 4CH OADM ITU CWDM	Table 1-30 on page 1-53 for minimum acceptable levels
OMX 1CH OADM ITU CWDM	Table 1-31 on page 1-54 for minimum acceptable levels

Note: For the second reading in Figure 1-12 on page 1-58, the signal passes through only one OMX after the VOA.

Step	
38	

If the power reading is	**Then**
within acceptable limits	replace the original patch cord that was connected to the THRU OUT port of the previous OMX. Then go to step 6.
not within acceptable limits	replace the previous OMX. See the chapter "Replacing shelf components" in *Maintenance and Replacement Procedures*, 323-1701-546. Then go to step 6.

Step	Action
39	Repeat step 5 to step 38 for the east and west directions and the C-band and L-band shelves in parallel configurations.
40	Reconnect fibers that you disconnected in step 3 and step 4, if any.
41	Seat all OCLD, OTR or Muxponder circuit packs in the shelves.

—**end**—

Procedure 1-4 (continued)
Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring

Table 1-21
Minimum acceptable Tx optical power level - DWDM OMXs

Number of OMXs	Type of OCLD/OTR/Muxponder				
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	–3.6 dBm	–0.6 dBm	–0.8 dBm	–5.4 dBm	–1.0 dBm
2	–4.2 dBm	–1.2 dBm	–1.4 dBm	–6.0 dBm	–1.6 dBm
3	–4.8 dBm	–1.8 dBm	–2.0 dBm	–6.6 dBm	–2.2 dBm
4	–5.4 dBm	–2.4 dBm	–2.6 dBm	–7.2 dBm	–2.8 dBm
5	–6.0 dBm	–3.0 dBm	–3.2 dBm	–7.8 dBm	–3.4 dBm
6	–6.6 dBm	–3.6 dBm	–3.8 dBm	–8.4 dBm	–4.0 dBm
7	–7.2 dBm	–4.2 dBm	–4.4 dBm	–9.0 dBm	–4.6 dBm
8	–7.8 dBm	–4.8 dBm	–5.0 dBm	–9.6 dBm	–5.2 dBm
9	–8.4 dBm	–5.4 dBm	–5.6 dBm	–10.2 dBm	–5.8 dBm
10	–9.0 dBm	–6.0 dBm	–6.2 dBm	–10.8 dBm	–6.4 dBm
11	–9.7 dBm	–6.7 dBm	–6.8 dBm	–11.4 dBm	–7.0 dBm
12	–10.2 dBm	–7.2 dBm	–7.4 dBm	–12.0 dBm	–7.6 dBm
13	–10.8 dBm	–7.8 dBm	–8.0 dBm	–12.6 dBm	–8.2 dBm
14	–11.4 dBm	–8.4 dBm	–8.6 dBm	–13.2 dBm	–8.8 dBm
15	–12.0 dBm	–9.0 dBm	–9.2 dBm	–13.8 dBm	–9.4 dBm

Table 1-22
Minimum acceptable Tx optical power level - DWDM OMX 4CH Enhanced

Number of OMXs	Type of OCLD/OTR/Muxponder				
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	–2.3 dBm	0.7 dBm	0.5 dBm	–4.1 dBm	0.3 dBm
2	–2.9 dBm	0.1 dBm	–0.1 dBm	–4.7 dBm	–0.3 dBm
3	–3.5 dBm	–0.5 dBm	–0.7 dBm	–5.3 dBm	–0.9 dBm
4	–4.1 dBm	–1.1 dBm	–1.4 dBm	–6.0 dBm	–1.5 dBm
5	–4.8 dBm	–1.8 dBm	–2.0 dBm	–6.6 dBm	–2.2 dBm
6	–5.4 dBm	–2.4 dBm	–2.6 dBm	–7.2 dBm	–2.8 dBm
7	–6.0 dBm	–3.0 dBm	–3.2 dBm	–7.8 dBm	–3.4 dBm
8	–6.6 dBm	–3.6 dBm	–3.8 dBm	–8.4 dBm	–4.0 dBm
9	–7.2 dBm	–4.2 dBm	–4.4 dBm	–8.9 dBm	–4.6 dBm
10	–7.8 dBm	–4.8 dBm	–5.0 dBm	–9.5 dBm	–5.1 dBm
11	–8.4 dBm	–5.4 dBm	–5.6 dBm	–10.1 dBm	–5.7 dBm
12	–9.0 dBm	–6.0 dBm	–6.1 dBm	–10.7 dBm	–6.3 dBm
13	–9.6 dBm	–6.6 dBm	–6.7 dBm	–11.3 dBm	–6.9 dBm
14	–10.2 dBm	–7.2 dBm	–7.3 dBm	–11.9 dBm	–7.5 dBm
15	–10.8 dBm	–7.8 dBm	–7.9 dBm	–12.5 dBm	–8.1 dBm

Table 1-23
Minimum acceptable Tx optical power level - OMX 4CH CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	–2.0 dBm	1.0 dBm	0.7 dBm	0.5 dBm
2	–3.5 dBm	–0.5 dBm	–0.8 dBm	–0.9 dBm
3	–5.2 dBm	–2.2 dBm	–2.4 dBm	–2.6 dBm

Table 1-24
Minimum acceptable Tx optical power level - OMX 1CH CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	–0.8 dBm	2.2 dBm	1.8 dBm	1.6 dBm
2	–1.6 dBm	1.4 dBm	1.1 dBm	0.9 dBm
3	–2.7 dBm	0.3 dBm	0.0 dBm	–0.2 dBm
4	–3.4 dBm	–0.4 dBm	–0.7 dBm	–0.8 dBm
5	–4.5 dBm	–1.5 dBm	–1.7 dBm	–1.9 dBm
6	–5.2 dBm	–2.2 dBm	–2.4 dBm	–2.6 dBm
7	–6.3 dBm	–3.3 dBm	–3.5 dBm	–3.7 dBm
8	–6.9 dBm	–3.9 dBm	–4.2 dBm	–4.3 dBm
9	–8.0 dBm	–5.0 dBm	–5.2 dBm	–5.4 dBm
10	–8.7 dBm	–5.7 dBm	–5.9 dBm	–6.1 dBm
11	–9.8 dBm	–6.8 dBm	–6.9 dBm	–7.1 dBm
12	–10.4 dBm	–7.4 dBm	–7.6 dBm	–7.8 dBm
13	–11.5 dBm	–8.5 dBm	–8.7 dBm	–8.8 dBm
14	–12.1 dBm	–9.1 dBm	–9.3 dBm	–9.5 dBm
15	–13.2 dBm	–10.2 dBm	–10.4 dBm	–10.6 dBm

Table 1-25
Minimum acceptable Tx optical power level - OMX 4CH OADM ITU CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	not applicable	not applicable	0.8 dBm	0.6 dBm
2	not applicable	not applicable	–0.5 dBm	–0.7 dBm
3	not applicable	not applicable	–2.3 dBm	–2.5 dBm

Table 1-26
Minimum acceptable Tx optical power level - OMX 1CH OADM ITU CWDM

Number of OMXs	Type of OCLD/OTR/Muxponder			
	OCLD 1.25 Gbit/s	OCLD 2.5 Gbit/s	OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
1	not applicable	not applicable	1.6 dBm	1.4 dBm
2	not applicable	not applicable	0.4 dBm	0.2 dBm
3	not applicable	not applicable	–0.6 dBm	–0.8 dBm
4	not applicable	not applicable	–1.8 dBm	–2.0 dBm
5	not applicable	not applicable	–2.8 dBm	–3.0 dBm
6	not applicable	not applicable	–4.0 dBm	–4.2 dBm
7	not applicable	not applicable	–5.0 dBm	–5.2 dBm
8	not applicable	not applicable	–6.2 dBm	–6.4 dBm
9	not applicable	not applicable	–7.2 dBm	–7.4 dBm
10	not applicable	not applicable	–8.4 dBm	–8.6 dBm
11	not applicable	not applicable	–9.4 dBm	–9.6 dBm
12	not applicable	not applicable	–10.6 dBm	–10.8 dBm
13	not applicable	not applicable	–11.6 dBm	–11.8 dBm
14	not applicable	not applicable	–12.8 dBm	–13.0 dBm
15	not applicable	not applicable	–13.8 dBm	–14.0 dBm

Table 1-27
Minimum acceptable Rx optical power level - DWDM OMXs

Number of OMXs	First reading (DWDM OMX Standard and DWDM OMX 4CH + Fiber Manager)	First reading (DWDM OMX 4CH Enhanced)	Second reading
1	–16.3 dBm	–15.1 dBm	–13.0 dBm
3	–17.5 dBm	–16.4 dBm	Not applicable
5	–18.7 dBm	–17.6 dBm	Not applicable
7	–19.9 dBm	–18.8 dBm	Not applicable
9	–21.1 dBm	–20.0 dBm	Not applicable

Table 1-27 (continued)
Minimum acceptable Rx optical power level - DWDM OMXs

Number of OMXs	First reading (DWDM OMX Standard and DWDM OMX 4CH + Fiber Manager)	First reading (DWDM OMX 4CH Enhanced)	Second reading
11	–22.3 dBm	–21.2 dBm	Not applicable
13	–23.5 dBm	–22.4 dBm	Not applicable
15	–24.7 dBm	–23.6 dBm	Not applicable

Table 1-28
Minimum acceptable Rx optical power level - OMX 4CH CWDM

Number of OMXs	First reading	Other readings
1	–14.6 dBm	–14.4 dBm
2	–16.3 dBm	Not applicable

Table 1-29
Minimum acceptable Rx optical power level - OMX 1CH CWDM

Number of OMXs	First reading	Other readings
1	–13.4 dBm	–13.0 dBm
3	–15.2 dBm	Not applicable
5	–17.0 dBm	Not applicable
7	–18.8 dBm	Not applicable
9	–20.5 dBm	Not applicable
11	–22.3 dBm	Not applicable
13	–24.0 dBm	Not applicable
15	–25.7 dBm	Not applicable

Table 1-30
Minimum acceptable Rx optical power level - OMX 4CH OADM ITU CWDM

Number of OMXs	First reading	Other readings
1	–14.5 dBm	–13.5 dBm
2	–16.3 dBm	Not applicable

Table 1-31
Minimum acceptable Rx optical power level - OMX 1CH OADM ITU CWDM

Number of OMXs	First reading	Other readings
1	–13.4 dBm	–13.4 dBm
3	–14.4 dBm	Not applicable
5	–15.6 dBm	Not applicable
7	–16.6 dBm	Not applicable
9	–17.8 dBm	Not applicable
11	–18.8 dBm	Not applicable
13	–20.0 dBm	Not applicable
15	–21.0 dBm	Not applicable

Figure 1-9
OMX continuity tests for OADM sites which use single-shelf wiring (Tx direction test)

OM1930t
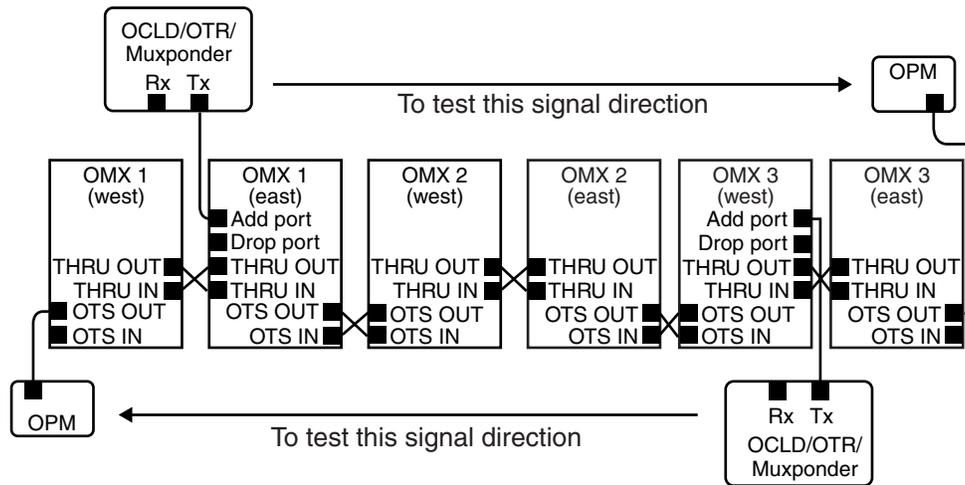
Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop". For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Figure 1-10
OPM readings for OMX continuity (Tx direction test)

OM1931t
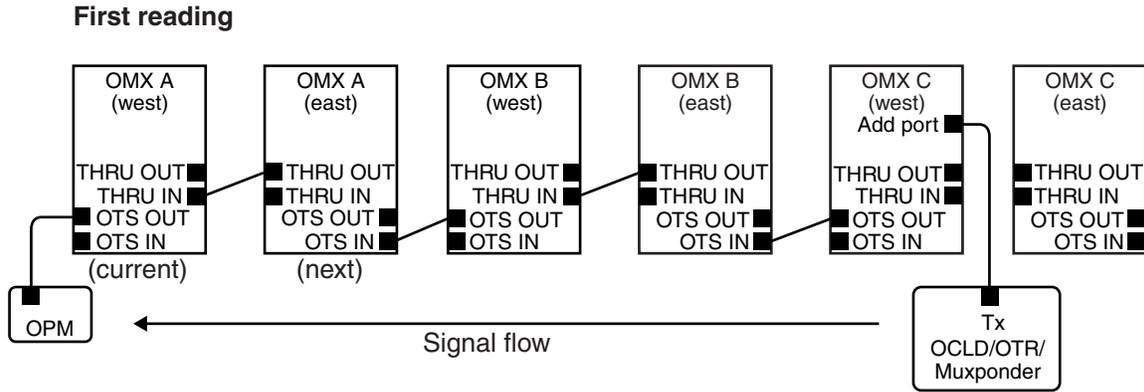
First reading

Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop". For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Second reading

Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop". For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Third reading
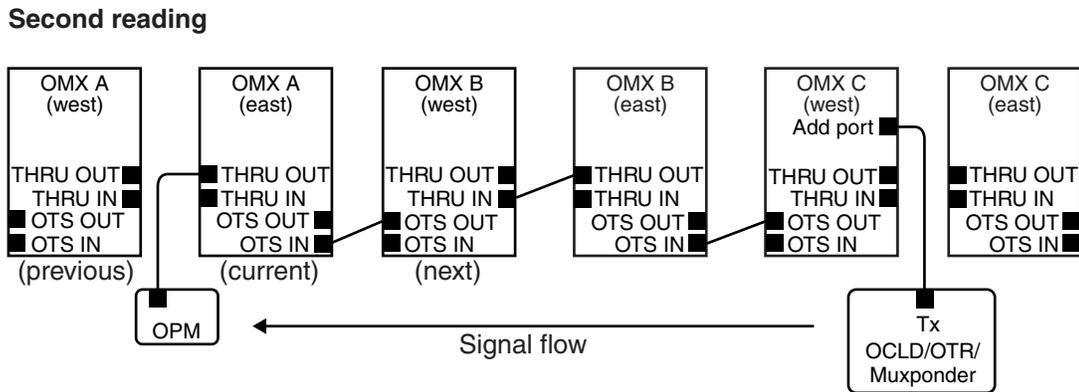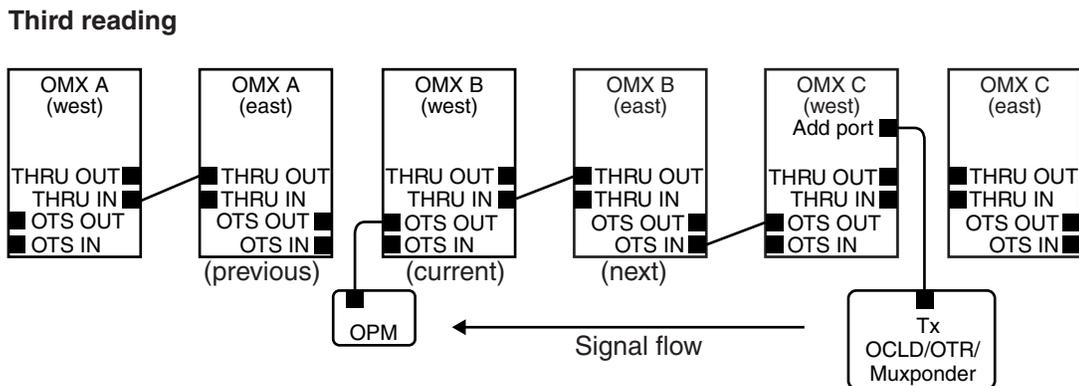
Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop". For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Figure 1-11
OMX continuity tests for OADM sites which use single-shelf wiring (Rx direction test)

OM1932t
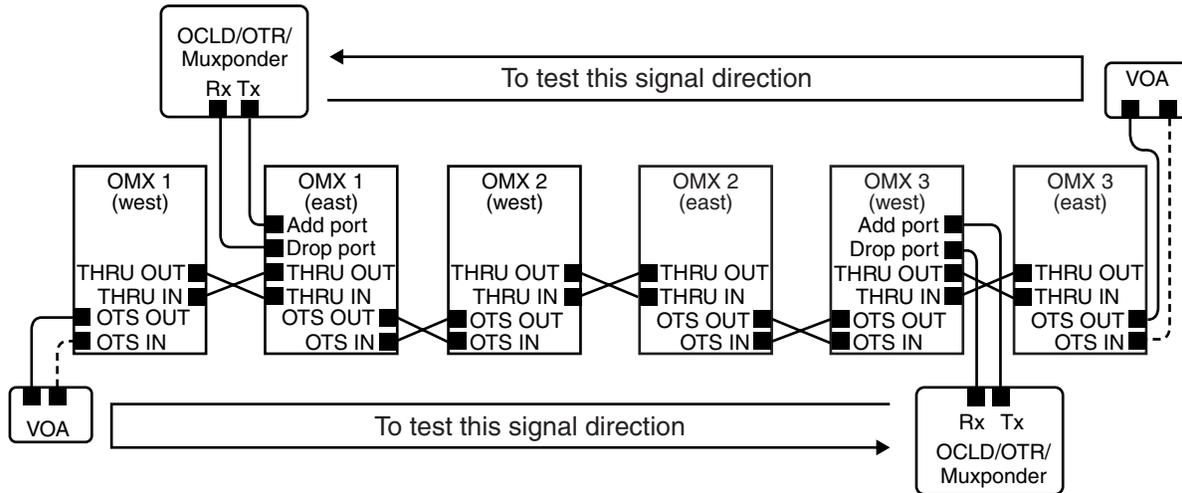
Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop".
For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Figure 1-12
OPM readings for OMX continuity (Rx direction test)

OM1933t

Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop".
For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop".
For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".
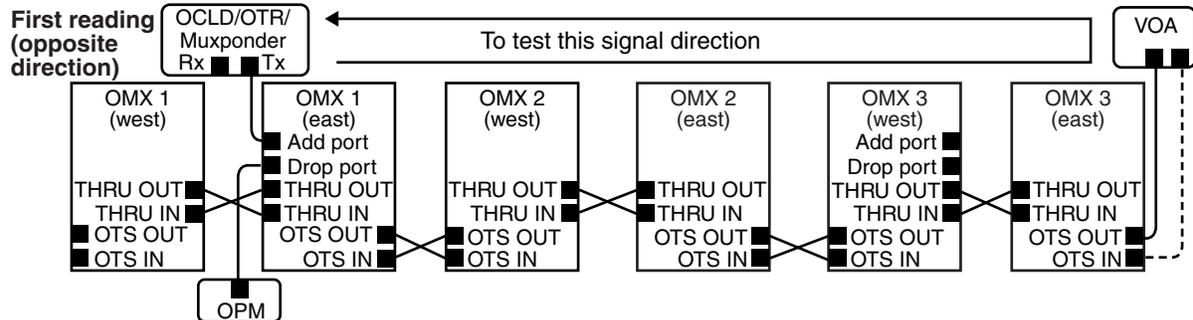
Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop".
For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Note: For DWDM OMXs, the add port is labeled "CH add" and the drop port is labeled "CH drop".
For CWDM OMXs, the add port is labeled "Band add" and the drop port is labeled "Band drop".

Procedure 1-5
Testing the optical continuity through the 16CH OMXs at a site

Use this procedure to verify signal continuity through the C/L splitter and coupler components of the OMX 16CH C-band (L IN to OTS OUT and OTS IN to L OUT) and the patch cords added to interconnect the OMXs. A successful test indicates:

- optical transmit power is correct
- signal continuity from shelf to shelf

This procedure must be performed for both the East-bound and West-bound directions.

Note: This procedure is only required for sites that use both the OMX 16CH C-band and the OMX 16CH L-band connected together using the L-band upgrade ports.

Requirements

Before you do this test, make sure that you have:

- powered on the shelf (see *Commissioning Procedures*, 323-1701-220)
- a minimum shelf configuration of one SP, one OCLD, OTR or Muxponder, one OMX, and the shelf database cards (OCMs in slots 9 and 10 for the Optical Metro 5200, and any circuit pack in slots 1 to 4, or 6 for the Optical Metro 5100) for each shelf at the site

Note: Other circuit packs may be present and fibered in the shelf, but they must not be seated.

- turned off Automatic Laser Shutdown (ALS) (see Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures*, 323-1701-310)

Note: The default setting for ALS is off.

- no pads in place at the CH DROP ports or at the CH ADD ports of the OMX 16CH C-band and the OMX 16CH L-band
- performed Procedure 1-1 and Procedure 1-2

—**continued**—

Procedure 1-5 (continued)
Testing the optical continuity through the 16CH OMXs at a site

Table 1-32 lists the tools and materials required for testing optical continuity.

Table 1-32
Tools and materials required for the optical continuity test

Item	Quantity	Supplied
Antistatic strap	1	no
Optical power meter (OPM) with an SC connector	1	no
Optical power meter (OPM) with an LC connector	1	no
Variable optical attenuator (VOA) with SC-SC connectors	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Optical patch cord	1	no

Precautions

> **CAUTION**
> **Invisible laser radiation**
> The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

> **CAUTION**
> **Risk of network reliability**
> Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—

Procedure 1-5 (continued)
Testing the optical continuity through the 16CH OMXs at a site

Expected results

The optical transmit power is correct, and there is signal continuity from shelf to shelf.

Action

Step	Action
1	Make sure that all OCLDs, OTRs or Muxponders are fibered correctly to their associated OMXs. Refer to Procedure 3-19, "Connecting an OMX to OCLD circuit packs" or, Procedure 3-20, "Connecting an OMX to Muxponder (MOTR) circuit packs" in *Connection Procedures*, 323-1701-221.
2	Make sure that all OMXs at the site are correctly fibered. Refer to Procedure 3-4, "Connecting OMX 16CH DWDM (C Band) to OMX 16CH DWDM (L Band)", in *Connection Procedures*, 323-1701-221.
3	Make sure that any fibers connected to the OTS OUT port and the OTS IN port of the West OMX 16CH C-band are labelled. Disconnect any fibers connected to the OTS OUT port and OTS IN port of the West OMX 16CH C-band.
4	Make sure that any fibers connected to the OTS OUT port and the OTS IN port of the East OMX 16CH C-band are labelled. Disconnect any fibers connected to the OTS OUT port and OTS IN port of the East OMX 16CH C-band.

Testing the optical continuity through the West OMXs - TX direction

Step	Action
5	Unseat all OCLD, OTR or Muxponder circuit packs connected to the West OMX 16CH C-band and the West OMX 16CH L-band except one OCLD, OTR or Muxponder circuit pack connected to the West OMX 16CH L-band.
6	Connect one end of a patch cord (which is known to be error-free) to the OTS OUT port of the West OMX 16CH C-band and the other end to the optical power meter (OPM). See Figure 1-13 on page 1-65.
7	Set the Optical Power Meter (OPM) to 1550 nm and record the power reading. See Table 1-33 on page 1-64 for minimum acceptable levels. The minimum acceptable level depends on whether the OCLD, OTR or Muxponder circuit pack is used for the test.

Step	If	**Then** go to
8	the OPM power reading meets the minimum acceptable power level	step 21
	otherwise	step 9

Step	Action
9	Disconnect the patch cord that connects the OTS OUT port of the West OMX 16CH L-band to the L IN port of the West OMX 16CH C-band.

—continued—

Procedure 1-5 (continued)
Testing the optical continuity through the 16CH OMXs at a site

Step	Action
10	Clean the SC connector of the OTS OUT port of the West OMX 16CH L-band and the SC connector of the L IN port of the West OMX 16CH C-band.
11	Clean the SC connectors of the patch cord disconnected in step 9.
12	Reconnect the patch cord from the OTS OUT port of the West OMX 16CH L-band to the L IN port of the West OMX 16CH C-band.
13	Set the Optical Power Meter (OPM) to 1550 nm and record the power reading. See Table 1-33 on page 1-64 for minimum acceptable levels. The minimum acceptable level depends on whether the OCLD, OTR or Muxponder circuit pack is used for the test.

14	**If**	**Then** go to
	the OPM power reading meets the minimum acceptable power level	step 21
	otherwise	step 15

Step	Action
15	Check the loss of the patch cord that connects the OTS OUT port of the West OMX 16CH L-band to the L IN port of the West OMX 16CH C-band. Do this by disconnecting the patch cord from the L IN port of the West OMX 16CH C-band and connecting it to an Optical Power Meter. Compare the power level value obtained to the value obtained when using another patch cord which is known to be error-free.

16	**If**	**Then** go to
	the original patch cord is too lossy	step 17
	otherwise	step 19

Step	Action
17	Replace the original patch cord that connects the OTS OUT port of the West OMX 16CH L-band to the L IN port of the West OMX 16CH C-band with another patch cord.
18	Go to step 6.
19	Replace the West OMX 16CH C-band.
20	Perform Procedure 1-2 and then restart this procedure.
21	Disconnect the OPM and the patch cord from the OMX.

Testing the optical continuity through the West OMXs - RX direction

Step	Action
22	Connect one end of a variable optical attenuator (VOA) with SC-SC connectors that is known to be error-free to the OTS OUT port of the West OMX 16CH C-band.
23	Connect the other end of the VOA to the OPM which is set to 1550 nm.
24	Adjust the VOA so that the OPM power reading is –12 dBm.

—**continued**—

Procedure 1-5 (continued)
Testing the optical continuity through the 16CH OMXs at a site

Step	Action
25	Disconnect the OPM and connect the unconnected end of the VOA to the OTS IN port of the West OMX 16CH C-band.
26	Locate the OCLD RX port, OTR LINE RX port or Muxponder LINE RX port of the OCLD, OTR or Muxponder circuit pack connected to the West OMX 16CH L-band.
27	Disconnect the patch cord at the port located in step 26 and connect it to the OPM. See Figure 1-14 on page 1-65.
28	Set the Optical Power Meter (OPM) to 1550 nm and record the power reading. See Table 1-34 on page 1-64 for minimum acceptable levels. The minimum acceptable level depends on whether the OCLD, OTR or Muxponder circuit pack is used for the test.

29	**If**	**Then** go to
	the OPM power reading meets the minimum acceptable power level	step 42
	otherwise	step 30

Step	Action
30	Disconnect the patch cord that connects the L OUT port of the West OMX 16CH C-band to the OTS IN port of the West OMX 16CH L-band.
31	Clean the SC connector of the L OUT port of the West OMX 16CH C-band and the SC connector of the OTS IN port of the West OMX 16CH L-band.
32	Clean the SC connectors of the patch cord disconnected in step 30.
33	Reconnect the patch cord from the L OUT port of the West OMX 16CH C-band to the OTS IN port of the West OMX 16CH L-band.
34	Set the Optical Power Meter (OPM) to 1550 nm and record the power reading. See Table 1-34 on page 1-64 for minimum acceptable levels. The minimum acceptable level depends on whether the OCLD, OTR or Muxponder circuit pack is used for the test.

35	**If**	**Then** go to
	the OPM power reading meets the minimum acceptable power level	step 42
	otherwise	step 36

Step	Action
36	Check the loss of the patch cord that connects the L OUT port of the West OMX 16CH C-band to the OTS IN port of the West OMX 16CH L-band. Do this by disconnecting the patch cord from the OTS IN port of the West OMX 16CH L-band and connecting it to an optical power meter. Compare the power level value obtained to the value obtained when using another patch cord which is known to be error-free.

—continued—

Procedure 1-5 (continued)
Testing the optical continuity through the 16CH OMXs at a site

Step	Action	
37	**If**	**Then** go to
	the original patch cord is too lossy	step 38
	otherwise	step 40
38	Replace the original patch cord that connects the L OUT port of the West OMX 16CH C-band to the OTS IN port of the West OMX 16CH L-band with another patch cord.	
39	Go to step 26.	
40	Replace the West OMX 16CH C-band.	
41	Perform Procedure 1-2 and then restart this procedure.	
42	Disconnect the OPM and reconnect the patch cord to the OCLD RX port, OTR LINE RX port or Muxponder LINE RX port.	
43	Remove the VOA.	
44	Seat all OCLD, OTR or Muxponder circuit packs connected to the West OMX 16CH C-band and the West OMX 16CH L-band (the ones which were unseated in step 5).	
45	Repeat step 5 to step 44 for the East OMXs.	
46	Reconnect fibers that you disconnected in step 3 and step 4, if any.	

—**end**—

Table 1-33
Minimum acceptable Tx optical power level - OMX 16CH DWDM

Type of OCLD/OTR/Muxponder		
OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced	Muxponder 10 Gbit/s GbE/FC
–2.4 dBm	–2.6 dBm	–2.6 dBm

Table 1-34
Minimum acceptable Rx optical power level - OMX 16CH DWDM

Type of OCLD/OTR/Muxponder		
OCLD/OTR 2.5 Gbit/s Flex	OTR 10 Gbit/s Enhanced	Muxponder 10 Gbit/s GbE/FC
–17.2 dBm	–17.2 dBm	–17.2 dBm

Figure 1-13
OMX continuity tests for OMX 16CH (Tx direction test)

OM2401p
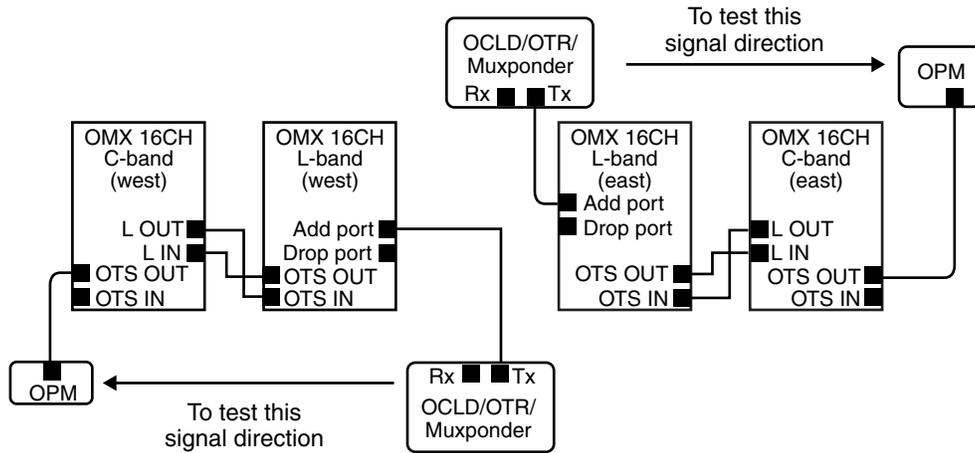
Figure 1-14
OMX continuity tests for OMX 16CH (Rx direction test)

OM2402p
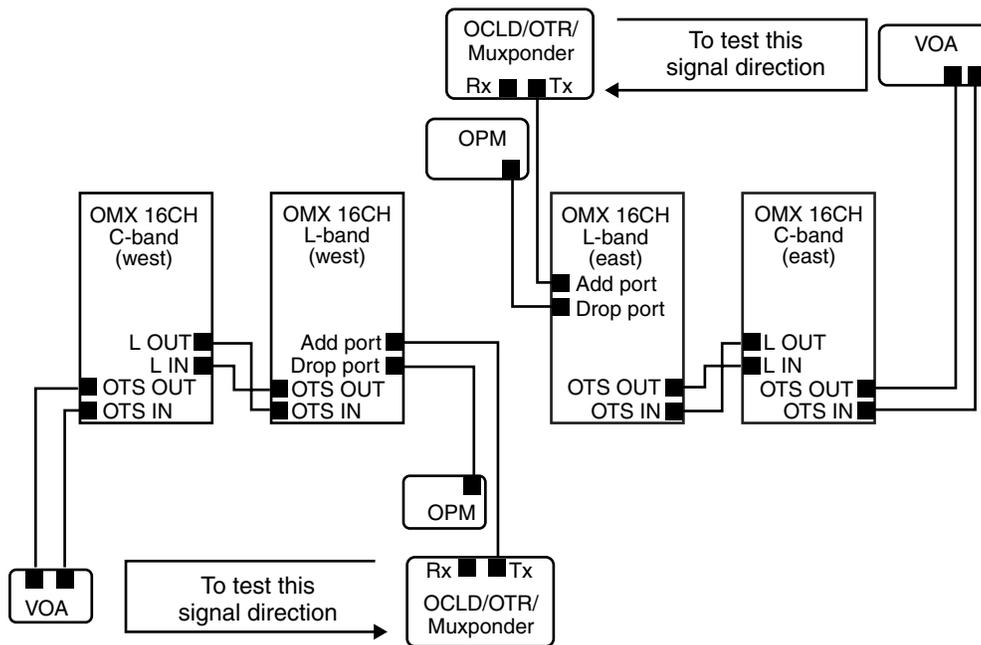
Procedure 1-6
Testing the Optical Metro 5100/5200 system

Use this procedure to:

- verify that the RX optical power values on OCLDs, OTRs and/or Muxponders meet the power targets provided by the Network Modeling Tool (NMT)

- verify that the RX optical power values on OFAs meet the power targets provided by the Network Modeling Tool (NMT) for amplified networks

- confirm signal continuity through your system

    Note: This procedure does not include bit error rate (BER) testing. BER testing is not a requirement. For BER testing on your system, contact your Nortel Networks account representative.

Requirements

Before you do this test, make sure

- you have performed the following actions:

    — you have installed all shelves and components. Refer to *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201 and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

    — you have commissioned all shelves. Refer to *Commissioning Procedures*, 323-1701-220

    — you have connected all optical components. Refer to *Connection Procedures*, 323-1701-221

    — you have performed Procedure 1-1, Procedure 1-2, and Procedure 1-3 (or Procedure 1-4) of this book at every site

    — you have installed fix pads at OMX drop ports, if required. See Procedure 3-45 "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX" in *Connection Procedures*, 323-1701-221

    — you have installed fix pads at OMX add ports, if required. See Procedure 3-44 "Installing an attenuator at the BAND ADD port in a DWDM OMX" in *Connection Procedures*, 323-1701-221

    — you have installed fix pads at add or drop ports of the DWDM OMX 16CH, if required. See Procedure 3-47, "Installing an LC-LC attenuator at the channel port in an OMX 16CH DWDM" in *Connection Procedures*, 323-1701-221

    — you have performed equalization for networks which use amplifiers. See "Equalizing amplified systems" in this book.

—continued—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

- know the test method to use. Two methods are available to perform this procedure:

  — Method A: test set is equipped at both ends of the connection

  — Method B: test set is equipped at one end and a hard loopback at the other end

If the network has been engineered using NMT, then you can use Method A in all cases. The NMT fails networks that exceed the regenerator limit as defined in "Rule 13: Jitter penalty" in the "Link engineering rules" chapter in *Network Planning and Link Engineering*, 323-1701-110. The regenerator count limit is also detailed in Table 1-35. You can only use Method B if the regenerator count (loopback case) for the connection does not exceed the regenerator count limit as defined in Table 1-35.

Table 1-35
Regenerator count limit

	OCLD 1.25 Gbit/s	OCLD/OTR 2.5 Gbit/s	OTR 10 Gbit/s	OTR 10 Gbit/s Enhanced or Muxponder 10 Gbit/s GbE/FC
Regenerator count limit	4	13	7	13

To determine the regenerator count (loopback case) for the connection, first identify the near-end OCI, OTR or Muxponder and the far-end OCI, OTR or Muxponder of the connection under test. The test set is connected to the near-end OCI, OTR or Muxponder. Then use one of the following formulas to determine the regenerator count (loopback case):

— if far-end circuit pack is an OCI: 2 x (number of regens) + 2

— if far-end circuit pack is an OTR: 2 x (number of regens) + 1

— if far-end circuit pack is a Muxponder: 2 x (number of regens) + 1

Note: If testing a connection which uses a 2.5 Gbit/s Flex 850 nm OTR and the Transponder Protection Tray, you can only use Method A. A hard loopback at the far-end node Transponder Protection Tray will cause the OTR RX port at the far-end node to report Loss of Signal condition due to the losses in the multimode version of the Transponder Protection Tray and the low output power of the OTR TX port.

—continued—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Table 1-36 lists the tools and materials required for testing the system.

Table 1-36
Tools and materials required for the system test

Item	Quantity	Supplied
Antistatic strap	1	no
Optical power meter (OPM) with an SC connector	1	no
Optical fiber cleaning kit	1	no
Optical patch cord	1	no
Protocol test set *Note:* The protocol test set required depends upon the OCI/OTR/Muxponder to be tested. For a list of OCIs/OTRs/Muxponders and protocols, see Table 1-37 on page 1-77.	1	no
Fiber inspection scope	1	no
Attenuator or patch cord with mini-VOA	1	no

—continued—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Precautions

CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of network reliability
Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

CAUTION
Risk of equipment damage
Refer to *Technical Specifications*, 323-1701-180, for the maximum input optical power to the receiver (Rx) of an OCLD circuit pack or the line-side receiver of an OTR or Muxponder circuit pack. If the optical power exceeds the limit, damage to the OCLD, OTR or Muxponder may result. You can avoid this damage by placing fixed attenuators at the OMX band drop. See Procedure 3-45 "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX" in *Connection Procedures*, 323-1701-221. If you are using the OMX 16CH, you can avoid this damage by placing fixed attenuators at the OMX drop ports. See Procedure 3-47, "Installing an LC-LC attenuator at the channel port in an OMX 16CH DWDM" in *Connection Procedures*, 323-1701-221. Do not loopback the OCLD transmitter (Tx) or the OTR/Muxponder line-side Tx directly to the OCLD Rx or OTR/Muxponder line-side Rx under any circumstances.

CAUTION
Risk of equipment damage
Damage to the client-side receiver (Rx) of the OTR 10 Gbit/s circuit pack may occur. Under no circumstances should the client-side transmitter (Tx) be loop-backed directly to the client-side receiver (Rx).

—**continued**—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Expected results

There is signal continuity in the system.

Action

Step	Action
1	Log in to System Manager. See Procedure 1-1, "Logging into the network" in *Provisioning and Operating Procedures,* 323-1701-310.
2	Select the Selected Shelves tab in the System Manager window to display network information.
3	Select the network name in the Selected Shelves tab and click **Apply**.
	The full network is displayed.
4	From the View menu, select Rediscover Network.
5	Verify that none of the shelves are shown in blue indicating a loss of contact with the shelf.
6	Select the Equipment-Facilities tab to retrieve the facility values of the network.
	• Refer to the link engineering information provided by the NMT (Network Modeling Tool) to verify that the RX values of the OCLDs, OTRs, Muxponders and OFAs are within range.
	• To store these values select Save As in the File Menu.
	Note: If the Rx values of the OCLDs, OTRs, Muxponders and OFAs do not meet link engineering specifications, verify with your next level of support.
7	Select the Fault-Active Alarms tab. Verify that the system is alarm free. If not refer to Trouble Clearing and Alarm Reference Guide NTP to clear the alarms.
8	Add traffic to the channel you would like to test. See Procedure 3-41 "Adding traffic to an end-to-end channel involving OCI and OCLD circuit packs", Procedure 3-43 "Adding traffic to an end-to-end channel involving OTR circuit packs", or Procedure 3-45 "Adding traffic to an end-to-end channel involving Muxponder circuit packs" in *Provisioning and Operating Procedures*, 323-1701-310. You may use one of the test protocols in Table 1-37 on page 1-77.

—continued—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Step	Action	
9	**If** the path	**Then**
	is protected	perform a forced switch at both ends of the connection (the near-end and far-end nodes) to ensure that the traffic is on the path that is under test. Follow Procedure 3-48, "Forcing traffic to one path on a protected channel" in *Provisioning and Operating Procedures*, 323-1701-310.
		Then go to step 10.
	is unprotected	go to step 10
10	**If** in the "Requirements" section you determined to test using	**Then** test the system using
	Method A	a test set on both ends of the connection. Set up the test sets to use the appropriate protocol as determined in step 8. Then go to step 15.
	Method B	a single test set with a hard loopback at the far-end node. Set up the test set to use the appropriate protocol as determined in step 8. Then go to step 11.

11   At the near-end, connect an optical patch cord between the Tx port of the optical test set and the RX connector of the OCI, OTR, Muxponder or the OTR Transponder Protection Tray that you are testing.

Note: Use the OPM to check the optical power level before inserting the optical patch cord into the RX connector. Verify that the power level is within the OCI, OTR or Muxponder RX specification. For power specification values, refer to Table 2-1 " Specifications for OCI circuit packs", Table 2-2 " Specifications for OCI SRM circuit packs", Table 2-30 " Specifications for OTR circuit packs—client side", or Table 2-43 " Specifications for Muxponder 10 Gbit/s circuit pack—client side" in *Technical Specifications*, 323-1701-180.

12   At the near-end, connect an optical patch cord between the Tx port of the OCI, OTR, Muxponder or OTR Transponder Protection Tray that you are testing and the Rx port of the optical test set.

Note: Before inserting the optical patch cord into the test set, verify that the OCI, OTR or Muxponder TX specification power level is within the test set's Rx specifications. If not, you may need to add an attenuator.

—continued—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Step	Action

13 At the corresponding shelf in the far-end node, determine if an attenuator is needed at the RX port of the OCI, OTR or the OTR Transponder Protection Tray that is the endpoint of the connection that is being tested so that the TX and RX port of the OCI, OTR or the OTR Transponder Protection Tray can be connected together using an optical patch cord (in step 14). The attenuator may be required to avoid overloading the RX port. You can use TX power and Rx power specifications in Table 2-1 " Specifications for OCI circuit packs", Table 2-2 " Specifications for OCI SRM circuit packs", or Table 2-30 " Specifications for OTR circuit packs—client side", and the insertion loss specifications in Table 1-32 "Transponder Protection Tray specifications" in *Technical Specifications*, 323-1701-180, to help determine whether an attenuator is needed. If an attenuator is needed, connect it to the RX port of the OCI, OTR or the OTR Transponder Protection Tray.

Note: Muxponder 10 Gbit/s GbE/FC circuit packs do not require an attenuator.

14 At the corresponding shelf in the far-end node, connect an optical patch cord between the Tx and Rx ports of the OCI, OTR, Muxponder or OTR Transponder Protection Tray that is the endpoint of the connection that is being tested. See Figure 1-15 on page 1-78 for an example of a far-end optical loopback test on an OCI circuit pack.

Note: Make sure that the ACTIVE indicator lamps are green on the OCIs that you are testing and the partner OCLDs, or on the OTRs or Muxponders that you are testing.

Go to step 19.

15 At the near-end, connect an optical patch cord between the Tx port of the optical test set and the Rx port of the OCI, OTR, Muxponder or OTR Transponder Protection Tray that you are testing.

Note: Use the OPM to check the optical power level before inserting the optical patch cord into the RX connector. Verify that the power level is within the OCI, OTR or Muxponder Rx specifications. If not, you may need to add an attenuator. For power specification values, refer to Table 2-1 " Specifications for OCI circuit packs", Table 2-2 " Specifications for OCI SRM circuit packs", Table 2-30 " Specifications for OTR circuit packs—client side", or Table 2-43 " Specifications for Muxponder 10 Gbit/s circuit pack—client side" in *Technical Specifications*, 323-1701-180.

16 At the near-end, connect an optical patch cord between the Tx port of the OCI, OTR, Muxponder or OTR Transponder Protection Tray that you are testing and the Rx port of the optical test set.

Note: Before inserting the optical patch cord into the test set, verify that the OCI, OTR or Muxponder TX specification power level is within the test set's Rx specifications. If not, you may need to add an attenuator.

—**continued**—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Step	Action

17   At the far-end, connect an optical patch cord between the Tx port of the optical test set and the Rx port of the OCI, OTR, Muxponder or the OTR Transponder Protection Tray that you are testing.

Note: Use the OPM to check the optical power level before inserting the optical patch cord into the RX connector. Verify that the power level is within the OCI's or OTR's Rx specifications. If not, you may need to add an attenuator. For power specification values, refer to Table 2-1 " Specifications for OCI circuit packs", Table 2-2 " Specifications for OCI SRM circuit packs", Table 2-30 " Specifications for OTR circuit packs—client side", or Table 2-43 " Specifications for Muxponder 10 Gbit/s circuit pack—client side" in *Technical Specifications*, 323-1701-180.

18   At the far-end, connect an optical patch cord between the Tx port of the OCI, OTR, Muxponder or the OTR Transponder Protection Tray that you are testing and the Rx port of the optical test set.

Note: Before inserting the optical patch cord into the test set, verify that the OCI, OTR or Muxponder TX specification power level is within the test set's Rx specifications. If not, you may need to add an attenuator.

19   Reset the optical test set and monitor the signal for at least 30 seconds.

20   Check for errors.

If	Then
errors are detected	clean the fibers and connections. Verify that the test set is working correctly. Then go to step 21. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.
no errors are detected	go to step 26

21   Reset the optical test set and monitor the signal for at least 30 seconds.

22   Check for errors.

If	**Then** go to
errors are detected	step 23
no errors are detected	step 26

23
If in the "Requirements" section you determined to test using	**Then**
Method A	go to step 24
Method B	perform "Testing graduated loopback" procedure in *Trouble Clearing and Alarm Reference Guide,* 323-1701-542

—**continued**—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Step	Action

24 You can perform procedure "Testing graduated loopback" in *Trouble Clearing and Alarm Reference,* 323-1701-542, to help isolate and resolve the problem. However, you can perform procedure "Testing graduated loopback" only after you have confirmed that the regenerator count (loopback case) for the connection does not exceed the regenerator count limit defined in Table 1-35 on page 1-67. To determine the regenerator count (loopback case) for the connection, first identify the near-end OCI, OTR or Muxponder and the far-end OCI, OTR or Muxponder of the connection under test. The test set is connected to the near-end OCI, OTR or Muxponder. Then use one of the following formulas to determine the regenerator count (loopback case):

- if far-end circuit pack is an OCI: 2 x (number of regens) + 2

- if far-end circuit pack is an OTR: 2 x (number of regens) + 1

- if far-end circuit pack is a Muxponder: 2 x (number of regens) + 1

If the regen count (loopback case) for the connection	**Then**
does not exceed the regenerator count limit defined in Table 1-35 on page 1-67	perform "Testing graduated loopback" procedure in *Trouble Clearing and Alarm Reference,* 323-1701-542
exceeds the regenerator count limit defined in Table 1-35 on page 1-67	go to step 25

25 To isolate and resolve the problem:

- clean the fibers and connectors on the optical components along the path between the near-end and far-end OCLDs, OTRs or Muxponders (for example, ECTs, PBEs, OFA circuit packs and patch panels). For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

- check the Tx and Rx power levels

- replace the near-end OCLD, OTR or Muxponder (see Note)

- replace the far-end OCLD, OTR or Muxponder (see Note)

- replace the near-end OCI (see Note)

- replace the far-end OCI (see Note)

- if errors still occur, contact Nortel Networks Technical Support.

Note: Follow the maintenance procedure appropriate to the type of circuit pack in *Maintenance and Replacement Procedures,* 323-1701-546.

—**continued**—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Step	Action
26	If you set a forced switch on the path in step 9, release the force switch at both ends of the connection (the near-end and far-end nodes). Follow Procedure 3-49, "Removing a manual, force, or lockout switch from a protection path", in *Provisioning and Operating Procedures*, 323-1701-310.

27	**If** the path	**Then**
	is protected	perform a forced switch at both ends of the connection (the near-end and far-end nodes) to ensure that the traffic is on the new path under test. Follow Procedure 3-48, "Forcing traffic to one path on a protected channel" in *Provisioning and Operating Procedures*, 323-1701-310.
		Then go to step 28.
	is unprotected	go to step 36

28	Reset the optical test set and monitor the signal for at least 30 seconds.
29	Check for errors.

If	**Then**
errors are detected	clean the fibers and connections. Verify that the test set is working correctly. Then go to step 30. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.
no errors are detected	go to step 35

30	Reset the optical test set and monitor the signal for at least 30 seconds.
31	Check for errors.

If	**Then** go to
errors are detected	step 32
no errors are detected	step 35

32	**If** in the "Requirements" section you determined to test using	**Then**
	Method A	go to step 33
	Method B	perform "Testing graduated loopback" procedure in *Trouble Clearing and Alarm Reference,* 323-1701-542

—continued—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Step	Action

33 You can perform procedure "Testing graduated loopback" in *Trouble Clearing and Alarm Reference,* 323-1701-542, to help isolate and resolve the problem. However, you can perform procedure "Testing graduated loopback" only after you have confirmed that the regenerator count (loopback case) for the connection does not exceed the regenerator count limit defined in Table 1-35 on page 1-67. To determine the regenerator count (loopback case) for the connection, first identify the near-end OCI, OTR or Muxponder and the far-end OCI, OTR or Muxponder of the connection under test. The test set is connected to the near-end OCI, OTR or Muxponder. Then use one of the following formulas to determine the regenerator count (loopback case):

- if far-end circuit pack is an OCI: 2 x (number of regens) + 2

- if far-end circuit pack is an OTR: 2 x (number of regens) + 1

- if far-end circuit pack is a Muxponder: 2 x (number of regens) + 1

If the regen count (loopback case) for the connection	**Then**
does not exceed the regenerator count limit defined in Table 1-35 on page 1-67	perform "Testing graduated loopback" procedure in *Trouble Clearing and Alarm Reference,* 323-1701-542
exceeds the regenerator count limit defined in Table 1-35 on page 1-67	go to step 34

34 To isolate and resolve the problem:

- clean the fibers and connectors on the optical components along the path between the near-end and far-end OCLDs, OTRs or Muxponders (for example, ECTs, PBEs, OFA circuit packs and patch panels). For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201

- check the Tx and Rx power levels

- replace the near-end OCLD, OTR or Muxponder (see Note:)

- replace the far-end OCLD, OTR or Muxponder (see Note:)

- replace the near-end OCI (see Note)

- replace the far-end OCI (see Note)

- if errors still occur, contact Nortel Networks Technical Support.

Note: Follow the maintenance procedure appropriate to the type of circuit pack in *Maintenance and Replacement Procedures,* 323-1701-546.

—**continued**—

Procedure 1-6 (continued)
Testing the Optical Metro 5100/5200 system

Step	Action
35	If you set a forced switch on the path in step 27 release the force switch at both ends of the connection (the near-end and far-end nodes). Follow Procedure 3-49, "Removing a manual, force, or lockout switch from a protection path", in *Provisioning and Operating Procedures*, 323-1701-310.
36	Repeat this procedure for every connection in your network, including every port of OCI SRM or Muxponder circuit packs.

—**end**—

Table 1-37
Test protocols

OCI/OTR/Muxponder Name	Test Protocols
OCI 1.25 Gbit/s 850 nm	Gigabit Ethernet
OCI ISC 1310 nm	Fibre Channel (up to Release 4.0) *Note:* For releases higher than Release 4.0, contact your next level of support.
OCI GbE 1310 nm	Gigabit Ethernet
OCI GbE 850 nm	Gigabit Ethernet
OCI 622 Mbit/s 1310 nm	OC-12 or STM-4
OCI 1.25 Gbit/s 1310 nm	OC-12 or STM-4
OCI 2.5 Gbit/s 1310 nm	OC-48 or STM-16
OCI SONET/SDH (and OCI IR) 1310 nm	OC-48 or STM-16 (when used with 2.5Gbit/s OCLD) OC12 or STM-4 (when used with 1.25 Gbit/s OCLD)
OCI SRM 1310 nm (per port)	OC-3 or STM-1
OCI SRM 1310 nm LC (per port)	OC-3 or STM-1
OCI SRM SONET/SDH 1310 nm (per port)	OC-12 or STM-4
OCI SRM ESCON (per port)	ESCON
OCI SRM GbE/FC 1310 nm (per port)	Gigabit Ethernet
OCI SRM GbE/FC 850 nm (per port)	Gigabit Ethernet
OCI SRM GbE/FC Enhanced 1310 nm (per port)	Gigabit Ethernet

Table 1-37 (continued)
Test protocols

OCI/OTR/Muxponder Name	Test Protocols
OCI SRM GbE/FC Enhanced 850 nm (per port)	Gigabit Ethernet
OCI SRM GbE 1310 nm (per port)	Gigabit Ethernet
OCI SRM GbE 850 nm (per port)	Gigabit Ethernet
OCI SRM SONET/SDH LTE	OC-3 or STM-1
OTR 2.5 Gbit/s Flex 1310 nm	OC-48 or STM-16
OTR 2.5 Gbit/s Flex 850 nm	Gigabit Ethernet
OTR 10 Gbit/s	OC-192 or STM-64
OTR 10 Gbit/s Enhanced	OC-192 or STM-64
Muxponder 10 Gbit/s GbE/FC (per port)	Gigabit Ethernet

Figure 1-15
Example of a far-end optical loopback test on an OCI circuit pack

OM0168t
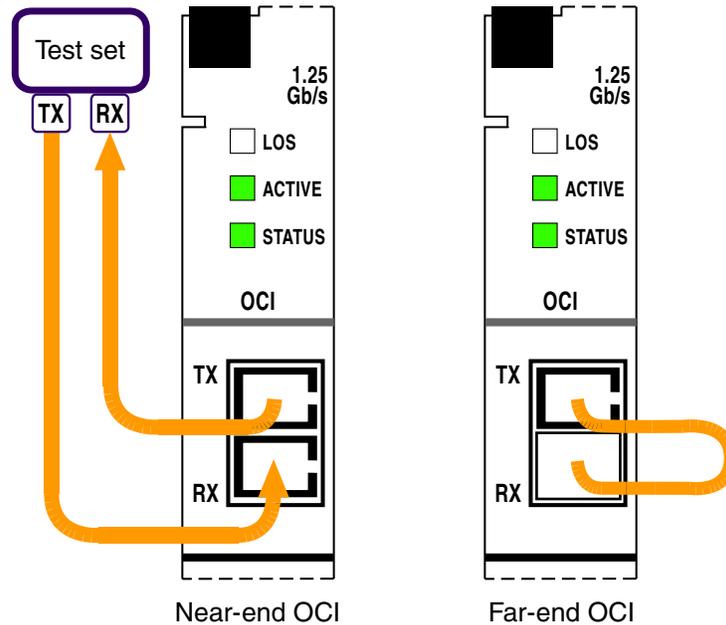
Procedure 1-7
Testing OSC installation

Follow this procedure to test if the OSC circuit pack and the OSC trays are installed correctly.

> ⚠️ **CAUTION**
> **Risk of loss of traffic**
> This procedure involves disconnecting fibers. This procedure disrupts traffic and should only be performed when traffic is protected.

Requirements

Before the test, make sure that:

- OSC trays, OSC circuit packs, fiber links, and patch cords have all been installed
- the OSC circuit pack is In-Service (IS) at both the equipment and facility levels
- the OSC circuit pack has no Loss of Signal lamp illuminated

Table 1-38 lists the tools and materials required for testing OSC installation.

Table 1-38
Tools and materials required for testing OSC installation

Item	Quantity	Supplied
Fiber cleaning kit	1	no
Fiber inspection scope	1	no

—continued—

Procedure 1-7 (continued)
Testing OSC installation

Precautions

	CAUTION
⚠	**Light source can damage your eyes** Do not look into the end of connectors on fiber-optic cables or into connectors on the faceplates of installed circuit packs. The light source used in fiber-optic devices can damage your eyes.

	CAUTION
⚠	**Risk of network reliability** Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Expected results

When you complete the procedure, you see the Loss of Signal lamp illuminated on the local and remote OSCs. If the lamps are not illuminated the OSC installation is incorrect. Reversed fiber connections is the most likely cause of this problem.

If you discover a problem with this test, refer to "Clearing OSC alarms" in the *Trouble Clearing and Alarm Reference Guide,* 323-1701-542.

Action

Step	Action
1	Make sure to clean all fibers and components before and after the steps in this procedure. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.
2	Identify the OSC drawer in the shelf.
3	Open the OSC drawer.
4	Identify the OSC west tray for the fiber link to the OSC circuit pack that you want to test.
5	Disconnect the fiber from the OTS IN connector on the OSC west tray. *The OSC-W Loss of Signal lamp (i.e., LOS lamp #2) for the local OSC circuit pack illuminates.*
6	Reconnect the fiber to the OTS IN connector on the OSC west tray.

—continued—

Procedure 1-7 (continued)
Testing OSC installation

Step	Action
7	Disconnect the fiber from the OTS OUT connector on the OSC west tray.
	The OSC-E Loss of Signal lamp (i.e., LOS lamp #1) for the remote OSC circuit pack illuminates.
8	Reconnect the fiber to the OTS OUT connector on the OSC west tray.
9	Identify the OSC east tray for the fiber link to the OSC circuit pack that you want to test.
10	Disconnect the fiber from the OTS IN connector on the OSC east tray.
	The OSC-E Loss of Signal lamp (i.e., LOS lamp #1) for the local OSC circuit pack illuminates.
11	Reconnect the fiber to the OTS IN connector on the OSC east tray.
12	Disconnect the fiber from the OTS OUT connector on the OSC east tray.
	The OSC-W Loss of Signal lamp (i.e., LOS lamp #2) for the remote OSC circuit pack illuminates.
13	Reconnect the fiber to the OTS OUT connector on the OSC east tray.
14	Close the OSC drawer.

—**end**—

Procedure 1-8
Testing site fibering for intrasite fault sectionalization

Follow this procedure to check that the site is fibered according to the supported site topology for intrasite fault sectionalization.

You normally perform this test during the shelf commissioning procedures. Always perform this test after you add a shelf to a site or when you remove a shelf from a site.

> ⚠ **CAUTION**
> **Risk of loss of traffic**
> This procedure involves disconnecting fibers. This procedure disrupts traffic and should only be performed when traffic is protected.

This test procedure applies to OADM, terminal, and OFA sites.

Requirements

Table 1-39 lists the tools and materials required for testing intrasite sectionalization.

Table 1-39
Tools and materials required for testing intrasite sectionalization

Item	Quantity	Supplied
Fiber-optic cleaning kit	1	no
Fiber inspection scope	1	no

Expected results

While completing this procedure, you will see Optical Signal Failure alarms. If Optical Signal Failure alarms do not occur or if the locations of the Optical Signal Failure alarms is not correct, then the OMXs are not correctly fibered.

If you discover a problem with this test, refer to "Troubleshooting fault sectionalization and System Level Equalization Control" in the *Trouble Clearing and Alarm Reference Guide,* 323-1701-542.

—**continued**—

Procedure 1-8 (continued)
Testing site fibering for intrasite fault sectionalization

Precautions

	CAUTION
	Light source can damage your eyes
	Do not look into the end of connectors on fiber-optic cables or into connectors on the faceplates of installed circuit packs. The light source used in fiber-optic devices can damage your eyes.

	CAUTION
	Risk of network reliability
	Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Action

Step	Action
1	Make sure to clean all fibers and components before and after the steps in this procedure. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.
2	Make sure that the Ethernet port 2 (10Base-T 2X) connections on the Maintenance Panel are properly connected at each shelf. See Figure 1-16 for the Optical Metro 5200 Maintenance Panel, and Figure 1-17 for the Optical Metro 5100 Maintenance Panel.

Procedure 1-8 (continued)
Testing site fibering for intrasite fault sectionalization

Step	Action

Figure 1-16
Optical Metro 5200 maintenance panel

OM0147p
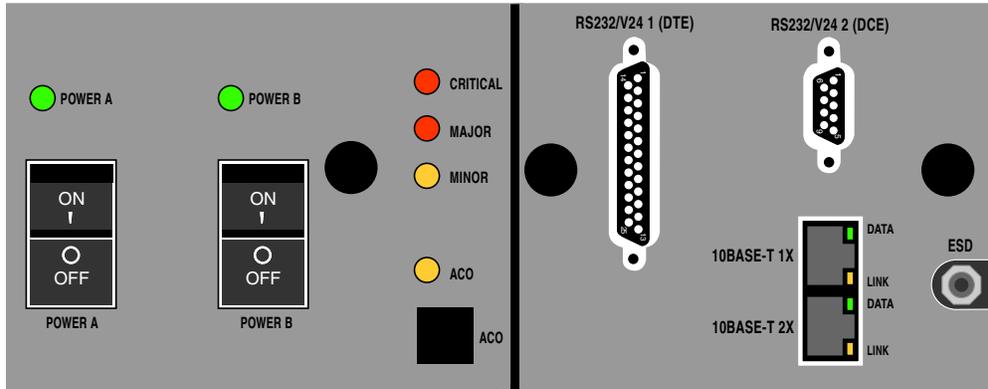
Figure 1-17
Optical Metro 5100 maintenance panel

OM0975t
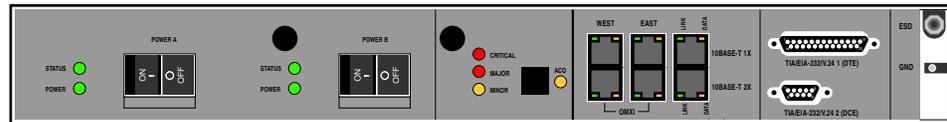
Power module   Maintenance
panel card

3   Make sure that the Optical System Identifier (OSID) is properly provisioned
for all line equipment, and for the OSC at each site. Make sure that OSC is
provisioned with fibering topology and configuration. For information on
provisioning the OSID, see Procedure 3-36, "Provisioning the optical system
identifier (OSID)"in 323-1701-310, *Provisioning and Operating Procedures.*
For information on provisioning the fibering topology and fibering
configuration, see Procedure 3-37 "Provisioning the fibering topology and
fibering configuration" in 323-1701-310, *Provisioning and Operating
Procedures.*

4   Make sure that the direction and location are properly provisioned for all OFAs
in the ring. See Procedure 3-34 "Provisioning OFA direction and location" in
323-1701-310, *Provisioning and Operating Procedures.*

5   Make sure that the direction, location and OFA Type are properly provisioned
for all APBEs in the ring. See Procedure 3-35 "Provisioning APBE direction,
location, and associated equipment" in 323-1701-310, *Provisioning and
Operating Procedures.*

—**continued**—

Procedure 1-8 (continued)
Testing site fibering for intrasite fault sectionalization

Step	Action
6	Make sure that IFS is enabled at all sites and that the ring has no Optical Signal Failure or Band Input Failure alarms. For information on enabling IFS, see Procedure 3-38, "Enabling intrasite fault sectionalization (IFS)"in *Provisioning and Operating Procedures,* 323-1701-310.

Testing the OADM or Terminal shelf

Step	Action
7	Disconnect the fiber from the OTS IN connector on the OMX for the shelf you want to test. Check the Active Alarms tab in System Manager to see if an Optical Signal Failure alarm was raised for both ends of the fiber. *Note:* Other alarms will be raised when disconnecting the fiber from the OTS IN connector on the OMX.
8	Make sure that the locations for the two Optical Signal Failure alarms are correct. If they are not, the OMXs have not been fibered correctly. *Note:* Ignore any Optical Signal Failure alarms raised at other sites.
9	Clean the fiber disconnected in step 7, and reconnect it to the OTS IN connector on the OMX. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.
10	Make sure that all Optical Signal Failure alarms clear and that there are no active Band Input Failure alarms.
11	Repeat step 7 through step 10 for each East OMX at the site.
12	Repeat step 7 through step 10 for each West OMX at the site.

Testing the OFA shelf

Step	Action	
13	**If** an APBE is	**Then** go to
	equipped in the OFA shelf	step 14
	not equipped in the OFA shelf	step 19

Step	Action
14	Disconnect the fiber from the Rx connector on the APBE circuit pack. *An Optical Signal Failure alarm should be raised at the Rx port of the APBE circuit pack.*
15	Make sure that another Optical Signal Failure alarm is raised at the correct location.
16	Clean the fiber disconnected from the APBE, and reconnect the fiber to the Rx connector on the APBE circuit pack. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.
17	Make sure that all Optical Signal Failure alarms clear.
18	Go to step 23

—continued—

Procedure 1-8 (continued)
Testing site fibering for intrasite fault sectionalization

Step	Action
19	Disconnect the fiber from the Rx connector on the OFA circuit pack.
	An Optical Signal Failure alarm should be raised at the Rx port of the OFA circuit pack.
20	Make sure that another Optical Signal Failure alarm is raised at the correct location.
21	Clean the fiber disconnected in step 19, and reconnect the fiber to the Rx connector on the OFA circuit pack. For information on cleaning, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.
22	Make sure that all Optical Signal Failure alarms clear.
23	Repeat step 13 through step 22 for all OFA shelves at the site.

—**end**—

Equalizing amplified systems

Overview

When amplifiers are used in your network, you must balance or equalize the power levels of the bands going into the OFA circuit packs to ensure that:

- channel power is evenly distributed at an amplifier site

- power inputs to the amplifier fall within acceptable ranges

- OSNR requirements are met

You can choose one of three methods to equalize power levels:

- distributed equalization

- centralized equalization

- centralized equalization using System Level Equalization Control (SLEC)

Distributed equalization

Distributed equalization is achieved by using attenuator pads in the OMX and at the input and output of the amplifier. The attenuator pads ensure that the signal power of each band is controlled so that all individual band power levels fall within acceptable variance limits going into the OFA circuit pack. The attenuator pads will most likely need to be installed at many different sites within the network, and are likely to be installed at a site other that the one where the amplifier is deployed.

Various levels of attenuator pads are available in a single kit that can be used for distributed equalization. The following kits are available:

- Attenuator kit for OFA or OSC (16 dB and 4 dB)

- OFA output attenuator kit

Centralized equalization

Centralized equalization occurs at the point in the network where the OFA circuit pack is located.

Optical Metro 5100/5200 offers three different components that can be used to equalize the individual band power levels prior to amplifying the aggregate C-band or L-band signal: Equalizer Coupler Tray (ECT), Per Band Equalizer

(PBE), Active Per Band Equalizer (APBE) and Active Per Band Equalizer Enhanced (APBE Enhanced). All three components allow you to attenuate signal power on a per-band basis. Whereas these components provide per-band power control, the OFA VGA circuit pack uses an eVOA (electrically controlled variable optical attenuator) to provide amplifier-band power control.

The ECT and the PBE are 1U high, rack-mounted components that contain variable optical attenuators (VOAs) that you use to manually adjust the power of individual bands. The APBE or APBE Enhanced is a two-slot wide circuit pack that contains electronic variable optical attenuators (eVOAs) that you use to adjust band power remotely, through the Optical Metro 5100/5200 graphical user interface. The OFA VGA is a three-slot wide circuit pack that contains an eVOA that you use to adjust amplifier band power remotely, through the Optical Metro 5100/5200 graphical user interface. That is, all four C-bands carried by the OFA VGA C-band circuit pack or all four L-bands carried by the OFA VGA L-band circuit pack are equally adjusted. The OFA VGA controls the aggregate power level.

The following components are available for implementing centralized equalization:

- ECT (C-band PBE and C&L Splitter/Coupler module)
- ECT (L-band PBE and C&L Splitter/Coupler module)
- ECT (C-band and L-band PBE and C&L Splitter/Coupler module)
- ECT (C&L Splitter/Coupler with VOA)
- PBE (C-band, without C&L Splitter/Coupler)
- PBE (L-band, without C&L Splitter/Coupler)
- PBE (C-band and L-band, without C&L Splitter/Coupler)
- APBE or APBE Enhanced circuit pack (C-band)
- APBE or APBE Enhanced circuit pack (L-band)
- OFA VGA circuit pack (C-band)
- OFA VGA circuit pack (L-band)

   Note: ECTs are not supported in Extended Metro networks.

Centralized equalization using SLEC

With the APBE or APBE Enhanced circuit pack and the OFA VGA circuit pack, an automated system-wide equalization or re-equalization of an Optical Metro 5200 amplified network is available. The System Level Equalization Control (SLEC) feature is responsible for the coordinated system-wide equalization or re-equalization of an amplified network.

SLEC can be triggered at anytime from a System Manager session. SLEC calculates the necessary information including topology and power levels, and performs the equalization activities by triggering the power control nodes to equalize in the calculated order. SLEC keeps the user updated with the current status of the equalization task.

SLEC overview

System level equalization is the act of adjusting per-band output power and amplifier gain settings to reach power targets that have been engineered for the system. The main functions of SLEC include:

- sequence through the APBE/APBE Enhanced and OFA VGA circuit packs in the proper order such that the user is not required to know system level topology
- check for fault information to ensure that topology information is accurate
- put appropriate APBE/APBE Enhanced facilities and OFA facilities in-service throughout the system when channels are added
- automatically update the channel count for every APBE/APBE Enhanced facility and OFA facility

The steady state mode (when not equalizing) keeps all of the components in constant gain mode. Upon initiation of SLEC, each of the gain-controllable devices (the APBE, APBE Enhanced and OFA VGA circuit packs) are adjusted to meet their pre-engineered power targets that have been provisioned at commissioning time and obtained from NMT or the Nortel Custom Equalization Report.

System Level Equalization is required in the following scenarios:

- When adding new channels
  - In this case, new channels are added to the existing bands. Each existing band is equipped with at least one existing channel. If any existing band does not have at least one existing channel, then the following case (i.e. Adding new bands applies).
- When adding new bands
  - In this case, new channels are added to existing empty channel bands. Existing bands imply that the OMXs for the bands are already installed and fibered into the network. This would be the case if the OMXs were installed during initial system installation taking into account a future channel count upgrade. If the OMXs of the new bands are not already installed and fibered in the network, contact Nortel Networks for assistance on how to add OMXs to an existing network.

- When removing channels

- When replacing components or fiber characteristics change causing additional (or less) loss in the system (for example, a splice on a broken fiber)

SLEC components

SLEC consists of two main components: a topology engine that automatically monitors and models the state of a system (OSID); and the SLEC application that uses the topology engine data to automatically instruct all gain-controllable devices (the APBE, APBE Enhanced and OFA VGA circuit packs) in a system to equalize to the provisioned power target. The topology engine gathers the majority of the information required by SLEC to perform its function.

The Topology engine
The first step in collecting topological information is to discover the site order in a system. To accomplish this, SLEC requires the deployment of OSC circuit packs at every site where SLEC is to be used. OSC not only provides a high-speed dedicated communication link between two sites, but also allows the automatic discovery of site adjacency information. Without OSC, site adjacency information is not available because the pass-through nature of WDM makes it difficult to know which site is a neighbor of another.

The topology engine at a site monitors its own configuration and communicates with other sites in the system, most often with its direct neighbors in the site order. With every site aware of which sites are its neighbors, the topology engine at a single site is then able to build a model of all components at the site, the channels that enter the site, the channels that drop at the site, the channels that are added at the site and the channels that are transmitted downstream from the site. Furthermore, the local topology model monitors site-level information such as which shelves are physically present at a site, which components are present, what channels are present and what provisioning exists. With all this information and the information from its neighbor site, a detailed model of the components can be created.

The SLEC application
The SLEC application that handles gain control of APBE, APBE Enhanced and OFA VGA circuit packs within a system (OSID) is itself a distributed application with a hierarchical organization. At each site, a SLEC site controller extracts information from the topology engine and makes decisions regarding whether or not the next gain controllable component (APBE, APBE Enhanced and OFA VGA circuit packs) at the site can be equalized. If it is safe to adjust the power of the component, the site controller instructs a shelf level controller that resides on all OFA shelves at a site to equalize the specific component. Components are equalized in a specific order as modeled by the topology engine. The SLEC shelf controller instructs the individual

component to adjust its output power and monitors the status for completion. On completion, the SLEC shelf controller reports status back to the site controller and the process is repeated for all components located at the site.

Once all components at the site have been addressed, the next site downstream is instructed to begin and the process continues until all sites within the system (OSID) have been addressed.

The SLEC application always equalizes all components in one direction before equalizing components in the opposite direction. SLEC equalizes the eastbound components at all sites and then all westbound components. Two modes of operation are available to equalize a system: "One-time" equalization that equalizes the system once, and "Continuous" equalization that constantly monitors and re-equalizes the system as required.

It is important to note that SLEC is not a link budget optimizer. The application only instructs each component to reach the required power target and then switch into constant gain mode. SLEC does not change the power target of a component that is provisioned at the time of initial installation. The power targets are obtained from NMT or the custom link engineering equalization.

SLEC modes of operation

SLEC has slightly different behavior depending on the type of configuration (Ring or Linear system topology) and operating mode (One-time or Continuous) selected.

One-time equalization mode

In One-time equalization mode, SLEC equalizes each direction twice. The order of equalization is eastbound phase 1, eastbound phase 2, westbound phase 1 and westbound phase 2.

Two equalization passes for each direction are required for mesh networks. Depending on the starting site that is chosen and network configuration, components that are equalized early in a phase can require further equalization once all components are equalized at sites preceding the starting site. The second pass for each direction is especially required in networks without a full terminal site. Although not an issue for linear configurations, two passes are still executed for simplicity purposes.

One complete round of equalization consists of the following seven phases:

1   System-level validation phase

2   Eastbound site-level validation phase

3   Eastbound phase 1 equalization phase

4   Eastbound phase 2 equalization phase

5   Westbound site-level validation phase

6   Westbound phase 1 equalization phase

7   Westbound phase 2 equalization phase

Continuous equalization mode
In Continuous equalization mode, SLEC visits all sites in the eastbound direction followed by all sites in the westbound direction and then continues this pattern repeatedly. If at any site it is discovered that a component is not transmitting at its aggregate output power target, SLEC commands the component to equalize. Equalizing one component can require equalization of other sites downstream; in such cases the SLEC re-equalizes the downstream sites when it visits them.

If no changes have taken place in system topology since the last pass of SLEC, no action is taken as each site is visited. All components remain in constant gain mode.

One complete round of equalization consists of the following five phases:

1   System-level validation phase

2   Eastbound site-level validation phase

3   Eastbound equalization phase

4   Westbound site-level validation phase

5   Westbound equalization phase

Equalization phases

Table 2-1 describes the different equalization phases.

Table 2-1
Equalization phases

Equalization phases	Description
System-level validation phase	The System-level validation phase is a preliminary validation phase in which SLEC: -Verifies that all sites in the system are operational (communication paths available for all sites) -Verifies that all sites in the system are capable of participating in a round of equalization -Resets (or clears) the last SLEC status of each site and each gain-controllable component at each site in both directions If everything is O.K., the Eastbound direction Site-level validation phase is started.
Site-level validation phase	The Eastbound or Westbound direction Site-level validation phase is a site-level validation of all gain-controllable components for the given direction within the site. In this phase the following attributes are verified: -All APBE eVOA facilities 1 to 4 must have the eVOA Provision parameter set to Channel, not Band -All HIP OFA circuit packs are preceded by an APBE circuit pack -All APBE circuit packs are followed by an OFA HIP or OFA VGA circuit pack
Equalization phase	During the equalization phase for each direction, each gain-controllable component within the site for the active direction is verified and then equalized, if possible. The order of component equalization within a site depends on site topology, the components present and the site chosen as the start site for the round of equalization. The order of component equalization is as follows: In each direction the start site for that direction is visited twice for each phase. At the start site, the first visit only equalizes the post-side components. The pre-side components are equalized in the second visit to the site for each phase. The order of component equalization is as follows. If no components are present in the position, equalization is skipped. 1.Post C-band components (first visit) 2.Post L-band components (first visit) 3.Pre C-band components (second visit) 4.Pre2 C-band components (second visit) 5.Pre L-band components (second visit) 6.Pre2 L-band components (second visit) At each OADM or Terminal site other than the start site, the order of component equalization is the following for each direction. 1.C-band Pre components 2.C-band Pre2 components 3.C-band Post components 4.L-band Pre components 5.L-band Pre2 components 6.L-band Post components At each OFA site, the order of component equalization is the following for each direction. 1.C-band Thru components 2.C-band Thru2 components 3.L-band Thru components 4.L-band Thru2 components At sites where the C-band is OADM or Terminal and L-band only contains line-amps, the order of component equalization is the following for each direction. 1.C-band Pre components 2.C-band Pre2 components 3.C-band Post components 4.L-band Thru components 5.L-band Thru2 components At sites where the C-band only contains line-amps and L-band is OADM or Terminal, the order of component equalization is the following for each direction. 1.C-band Thru components 2.C-band Thru2 components 3.L-band Pre components 4.L-band Pre2 components 5.L-band Post components

SLEC only operates on systems that conform to the deployment rules outlined in Table 2-2.

Table 2-2
SLEC deployment rules

Rule	Description
1	OSC is equipped at every site in a system where SLEC is used
2	An Ethernet hub must be installed at sites having more than two shelves. The Ethernet hub is needed to hub together all the shelves using their Ethernet port 2. When a site has only two shelves, an RJ-45 cross-over cable can be used to connect the two shelves.
3	At multi-shelf sites, all shelves at the site must have the same site identifier and the same hubbing group.
4	All OFA circuit packs in the system are either OFA HIP or OFA VGA. An APBE or APBE Enhanced circuit pack must be placed before all OFA HIP circuit packs.
5	The first amplifier a channel encounters must be equalized using an APBE or APBE Enhanced circuit pack. This amplifier cannot be equalized using fixed attenuator pads, a PBE or a discrete VOA.
6	All power targets must be obtained from NMT. For Extended Metro systems, the power targets must be obtained from the Nortel Custom Equalization Report.
7	Circuit packs in the same band must be of the same type or must be part of this group: OCLD 2.5 Gbit/s, OCLD/OTR 2.5 Gbit/s Flex, OCLD/OTR 2.5 Gbit/s Universal, OTR 10 Gbit/s Enhanced, Muxponder 10 Gbit/s. OCLD 1.25 Gbit/s circuit packs cannot be part of this group.
8	OMX type must be OMX 4CH Enhanced.
9	All OCLD, OTR, Muxponder circuit packs in the shelf's west plane must be fibered to a west OMX. All OCLD, OTR, Muxponder circuit packs in the shelf's east plane must be fibered to an east OMX.
10	Off-power balancing (different power levels per band at an APBE or APBE Enhanced) is not used.

Table 2-3 identifies the user provisioning required for SLEC to operate.

Table 2-3
User provisioning required for SLEC to operate

Parameters	Description
Direction and location	For OFA, APBE, and APBE Enhanced circuit packs, the location (pre, post, thru, pre2, thru2) and direction (eastbound, westbound) must be provisioned. The OFA, APBE, and APBE Enhanced direction and location information is required even when SLEC is not used. If it is not, the "Incomplete Provisioning" alarm is raised. Also, for the APBE or APBE Enhanced circuit pack, the APBE associated equipment attributes must be provisioned. For OCLD, OTR, Muxponder and OMX components, the direction is derived from the slot number, and the location is implicit.
OSID	For interconnected rings or networks that contain more than one optical system, an optical system identifier (OSID) must be provisioned to associate line equipment to the optical system. For consistency, all components on the same optical system should have the same OSID provisioned.
	If all equipment in the system has a blank OSID, then SLEC assumes it is all on the same system. If any piece of equipment is ever given a non-blank OSID, then SLEC fails or halts until all equipment is given the same OSID (blank or otherwise). A blank OSID is only allowed when it is the only OSID, and other features that do not support blank OSIDs are not being used (IFS, multiple-system network, hub and spoke).
	OCLD, OTR, Muxponder, OSC, APBE, APBE Enhanced, or OFA circuit packs that are seated in a shelf but are in the deleted state prevent SLEC from running. These circuit packs must be unseated or be put in the out-of-service state with the OSID provisioned to allow SLEC to run.
Power targets	Power targets must be provisioned for each gain-controllable device (APBE, APBE Enhanced, and OFA VGA). The power targets are obtained from NMT. For Extended Metro systems, the power targets are obtained from the Nortel Custom Equalization Report. Even if the system requires re-equalization following a channel addition/removal, those powers targets should not have to be changed as long as the system has been validated for the channel addition/removal with the same targets.
	APBE, APBE Enhanced, and OFA VGA channel counts do not need to be provisioned because SLEC automatically determines the channel count.
	APBE or APBE Enhanced eVOA facilities 1 to 4 must have the eVOA Provision parameter set to Channel, not Band.

Table 2-3 (continued)
User provisioning required for SLEC to operate

Parameters	Description
OSC equipment attributes for linear systems	Not Connected must be set for either the West Neighbor attribute or the East Neighbor attribute at the end-point nodes of a linear system.
Automatic Laser Shutdown	ALS must be disabled before SLEC is used to equalize a newly installed system or when SLEC is used to re-equalize a system as a result of band addition/removal. ALS can be turned on after SLEC completes. ALS does not need to be disabled when SLEC is used to re-equalize a system as a result of channel addition/removal.
Ethernet Port 2	The default values for the Ethernet Port 2 IP address and Ethernet Port 2 mask must be used.
	At multi-shelf sites, all shelves at the site must have the same Ethernet Port 2 access control (None, Filter or Encrypt) provisioned and Ethernet Port 2 must be enabled. It is recommended to also enable Ethernet Port 2 alarming to facilitate troubleshooting (when errors are reported).

Definition of per-band average channel power

The per-band average channel power in dBm is the average power of all channels used within the band. For example, consider the case when all four channels of band 1 are used and have the following power levels:

- Band 1, Channel 1 = -18.0 dBm

- Band 1, Channel 2 = -18.3 dBm

- Band 1, Channel 3 = -22.1 dBm

- Band 1, Channel 4 = -22.4 dBm

In this case, the average channel power of band 1 is -19.73 dBm.

Note: To calculate the average channel power in dBm, convert the power level of each channel to milliwatts, take the average of all channels used, then convert the average in milliwatts to dBm. Refer to the following formulas.

To convert from dBm to milliwatts: $P(\text{milliwatts}) = 10^{(P(\text{dBm})/10)}$

To convert from milliwatts to dBm: $P(\text{dBm}) = 10 \log_{10} P(\text{milliwatts})$

Definition of amplifier band average channel power

The amplifier band average channel power in dBm is the average power of all channels present within the amplifier band. An amplifier band includes bands 1 to 4 for a C-band amplifier and bands 5 to 8 for a L-band amplifier.

For example, if only Band 1 and Band 3 are present at the input of a C-band amplifier (the two bands being full-filled with 4 channels each), the average channel power should be calculated only on the 8 channels, not 16.

Note: To calculate the average channel power in dBm, convert the power level of each channel to milliwatts, take the average of all channels used, then convert the average in milliwatts to dBm. Refer to the following formulas.

To convert from dBm to milliwatts: $P(\text{milliwatts}) = 10^{(P(\text{dBm})/10)}$

To convert from milliwatts to dBm: $P(\text{dBm}) = 10 \log_{10} P(\text{milliwatts})$

Wavelength of each band and channel

Table 2-4 displays the wavelength for each band and channel. This table is for reference use only and is referenced in the equalization procedures in this document.

Table 2-4
Wavelength of each band and channel

Band and channel	Wavelength (nm)
Band 1 Channel 1	1528.77
Band 1 Channel 2	1533.47
Band 1 Channel 3	1530.33
Band 1 Channel 4	1531.90
Band 2 Channel 1	1538.19
Band 2 Channel 2	1542.94
Band 2 Channel 3	1539.77
Band 2 Channel 4	1541.35
Band 3 Channel 1	1547.72
Band 3 Channel 2	1552.52
Band 3 Channel 3	1549.32
Band 3 Channel 4	1550.92
Band 4 Channel 1	1557.36

Table 2-4 (continued)
Wavelength of each band and channel

Band and channel	Wavelength (nm)
Band 4 Channel 2	1562.33
Band 4 Channel 3	1558.98
Band 4 Channel 4	1560.61
Band 5 Channel 1	1570.42
Band 5 Channel 2	1575.37
Band 5 Channel 3	1572.06
Band 5 Channel 4	1573.71
Band 6 Channel 1	1580.35
Band 6 Channel 2	1585.36
Band 6 Channel 3	1582.02
Band 6 Channel 4	1583.69
Band 7 Channel 1	1590.41
Band 7 Channel 2	1595.49
Band 7 Channel 3	1592.10
Band 7 Channel 4	1593.80
Band 8 Channel 1	1600.60
Band 8 Channel 2	1605.73
Band 8 Channel 3	1602.31
Band 8 Channel 4	1604.02

Types of amplifier configurations

Amplifiers can be configured in one of three ways:

- Pre-amp
- Pre1, Pre2 (dual Pre in extended metro)
- Thru1-Thru2 (dual line amplifier)
- Post-amp
- Line-amp

> **ATTENTION**
> If you are not using SLEC, before you connect fiber to the OFA OUT port of Pre-amp configurations, it is important to validate that the per channel output power of the OFA does not exceed the input power tolerances of the OCLD, OTR or Muxponder circuit packs connected to it. For power level information, see *Technical Specifications,* 323-1701-180. You can avoid exceeding the input power tolerances of the OCLD, OTR or Muxponder by placing fixed attenuators at the OMX BAND RX port (this port is labeled BAND DROP if the OMX type is OMX [Standard]). See Procedure 3-45, "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX" in *Connection Procedures*, 323-1701-221.

Network Modeling Tool

The eVOAs in an APBE or an APBE Enhanced, the eVOA in an OFA VGA or the manual VOAs in an ECT/PBE equalize the optical power of each signal, based on power targets that you set. To determine your power targets, it is a requirement that you run the Network Modeling Tool (NMT) before you equalize. When using the NMT, Nortel Networks recommends that you use a model that anticipates future growth of the network. By doing this, you can eliminate the need to update the power targets on the network each time you add a channel. If there are changes to the network other than channel additions, you should rerun the NMT using a new model, and obtain new power targets.

Centralized equalization with APBEs

The APBE or APBE Enhanced controls the optical power of each band within the C-band, or L-band, using an electrical variable optical attenuator (eVOA). In the System Manager, these eVOAs are facilities that belong to an APBE or an APBE Enhanced and are managed through ports 1 to 4. Port 5 is used to monitor the total output power of the aggregate signal.

Note: When changing the provisioning information for an APBE or an APBE Enhanced, the "APBE–Incomplete Provisioning" alarm can be raised. For information see Procedure 12-6 "APBE—Incomplete Provisioning" in *Trouble Clearing and Alarm Reference*, 323-1701-542.

Table 2-5 lists the mapping between APBE or APBE Enhanced ports and band numbers.

Table 2-5
APBE port assignments

Port	Band number in the C-band	Band number in the L-band
1	1	5
2	2	6
3	3	7
4	4	8
5	Represents the total optical power of the output C-band or L-band signal, for performance monitoring.	

You must put APBE or APBE Enhanced facilities in-service (IS) and take facilities out-of-service (OOS) in the following sequence:

1 Put the APBE or APBE Enhanced circuit pack IS before putting port 5 facility IS.

2 Put port 5 IS before putting ports 1 to 4 IS.

3 Take ports 1-4 OOS before putting port 5 OOS.

4 Put port 5 OOS before putting the APBE circuit pack OOS.

Cascading amplifiers

Some network configurations can require you to connect OFA shelves to one another, forming a chain of cascading amplifiers. If you have cascading amplifiers, you must make sure that you equalize signals entering the OFAs in the correct order, starting with the transmitting OCLD, OTR or Muxponder, moving toward the receiving OCLD, OTR or Muxponder, and in both directions. When using SLEC to equalize the system, the equalization order is determined by software.

Figure 2-1 shows one example of cascading amplifiers.

Figure 2-1
Cascading amplifiers

OM0963t
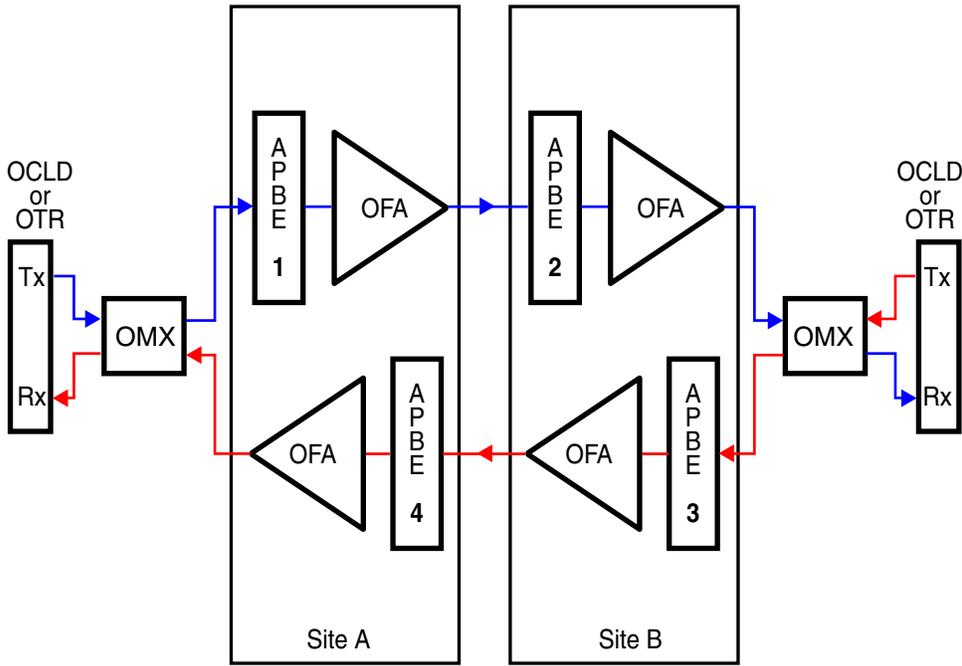
For example, when you provision in an up-stream direction, you must provision APBE 1 before you provision APBE 2. When you provision in a down-stream direction, you must provision APBE 3 before you provision APBE 4.

> *Note:* There are no C/L splitter/couplers shown in Figure 2-1. It is assumed that you have already split the C-band and L-band before the signal reaches the APBE or APBE Enhanced.

In cascaded amplifier configurations, the APBE or APBE Enhanced receive power monitors may display valid power readings for bands that are not carrying signals (traffic or otherwise). For example, in the configuration shown in Figure 2-1 on page 2-15, APBE 2 may measure amplifier noise from the OFA at Site A as a valid receive signal.

Extended Metro DWDM

Extended Metro DWDM is an Optical Metro 5200 system solution that enables system reach up to 600 km without the need for regeneration. Eliminating the need for regeneration can result in significant network cost savings. By applying a set of engineering rules, it is possible to extend the reach of Optical Metro 5200 systems beyond typical metro distances.

Link engineering rules are required to manage non-linear effects. For example, the launch power into the fiber is reduced, all traffic carrying wavelengths must be a minimum of 1 Gbit/s, and per-band power control is required at specific points along the link to manage tilt in the channel powers caused by Stimulated Raman Scattering (SRS).

The Extended Metro solution enables system reach up to 600 km without the need for regeneration using DSCMs. DSCMs are only supported on NDSF. The following line-side circuit packs must be used in these Extended Metro links:

• OTR 10 Gbit/s Enhanced

• Muxponder 10 Gbit/s GbE/FC

• Muxponder 10 Gbit/s GbE/FC with VCAT

• OCLD 2.5 Gbit/s Universal

• OTR 2.5 Gbit/s Universal 1310 nm

• OTR 2.5 Gbit/s Universal 850 nm

Link engineering for specific applications is a custom exercise performed by Nortel Networks. All Extended Metro DWDM system deployments require a Nortel Custom Equalization Report. A sample Nortel Custom Equalization Report is included in Table 2-6.

Link engineering of Extended Metro DWDM systems is not supported in NMT nor is it supported using manual calculations. Contact Nortel Networks for custom link engineering and to obtain the Nortel Custom Equalization Report for your Extended Metro system.

Table 2-6
Sample Nortel custom equalization report

Network Name	Network Example
Customer Name	Nortel Networks
Design Team	OM5200 System Characterization
Date	February 26, 2004

OM2663p
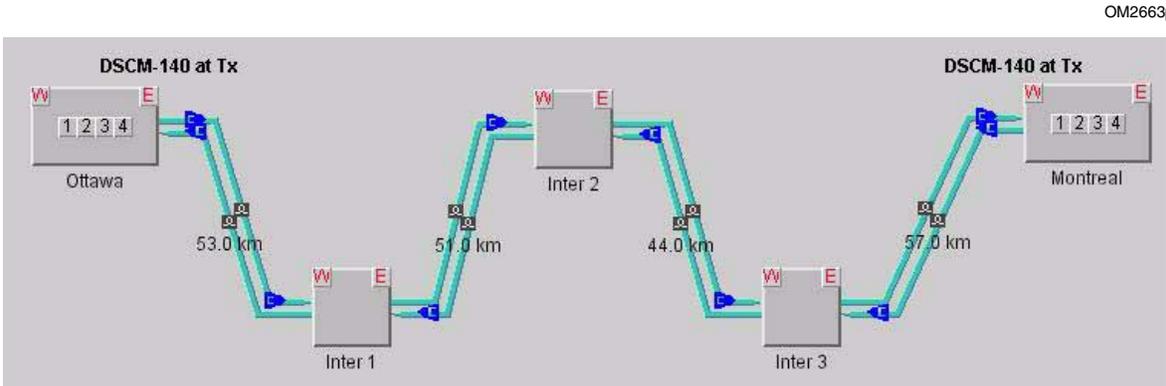
Clockwise →

Clockwise

Site Ottawa (see Note 1)

			C Band				L Band			
			B1	B2	B3	B4	B5	B6	B7	B8
OMX Pads (dB)	Add	East	—	—	—	—	X	X	X	X
Post Position			PBE				X			
Power Control Device										
	Power Targets (dBm / ch)		-20	-20	-20	-20	X	X	X	X
	Amplifier Output Pads (dB)		2							
OSC Pads (dB)	Add	East	4							

Table 2-6 (continued)
Sample Nortel custom equalization report

Inter 1									
			C Band				L Band			
			B1	B2	B3	B4	B5	B6	B7	B8
Pre Position			VOA				X			
Power Control Device										
	Power Targets (dBm / ch)		-20				X	X	X	X
	Amplifier Output Pads (dB)		2				X			
OSC Pads (dB)	Add	East	4							
	Drop	West	—							

Inter 2									
			C Band				L Band			
			B1	B2	B3	B4	B5	B6	B7	B8
Pre Position			VOA				X			
Power Control Device										
	Power Targets (dBm / ch)		-20				X	X	X	X
	Amplifier Output Pads (dB)		2				X			
OSC Pads (dB)	Add	East	4							
	Drop	West	—							

Inter 3									
			C Band				L Band			
			B1	B2	B3	B4	B5	B6	B7	B8
Pre Position			PBE				X			
Power Control Device										
	Power Targets (dBm / ch)		-21	-21	-21	-21	X	X	X	X
	Amplifier Output Pads (dB)		1				X			
OSC Pads (dB)	Add	East	4							
	Drop	West	—							

Table 2-6 (continued)
Sample Nortel custom equalization report

Montreal		C Band				L Band			
		B1	B2	B3	B4	B5	B6	B7	B8
Pre Position		VOA				X			
Power Control Device									
Power Targets (dBm / ch)		-20				X	X	X	X
Amplifier Output Pads (dB)		0				X			
OMX Pads (dB) Drop (see Note 2) West		14	14	14	14	X	X	X	X
OSC Pads (dB) Drop West		—							

Power required at Rx (see Note 3)	Band 1				Band 2				Band 3				Band 4			
	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21
	Band 5				Band 6				Band 7				Band 8			
	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Counterclockwise

Site Montreal

		C Band				L Band			
		B1	B2	B3	B4	B5	B6	B7	B8
OMX Pads (dB) Add West		—	—	—	—	X	X	X	X
Post Position		PBE				X			
Power Control Device									
Power Targets (dBm / ch)		-20	-20	-20	-20	X	X	X	X
Amplifier Output Pads (dB)		2				X			
OSC Pads (dB) Add West		4							

Table 2-6 (continued)
Sample Nortel custom equalization report

Inter 3									
		C Band				L Band			
		B1	B2	B3	B4	B5	B6	B7	B8
Pre Position		VOA				X			
Power Control Device									
	Power Targets (dBm / ch)	-20				X	X	X	X
	Amplifier Output Pads (dB)	2				X			
OSC Pads (dB)	Add West	4							
	Drop East	—							

Inter 2									
		C Band				L Band			
		B1	B2	B3	B4	B5	B6	B7	B8
Pre Position		VOA				X			
Power Control Device									
	Power Targets (dBm / ch)	-20				X	X	X	X
	Amplifier Output Pads (dB)	2				X			
OSC Pads (dB)	Add West	4							
	Drop East	—							

Inter 1									
		C Band				L Band			
		B1	B2	B3	B4	B5	B6	B7	B8
Pre Position		PBE				X			
Power Control Device									
	Power Targets (dBm / ch)	-21	-21	-21	-21	X	X	X	X
	Amplifier Output Pads (dB)	1				X			
OSC Pads (dB)	Add West	4							
	Drop East	—							

Table 2-6 (continued)
Sample Nortel custom equalization report

Ottawa									
			C Band				L Band			
			B1	B2	B3	B4	B5	B6	B7	B8
Pre Position			VOA				X			
Power Control Device										
Power Targets (dBm / ch)			-20				X	X	X	X
Amplifier Output Pads (dB)			0				X			
OMX Pads (dB)	Drop (see Note 2)	East	14	14	14	14	X	X	X	X
OSC Pads (dB)	Drop	East	—							

Power required at Rx (see Note 3)	Band 1				Band 2				Band 3				Band 4			
	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21	-21
	Band 5				Band 6				Band 7				Band 8			
	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4	C1	C2	C3	C4
	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Legend	X = Not present in this network
	— = No pads required

Note 1: Equalization should start at this site with the Post amplifiers and should be performed in the site order shown in this equalization report.

Note 2: To help derisk in-service channel addition, the overload pad value should be determined based on field measurement during equalization.

Note 3: The powers shown here are minimal powers required at Rx to guarantee expected performance.

Procedure lists

Table 2-7, Table 2-8 and Table 2-9 list the procedures in this chapter.

Table 2-7
Procedures for performing equalization on newly installed amplified systems

Procedure	Page	Comments
Centralized equalization		
2-1 Equalizing a newly installed amplified system	2-24	Required for equalizing a newly installed amplified system.
2-3 Equalizing a newly installed amplified system or Extended Metro system using SLEC	2-50	Required for equalizing a newly installed amplified system or Extended Metro systems using SLEC.
Distributed equalization		
2-4 Equalizing a newly installed amplified system that uses distributed equalization	2-59	Required for equalizing an amplified system that use distributed equalization.
Extended Metro equalization		
2-2 Equalizing a newly installed Extended Metro amplified system	2-37	Required for equalizing an Extended Metro amplified system.
2-3 Equalizing a newly installed amplified system or Extended Metro system using SLEC	2-50	Required for equalizing a newly installed amplified system or Extended Metro system using SLEC.

Table 2-8
Procedures for performing re-equalization on already installed amplified systems

Procedure	Page	Comments
Centralized equalization		
2-5 Re-equalizing an amplified system	2-66	Use this procedure to re-equalize an amplified system when adding a new channel, when adding a new band, when removing a channel or after an optical component replacement.
2-6 Re-equalizing an Extended Metro amplified system	2-85	Use this procedure to re-equalize an amplified system when adding a new channel, when adding a new band, when removing a channel or after an optical component replacement.
2-7 Re-equalizing an amplified system using SLEC when adding new channels	2-102	Use this procedure to re-equalize an amplified system or Extended Metro system using SLEC when adding new channels.

Table 2-8 (continued)
Procedures for performing re-equalization on already installed amplified systems

Procedure	Page	Comments
2-8 Re-equalizing an amplified system using SLEC after an optical component replacement or a link budget change	2-107	Use this procedure to re-equalize amplified systems or Extended Metro systems after an optical component replacement or a link budget change.
2-9 Re-equalizing an amplified system using SLEC when adding new bands	2-111	Use this procedure to re-equalize an amplified system or Extended Metro system using SLEC when adding new bands.
2-10 Re-equalizing an amplified system using SLEC when removing channels	2-118	Use this procedure to re-equalize an amplified system or Extended Metro system using SLEC when removing channels.

Table 2-9
Common procedures for performing equalization

Procedure	Page	Comments
Centralized equalization		
2-11 Taking a band out-of-service	2-123	Required to take a band out-of-service in systems that use APBE or APBE Enhanced circuit packs.
2-12 Re-equalizing optical power of a band	2-125	Required to re-equalize the optical power of a band, using the existing provisioning information, in systems that use APBE or APBE Enhanced circuit packs.
2-13 Starting or stopping System Level Equalization Controller	2-127	Use this procedure to start or stop SLEC.
2-14 Provisioning target power on the APBE or APBE Enhanced circuit pack when using SLEC	2-129	Use this procedure to provision the target power for the APBE or APBE Enhanced circuit pack when using SLEC.
2-15 Provisioning target power on the OFA VGA circuit pack when using SLEC	2-131	Use this procedure to provision the target power for the OFA VGA facility when using SLEC.
2-16 Provisioning the connected direction at the end-point nodes of a linear system	2-133	Use this procedure to provision the connected direction at the end-point nodes of a linear system.
2-17 Re-equalizing optical power of a band using a VGA OFA	2-135	Use this procedure to re-equalize the optical power of a band using a VGA OFA.

Procedure 2-1
Equalizing a newly installed amplified system

Use this procedure to equalize a newly installed amplified system.

You must perform this procedure in both the west and east directions. If the system does not have a true optical seam, the system may require fine-tuning of the optical power after the first pass of equalization is completed.

Requirements

Before you begin this procedure make sure that

- you wear an antistatic wrist strap while performing this procedure if Discrete VOAs, ECTs, PBEs or Pads are used as power control devices

- you are logged into the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- the APBE, APBE Enhanced and OFA VGA circuit packs are In-Service if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- the equalization prerequisites as shown in Table 2-10 are met

—**continued**—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Table 2-10
Prerequisites for equalizing an amplified system

Prerequisite #	Description
1	Ensure that the system passes when run on the Network Modeling Tool. From NMT, obtain the target per-band average channel power for the bands in your system as well as information with respect to fixed attenuator pads required in the system. If this is an Extended Metro system, obtain the Nortel Custom Equalization Report. Determine the fixed attenuator pads required for the OSC (see OSC link engineering in *Network Planning and Link Engineering*, 323-1701-310).
2	Install Optical Metro 5200 Shelves and Components (see *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201)
3	Commission Optical Metro 5200 Shelves (see *Commissioning Procedures*, 323-1701-220)
4	Provision Automatic Laser Shutdown (ALS) to be disabled on the shelves that contain the OCLD, OTR or Muxponder circuit packs. See Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures*, 323-1701-310.
5	Connect the optical components (See *Connection Procedures*, 323-1701-221). In these procedures, optical patch cords are run to the OFA slot positions but are not connected to the OFA IN or OFA OUT ports unless an APBE or APBE Enhanced circuit pack is used to equalize the OFA IN signal. The optical patch cords are only connected to the OFA IN and OFA OUT ports after equalization.
6	Perform Shelf and Site testing procedures. See the following: Procedure 1-1 "Testing the shelf lamps" Procedure 1-2 "Testing an Optical Metro 5100/5200 WDM OMX" Procedure 1-3 "Testing the optical continuity through the OMXs at a site" Procedure 1-4 "Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring"
7	Install fixed attenuator pads as described in the NMT report or the Nortel Custom Equalization Report and install fixed attenuator pads for the OSC as determined in prerequisite # 1. See *Connection Procedures*, 323-1701-221.

—**continued**—

2-26 Equalizing amplified systems

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

ATTENTION

If the power control device is connected to an OFA in a Pre-amp configuration, validate that the output power of the OFA does not exceed the input power tolerances of the OCLD, OTR or Muxponder circuit packs to which it is connected. For power tolerance information, see *Technical Specifications*, 323-1701-180. You can avoid exceeding the input power tolerances of the OCLD, OTR or Muxponder by placing fixed attenuators at the OMX BAND RX port (this port is labeled BAND DROP if the OMX type is OMX [Standard]). See Procedure 3-45 "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX" in *Connection Procedures*, 323-1701-221.

Table 2-11 lists the tools and materials required to complete this procedure if any OFA in the system uses one of the following power control devices: ECT, Discrete VOA, PBE or Pad.

Table 2-11
Tools and materials required when an ECT, Discrete VOA, PBE or Pad are used to control power into an OFA

Item	Quantity	Supplied
Antistatic strap	1	no
Optical spectrum analyser (OSA)	1	no
Optical Power Meter (OPM)	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Patch cord with SC-SC connectors	as required	no
Flat-head screwdriver	1	no
Network diagram	1	no
Correct power target values, as output by the Network Modeling Tool	-	-

—continued—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Table 2-12 lists the tools and materials required to complete this procedure if each OFA uses an APBE or APBE Enhanced as the power control device or the OFA is an OFA VGA. The system does not use an ECT, Discrete VOA, PBE or Pad to control power into an OFA.

Table 2-12
Tools and materials required when an ECT, Discrete VOA, PBE or Pad are not used to control power into an OFA

Item	Quantity	Supplied
Network diagram	1	no
Correct power target values, as output by the Network Modeling Tool	-	-

Precautions

> **CAUTION**
> **Invisible laser radiation**
> The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

> **CAUTION**
> **Risk of network reliability**
> Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—c

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

> **CAUTION**
> **Possible risk of damage to equipment and fiber**
> Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.
>
> Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.
>
> Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

> **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes on an APBE, APBE Enhanced or OFA VGA circuit pack. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

—continued—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

> **ATTENTION**
>
> If you have cascading amplifiers, you must make sure that you equalize signals entering the OFAs in the correct order, starting with the transmitting OCLD, OTR or Muxponder, moving toward the receiving OCLD, OTR or Muxponder, and in both directions.

> **ATTENTION**
>
> When using ECTs or PBEs, if the unused bands are not sufficiently attenuated, the ring can become a feedback loop causing signal-to-noise ratios to fall to unacceptable levels. As a result of the additional noise, the LOS (loss of signal) indicator lamp on the OFA circuit pack does not light, even though the traffic-carrying channels are lost.
>
> For bands that are not used, the VOAs should be set to their maximum value so that the noise level in the unused bands is reduced to its minimum value.

Action

Step	Action	
1	Locate the site with the most bands present and choose the direction (clockwise or counterclockwise) to follow to equalize the bands.	
2	Following the optical signal, proceed to the first location with an OFA downstream from the site identified in step 1.	
3	**If**	**Then** go to
	the power control device at the input to the OFA is an APBE or APBE Enhanced	step 8
	there is no power control device at the input to the OFA and the OFA type is OFA VGA	step 4
	the power control device at the input to the OFA is an ECT, Discrete VOA, PBE or Pad	step 45
4	In the Selected Shelves area of the System Manager: • select the shelf that houses the OFA VGA • click on the **Apply** button	
5	In the Optical Metro System Manager window: • click on the **Equipment** tab • click on the **Facilities** tab *The Facilities list appears.*	

—continued—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Step	Action
6	Double-click on the OFA VGA facility.
	The Optical Metro Facility dialog box appears.
7	Go to step 32.
8	In the Selected Shelves area of the System Manager:
	• select the shelf that houses the APBE or APBE Enhanced that precedes the OFA
	• click on the **Apply** button
9	In the Optical Metro System Manager window:
	• click on the **Equipment** tab
	• click on the **Facilities** tab
	The Facilities list appears.
10	From the displayed list, double-click on port 5 of the APBE or APBE Enhanced that precedes the OFA.
	The Optical Metro Facility dialog box appears.
11	In the State area, select IS from the Administrative drop-down list.
12	Click **OK** to apply the provisioning information and close the dialog box.
13	From the displayed list, double-click on the port for the band you need to equalize using the power targets identified by the Network Modeling Tool.
	The Optical Metro Facility dialog box appears.
	Note: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.

14	**If** you are provisioning the eVOAs on a per	**Then** go to
	channel basis	step 15
	band basis	step 19

Step	Action
15	In the eVOA Provision area of the dialog box, select Channel.
16	In the Channel area, select the number of channels present in the band from the Number of Channels drop-down list.
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
17	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Network Modeling Tool.
18	Go to step 21.
19	In the eVOA Provision area, select Band.
20	In the Band Power Target field, enter the per-band power target from the Network Modeling Tool.

—**continued**—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Step	Action
21	In the State area, select IS from the Administrative drop-down list.
22	Click **OK** to apply the provisioning information.
	A confirmation dialog box appears.
23	Click **Yes**.
24	Right-click on the port for the band you need to equalize and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
25	Click on **Equalize**.
	The Power Equalization dialog appears.
	Note: The APBE can take up to two minutes to equalize the optical power after you make a provisioning change.
26	Click on the **Close** button.
27	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
28	Click on the **Close** button.
29	Repeat step 13 to step 28 for all bands.
30	From the displayed list, double-click on the OFA being equalized.
	The Optical Metro Facility dialog box appears.

Step	If	**Then** go to
31	the OFA type is OFA VGA	step 32
	otherwise	step 42

Step	Action
32	In the State area, select IS from the Administrative drop-down list.
33	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
34	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Network Modeling Tool.
35	Click **OK**.
36	Right-click on the OFA VGA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.

—**continued**—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Step	Action
37	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
38	Click on the **Close** button.
39	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
40	Click on the **Close** button.
41	Go to step 78.
42	In the State area, select IS from the Administrative drop-down list.
43	Click **OK**.
44	Go to step 78.
45	Connect the OFA IN fiber to an Optical Spectrum Analyzer (OSA).
46	**If** the power control device at the input to the OFA is **Then** go to

If the power control device at the input to the OFA is	Then go to
a Pad	step 47
NT0H31AD ECT	step 49
Discrete VOA	step 51
PBE	step 54
NT0H31AC, NT0H31AB or NT0H31AC ECT	step 55

Step	Action
47	If necessary, adjust the power level by selecting the appropriate pad value such that the amplifier band average channel power level is within ±1 dB of the target identified by the Network Modeling Tool.
	Note: Refer to "Definition of amplifier band average channel power" on page 2-11 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.
48	Go to step 56.

—**continued**—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Step	Action
49	If necessary, adjust the power level by turning the screw on the VOA that is associated with the amplifier band such that the amplifier band average channel power level equals the target identified by the Network Modeling Tool.

Note 1: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 2: When an NT0H31AD ECT is used, per-band equalization is achieved at upstream OFAs that were equalized with APBE/APBE Enhanced circuit packs, PBEs or the NT0H31AA, NT0H31AB or NT0H31AC ECT type. The NT0H31AD ECT type attenuates all four C-bands using a single C-band VOA and all four L-bands using a single L-band VOA.

Note 3: Refer to "Definition of amplifier band average channel power" on page 2-11 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Step	Action
50	Go to step 56.
51	Open the Discrete VOA drawer in order to get access to the VOAs.
52	If necessary, adjust the power level by turning the screw on the VOA that is associated with the amplifier band such that the amplifier band average channel power level equals the target identified by the Network Modeling Tool.

Note 1: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 2: When a Discrete VOA is used, per-band equalization is achieved at upstream OFAs that were equalized with APBE/APBE Enhanced circuit packs, PBEs or the NT0H31AA, NT0H31AB or NT0H31AC ECT type.

Note 3: Refer to "Definition of amplifier band average channel power" on page 2-11 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Step	Action
53	Go to step 56.
54	Open the PBE drawer in order to get access to the VOAs.

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Step	Action
55	If necessary, adjust the power level of a band by turning the screw on the VOA that is associated with the band such that the per-band average channel power level equals the target identified by the Network Modeling Tool. Repeat this step for each band identified by the Network Modeling Tool.

Note 1: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 2: For bands that are not used, set the attenuation to the maximum value so that the noise level in the unused bands is reduced to its minimum value.

Note 3: Refer to "Types of amplifier configurations" on page 2-12 for the definition of per-band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

56	Disconnect the OFA IN fiber from the OSA and connect it to an Optical Power Meter (OPM). Using an OPM, check the aggregate power level and make sure that it does not exceed the OFA maximum total Rx power, as specified in the "Link engineering components" chapter of *Network Planning and Link Engineering*, 323-1701-110.
57	Disconnect the OFA IN fiber from the OPM and connect it to the OFA IN port.

ATTENTION

To avoid potential non-linearity effects as identified by the Network Modeling Tool, verify that the OFA OUT port is padded to lower the launch power into the fiber, if necessary.

58	Connect the OFA OUT fiber to the OFA OUT port.
59	In the Selected Shelves area of the System Manager:

- select the shelf that houses the OFA being equalized
- click on the **Apply** button

60	In the Optical Metro System Manager window:

- click on the **Equipment** tab
- click on the **Facilities** tab

The Facilities list appears.

61	From the displayed list, double-click on the OFA being equalized.

The Optical Metro Facility dialog box appears.

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Step	Action

62	**If**	**Then** go to
	the OFA type is OFA VGA	step 63
	otherwise	step 73

63	In the State area, select IS from the Administrative drop-down list.	
64	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.	
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.	
65	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Network Modeling Tool.	
66	Click **OK**.	
67	Right-click on the OFA VGA facility and select the **Equalize** menu item.	
	The Component Level Power Equalization screen appears.	
68	Click on **Adjust Power**.	
	The Power Equalization dialog appears.	
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.	
69	Click on the **Close** button.	
70	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.	
71	Click on the **Close** button.	
72	Go to step 75.	
73	In the State area, select IS from the Administrative drop-down list.	
74	Click **OK**.	

75	**If** the power control device at the input to the OFA is	**Then** go to
	ECT or Pad	step 78
	PBE or Discrete VOA	step 76

76	In the PBE or Discrete VOA drawer, make sure that you have lowered all the bulkheads and that the fibers are routed correctly around the fiber management components.	

—**continued**—

Procedure 2-1 (continued)
Equalizing a newly installed amplified system

Step	Action
77	Close the PBE or Discrete VOA drawer.
78	Repeat step 3 to step 77 for all OFAs in the direction of the signal flow at the site.
79	Go to the next site with an OFA in the direction of the signal flow.
80	Repeat step 3 to step 79 for each OFA in the direction of the signal flow until you reach the site marked as the beginning point.
81	Repeat step 1 to step 80 for the opposite direction of the signal flow.

—**end**—

Procedure 2-2
Equalizing a newly installed Extended Metro amplified system

Use this procedure to equalize a newly installed Extended Metro amplified system.

Perform this procedure in both the west and east directions. If the system does not have a true optical seam, the system can require fine-tuning of the optical power after the first pass of equalization is completed.

Requirements

Before you begin this procedure make sure that

- you wear an antistatic wrist strap while performing this procedure

- you are logged into the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- if APBE, APBE Enhanced and OFA VGAs circuit packs are In-Service if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- the equalization prerequisites as shown in Table 2-10 on page 2-25 are met

---

ATTENTION

If the power control device is connected to an OFA in a Pre-amp configuration, validate that the output power of the OFA does not exceed the input power tolerances of the OCLD, OTR or Muxponder circuit packs to which it is connected. For power tolerance information, see *Technical Specifications*, 323-1701-180. You can avoid exceeding the input power tolerances of the OCLD, OTR or Muxponder by placing fixed attenuators at the OMX BAND RX port. See Procedure 3-45 "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX" in *Connection Procedures*, 323-1701-221.

—continued—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Table 2-13 lists the tools and materials required to complete this procedure.

Table 2-13
Tools and materials required

Item	Quantity	Supplied
Antistatic strap	1	no
Optical spectrum analyser (OSA)	1	no
Optical Power Meter (OPM)	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Patch cord with SC-SC connectors	as required	no
Flat-head screwdriver	1	no
An outline schematic of the design indicating the position of amplifiers and regenerators (provided by the Nortel Networks link engineering team)	1	yes
Correct power target values, as output by the Network Networks Custom Equalization Report	-	yes

Precautions

CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of network reliability
Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

CAUTION
Possible risk of damage to equipment and fiber
Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.

Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.

Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

CAUTION
Risk of incorrect backup file
Back up the shelf after provisioning changes on a APBE , APBE Enhanced or OFA VGA circuit pack. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

ATTENTION
If you have cascading amplifiers, you must make sure that you equalize signals entering the OFAs in the correct order, starting with the transmitting OCLD, OTR or Muxponder, moving toward the receiving OCLD, OTR or Muxponder, and in both directions.

—continued—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

> **ATTENTION**
> When using PBEs, if the unused bands are not sufficiently attenuated, the ring can become a feedback loop causing signal-to-noise ratios to fall to unacceptable levels. As a result of the additional noise, the LOS (loss of signal) indicator lamp on the OFA circuit pack does not light, even though the traffic-carrying channels are lost.
>
> For bands that are not used, the VOAs should be set to their maximum value so that the noise level in the unused bands is reduced to its minimum value.

Action

Step	Action	
1	Determine the equalization starting point, direction and order identified in the Nortel Custom Equalization Report.	
2	**If**	**Then** go to
	the power control device at the input to the OFA is an APBE or APBE Enhanced	step 7
	there is no power control device at the input to the OFA and the OFA type is OFA VGA	step 3
	the power control device at the input to the OFA is a Discrete VOA, PBE or Pad	step 54
	there is no OFA at the site	step 95
3	In the Selected Shelves area of the System Manager: • select the shelf that houses the OFA VGA • click on the **Apply** button	
4	In the Optical Metro System Manager window: • click on the **Equipment** tab • click on the **Facilities** tab *The Facilities list appears.*	

—continued—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
5	Double-click on the OFA VGA facility.
	The Optical Metro Facility dialog box appears.
6	Go to step 41.
7	In the Selected Shelves area of the System Manager:
	• select the shelf that houses the APBE or APBE Enhanced, which precedes the OFA
	• click on the **Apply** button
8	In the Optical Metro System Manager window:
	• click on the **Equipment** tab
	• click on the **Facilities** tab
	The Facilities list appears.

9	**If**	**Then** go to
	this is the second equalization run on the same OFA (for systems which do not have a true optical seam)	step 10
	otherwise	step 23

Step	Action
10	From the displayed list, right-click on the port for the band you need to equalize and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
	Note: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.
11	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
12	Click on the **Close** button.
13	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
14	Click on the **Close** button.
15	Repeat step 10 to step 14 for all bands.

16	**If**	**Then** go to
	the OFA type is OFA VGA	step 17
	otherwise	step 93

—**continued**—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
17	From the displayed list, right-click on the OFA VGA facility being equalized and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
18	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
19	Click on the **Close** button.
20	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
21	Click on the **Close** button.
22	Go to step 93.
23	From the displayed list, double-click on port 5 of the APBE or APBE Enhanced that precedes the OFA.
	The Optical Metro Facility dialog box appears.
24	In the State area, select IS from the Administrative drop-down list.
25	Click **OK** to apply the provisioning information and close the dialog box.
26	From the displayed list, double-click on the port for the band you need to equalize using the power targets identified by the Nortel Custom Equalization Report.
	The Optical Metro Facility dialog box appears.
	Note: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.
27	In the eVOA Provision area of the dialog box, select Channel.
28	In the Channel area, select the number of channels present in the band from the Number of Channels drop-down list.
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
29	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Nortel Custom Equalization Report.
30	In the State area, select IS from the Administrative drop-down list.
31	Click **OK** to apply the provisioning information.
	A confirmation dialog box appears.
32	Click **Yes**.

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
33	Right-click on the port for the band you need to equalize and select the **Equalize** menu item. *The Component Level Power Equalization screen appears.*
34	Click on **Adjust Power**. *The Power Equalization dialog appears.* ***Note:*** The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
35	Click on the **Close** button.
36	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
37	Click on the **Close** button. ***Note:*** If the system does not have a true optical seam, it is possible that the signals of certain bands have not passed through an equalizer yet. As a result, the target power of those bands are not available during the first equalization run. If this situation applies, a note appears in the Nortel Custom Equalization Report.
38	Repeat step 26 to step 37 for all bands.
39	From the displayed list, double-click on the OFA being equalized. *The Optical Metro Facility dialog box appears.*

40	**If**	**Then** go to
	the OFA type is OFA VGA	step 41
	otherwise	step 51

Step	Action
41	In the State area, select IS from the Administrative drop-down list.
42	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list. ***Note:*** Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
43	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Nortel Custom Equalization Report.
44	Click **OK**.
45	Right-click on the OFA VGA facility and select the **Equalize** menu item. *The Component Level Power Equalization screen appears.*

—**continued**—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
46	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
47	Click on the **Close** button.
48	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
49	Click on the **Close** button.
50	Go to step 93.
51	In the State area, select IS from the Administrative drop-down list.
52	Click **OK**.
53	Go to step 93.
54	Connect the OFA IN fiber to an Optical Spectrum Analyzer (OSA).

55

If the power control device at the input to the OFA is	**Then** go to
a Pad	step 56
Discrete VOA	step 58
PBE	step 61

56 If necessary, adjust the power level by selecting the appropriate pad value such that the amplifier band average channel power level is within ±1 dB of the target identified in the Nortel Custom Equalization Report.

Note 1: Refer to "Definition of amplifier band average channel power" on page 2-11 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Note 2: If the system does not have a true optical seam, it is possible that the signals of certain bands have not passed through an equalizer yet. As a result, the power of those bands are not available during the first equalization run. If this situation applies, a note appears in the Nortel Custom Equalization Report. In this case, calculate the amplifier band average channel power based on the channels visible on the OSA.

57 Go to step 63.

—**continued**—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
58	Open the Discrete VOA drawer in order to get access to the VOAs.
59	If necessary, adjust the power level by turning the screw on the VOA that is associated with the amplifier band such that the amplifier band average channel power level equals the target identified in the Nortel Custom Equalization Report.

Note 1: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 2: When a Discrete VOA is used, per-band equalization is achieved at upstream OFAs that were equalized with APBE or APBE Enhanced circuit packs or PBEs.

Note 3: Refer to "Definition of amplifier band average channel power" on page 2-11 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Note 4: If the system does not have a true optical seam, it is possible that the signals of certain bands have not passed through an equalizer yet. As a result, the power of those bands are not available during the first equalization run. If this situation applies, a note appears in the Nortel Custom Equalization Report. In this case, calculate the amplifier band average channel power based on the channels visible on the OSA.

Step	Action
60	Go to step 63.
61	Open the PBE drawer in order to get access to the VOAs.
62	If necessary, adjust the power level of a band by turning the screw on the VOA that is associated with the band such that the per-band average channel power level equals the target identified in the Nortel Custom Equalization Report. Repeat this for each band identified in the Nortel Custom Equalization Report.

Note 1: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 2: For bands that are not used, set the attenuation to the maximum value so that the noise level in the unused bands is reduced to its minimum value.

Note 3: Refer to "Definition of per-band average channel power" on page 2-10 for the definition of per-band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Note 4: If the system does not have a true optical seam, it is possible that the signals of certain bands have not passed through an equalizer yet. As a result, the target power of those bands are not available during the first equalization run. If this situation applies, a note appears in the Nortel Custom Equalization Report.

—continued—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
63	Disconnect the OFA IN fiber from the OSA and connect it to the OFA IN port.

64	If	**Then** go to
	this is the second equalization run on the same OFA (for systems that do not have a true optical seam)	step 82
	otherwise	step 65

65	In the Selected Shelves area of the System Manager:

- select the shelf that houses the OFA being equalized

- click on the **Apply** button

66	In the Optical Metro System Manager window:

- click on the **Equipment** tab

- click on the **Facilities** tab

The Facilities list appears.

67	From the displayed list, double-click on the OFA facility being equalized.

The Optical Metro Facility dialog box appears.

68	If	**Then** go to
	the OFA type is OFA VGA	step 69
	otherwise	step 79

69	In the State area, select IS from the Administrative drop-down list.
70	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.

Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.

71	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Nortel Custom Equalization Report.
72	Click **OK**.
73	Right-click on the OFA VGA facility and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

74	Click on **Adjust Power**.

The Power Equalization dialog appears.

Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.

—**continued**—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
75	Click on the **Close** button.
76	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
77	Click on the **Close** button.
78	Go to step 80.
79	In the State area, select IS from the Administrative drop-down list.
80	Click **OK**.
81	Connect the OFA OUT fiber to the OFA OUT port.

82   **If** the power control device at the input to the OFA is a   **Then** go to

Pad	step 93
PBE or Discrete VOA	step 83

83   In the PBE or Discrete VOA drawer, make sure that you have lowered all the bulkheads and that the fibers are routed correctly around the fiber management components.

84   Close the PBE or Discrete VOA drawer.

85   **If**   **Then** go to

the OFA type is OFA VGA	step 86
otherwise	step 93

86   In the Selected Shelves area of the System Manager:

- select the shelf that houses the OFA being equalized
- click on the **Apply** button

87   In the Optical Metro System Manager window:

- click on the **Equipment** tab
- click on the **Facilities** tab

The Facilities list appears.

88   From the displayed list, right-click on the OFA VGA facility being equalized and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

—continued—

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
89	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
90	Click on the **Close** button.
91	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
92	Click on the **Close** button.
93	Repeat step 2 to step 92 for all OFAs in the direction identified in step 1 at the site.

94	**If**	**Then** go to
	you are at a line amplifier site	step 96
	otherwise	step 95

95	Verify that the per-band average channel power at each OMX meets the following requirements:

- The per-band average channel power at each OMX is within -15 to -17 dBm. If necessary, add a fixed attenuator pad or replace the existing fixed attenuator pad at the OMX BAND RX port such that the requirement is met

- if the preceding requirement cannot be met because the power levels are too weak, the channel power level at each OCLD, OTR or Muxponder circuit pack Rx port must be greater than or equal to the "Power required at Rx" value included in the Nortel Custom Equalization Report.

Note 1: If this site is the starting point for equalization in a ring topology, do not perform this step until you equalize around the ring and return to this site.

Note 2: If the system does not have a true optical seam, it may be necessary to perform two equalization runs around a ring. If this situation applies, a note appears in the Nortel Custom Equalization Report. If two equalization runs are necessary, perform this step during the second equalization run.

Note 3: You can measure the power level at the OCLD, OTR or Muxponder circuit pack Rx port using either an Optical Power Meter or the System Manager Equipment/Facilities screen.

Note 4: Refer to "Definition of per-band average channel power" on page 2-10 for the definition of per-band average channel power.

Procedure 2-2 (continued)
Equalizing a newly installed Extended Metro amplified system

Step	Action
96	Go to the next site in the order identified in step 1.
97	Repeat step 2 to step 96 until you reach the site marked as the starting point.
	Note: If the system does not have a true optical seam, a second equalization run may be necessary. If this situation applies, a note appears in the Nortel Custom Equalization Report. If a second equalization run is necessary, repeat step 2 to step 97.
98	Repeat step 1 to step 97 for the opposite direction of the signal flow.

—end—

Procedure 2-3
Equalizing a newly installed amplified system or Extended Metro system using SLEC

Use this procedure to equalize a newly installed amplified system or Extended Metro system using System Level Equalization Controller (SLEC). This procedure is performed on each system using the same OSID.

Note: For SLEC troubleshooting procedures, refer to the Trouble Clearing and Alarm Reference guide, 323-1701-542.

Requirements

Before you begin this procedure make sure that

- you are logged in to the System Manager as an Admin level user
- you know the OSID of the system to equalize
- the SLEC deployment rules as described in Table 2-2 on page 2-8 are met
- the equalization prerequisites as described in Table 2-14 on page 2-51 are met

Table 2-14
Prerequisites for equalizing an amplified system using SLEC

Prerequisite #	Description
1	a) Ensure that the system passes when run on the Network Modeling Tool.
	b) From NMT, obtain the target per-band average channel power for each port of all APBE or APBE Enhanced circuit packs and all OFA VGA circuit packs in your system as well as information with respect to fixed attenuator pads required in the system.
	c) If this is an Extended Metro system, obtain the Nortel Custom Equalization Report.
	d) Determine the fixed attenuator pads required for the OSC (see OSC link engineering in *Network Planning and Link Engineering*, 323-1701-310).
	e) If the system is a linear system, you must obtain the following information from your network planning group:
	• the two end-point nodes of the linear system
	• for each end-point node which direction is the connected direction
	• for each end-point node the shelf name of the shelf equipped with the OSC circuit pack
	f) For each shelf, you must obtain the following information from your network planning group:
	• OSID for each of the following equipment: OCLD, OTR, Muxponder, OSC, OFA, APBE, APBE Enhanced, OMX
	• Directional and Location for each APBE, APBE Enhanced and OFA circuit pack
	• APBE associated equipment attributes for each APBE or APBE Enhanced circuit pack. The associated equipment attributes are the equipment and equipment type that the APBE or APBE Enhanced connects to. Possible values are OFA (with OFA types of Standard, High Input Power and Variable Gain) and DSCM (with DSCM type of 1).
2	Install Optical Metro 5200 Shelves and Components (see *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201)
3	Commission Optical Metro 5200 Shelves (see *Commissioning Procedures*, 323-1701-220)

Table 2-14 (continued)
Prerequisites for equalizing an amplified system using SLEC

Prerequisite #	Description
4	Provision parameters as follows: a) For each shelf at the site: • Provision the Location and Direction for each OFA, APBE and APBE Enhanced circuit pack. Use the values obtained in prerequisite #1. See — Procedure 3-34 "Provisioning OFA direction and location" in *Provisioning and Operating Procedures*, 323-1701-310 — Procedure 3-35 "Provisioning APBE direction, location, and associated equipment" in *Provisioning and Operating Procedures*, 323-1701-310 • Provision the target per-band average channel power for each OFA VGA circuit pack and for each APBE or APBE Enhanced circuit pack. Use the power targets obtained in prerequisite #1. See — Procedure 2-14 "Provisioning target power on the APBE or APBE Enhanced circuit pack when using SLEC" and Procedure 2-15 "Provisioning target power on the OFA VGA circuit pack when using SLEC" in this NTP • Provision the OSID for each of the following equipment: OCLD, OTR, Muxponder, OSC, OFA, APBE or APBE Enhanced, OMX. Use the values obtained in prerequisite #1. See — Procedure 3-36 "Provisioning the optical system identifier (OSID)"in *Provisioning and Operating Procedures*, 323-1701-310 • Provision Automatic Laser Shutdown (ALS) to be disabled (if the shelf contains only OFA or APBE or APBE Enhanced equipment, this step can be skipped). See — Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures*, 323-1701-310 b) If this site is the end-point node of a linear system, provision the connected direction. See — Procedure 2-16 "Provisioning the connected direction at the end-point nodes of a linear system" in this NTP c) The default values for the Ethernet Port 2 IP address and Ethernet Port 2 mask must be used. At multi-shelf sites, all shelves at the site must have the same Ethernet Port 2 access control (None, Filter or Encrypt) provisioned and Ethernet Port 2 must be enabled. It is recommended to also enable Ethernet Port 2 alarming for easier troubleshooting when errors are reported. See — Procedure 1-25 "Provisioning Ethernet port alarms", Procedure 1-26 "Provisioning Ethernet and serial ports" and Procedure 1-27 "Provisioning Ethernet port 2 access control" in *Provisioning and Operating Procedures*, 323-1701-310

Table 2-14 (continued)
Prerequisites for equalizing an amplified system using SLEC

Prerequisite #	Description
5	Connect the optical components (see *Connection Procedures*, 323-1701-221)
6	Perform Shelf and Site testing procedures. See the following procedures in this document: — Procedure 1-1 "Testing the shelf lamps" — Procedure 1-2 "Testing an Optical Metro 5100/5200 WDM OMX" — Procedure 1-3 "Testing the optical continuity through the OMXs at a site" — Procedure 1-4 "Testing the optical continuity through the OMXs at an OADM site that uses single-shelf wiring"
7	Install fixed attenuator pads as described in the NMT report or the Nortel Custom Equalization Report. Do not install the fixed attenuator pads at the OMX BAND RX ports. (You install the fixed attenuator pads in a subsequent step.) Install fixed attenuator pads for the OSC as determined in prerequisite #1 (see *Connection Procedures*, 323-1701-221).
8	If the site has OMXs: • Unseat from the shelf or shelves all West OCLD, OTR or Muxponder circuit packs except for the first channel in each band. • Unseat from the shelf or shelves all East OCLD, OTR or Muxponder circuit packs except for the first channel in each band. • For each West OMX, disconnect the patch cord connected to the first Channel Drop port (this corresponds to the channel of the seated West OCLD, OTR or Muxponder circuit packs). • For each East OMX, disconnect the patch cord connected to the first Channel Drop port (this corresponds to the channel of the seated East OCLD, OTR or Muxponder circuit packs).
9	Connect the OSC to the backbone (see *Connection Procedures*, Part 2, 323-1701-221)
10	Repeat prerequisite 1 to prerequisite 9 at all sites in the system.

—**continued**—

Procedure 2-3 (continued)
Equalizing a newly installed amplified system or Extended Metro system using SLEC

Table 2-15 lists the tools and materials required to complete this procedure.

Table 2-15
Tools and materials required to complete this procedure

Item	Quantity	Supplied
Antistatic strap	1	no
Optical power meter	1	no
Fiber inspection scope	1	no
Patch cord SC-SC connectors	as required	no

Precautions

CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of network reliability
Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—

Procedure 2-3 (continued)
Equalizing a newly installed amplified system or Extended Metro system using SLEC

> ⚠ **CAUTION**
> **Possible risk of damage to equipment and fiber**
> Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.
>
> Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.
>
> Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

Action

Step	Action
1	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item.
	The Optical Metro System Level Equalization Control window opens.
2	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu.
	A list of Site Ids that belong to the specified OSID is displayed.
3	Click on **Equalize System.**
	A SLEC information window opens.

—continued—

Procedure 2-3 (continued)
Equalizing a newly installed amplified system or Extended Metro system using SLEC

4   Click on **Close**.

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA and APBE/APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE/APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase
- Eastbound site-level validation phase
- Eastbound phase 1 equalization phase
- Eastbound phase 2 equalization phase
- Westbound site-level validation phase
- Westbound phase 1 equalization phase
- Westbound phase 2 equalaization phase

5   At a site that has OMXs, measure the power at the first Channel Drop port of a West OMX using an Optical Power Meter (OPM).

If the measured power level is	**Then** go to
less than or equal to –15 dBm	step 8
higher than –15 dBm	step 6

6   Choose a fixed attenuator such that the power level is between –15 dBm and –17 dBm.

7   Connect the fixed attenuator to the OMX Band Drop port. Refer to Procedure 3-45 "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX" in *Connection Procedures*, 323-1701-221.

8   Identify the patch cord that connects to the Line Rx port of the first channel West OCLD, OTR or Muxponder circuit pack. Connect the patch cord to the first Channel Drop port.

9   Repeat step 5 to step 8 for each West OMX and then for each East OMX.

10   Insert in the shelf or shelves all West OCLD, OTR or Muxponder circuit packs of the other channels of each band. Make sure that all circuit packs have their Line Tx and Line Rx patch cords connected.

—**continued**—

Procedure 2-3 (continued)
Equalizing a newly installed amplified system or Extended Metro system using SLEC

Step	Action
11	Insert in the shelf or shelves all East OCLD, OTR or Muxponder circuit packs of the other channels of each band. Make sure that all circuit packs have their Line Tx and Line Rx patch cords connected.
12	Repeat step 5 to step 11 at all sites in the system that have OMXs.
13	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item.
	The Optical Metro System Level Equalization Control window opens.
14	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu.
	A list of Site IDs that belong to the specified OSID is displayed.
15	Click on **Equalize System.**
	A SLEC information window opens.
16	Click on **Close**.

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA and APBE/APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE/APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase
- Eastbound site-level validation phase
- Eastbound phase 1 equalization phase
- Eastbound phase 2 equalization phase
- Westbound site-level validation phase
- Westbound phase 1 equalization phase
- Westbound phase 2 equalization phase

—**continued**—

Procedure 2-3 (continued)
Equalizing a newly installed amplified system or Extended Metro system using SLEC

Step	Action
17	If required turn on ALS. Refer to Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures*, 323-1701-310.

18	**If**	**Then**
	you would like to start continuous SLEC	go to step 19
	otherwise	you have completed this procedure

19	Click on **Continuously Equalize System.**
	A SLEC information window opens.

20	Click on **Close**.
	SLEC is equalizing the network.

<div align="center">—end—</div>

Procedure 2-4
Equalizing a newly installed amplified system that uses distributed equalization

Use this procedure to equalize a newly amplified systems that use distributed equalization.

This procedure must be performed in both the west and east directions. If the system does not have a true optical seam, the system can require fine-tuning of the optical power after the first pass of equalization is completed.

Requirements

Before you begin this procedure make sure that the equalization prerequisites as described in Table 2-2 on page 2-8 are met. You must wear an antistatic wrist strap while performing this procedure.

You must know the definition of pass-through and add bands. Figure 2-2 shows an example of pass-through and add bands.

Figure 2-2
Pass-through bands and add bands at the input to an OFA

OM1265p
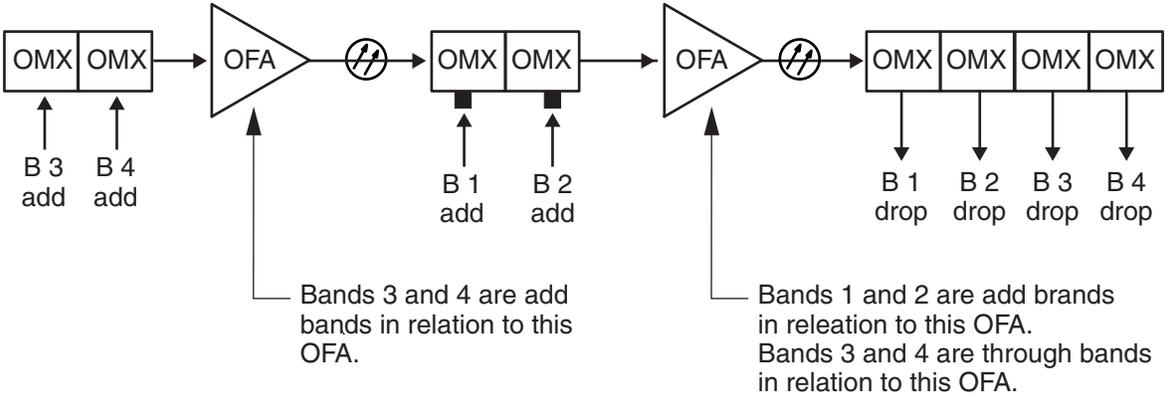
| OMX | OMX | → | OFA | // | OMX | OMX | → | OFA | // | OMX | OMX | OMX | OMX |

B 3
add

B 4
add

B 1
add

B 2
add

B 1
drop

B 2
drop

B 3
drop

B 4
drop

Bands 3 and 4 are add bands in relation to this OFA.

Bands 1 and 2 are add brands in releation to this OFA.
Bands 3 and 4 are through bands in relation to this OFA.

ATTENTION
Before you equalize power, you must turn off the automatic laser shutdown (ALS) on the shelves that contain the OCLD, OTR or Muxponder at the originating and terminating sites.

—continued—

Procedure 2-4 (continued)
Equalizing a newly installed amplified system that uses distributed equalization

Table 2-16 lists the tools and materials required to complete this procedure.

Table 2-16
Tools and materials required

Item	Quantity	Supplied
Antistatic strap	1	no
Optical spectrum analyser (OSA)	1	no
Optical Power Meter (OPM)	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Patch cord with SC-SC connectors	as required	no
Network diagram	1	no
Correct power target values when all margins are reduced to 0 dB output from the NMT Network Power Report and the NMT Network Equalization Report	-	-

Precautions

CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of affecting network reliability
Fiber connectors should always be cleaned prior to making connections to ensure network reliability.

—continued—

Procedure 2-4 (continued)
Equalizing a newly installed amplified system that uses distributed equalization

CAUTION
Possible risk of damage to equipment and fiber
Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.

Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.

Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

ATTENTION
If you have cascading amplifiers, you must make sure that you equalize signals entering the OFAs in the correct order, starting with the transmitting OCLD, OTR or Muxponder, moving toward the receiving OCLD, OTR or Muxponder, and in both directions.

Action

Step	Action
1	**If** the system / **Then** go to
	does not have a true optical seam site — step 4
	has a true optical seam site — step 2
2	Start at the true optical seam site and choose the direction (clockwise or counterclockwise) to follow to equalize the bands.
3	Go to step 5.
4	Start at the site with the most bands present in the C-band or L-band and choose the direction (clockwise or counterclockwise) to follow to equalize the bands.
	Note: Prefer a site with 4 C-bands and 0 L-bands to a site with 3 C-bands and 3 L-bands.
5	Connect the C-band (or L-band) OFA input fiber to an Optical Spectrum Analyzer (OSA).

—**continued**—

Procedure 2-4 (continued)
Equalizing a newly installed amplified system that uses distributed equalization

Step	Action
6	Identify the band with the lowest per-band average channel power.

Note 1: Refer to "Types of amplifier configurations" on page 2-12 for the definition of per-band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Note 2: Pass-through bands are considered as a single band.

7 If necessary, adjust the power level by adding a pad between the fiber and the OSA such that the power for each channel in the band is slightly above the NMT power values.

Note 1: Due to the pad value granularity, a 2 dB difference is acceptable as long as the power for each channel in the band is slightly above the NMT power values.

Note 2: If it is impossible to reach the NMT power values, make sure that the problem is not as a result of the fact that the system does not have a true optical seam and that you have not yet equalized an upstream amplifier. If this is the case, take no action.

8	**If** the band identified in step 6 is	**Then** go to
	not a pass-through band	step 12
	a pass-through band	step 9

Note: Pass-through bands are considered as a single band.

9 Identify all other bands, if any, that are not a pass-through band.

Note: Pass-through bands are considered as a single band.

10 If necessary, for each band identified in step 9, adjust the power level for each channel in the band by adding a pad at the band's OMX add port such that the power for each channel in the band is slightly above the NMT power values.

Note 1: Follow the procedure "Installing an attenuator at the BAND ADD port in a DWDM OMX" on page 3-309 of *Connection Procedures*, 323-1701-221, for adding a pad at the OMX add port.

Note 2: Due to the pad value granularity, a 2 dB difference is acceptable as long as the power for each channel in the band is slightly above the NMT power values.

Note 3: If it is impossible to reach the NMT power values, try to move the pad that was added in step 7 to the output of the upstream amplifier. If a pad is already present at the output of the upstream amplifier, increase the value of this pad. Go to step 9.

—**continued**—

Procedure 2-4 (continued)
Equalizing a newly installed amplified system that uses distributed equalization

Step	Action
11	Go to step 16.
12	Identify all other added bands, if any.
13	If necessary, for each band identified in step 12, adjust the power level for each channel in the band by adding a pad at the band's OMX add port such that the power for each channel in the band is slightly above the NMT power values.
	Note 1: Follow the procedure "Installing an attenuator at the BAND ADD port in a DWDM OMX" on page 3-309 of *Connection Procedures*, 323-1701-221, for adding a pad at the OMX add port.
	Note 2: Due to the pad value granularity, a 2 dB difference is acceptable as long as the power for each channel in the band is slightly above the NMT power values.
	Note 3: If it is impossible to reach the NMT power values, try to move the pad that was added in step 7 to the add port of the appropriate OMX. Go to step 12.
14	Identify the pass-through band, if any.
	Note: Pass-through bands are considered as a single band.
15	If necessary, adjust the power level of the band by adding a pad at the output of the upstream amplifier or if a pad is already present at the output of the upstream amplifier, increase the pad value such that the power for each channel in the band is slightly above the NMT power values.
	Note 1: Due to the pad value granularity, a 2 dB difference is acceptable as long as the power for each channel in the band is slightly above the NMT power values.
	Note 2: If it is impossible to reach the NMT power value, make sure that the problem is not as a result of the fact that the system does not have a true optical seam and that you have not yet equalized an upstream amplifier. If this is the case, take not action.
	Note 3: If it is impossible to reach the NMT power values, try to move the pad that was added in step 7 to the add port of the appropriate OMX. Go to step 12.
16	Disconnect the OFA input fiber (and the pad, if any) from the OSA and connect the fiber (and the pad, if any) to an Optical Power Meter (OPM). Using an OPM, check the aggregate power level.

—**continued**—

Procedure 2-4 (continued)
Equalizing a newly installed amplified system that uses distributed equalization

Step	Action
17	Compare the measured aggregate power to the NMT aggregate input power value. Due to pad value granularity, a 2 dB difference is acceptable. If the aggregate power measured is outside the 2 dB difference, increase/decrease the pad value such that the measured aggregate power is in the 2 dB range.
	Note: If it is impossible to reach the NMT power value, make sure that the problem is not as a result of the fact that the system does not have a true optical seam and that you have not yet equalized an upstream amplifier. If this is the case, take no action.
18	Verify that the measured aggregate power does not exceed the OFA maximum total Rx power, as specified in the "Link engineering components"chapter of *Network Planning and Link Engineering*, 323-1701-110. If the power is too high, increase the pad value until it does not exceed the OFA maximum total Rx power.
19	Disconnect the OFA input fiber (and the pad, if any) from the OPM and connect it to the OSA.
20	For each band, verify that the per-band average channel power is above the NMT power values.
	Note: If it is impossible to reach the NMT power values, make sure that the problem is not as a result of the fact that the system does not have a true optical seam and that you have not yet equalized an upstream amplifier. If this is the case, take not action.
21	Disconnect the OFA input fiber (and the pad, if any) from the OSA and connect it to the OFA IN port.
22	Put the pad value prescribed by NMT at the OFA OUT port. Follow the procedure "Installing an attenuator at the output of an OFA circuit pack" on page 3-330 in *Connection Procedures,* 323-1701-221.
23	In the Selected Shelves area of the System Manager: • select the shelf that houses the OFA being equalized • click on the **Apply** button
24	In the Optical Metro System Manager window: • click on the **Equipment** tab • click on the **Facilities** tab *The Facilities list appears.*
25	From the displayed list, select the OFA being equalized.
26	Double-click on the facility. *The Optical Metro Facility dialog box appears.*

—continued—

Procedure 2-4 (continued)
Equalizing a newly installed amplified system that uses distributed equalization

Step	Action
27	In the State area, select IS from the Administrative drop-down list.
28	Click **OK**.
29	Connect the OFA output fiber to the OFA OUT port.
30	Repeat step 5 to step 29 for the L-band (or C-band) OFA.
31	Go to the next site with an OFA in the direction of the signal flow.
32	Repeat step 5 to step 31 for each OFA in the direction of the signal flow until you reach the site marked as the beginning point.
33	Repeat step 1 to step 32 for the opposite direction of the signal flow.

—**end**—

Procedure 2-5
Re-equalizing an amplified system

Use this procedure to re-equalize an amplified system after an optical component is replaced, when adding a new channel, when adding a new band or when removing a channel.

Adding a new channel means a new channel is added to an existing band. The existing band is equipped with at least one existing channel. If the existing band does not have at least one existing channel, then the following case (i.e. Adding a new band applies).

Adding a new band means a new channel is added to an existing empty channel band. An existing band implies that the OMX for the band is already installed and fibered into the network. This would be the case if the OMX was installed during initial system installation taking into account a future channel count upgrade. If the OMX of the new band is not already installed and fibered in the network, contact Nortel Networks for assistance on how to add OMXs to an existing network.

> *Note:* You cannot add or remove multiple channels using this procedure. If you need to add or remove multiple channels, you must perform this procedure for each channel addition or removal.

This procedure may affect existing traffic. This depends on the strategy used to equalize and control the power in the system.

- If ECTs, PBEs or Discrete VOAs are used to control the power at the input to an OFA, it is possible to read the power using the input tap of the High Input Power OFA and make adjustments to the power without having to disconnect traffic carrying fiber. However, since adjusting the power on these devices is a manual operation (by turning the VOA screw), under attenuating the power can create an OFA overload alarm and over attenuating the power can trigger an OSNR hit or an OFA Rx Loss of signal alarm. Also, when these power control devices are used along with the Standard OFA, service is interrupted during the re-equalization procedure since this OFA type does not have an input tap.

- If PBEs are used to control the power at the input to an OFA VGA, it is possible to read the power using the input tap of the OFA VGA and make adjustments to the power without having to disconnect traffic carrying fiber. However, since adjusting the power on these devices is a manual operation (by turning the VOA screw), under attenuating the power can create an OFA overload alarm and over attenuating the power can trigger an OSNR hit or an OFA Rx Loss of signal alarm.

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

- If ECTs or PBEs are used to control the power at the input to an OFA and you are adding a new channel to an existing band that does not have any existing channels, there is a possibility of exceeding the OFA Rx power high fail threshold value. This will cause an outage if the ECT or PBE attenuator for that band is not at its maximum attenuation.

- If a fixed attenuator is used to control the power at the input to an OFA, it is not possible to guarantee that you will not be required to change the value of the attenuator following a channel addition or hardware replacement. Similarly, if no power control device is present at the input to the amplifier, a fixed attenuator may be required. Since disconnecting the OFA fiber is required to change or add an attenuator, existing traffic will be affected.

- Using APBE or APBE Enhanced circuit packs to control the power at the input to an OFA or using the OFA VGA allows the power to be adjusted without triggering OFA alarms or affecting existing traffic.

To reduce the impact on existing traffic, you can switch protected traffic away from the span being re-equalized. See Procedure 4-7 "Switching traffic off a span in a path-protected network" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Requirements

ATTENTION
Before you equalize power, you must turn off the automatic laser shutdown (ALS) on the shelves that contain the OCLD, OTR or Muxponder at the originating and terminating sites.

Follow the following requirements listed depending on the reason why you are re-equalizing.

Case 1: Optical component replacement

- You must wear an antistatic wrist strap while performing this procedure

- You must be logged in to the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- The APBE, APBE Enhanced and OFA VGA circuit packs must be In-Service if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Case 2: Adding a new channel
- You must wear an antistatic wrist strap while performing this procedure

- You must be logged in to the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- The APBE, APBE Enhanced and OFA VGA circuit packs must be In-Service if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- The fiber connections between the new OCLD, OTR, or Muxponder and the OMXs have been made before inserting the circuit pack. Do not make the fiber connections while the circuit pack is installed in the shelf otherwise you can impact the existing channels. When an OCLD, OTR or Muxponder circuit pack is inserted, its output power is gradually brought to its final power level. This reduces the amount of transient power at the downstream OFA.

Case 3: Adding a new band
- You must wear an antistatic wrist strap while performing this procedure

- If APBE or APBE Enhanced circuit packs are used as power control devices,

    — you must be logged in to the System Manager as an Admin level user and the APBE or APBE Enhanced circuit packs must be In-Service.

    — the APBE or APBE Enhanced band port you want to add the new channel to is In-Service.

- If OFA VGAs are used as power control devices, you must be logged in to the System Manager as an Admin level user and the OFA VGA circuit pack must be In-Service.

- The fiber connections between the new OCLD, OTR, or Muxponder and the OMXs have been made before inserting the circuit pack. Do not make the fiber connections while the circuit pack is installed in the shelf otherwise you can impact the existing channels. When an OCLD, OTR or Muxponder circuit pack is inserted, its output power is gradually brought to its final power level. This reduces the amount of transient power at the downstream OFA.

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Note: If ECTs or PBEs are used as the per-band power control device, before you insert the OCLDs, OTRs or Muxponders you must ensure you disconnect the fiber at the BAND RX port (this port is labeled BAND DROP if the OMX type is OMX [Standard]) of the OMXs of the new band. This prevents OCLD, OTR or Muxponder receiver damage. This fiber will be reconnected during the procedure. This note does not apply if APBE or APBE Enhanced circuit packs are used as the per-band power control device.

Case 4: Removing a channel

- You must wear an antistatic wrist strap while performing this procedure

- You must be logged in to the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- The fiber connected to the OCLD Tx port, OTR Line-side Tx port or Muxponder Line-side Tx port is disconnected before removing the OCLD, OTR or Muxponder from the shelf. The circuit pack continues to transmit a signal as long as it is seated in the shelf. If you do not disconnect the fiber from the circuit pack before unseating the circuit pack, you can impact the existing channels.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Table 2-17 lists the tools and materials required to complete this procedure if any OFA in the system uses one of the following power control devices: ECT, Discrete VOA, PBE or Pad.

Table 2-17
Tools and materials required when an ECT, Discrete VOA, PBE or Pad are used to control power into an OFA

Item	Quantity	Supplied
Antistatic strap	1	no
Optical spectrum analyser (OSA)	1	no
Optical Power Meter (OPM)	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Patch cord with SC-SC connectors	as required	no
Patch cord with SC-LC connectors	as required	no
Flat-head screwdriver	1	no
Network diagram	1	no
Correct power target values, as output by the Network Modeling Tool	-	-

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Table 2-18 lists the tools and materials required to complete this procedure if each OFA uses an APBE or APBE Enhanced as the power control device or the OFA is an OFA VGA. That is, the system does not use an ECT, Discrete VOA, PBE or Pad to control power into an OFA.

Table 2-18
Tools and materials required when an ECT, Discrete VOA, PBE or Pad are not used to control power into an OFA

Item	Quantity	Supplied
Network diagram	1	no
Correct power target values, as output by the Network Modeling Tool	-	-

Precautions

Channels must be added/removed one channel at a time.

	CAUTION
	Invisible laser radiation
	The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

	CAUTION
	Risk of network reliability
	Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

> **CAUTION**
> **Possible risk of damage to equipment and fiber**
> Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.
>
> Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.
>
> Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

> **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes on an APBE, APBE Enhanced or OFA VGA circuit pack. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

> **ATTENTION**
> If you have cascading amplifiers, you must make sure that you equalize signals entering the OFAs in the correct order, starting with the transmitting OCLD, OTR or Muxponder, moving toward the receiving OCLD, OTR or Muxponder, and in both directions.

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

> **ATTENTION**
>
> When using ECTs or PBEs, if the unused bands are not sufficiently attenuated, the ring can become a feedback loop causing signal-to-noise ratios to fall to unacceptable levels. As a result of the additional noise, the LOS (loss of signal) indicator lamp on the OFA circuit pack does not light, even though the traffic-carrying channels are lost.
>
> For bands that are not used, the VOAs should be set to their maximum value so that the noise level in the unused bands is reduced to its minimum value.

Action

Step	Action
1	Determine the equalization starting and ending point, direction and order.

Note 1: If you are re-equalizing because you are adding or removing a channel in a ring topology and there is no site where all bands in the system are added/dropped, the starting point is the add side of one of the sites where the channel is being added or removed. Go around the ring once and then repeat the equalization for the first amplifier that was equalized (so the first amplifier is equalized twice and the rest are equalized once).

Note 2: If you are re-equalizing because you are adding or removing a channel in a ring topology and there is at least one site where all bands in the system are added/dropped, start on the add side of one of these sites and go around the ring once ending at the drop side of the starting site.

Note 3: If you are re-equalizing because you have changed a component, the starting point is at the component that has been replaced, or the first applicable place downstream from it. You can stop once the first OFA that has an ECT, PBE or an APBE or APBE Enhanced has been equalized.

Step	If	Then go to
2	the power control device at the input to the OFA is an APBE or APBE Enhanced	step 22
	there is no power control device at the input to the OFA and the OFA type is OFA VGA	step 3
	the power control device at the input to the OFA is an ECT, Discrete VOA, PBE or Pad	step 72
	there is no OFA at the site or no power control device at the input to an OFA	step 114

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
3	In the Selected Shelves area of the System Manager:
	• select the shelf that houses the OFA VGA
	• click on the **Apply** button
4	In the Optical Metro System Manager window:
	• click on the **Equipment** tab
	• click on the **Facilities** tab
	The Facilities list appears.

5	**If**	**Then** go to
	you are re-equalizing since you are adding or removing a channel	step 12
	otherwise	step 6

Step	Action
6	From the displayed list, right-click on the OFA VGA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
7	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
8	Click on the **Close** button.
9	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
10	Click on the **Close** button.
11	Go to step 113.
12	From the displayed list, double-click on the OFA VGA facility.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
13	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
14	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Network Modeling Tool.
15	Click **OK**.
16	Right-click on the OFA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
17	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
18	Click on the **Close** button.
19	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
20	Click on the **Close** button.
21	Go to step 113.
22	In the Selected Shelves area of the System Manager:
	• select the shelf that houses the APBE or APBE Enhanced that precedes the OFA
	• click on the **Apply** button
23	In the Optical Metro System Manager window:
	• click on the **Equipment** tab
	• click on the **Facilities** tab
	The Facilities list appears.

24	**If**	**Then** go to
	you are re-equalizing since you are adding or removing a channel	step 38
	otherwise	step 25

25	From the displayed list, right-click on the port for the band you must equalize and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
	Note: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
26	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
27	Click on the **Close** button.
28	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
29	Click on the **Close** button.
30	Repeat step 25 to step 29 for all bands.

31	**If**	**Then** go to
	the APBE or APBE Enhanced precedes an OFA VGA	step 32
	otherwise	step 113

Step	Action
32	From the displayed list, right-click on the OFA VGA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
33	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
34	Click on the **Close** button.
35	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
36	Click on the **Close** button.
37	Go to step 113.
38	From the displayed list, double-click on the port for the band you must equalize using the power targets identified by the Network Modeling Tool. This is the band of the added or removed channel.
	The Optical Metro Facility dialog box appears.
	Note: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action

39	**If**	**Then** go to
	the Administrative field displays OOS in the State area	step 40
	otherwise	step 41

40 In the State area, select IS from the Administrative drop-down list.

41	**If** you are provisioning the eVOAs on a per	**Then** go to
	channel basis	step 42
	band basis	step 46

42 In the eVOA Provision area of the dialog box, select Channel.

43 In the Channel area, select the number of channels present in the band from the Number of Channels drop-down list.

Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.

44 In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Network Modeling Tool.

45 Go to step 48.

46 In the eVOA Provision area, select Band.

47 In the Band Power Target field, enter the per-band power target from the Network Modeling Tool.

48 Click **OK** to apply the provisioning information.

A confirmation dialog box appears.

49 Click **Yes**.

50 Right-click on the port for the band you need to equalize and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

51 Click on **Adjust Power**.

The Power Equalization dialog appears.

Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.

52 Click on the **Close** button.

53 Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
54	Click on the **Close** button.
55	From the displayed list, right-click on the port of another in-service band and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
	Note 1: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.
	Note 2: All bands must be re-equalized when a channel is added or removed.
56	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
57	Click on the **Close** button.
58	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
59	Click on the **Close** button.
60	Repeat step 38 to step 59 for all bands.

61	**If**	**Then** go to
	the APBE or APBE Enhanced precedes an OFA VGA	step 62
	otherwise	step 113

Step	Action
62	From the displayed list, double-click on the OFA VGA facility.
63	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
64	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Network Modeling Tool.
65	Click **OK**.
66	Right-click on the OFA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
67	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
68	Click on the **Close** button.
69	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
70	Click on the **Close** button.
71	Go to step 113.

72	**If** the OFA type is	**Then** go to
	Standard OFA	step 73
	High Input Power OFA or OFA VGA	step 75

73	Disconnect the OFA IN fiber from the OFA IN port and connect it to an Optical Spectrum Analyzer (OSA).
74	Go to step 76.
75	Using an optical patch cord, connect the OFA input tap port to an Optical Spectrum Analyzer (OSA).

76	**If** the power control device at the input to the OFA is	**Then** go to
	a Pad	step 77
	NT0H31AD ECT	step 79
	Discrete VOA	step 81
	PBE	step 84
	NT0H31AC, NT0H31AB or NT0H31AC ECT	step 85

77	If necessary, adjust the power level by selecting the appropriate pad value such that the amplifier band average channel power level is within ±1 dB of the target identified by the Network Modeling Tool.

ATTENTION

The OFA IN fiber connected to the OFA IN port must be disconnected if a pad needs to be added or replaced. This action will affect service.

Note 1: The High Input Power OFA and OFA VGA input tap's power level is less than the actual power level at the OFA IN port by the amount indicated on the OFA's faceplate label. You must take this into account when comparing the OSA power level to the power level given by the Network Modeling Tool.

Note 2: Refer to "Types of amplifier configurations" on page 2-12 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

—continued—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
78	Go to step 86.
79	If necessary, adjust the power level by turning the screw on the VOA that is associated with the amplifier band such that the amplifier band average channel power level equals the target identified by the Network Modeling Tool.

79 (continued)

Note 1: The High Input Power OFA input tap's power level is less than the actual power level at the OFA IN port by the amount indicated on the OFA's faceplate label. You must take this into account when comparing the OSA power level to the power level given by the Network Modeling Tool.

Note 2: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 3: When an NT0H31AD ECT is used, per-band equalization is achieved at upstream OFAs that were equalized with APBE/APBE Enhanced circuit packs, PBEs or the NT0H31AA, NT0H31AB or NT0H31AC ECT type. The NT0H31AD ECT type attenuates all four C-bands using a single C-band VOA and all four L-bands using a single L-band VOA.

Note 4: Refer to "Types of amplifier configurations" on page 2-12 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Step	Action
80	Go to step 86.
81	Open the Discrete VOA drawer to get access to the VOAs.
82	If necessary, adjust the power level by turning the screw on the VOA that is associated with the amplifier band such that the amplifier band average channel power level equals the target identified by the Network Modeling Tool.

82 (continued)

Note 1: The High Input Power OFA input tap's power level is less than the actual power level at the OFA IN port by the amount indicated on the OFA's faceplate label. You must take this into account when comparing the OSA power level to the power level given by the Network Modeling Tool.

Note 2: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 3: When a Discrete VOA is used, per-band equalization is achieved at upstream OFAs that were equalized with APBE/APBE Enhanced circuit packs, PBEs or the NT0H31AA, NT0H31AB or NT0H31AC ECT type.

Note 4: Refer to "Types of amplifier configurations" on page 2-12 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

Step	Action
83	Go to step 86.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
84	Open the PBE drawer to get access to the VOAs.
85	If necessary, adjust the power level of a band by turning the screw on the VOA that is associated with the band such that the per-band average channel power level equals the target identified by the Network Modeling Tool. If necessary, repeat this action for each band that requires re-equalization.

Note 1: The High Input Power OFA and OFA VGA input tap's power level is less than the actual power level at the OFA IN port by the amount indicated on the OFA's faceplate label. You must take this into account when comparing the OSA power level to the power level given by the Network Modeling Tool.

Note 2: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 3: For bands that are not used, set the attenuation to the maximum value so that the noise level in the unused bands is reduced to its minimum value.

Note 4: Refer to "Types of amplifier configurations" on page 2-12 for the definition of per-band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

86	**If** the OFA type is	**Then** go to
	Standard OFA	step 87
	High Input Power OFA or OFA VGA	step 90

87	Disconnect the OFA IN fiber from the OSA.
88	Connect the OFA IN fiber to the OFA IN port.
89	Go to step 91.
90	Disconnect the OSA from the OFA input tap port.

91	**If** the power control device at the input to the OFA is	**Then** go to
	ECT or Pad	step 113
	PBE or Discrete VOA	step 92

92	In the PBE or Discrete VOA drawer, make sure that you have lowered all the bulkheads and that the fibers are routed correctly around the fiber management components.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
93	Close the PBE or Discrete VOA drawer.

94	**If**	**Then** go to
	the OFA type is OFA VGA	step 95
	otherwise	step 113

95	In the Selected Shelves area of the System Manager:

- select the shelf that houses the OFA VGA
- click on the **Apply** button

96	In the Optical Metro System Manager window:

- click on the **Equipment** tab
- click on the **Facilities** tab

The Facilities list appears.

97	**If**	**Then** go to
	you are re-equalizing since you are adding or removing a channel	step 104
	otherwise	step 98

98	From the displayed list, right-click on the OFA VGA facility and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

99	Click on **Adjust Power**.

The Power Equalization dialog appears.

Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.

100	Click on **Close** button.
101	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
102	Click on **Close** button.
103	Go to step 113.
104	From the displayed list, double-click on the OFA VGA facility.
105	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.

Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
106	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Network Modeling Tool.
107	Click **OK**.
108	Right-click on the OFA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
109	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
110	Click on **Close** button.
111	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
112	Click on the **Close** button.
113	If necessary, repeat step 112 to step 112 for all OFAs in the direction of the signal flow at the site.
	Note: When an optical component is replaced, an amplifier band must be re-equalized if channels from that amplifier band pass through the component. For example, only the C-band has to be re-equalized if a C-band OFA is replaced, but both C and L bands must be re-equalized if an OSC tray is replaced.

114	**If**	**Then** go to
	you are adding a new channel to an existing band that has no existing channels and ECTs or PBEs are used as the OFA per-band power control device	step 115
	otherwise	step 117

115	**If**	**Then** go to
	the site you are at drops the new channel (to an OLCD, OTR or Muxponder) in the direction you are equalizing and all OFAs the new channel traverses have been equalized	step 116
	otherwise	step 117

—**continued**—

Procedure 2-5 (continued)
Re-equalizing an amplified system

Step	Action
116	Add a fixed attenuator pad at the BAND RX port (this port is labeled BAND DROP if the OMX type is OMX [Standard]) of the OMX having the value described in the Network Modeling Tool report and connect the fiber that normally connects to the OMX BAND RX port (this is the fiber that was disconnected before the procedure was started, as per the note in the Requirements section).
117	Go to the next site in the order identified in step 1.
118	Repeat step 2 to step 117 until you reach the site marked as the equalization end point.
119	If necessary, repeat step 1 to step 118 for the opposite direction of the signal flow.
120	For systems that use APBE or APBE Enhanced circuit packs as power control devices, if you have removed channels and as a result there are no remaining channels in a band, perform Procedure 2-11, "Taking a band out-of-service" on page 2-123.

—**end**—

Procedure 2-6
Re-equalizing an Extended Metro amplified system

Use this procedure to re-equalize an Extended Metro amplified system after an optical component is replaced, when adding a new channel, when adding a new band or when removing a channel.

Adding a new channel means a new channel is added to an existing band. The existing band is equipped with at least one existing channel. If the existing band does not have at least one existing channel, then the following case (i.e. Adding a new band applies).

Adding a new band means a new channel is added to an existing empty channel band. An existing band implies that the OMX for the band is already installed and fibered into the network. This would be the case if the OMX was installed during initial system installation taking into account a future channel count upgrade. If the OMX of the new band is not already installed and fibered in the network, contact Nortel Networks for assistance on how to add OMXs to an existing network.

> *Note:* You cannot add or remove multiple channels using this procedure. If you need to add or remove multiple channels, you must perform this procedure for each channel addition or removal.

This procedure can affect existing traffic. This depends on the strategy used to equalize and control the power in the system.

- If PBEs or Discrete VOAs are used to control the power at the input to an OFA, it is possible to read the power using the input tap of the High Input Power OFA and make adjustments to the power without having to disconnect traffic carrying fiber. However, since adjusting the power on these devices is a manual operation (by turning the VOA screw), under attenuating the power can create an OFA overload alarm and over attenuating the power can trigger an OSNR hit or an OFA Rx Loss of signal alarm.

- If PBEs are used to control the power at the input to an OFA VGA, it is possible to read the power using the input tap of the OFA VGA and make adjustments to the power without having to disconnect traffic-carrying fiber. However, since adjusting the power on these devices is a manual operation (by turning the VOA screw), under attenuating the power can create an OFA overload alarm and over attenuating the power can trigger an OSNR hit or an OFA Rx Loss of signal alarm.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

- If PBEs are used to control the power at the input to an OFA and you are adding a new channel to an existing band that does not have any existing channels, there is a possibility of exceeding the OFA Rx power high fail threshold value. This action causes an outage if the PBE attenuator for that band is not at its maximum attenuation.

- If a fixed attenuator is used to control the power at the input to an OFA, it is not possible to guarantee that you will not be required to change the value of the attenuator following a channel addition or hardware replacement. Similarly, if no power control device is present at the input to the amplifier, a fixed attenuator may be required. Since disconnecting the OFA fiber is required to change or add an attenuator, existing traffic will be affected.

- Using APBE or APBE Enhanced circuit packs to control the power at the input to an OFA or using the OFA VGA allows the power to be adjusted without triggering OFA alarms or affecting existing traffic.

To reduce the impact on existing traffic, you can switch protected traffic away from the span being re-equalized. See Procedure 4-7 "Switching traffic off a span in a path-protected network" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Requirements

> **ATTENTION**
> Before you equalize power, you must turn off the automatic laser shutdown (ALS) on the shelves that contain the OCLD, OTR or Muxponder at the originating and terminating sites.

Follow the following requirements listed depending on the reason why you are re-equalizing:

Case 1: Optical component replacement
- You must wear an antistatic wrist strap while performing this procedure
- You must be logged in to the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices
- The APBE, APBE Enhanced and OFA VGA circuit packs must be In-Service if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Case 2: Adding a new channel

- You must wear an antistatic wrist strap while performing this procedure

- You must be logged in to the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- The APBE, APBE Enhanced and OFA VGA circuit packs must be In-Service if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- The fiber connections between the new OCLDs, OTRs or Muxponders and the OMXs have been made before inserting the circuit pack. Do not make the fiber connections while the circuit pack is installed in the shelf; otherwise you can impact the existing channels. When an OCLD, OTR or Muxponder circuit pack is inserted, its output power is gradually brought to its final power level. This reduces the amount of transient power at the downstream OFA.

Case 3: Adding a new band

- You must wear an antistatic wrist strap while performing this procedure.

- You must be logged in to the System Manager as an Admin level user and the OFA VGA circuit pack must be In-Service if OFA VGA circuit packs are used as power control devices

- If APBE or APBE Enhanced circuit packs are used as per-band power control devices,

  — you must be logged in to the System Manager as an Admin level user and the APBE or APBE Enhanced circuit packs must be In-Service

  — the APBE or APBE Enhanced band port you want to add the new channel to is In-Service

  — the fiber connections between the new OCLDs, OTRs or Muxponders and the OMXs have been made before inserting the circuit pack. Do not make the fiber connections while the circuit pack is installed in the shelf; otherwise you can impact the existing channels. When an OCLD, OTR or Muxponder circuit pack is inserted, its output power is gradually brought to its final power level. This reduces the amount of transient power at the downstream OFA.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

— you must install fixed attenuator pads at the BAND RX and BAND TX port of the OMXs of the new channel in the system as described in the Nortel Custom Equalization Report. See Procedure 3-44 "Installing an attenuator at the BAND ADD port in a DWDM OMX" and Procedure 3-45 "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX" in *Connection Procedures*, 323-1701-221, for procedures on how to install a fixed attenuator pad at the OMX BAND TX or BAND RX port.

- If PBEs are used as per-band power control devices,

   — the fiber connections between the new OCLDs, OTRs or Muxponders and the OMXs have been made before inserting the circuit pack. Do not make the fiber connections while the circuit pack is installed in the shelf; otherwise you can impact the existing channels. When an OCLD, OTR or Muxponder circuit pack is inserted, its output power is gradually brought to its final power level. This reduces the amount of transient power at the downstream OFA.

   Note: Before you insert the OCLDs, OTRs or Muxponders you must make sure that you disconnect the fiber at the BAND RX port of the OMXs of the new band. This prevents OCLD, OTR or Muxponder receiver damage. This fiber will be reconnected during the procedure.

   — you must install fixed attenuator pads at the BAND TX port of the OMXs of the new channel in the system as described in the Nortel Custom Equalization Report. See Procedure 3-44 "Installing an attenuator at the BAND ADD port in a DWDM OMX" in *Connection Procedures*, 323-1701-221, for procedures on how to install a fixed attenuator pad at the OMX BAND TX port.

Case 4: Removing a channel

- You must wear an antistatic wrist strap while performing this procedure

- You must be logged in to the System Manager as an Admin level user if APBE, APBE Enhanced or OFA VGA circuit packs are used as power control devices

- The fiber connected to the OCLD Tx port, OTR Line-side Tx port or Muxponder Line-side Tx port is disconnected before removing the OCLDs/OTRs from the shelf. The circuit pack continues to transmit a signal as long as it is seated in the shelf. If you do not disconnect the fiber from the circuit pack before unseating the circuit pack, you can impact the existing channels.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Table 2-19 lists the tools and materials required to complete this procedure.

Table 2-19
Tools and materials required

Item	Quantity	Supplied
Antistatic strap	1	no
Optical spectrum analyser (OSA)	1	no
Optical Power Meter (OPM)	1	no
Optical fiber cleaning kit	1	no
Fiber inspection scope	1	no
Patch cord with SC-SC connectors	as required	no
Patch cord with SC-LC connectors	as required	no
Flat-head screwdriver	1	no
An outline schematic of the design indicating the position of amplifiers and regenerators (provided by the Nortel Networks link engineering team)	1	yes
Correct power target values, as output by the Network Networks Custom Equalization Report	-	yes

Precautions

Channels must be added/removed one channel at a time.

	CAUTION
	Invisible laser radiation
	The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

	CAUTION
	Risk of network reliability
	Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

⚠ **CAUTION**
Possible risk of damage to equipment and fiber
Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.

Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.

Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

⚠ **CAUTION**
Risk of incorrect backup file
Back up the shelf after provisioning changes on an APBE, APBE Enhanced or OFA VGA circuit pack. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

ATTENTION
If you have cascading amplifiers, you must make sure that you equalize signals entering the OFAs in the correct order, starting with the transmitting OCLD, OTR or Muxponder, moving toward the receiving OCLD, OTR or Muxponder, and in both directions.

ATTENTION
When using PBEs, if the unused bands are not sufficiently attenuated, the ring can become a feedback loop causing signal-to-noise ratios to fall to unacceptable levels. As a result of the additional noise, the LOS (loss of signal) indicator lamp on the OFA circuit pack does not light, even though the traffic-carrying channels are lost.

For bands that are not used, the VOAs should be set to their maximum value so that the noise level in the unused bands is reduced to its minimum value.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Action

Step	Action
1	Determine the equalization starting and ending point, direction and order.

Note 1: If you are re-equalizing because you are adding or removing a channel in a linear topology, the starting and ending points are the same as those in the Nortel Custom Equalization Report.

Note 2: If you are re-equalizing because you are adding or removing a channel in a ring topology and there is no site where all bands in the system are added/dropped, the starting point is the add side of one of the sites where the channel is being added or removed. Go around the ring once and then repeat the equalization for the first amplifier that was equalized (so the first amplifier is equalized twice and the rest are equalized once).

Note 3: If you are re-equalizing because you are adding or removing a channel in a ring topology and there is at least one site where all bands in the system are added/dropped, start on the add side of one of these sites and go around the ring once ending at the drop side of the starting site.

Note 4: If you are re-equalizing because you have changed a component, the starting point is at the component that has been replaced, or the first applicable place downstream from it. You can stop once the first OFA that has a PBE or an APBE/APBE Enhanced has been equalized.

Step	If	**Then** go to
2	the power control device at the input to the OFA is an APBE or APBE Enhanced	step 22
	there is no power control device at the input to the OFA and the OFA type is OFA VGA	step 3
	the power control device at the input to the OFA is a Discrete VOA, PBE or Pad	step 68
	there is no OFA at the site	step 101

3 In the Selected Shelves area of the System Manager:

- select the shelf that houses the OFA VGA
- click on the **Apply** button

4 In the Optical Metro System Manager window:

- click on the **Equipment** tab
- click on the **Facilities** tab

The Facilities list appears.

—**continued**—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action

5

If	**Then** go to
you are re-equalizing since you are adding or removing a channel	step 12
otherwise	step 6

6 From the displayed list, right-click on the OFA VGA facility and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

7 Click on **Adjust Power**.

The Power Equalization dialog appears.

Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.

8 Click on the **Close** button.

9 Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.

10 Click on the **Close** button.

11 Go to step 100.

12 From the displayed list, double-click on the OFA VGA facility.

13 In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.

Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.

14 In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Nortel Custom Equalization Report.

15 Click **OK**.

16 Right-click on the OFA facility and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

17 Click on **Adjust Power**.

The Power Equalization dialog appears.

Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.

18 Click on the **Close** button.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action
19	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
20	Click on the **Close** button.
21	Go to step 100.
22	In the Selected Shelves area of the System Manager: • select the shelf that houses the APBE or APBE Enhanced that precedes the OFA • click on the **Apply** button
23	In the Optical Metro System Manager window: • click on the **Equipment** tab • click on the **Facilities** tab *The Facilities list appears.*

24	**If**	**Then** go to
	you are re-equalizing since you are adding or removing a channel	step 38
	otherwise	step 25

Step	Action
25	From the displayed list, right-click on the port for the band you need to equalize and select the **Equalize** menu item. *The Component Level Power Equalization screen appears.* ***Note:*** Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.
26	Click on **Adjust Power**. *The Power Equalization dialog appears.* ***Note:*** The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
27	Click on the **Close** button.
28	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
29	Click on the **Close** button.
30	Repeat step 25 to step 29 for all bands.

31	**If**	**Then** go to
	the APBE or APBE Enhanced precedes an OFA VGA	step 32
	otherwise	step 100

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action
32	From the displayed list, right-click on the OFA VGA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
33	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
34	Click on the **Close** button.
35	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
36	Click on the **Close** button.
37	Go to step 100.
38	From the displayed list, double-click on the port for the band you need to equalize using the power targets identified by the Nortel Custom Equalization Report. This is the band of the added or removed channel.
	The Optical Metro Facility dialog box appears.
	Note: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.

39	**If**	**Then** go to
	the Administrative field displays OOS in the State area	step 40
	otherwise	step 41

Step	Action
40	In the State area, select IS from the Administrative drop-down list.
41	In the eVOA Provision area of the dialog box, select Channel.
42	In the Channel area, select the number of channels present in the band from the Number of Channels drop-down list.
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
43	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Nortel Custom Equalization Report.
44	Click **OK** to apply the provisioning information.
	A confirmation dialog box appears.
45	Click **Yes**.

—**continued**—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action
46	Right-click on the port for the band you need to equalize and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
47	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
48	Click on the **Close** button.
49	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
50	Click on the **Close** button.
51	From the displayed list, right-click on the port of another in-service band and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
	Note 1: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.
	Note 2: All bands must be re-equalized when a channel is added or removed.
52	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
53	Click on the **Close** button.
54	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
55	Click on the **Close** button.
56	Repeat step 38 to step 55 for all bands.

Step	If	**Then** go to
57	the APBE or APBE Enhanced precedes an OFA VGA	step 58
	otherwise	step 100

Step	Action
58	From the displayed list, double-click on the OFA VGA facility.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action
59	In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.
	Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.
60	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Nortel Custom Equalization Report.
61	Click **OK**.
62	Right-click on the OFA facility and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.
63	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.
64	Click on the **Close** button.
65	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
66	Click on the **Close** button.
67	Go to step 100.
68	Using an optical patch cord, connect the OFA input tap port to an Optical Spectrum Analyzer (OSA).
69	**If** the power control device at the input to the OFA is	**Then** go to

a Pad	step 70
a Discrete VOA	step 72
a PBE	step 75

—**continued**—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action
70	If necessary, adjust the power level by selecting the appropriate pad value such that the amplifier band average channel power level is within ±1 dB of the target identified in the Nortel Custom Equalization Report.

> **ATTENTION**
> The OFA IN fiber connected to the OFA IN port must be disconnected if a pad needs to be added or replaced. This action affects service.

Note 1: The input tap's power level is less than the actual power level at the OFA IN port by the amount indicated on the OFA's faceplate label. You must take this into account when comparing the OSA power level to the power level given in the Nortel Custom Equalization Report.

Note 2: Refer to "Definition of amplifier band average channel power" on page 2-11 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

71   Go to step 77.

72   Open the Discrete VOA drawer to get access to the VOAs.

73   If necessary, adjust the power level by turning the screw on the VOA that is associated with the amplifier band such that the amplifier band average channel power level equals the target identified in the Nortel Custom Equalization Report.

Note 1: The input tap's power level is less than the actual power level at the OFA IN port by the amount indicated on the OFA's faceplate label. You must take this into account when comparing the OSA power level to the power level given in the Nortel Custom Equalization Report.

Note 2: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 3: When a Discrete VOA is used, per-band equalization is achieved at upstream OFAs that were equalized with APBE/APBE Enhanced circuit packs or PBEs.

Note 4: Refer to "Definition of amplifier band average channel power" on page 2-11 for the definition of amplifier band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

74   Go to step 77.

75   Open the PBE drawer in order to get access to the VOAs.

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action

76 If necessary, adjust the power level of a band by turning the screw on the VOA that is associated with the band such that the per-band average channel power level equals the target identified in the Nortel Custom Equalization Report. If necessary, repeat this action for each band that requires re-equalization.

Note 1: The input tap's power level is less than the actual power level at the OFA IN port by the amount indicated on the OFA's faceplate label. You must take this into account when comparing the OSA power level to the power level given in the Nortel Custom Equalization Report.

Note 2: To increase the attenuation, turn the screw clockwise. To decrease the attenuation, turn the screw counter-clockwise.

Note 3: For bands that are not used, set the attenuation to the maximum value so that the noise level in the unused bands is reduced to its minimum value.

Note 4: Refer to "Types of amplifier configurations" on page 2-12 for the definition of per-band average channel power. Refer to Table 2-4 on page 2-11 for the wavelength grid.

77 Disconnect the OSA from the OFA input tap port.

78

If the power control device at the input to the OFA is	**Then** go to
a Pad	step 100
a PBE or Discrete VOA	step 79

79 In the PBE or Discrete VOA drawer, make sure that you have lowered all the bulkheads and that the fibers are routed correctly around the fiber management components.

80 Close the PBE or Discrete VOA drawer.

81

If	**Then** go to
the OFA type is OFA VGA	step 82
otherwise	step 100

82 In the Selected Shelves area of the System Manager:

- select the shelf that houses the OFA VGA
- click on the **Apply** button

83 In the Optical Metro System Manager window:

- click on the **Equipment** tab
- click on the **Facilities** tab

The Facilities list appears.

—continued—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action

84	**If**	**Then** go to
	you are re-equalizing since you are adding or removing a channel	step 91
	otherwise	step 85

85   From the displayed list, right-click on the OFA VGA facility and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

86   Click on **Adjust Power**.

The Power Equalization dialog appears.

Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.

87   Click on **Close** button.

88   Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.

89   Click on **Close** button.

90   Go to step 100.

91   From the displayed list, double-click on the OFA VGA facility.

92   In the Channel area, select the number of channels present in the amplifier-band from the Number of Channels drop-down list.

Note: Make sure that you select the number of channels with optical power, and not the number of traffic-carrying channels.

93   In the Channel area, in the Channel Output Power Target field, enter the per-channel power target from the Nortel Custom Equalization Report.

94   Click **OK**.

95   Right-click on the OFA facility and select the **Equalize** menu item.

The Component Level Power Equalization screen appears.

96   Click on **Adjust Power**.

The Power Equalization dialog appears.

Note: The OFA VGA can take up to two minutes to equalize the optical power after you make a provisioning change.

97   Click on **Close** button.

—**continued**—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action
98	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
99	Click on the **Close** button.
100	If necessary, repeat step 2 to step 99 for all OFAs in the direction identified in step 1 at the site.

Note 1: All bands must be re-equalized when a channel is added or removed. For example, if a new C-band channel is added, the L-band channels also need to be re-equalized.

Note 2: When an optical component is replaced, an amplifier band must be re-equalized if channels from that amplifier band pass through the component. For example, only the C-band has to be re-equalized if a C-band OFA is replaced, but both C and L bands must be re-equalized if an OSC tray is replaced.

101	**If**	**Then** go to
	you are adding a new channel to an existing band that has no existing channels and PBEs are used as the OFA per-band power control device (in which case you had disconnected the fiber at the BAND RX port of the OMXs of the new band before beginning this procedure)	step 102
	you are adding a new channel to an existing band that has no existing channels and APBE or APBE Enhanced are used as the OFA per-band power control device	step 105
	otherwise	step 107

102	**If**	**Then** go to
	the site you are at drops the new channel (to an OLCD, OTR or Muxponder) in the direction identified in step 1 and all OFAs the new channel traverses have been equalized	step 103
	otherwise	step 107

103	Add a fixed attenuator pad at the BAND RX port of the OMX having the value described in the Nortel Custom Equalization Report and connect the fiber that normally connects to the OMX BAND RX port (this is the fiber that was disconnected before the procedure was started, according to the note in the Requirements section).
104	Go to step 106.

—**continued**—

Procedure 2-6 (continued)
Re-equalizing an Extended Metro amplified system

Step	Action	
105	**If**	**Then** go to
	the site you are at drops the new channel (to an OLCD, OTR or Muxponder) in the direction identified in step 1 and all OFAs the new channel traverses have been equalized	step 106
	otherwise	step 107

106   Verify that the power of the new channel at the OCLD, OTR or Muxponder circuit pack Rx port meets the following requirements:

- the channel power is within −15 to −17 dBm. If necessary, add a fixed attenuator pad or replace the existing fixed attenuator pad at the OMX BAND RX port such that this requirement is met

- if the above requirement cannot be met because the power level is too weak, the channel power level must be greater than or equal to the "Power required at Rx" value described in the Nortel Custom Equalization Report.

Note: You can measure the power level at the OCLD, OTR or Muxponder circuit pack Rx port using either an Optical Power Meter or the System Manager Equipment/Facilities screen.

107   Go to the next site in the order identified in step 1.

108   Repeat step 2 to step 107 until you reach the site marked as the ending point.

109   If necessary, repeat step 1 to step 108 for the opposite direction of the signal flow.

110   For systems that use APBE or APBE Enhanced circuit packs as power control devices, if you have removed channels and as a result there are no remaining channels in a band, perform Procedure 2-11, "Taking a band out-of-service" on page 2-123.

—**end**—

Procedure 2-7
Re-equalizing an amplified system using SLEC when adding new channels

Use this procedure to re-equalize amplified systems or Extended Metro systems using SLEC when adding new channels. In this case, new channels are added to existing bands. Each existing band must be equipped with at least one existing channel. If any existing band does not have at least one existing channel, then use Procedure 2-9 "Re-equalizing an amplified system using SLEC when adding new bands" on page 2-111 first to add the new bands before executing this procedure.

This procedure does not affect existing traffic.

Note: For SLEC troubleshooting procedures, refer to the *Trouble Clearing and Alarm Reference Guide*, 323-1701-542.

Requirements

Before you begin this procedure make sure that

- you are logged in to the System Manager as an Admin level user
- you know the OSID of the system to re-equalize
- the SLEC deployment rules as described in Table 2-2 on page 2-8 are met
- the prerequisites as described in Table 2-20 on page 2-103 are met

Table 2-20
Prerequisites for re-equalizing a system using SLEC when adding new channels

Prerequisite #	Description
1	Ensure that the system passes when validated using the Network Modelling Tool.
	If this is an Extended Metro System, obtain the Nortel Custom Equalization Report.
2	This procedure can be run while Continuous SLEC is running. However, be aware that SLEC will raise the Equalization Failed event for one or multiple sites and the following status results in the SLEC System Manager screen during the procedure.
	— Topology error
	— Unexpected input power change
	— Detected incomplete transmit/receive pair
	— A component upstream failed to equalize
	This is expected and does not indicate any impact to existing channels. Failures occur because SLEC detects changes in the system topology. To ensure correct operation, SLEC only attempts equalization when the system topology is stable and determined to be accurate.
	Alternatively, to avoid the failure event generation, you can halt Continuous SLEC before proceeding to the next step. Refer to Procedure 2-13 on page 2-127 to halt Continuous SLEC.
3	Connect the Line Tx and Line Rx of the West OCLD, OTR or Muxponder circuit packs of the new channels to the corresponding OMX Channel Add and Channel Drop ports (see *Connection Procedures*, 323-1701-221). If necessary, repeat for the East OCLD, OTR ot Muxponder circuit packs of the new channels.
4	Seat the circuit packs of the new channels into the shelf or shelves.
5	Provision the OSID parameter for the newly added circuit packs. See Procedure 3-36 "Provisioning the optical system identifier (OSID)" in *Provisioning and Operating Procedures*, 323-1701-310.
	Note: If all equipment in the system has a blank OSID, then SLEC assumes it is all on the same system. If any piece of equipment is ever given a non-blank OSID, then SLEC fails or halts until all equipment is given the same OSID (blank or otherwise). A blank OSID is only allowed when it is the only OSID, and you are not using features that do not support blank (IFS, multiple-system network, hub and spoke).
6	Repeat prerequisite 3 to prerequisite 4 at all sites in the network where the new channels are being added.

—continued—

Procedure 2-7 (continued)
Re-equalizing an amplified system using SLEC when adding new channels

CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of network reliability
Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

CAUTION
Possible risk of damage to equipment and fiber
Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.

Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.

Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

—continued—

Procedure 2-7 (continued)
Re-equalizing an amplified system using SLEC when adding new channels

Action

Step	Action	
1	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item.	
	The Optical Metro System Level Equalization Control window opens.	
2	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu.	
	A list of Site IDs that belong to the specified OSID is displayed.	
3	**If**	**Then** go to
	Continuous SLEC is running (the System Status field displays Continuous Equalization mode)	step 10
	otherwise (the System Status field displays Idle)	step 4
4	Click on **Equalize System.**	
	A SLEC information window opens.	
5	Click on **OK**.	

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA, APBE and APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE/APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase

- Eastbound site-level validation phase

- Eastbound phase 1 equalization phase

- Eastbound phase 2 equalization phase

- Westbound site-level validation phase

- Westbound phase 1 equalization phase

- Westbound phase 2 equalization phase

—continued—

Procedure 2-7 (continued)
Re-equalizing an amplified system using SLEC when adding new channels

Step	Action	
6	**If**	**Then** go to
	Continuous SLEC was halted before this procedure was started	step 7
	otherwise	step 10
7	Click on the **Continuously Equalize System** button.	
	A SLEC information window is opened.	
8	Click on **Close.**	
	SLEC is equalizing the system.	
9	You have competed this procedure.	
10	Since Continuous equalization is running, SLEC will raise the Equalization Failed event for one or multiple sites in the Event Console. The Optical Metro System Level Equalization Control window will show Equalization Status failed and some of the following status results will appear in the Details window:	

- Topology error

- Unexpected input power change

- Detected incomplete transmit/receive pair

- A component upstream failed to equalize

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button.

Step	Action	
11	Ignore the failure events. SLEC will run without failure events once the system topology stabilizes and is determined to be accurate.	
12	Wait for the "Continuous Equalization finished-successful" message to be displayed in the System Status field.	
13	Monitor the equalization process for one more round to make sure that the Continuous Equalization round has completed.	
14	You have completed this procedure.	

—**end**—

Procedure 2-8
Re-equalizing an amplified system using SLEC after an optical component replacement or a link budget change

Use this procedure to re-equalize an amplified system or Extended Metro system after an optical component replacement or a link budget change.

Requirements

Before you begin this procedure make sure that

- the optical component has been changed and the root cause for a link budget change has been cleared
- you are logged in to the System Manager as an Admin level user
- you know the OSID of the system to re-equalize

Precautions

Component replacement procedures and this procedure can be performed while Continuous SLEC is running. However, be aware that SLEC will raise the Equalization Failed event for one or multiple sites. The Optical Metro System Level Equalization Control window will show Equalization Status Failed and some of the following status results in the Details window:

- Topology error
- Unexpected input power change
- Detected incomplete transmit/receive pair
- A component upstream failed to equalize

This is expected does not indicate any impact to traffic. Failures occur because SLEC detects changes in the system topology. To ensure correct operation, SLEC only attempts equalization when the system topology is stable and determined to be accurate.

Alternatively, to avoid the failure event generation, you can halt Continuous SLEC before the procedure is started. Refer to to halt Continuous SLEC.

—**continued**—

Procedure 2-8 (continued)
Re-equalizing an amplified system using SLEC after an optical component replacement or a link budget change

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CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of network reliability
Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

CAUTION
Possible risk of damage to equipment and fiber
Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.

Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.

Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

—continued—

Procedure 2-8 (continued)
Re-equalizing an amplified system using SLEC after an optical component replacement or a link budget change

Action

Step	Action
1	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item.
	The Optical Metro System Level Equalization Control window opens.
2	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu.
	A list of Site IDs that belong to the specified OSID is displayed.

Step	If	**Then** go to
3	Continuous SLEC is running (i.e., the System Status field displays Continuous Equalization mode)	step 10
	otherwise (i.e., the System Status field displays Idle)	step 4

Step	Action
4	Click on **Equalize System.**
	A SLEC information window opens.
5	Click on **OK**.

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA, APBE and APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE/APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase
- Eastbound site-level validation phase
- Eastbound phase 1 equalization phase
- Eastbound phase 2 equalization phase
- Westbound site-level validation phase
- Westbound phase 1 equalization phase
- Westbound phase 2 equalization phase

—continued—

Procedure 2-8 (continued)
Re-equalizing an amplified system using SLEC after an optical component replacement or a link budget change

Step	Action	
6	**If**	**Then** go to
	Continuous SLEC was halted before this procedure was started	step 7
	otherwise	step 9
7	Click on the **Continuously Equalize System** button.	
	A SLEC information window is opened.	
8	Click on **Close.**	
	SLEC is equalizing the system.	
9	You have competed this procedure.	
10	Since Continuous equalization is running, SLEC will raise the Equalization Failed event for one or multiple sites in the Event Console. The Optical Metro System Level Equalization Control window will show Equalization Status failed and some of the following status results will appear in the Details window:	

- Topology error

- Unexpected input power change

- Detected incomplete transmit/receive pair

- A component upstream failed to equalize

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button.

11	Ignore the failure events. SLEC will run without failure events once the system topology stabilizes and is determined to be accurate.
12	Wait for the "Continuous Equalization finished-successful" message to be displayed in the System Status field.
13	Monitor the equalization process for one more round to make sure that the Continuous Equalization round has completed.
14	You have completed this procedure.

—**end**—

Procedure 2-9
Re-equalizing an amplified system using SLEC when adding new bands

Use this procedure to re-equalize amplified systems or Extended Metro systems using SLEC when adding new bands. In this case, new channels are added to existing empty channel bands. Existing bands imply that the OMXs for the bands are already installed and fibered into the network. This would be the case if the OMXs were installed during initial system installation taking into account a future channel count upgrade. If the OMXs of the new bands are not already installed and fibered in the network, contact Nortel Networks for assistance on how to add OMXs to an existing network.

This procedure does not affect existing traffic.

Note: For SLEC troubleshooting procedures, refer to the *Trouble Clearing and Alarm Reference Guide*, 323-1701-542.

Requirements

Before you begin this procedure make sure that

- you are logged in to the System Manager as an Admin level user
- you know the OSID of the system to re-equalize
- the SLEC deployment rules as described in Table 2-2 on page 2-8 are met
- that the prerequisites as described in Table 2-21 on page 2-112 are met

Table 2-21
Prerequisites for re-equalizing a system using SLEC when adding new bands

Prerequisite #	Description
1	a) Ensure that the system passes when validated using the Network Modelling Tool. b) From NMT, obtain the target per-band average channel power for each APBE or APBE Enhanced port that contains the new channels. c) If this is an Extended Metro system, obtain the Nortel Custom Equalization Report. d) For each shelf, you must obtain the following information from your network planning group: OSID for each new circuit pack.
2	If continuous SLEC is running, halt it. See Procedure 2-13 on page 2-127 "Starting or stopping System Level Equalization Controller".
3	Connect the Line Tx and Line Rx ports of the OCLD, OTR or Muxponder circuit packs of the new channels to their corresponding OMX Channel Add and Channel Drop ports (see *Connection Procedures*, 323-1701-221). For the first channel of each new band, you can route the patch cord from the Line Rx port of the circuit pack to the OMX Channel Drop port. Do not connect the patch cord to the OMX Channel Drop port; leave the patch cord dangling close to the port in the OMX tray.
4	Seat into the shelf or shelves only the first channel West OCLD, OTR or Muxponder circuit pack of each band. All other channel West circuit packs of each new band must not be seated. Seat into the shelf or shelves only the first channel East OCLD, OTR or Muxponder circuit pack of each new band. All other channel East circuit packs of each new band must not be seated.
5	Provision parameters as follows: a) For each shelf equipped with an APBE or APBE Enhanced at the site: For each APBE or APBE Enhanced port of the new bands, provision the target per-band average channel power. Use the power targets obtained in prerequisite 1. See — Procedure 2-14, "Provisioning target power on the APBE or APBE Enhanced circuit pack when using SLEC" in this NTP b) For each shelf at the site (if the shelf contains only OFA, APBE or APBE Enhanced equipment, this step can be skipped): • Provision the OSID for each new circuit pack. Use the values obtained in prerequisite 1. See — Procedure 3-36 "Provisioning the optical system identifier (OSID)" in *Provisioning and Operating Procedures*, 323-1701-310 • Provision Automatic Laser Shutdown (ALS) to be disabled. See — Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures* Part 1, 323-1701-310
6	Repeat prerequisite 3 to prerequisite 5 at all sites in the system where the new bands are being added.

Table 2-22 lists the tools and materials required to complete this procedure.

Table 2-22
Tools and materials required to complete this procedure

Item	Quantity	Supplied
Antistatic strap	1	no
Optical power meter	1	no
Fiber inspection scope	1	no
Patch cord SC-SC connectors	as required	no

—continued—

Procedure 2-9 (continued)
Re-equalizing an amplified system using SLEC when adding new bands

Precautions

	CAUTION
	Invisible laser radiation
	The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

	CAUTION
	Risk of network reliability
	Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

	CAUTION
	Possible risk of damage to equipment and fiber
	Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so could can damage to the connector unit, the fibers attached to the connector unit, or both.
	Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.
	Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

—continued—

Procedure 2-9 (continued)
Re-equalizing an amplified system using SLEC when adding new bands

Action

Step	Action
1	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item.
	The Optical Metro System Level Equalization Control window opens.
2	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu.
	A list of Site Ids that belong to the specified OSID is displayed.
3	Click on **Equalize System.**
	A SLEC information window opens.
4	Click on **OK**.

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA, APBE and APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE/APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase
- Eastbound site-level validation phase
- Eastbound phase 1 equalization phase
- Eastbound phase 2 equalization phase
- Westbound site-level validation phase
- Westbound phase 1 equalization phase
- Westbound phase 2 equalization phase

Step	Action
5	At a site that has the new band OMXs, measure the power at the first Channel Drop port of a new band West OMX using an Optical Power Meter (OPM).

If the measured power level is	**Then**
less than or equal to –15 dBm	step 8
higher than –15 dBm	step 6

—continued—

Procedure 2-9 (continued)
Re-equalizing an amplified system using SLEC when adding new bands

Step	Action
6	Choose a fixed attenuator such that the power level is between –15 dBm and –17 dBm.
7	Connect the fixed attenuator to the OMX BAND RX port. Refer to Procedure 3-45 "Installing an attenuator at the BAND DROP port in a CWDM or DWDM OMX", *Connection Procedures*, 323-1701-221.
8	Identify the patch cord that connects to the Line Rx port of the first channel West OCLD, OTR or Muxponder circuit pack. Connect the patch cord to the first Channel Drop port.
9	Repeat step 5 to step 8 for each new band West OMX and then for each new band East OMX.
10	Insert in the shelf or shelves all West OCLD, OTR or Muxponder circuit packs of the remaining channels of each new band. Make sure that all circuit packs have their Line Tx and Line Rx patch cords connected.
11	Insert in the shelf or shelves all East OCLD, OTR or Muxponder circuit packs of the remaining channels of each new band. Make sure that all circuit packs have their Line Tx and Line Rx patch cords connected.
12	Provision the OSID for the circuit packs inserted in step 10 and step 11. See Procedure 3-34 "Provision the optical system identifier " in *Provisioning and Operating Procedures*, 323-1701-310.
13	Repeat step 5 to step 12 at all sites in the system where the new bands are being added.
14	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item. *The Optical Metro System Level Equalization Control window opens.*
15	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu. *A list of Site Ids that belong to the specified OSID is displayed.*
16	Click on **Equalize System.** *A SLEC information window opens.*

<p align="center">—continued—</p>

Procedure 2-9 (continued)
Re-equalizing an amplified system using SLEC when adding new bands

Step	Action
17	Click on **OK**.

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA, APBE and APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE/APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase
- Eastbound site-level validation phase
- Eastbound phase 1 equalization phase
- Eastbound phase 2 equalization phase
- Westbound site-level validation phase
- Westbound phase 1 equalization phase
- Westbound phase 2 equalization phase

Step	Action
18	If required, turn on ALS. Refer to Procedure 1-43 "Enabling or disabling automatic laser shutdown" in *Provisioning and Operating Procedures*, 323-1701-310.

19	**If**	**Then** go to
	Continuous SLEC was halted before this procedure was started	step 20
	otherwise	step 22

Step	Action
20	Click on **Continuously Equalize System.**
	A SLEC information window opens.
21	Click on **Close.**
	SLEC is equalizing the system.
22	You have completed this procedure.

—**end**—

Procedure 2-10
Re-equalizing an amplified system using SLEC when removing channels

Use this procedure to re-equalize amplified systems or Extended Metro systems using SLEC when removing channels.

This procedure does not affect existing traffic.

Note: For SLEC troubleshooting procedures, refer to the Trouble Clearing and Alarm Reference guide, 323-1701-542.

Requirements

Before you start this procedure, make sure that

• you are logged in to the System Manager as an Admin level user

• you know the OSID of the system to re-equalize

• the SLEC deployment rules as described in Table 2-2 on page 2-8 are met

• the prerequisites as described in Table 2-23 on page 2-119 are met

Procedure 2-10 (continued)
Re-equalizing an amplified system using SLEC when removing channels

Table 2-23
Prerequisites for re-equalizing a system using SLEC when removing channels

Prerequisite #	Description
1	Ensure that the system passes when validated using the Network Modeling Tool. If this is an Extended Metro System, obtain the Nortel Custom Equalization Report.
2	This procedure can be run while Continuous SLEC is running. However, be aware that SLEC will raise the Equalization Failed event for one or multiple sites and the following status results in the SLEC System Manager screen during the procedure. — Topology error — Unexpected input power change — Detected incomplete transmit/receive pair — A component upstream failed to equalize This is expected and does not indicate any impact to existing channels. Failures occur because SLEC detects changes in the system topology. To ensure correct operation, SLEC only attempts equalization when the system topology is stable and determined to be accurate. Alternatively, to avoid the failure event generation, you can halt Continuous SLEC before proceeding to the next step. Refer to Procedure 2-13 on page 2-127 to halt Continuous SLEC.
3	Deprovision the channels assignments and circuit packs for the channels to be removed. See "Sequence for deprovisioning a wavelength" in *Provisioning and Operating Procedures*, 323-1701-310.
4	For each channel to remove, disconnect the patch cords from the Line Tx and Line Rx ports of the OCLD, OTR or Muxponder circuit packs from their corresponding OMX Channel Add and Channel Drop ports and then unseat the circuit packs.
4	Repeat prerequisite #3 and prerequisite #4 at all sites in the system where the channels need to be removed.

Table 2-24 lists the tools and materials required to complete this procedure.

Table 2-24
Tools and materials required to complete this procedure

Item	Quantity	Supplied
Antistatic strap	1	no

—continued—

Procedure 2-10 (continued)
Re-equalizing an amplified system using SLEC when removing channels

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CAUTION
Invisible laser radiation
The Optical Metro 5100/5200 operates up to a Hazard Level of k x 3A (IEC 60825-2:2000) or 1M (IEC 60825-2:2004). Use only viewing instruments with proper optical attenuation.

CAUTION
Risk of network reliability
Make sure that all connectors are cleaned before you make the connections (or re-connections) described in this procedure. For cleaning information, see the chapter "Cleaning connectors", in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

CAUTION
Possible risk of damage to equipment and fiber
Make sure that the bulkhead connectors are lowered and snapped into place before closing the drawer. Failure to do so can cause damage to the connector unit, the fibers attached to the connector unit, or both.

Observe the minimum bend radius of 1.18-inches (30-mm) for the patch cords. Always use the fiber management components in the drawer to route the fiber.

Allow for sufficient slack in the fibers entering and exiting the drawer. If sufficient slack is not left, the fibers can become stretched and damaged when the drawer is opened.

—continued—

Procedure 2-10 (continued)
Re-equalizing an amplified system using SLEC when removing channels

Action

Step	Action
1	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item.
	The Optical Metro System Level Equalization Control window opens.
2	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu.
	A list of Site IDs that belong to the specified OSID is displayed.

3	**If**	**Then** go to
	Continuous SLEC is running (the System Status field displays Continuous Equalization mode)	step 10
	otherwise (i.e., the System Status field displays Idle)	step 4

Step	Action
4	Click on **Equalize System.**
	A SLEC information window opens.
5	Click on **OK**.

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA, APBE and APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE/APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase
- Eastbound site-level validation phase
- Eastbound phase 1 equalization phase
- Eastbound phase 2 equalization phase
- Westbound site-level validation phase
- Westbound phase 1 equalization phase
- Westbound phase 2 equalization phase

—continued—

Procedure 2-10 (continued)
Re-equalizing an amplified system using SLEC when removing channels

Step	Action

6	**If**	**Then** go to
	Continuous SLEC was halted before this procedure was started	step 7
	otherwise	step 14

7   Click on the **Continuously Equalize System** button.

A SLEC information window is opened.

8   Click on **Close.**

SLEC is equalizing the system.

9   Go to step 14.

10   Since Continuous equalization is running, SLEC will raise the Equalization Failed event for one or multiple sites in the Event Console. The Optical Metro System Level Equalization Control window will show Equalization Status failed and some of the following status results will appear in the Details window:

- Topology error

- Unexpected input power change

- Detected incomplete transmit/receive pair

- A component upstream failed to equalize

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button.

11   Ignore the failure events. SLEC will run without failure events once the system topology stabilizes and is determined to be accurate.

12   Wait for the "Continuous Equalization finished-successful" message to be displayed in the System Status field.

13   Monitor the equalization process for one more round to make sure that the Continuous Equalization round has completed.

14   For systems that use APBE or APBE Enhanced circuit packs as power control devices, if you have removed channels and as a result there are no remaining channels in a band, perform Procedure 2-11, "Taking a band out-of-service" on page 2-123.

—end—

Procedure 2-11
Taking a band out-of-service

Use this procedure to take a band out-of-service in systems which use APBE or APBE Enhanced circuit packs.

Requirements

You must be logged in to the System Manager as an Admin level user.

Precautions

> ⚠ **CAUTION**
> **Risk of service interruption**
> If you remove a band from service that is carrying traffic, the traffic will be interrupted.

> ⚠ **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Action

Step	Action	
1	**If**	**Then** go to
	this band is part of a cascaded APBE/amplifier chain	step 2
	this band is not part of a cascaded APBE/amplifier chain	step 3
2	Identify the order of the APBE or APBE circuit packs in the band path. Start with the first APBE or APBE circuit pack in the path and perform the rest of the steps in this procedure.	
3	In the Selected Shelves area of the System Manager:	

- select the shelf that houses the APBE or APBE Enhanced circuit pack
- click on the **Apply** button

—continued—

Procedure 2-11 (continued)
Taking a band out-of-service

Step	Action
4	In the Optical Metro System Manager window:
	• click on the **Equipment** tab
	• click on the **Facilities** tab
	The Facilities list appears.
5	From the displayed list, select the port for the band you want to take out-of-service.
	Note: Refer to Table 2-5 on page 2-14 for APBE or APBE Enhanced port assignments.
6	Double-click on the facility.
	The Optical Metro Facility dialog box appears.
7	In the State area, select OOS from the Administrative drop-down list.
8	Click **OK** to apply the provisioning information.
	A confirmation dialog box appears.
9	Click **Yes**.
10	If this band is part of a cascaded amplifier chain, you must repeat this procedure to remove the band from each APBE or APBE Enhanced circuit pack in the path. Make sure that you perform the procedure on the APBE or APBE Enhanced circuit packs in the correct order.
11	Repeat step 3 to step 10 for the opposite direction of the signal flow.

—end—

Procedure 2-12
Re-equalizing optical power of a band

Use this procedure to re-equalize the optical power of a band, using the existing provisioning information, in systems which use APBE or APBE Enhanced circuit packs.

Note: This procedure should not be used to equalize a system, but to equalize only an APBE or APBE Enhanced circuit pack.

Requirements

You must be logged in to the System Manager as an Admin level user.

Precautions

> **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Action

Step	Action
1	In the Selected Shelves area of the System Manager: • select the shelf that houses the APBE or APBE Enhanced circuit pack • click on the **Apply** button
2	In the Optical Metro System Manager window: • click on the **Equipment** tab • click on the **Facilities** tab *The Facilities list appears.*
3	From the displayed list, right-click on the port for the band you must equalize and select the **Equalize** menu item. *The Component Level Power Equalization screen appears.* *Note:* Refer to Table 2-5 on page 2-14 for APBE or APBE Enhanced port assignments.

—continued—

Procedure 2-12 (continued)
Re-equalizing optical power of a band

Step	Action
4	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
5	Click on the **Close** button.
6	Click on the Refresh button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the Refresh button.
7	Click on the **Close** button.

<div align="center">—end—</div>

Procedure 2-13
Starting or stopping System Level Equalization Controller

Use this procedure to start or stop SLEC.

Requirements

Before you begin this procedure make sure that

- you are logged in to the System Manager as an Admin level user
- you know the OSID of the system to start or stop SLEC on

Action

Step	Action
1	From the System Manager **Admin** top level menu, select the **System Level Equalization Control** menu item.
	The Optical Metro System Level Equalization Control window opens.
2	Select the OSID of the system to equalize from the **Please Select an OSID** pull down menu.
	A list of Site Ids that belong to the specified OSID is displayed.

3	**If** you want to	**Then** go to
	stop SLEC	step 4
	start One-time SLEC	step 8
	start Continuous SLEC	step 7

Step	Action
4	Click on **Stop Equalization.**
	A confirmation window opens.
5	Click on **OK.**
6	An SLEC Confirmation window opens. Click on **Close**.
	You have completed the procedure.
7	Click on **Continuously Equalize System.**
	Note: You can check the Auto Refresh checkbox for a real-time event status update or click on Refresh button
	You have completed the procedure.
8	Click on **Equalize System.**
	A SLEC information window opens.

—continued—

Procedure 2-13 (continued)
Starting or stopping System Level Equalization Controller

Step	Action
9	Click on **OK**.

Note: You can check the Auto Refresh checkbox for a real-time event status update or click on the Refresh button. The equalization time to complete depends on the number of OFA, APBE and APBE Enhanced components in your system. On average, each OFA (VGA or HIP) takes 5 seconds and each APBE or APBE Enhanced takes 30 seconds. There are nominal delays at other times: when SLEC switches directions (5 seconds) and when SLEC puts a facility in-service (15 seconds). As an example, on a system consisting of 55 components, the equalization time is about 24 minutes. The equalization status field displays "Completed" for all rows in the Site List when equalization has completed. One complete round of equalization consists of the following seven phases.

- System-level validation phase
- Eastbound site-level validation phase
- Eastbound phase 1 equalization phase
- Eastbound phase 2 equalization phase
- Westbound site-level validation phase
- Westbound phase 1 equalization phase
- Westbound phase 2 equalization phase

—**end**—

Procedure 2-14
Provisioning target power on the APBE or APBE Enhanced circuit pack when using SLEC

Use this procedure to provision the target power for the APBE or APBE Enhanced circuit pack when using SLEC.

Requirements

Before you begin this procedure make sure that:

- you obtain the target per-band average channel power for each port of the APBE or APBE Enhanced circuit pack from the Network Modeling Tool. If this is an Extended Metro system, obtain the per-channel power target from the Nortel Custom Equalization Report.
- you are logged in to the System Manager as an Admin level user
- the APBE or APBE Enhanced circuit pack is in the In-Service state

Precautions

> **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Action

Step	Action
1	In the Selected Shelves area of the System Manager:
	• select the shelf that houses the APBE or APBE Enhanced circuit pack
	• click on the **Apply** button
2	In the Optical Metro System Manager window:
	• click on the **Equipment** tab
	• click on the **Facilities** tab
	The Facilities list appears.

—**continued**—

Procedure 2-14 (continued)
Provisioning target power on the APBE or APBE Enhanced circuit pack when using SLEC

Step	Action
3	Double-click on the APBE or APBE Enhanced port facility.
	The Optical Metro Facility dialog box appears.
	Note: Refer to Table 2-5 on page 2-14 for the APBE or APBE Enhanced port assignments.
4	In the eVOA Provision area, in the Channel Output Power Target field, enter the per-channel power target obtained from the Network Modeling Tool. If this is an Extended Metro system, the per-channel power target is obtained from the Nortel Custom Equalization Report.
	Note: The Administrative field and the Number of Channels field do not need to be provisioned. These fields will be set automatically by SLEC.
5	Click **OK**.
	A confirmation dialog is displayed.
6	In the confirmation dialog, click on **Yes**.
7	If necessary, repeat step 3 to step 6 for each band.

—**end**—

Procedure 2-15
Provisioning target power on the OFA VGA circuit pack when using SLEC

Use this procedure to provision the target power for the OFA VGA facility when using SLEC.

Requirements

Before you begin this procedure make sure that:

• you obtain the target per-band average channel power for the OFA VGA from the Network Modeling Tool. If this is an Extended Metro system, obtain the per-channel power target from the Nortel Custom Equalization Report.

• you are logged in to the System Manager as an Admin level user

• the OFA VGA circuit pack is in the In-Service state

Precautions

> ⚠ **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Action

Step	Action
1	In the Selected Shelves area of the System Manager: • select the shelf that houses the OFA VGA • click on the **Apply** button
2	In the Optical Metro System Manager window: • click on the **Equipment** tab • click on the **Facilities** tab *The Facilities list appears.*
3	Double-click on the OFA VGA facility. *The Optical Metro Facility dialog box appears.*

—continued—

Procedure 2-15 (continued)
Provisioning target power on the OFA VGA circuit pack when using SLEC

Step	Action
4	In the Channel area, in the Channel Output Power Target field, enter the per-channel power target obtained from the Network Modeling Tool. If this is an Extended Metro system, the per-channel power target is obtained from the Nortel Custom Equalization Report. *Note:* The Administrative field and the Number of Channels field do not need to be provisioned. These fields will be set automatically by SLEC.
5	Click **OK**.

<div align="center">—end—</div>

Procedure 2-16
Provisioning the connected direction at the end-point nodes of a linear system

Use this procedure to provision the connected direction at the end-point nodes of a linear system.

Requirements

Before you begin this procedure make sure that:

- you know the shelf name of the shelf equipped with the OSC circuit pack for each end-point node
- you know which direction of the end-point node is connected
- you are logged in to the System Manager as an Admin level user

Precautions

> **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Action

Step	Action
1	In the Selected Shelves area of the System Manager: • select the shelf that houses the OSC circuit pack of an end-point node • click on the **Apply** button
2	In the Optical Metro System Manager window: • click on the **Equipment** tab • click on the **Inventory** tab *The Inventory list appears.*
3	Double-click on the OSC equipment. *The Optical Metro Inventory dialog box appears.*
4	For the West Neighbor field select Connected if the West direction is connected or Not Connected if the West direction is not connected.

—continued—

Procedure 2-16 (continued)
Provisioning the connected direction at the end-point nodes of a linear system

Step	Action
5	For the East Neighbor field select Connected if the East direction is connected or Not Connected if the East direction is not connected.
6	Click **OK**.
7	Repeat step 1 to step 6 for the other end-point node.

—*end*—

Procedure 2-17
Re-equalizing optical power of a band using a VGA OFA

Use this procedure to re-equalize the optical power of a band, using the existing provisioning information, in systems that use VGA OFAs.

Note: This procedure should not be used to equalize a system, but to equalize only an OFA VGA circuit pack.

Requirements

You must be logged in to the System Manager as an Admin level user.

Precautions

> **CAUTION**
> **Risk of incorrect backup file**
> Back up the shelf after provisioning changes. Otherwise, the shelf could be restored from an out-of-date backup file in the event of shelf failure. See Procedure 1-36, "Backing up shelf configuration data" in *Provisioning and Operating Procedures*, 323-1701-310, for details.

Action

Step	Action
1	In the Selected Shelves area of the System Manager:
	• select the shelf that houses the VGA OFA
	• click on the **Apply** button
2	In the Optical Metro System Manager window:
	• click on the **Equipment** tab
	• click on the **Facilities** tab
	The Facilities list appears.
3	From the displayed list, right-click on the port for the band you need to equalize and select the **Equalize** menu item.
	The Component Level Power Equalization screen appears.

—**continued**—

Procedure 2-17 (continued)
Re-equalizing optical power of a band

Step	Action
4	Click on **Adjust Power**.
	The Power Equalization dialog appears.
	Note: The APBE or APBE Enhanced can take up to two minutes to equalize the optical power after you make a provisioning change.
5	Click on the **Close** button.
6	Click on the **Refresh** button and verify that the Power Control Status field displays "Completed". If not, wait a few minutes and then click on the **Refresh** button.
7	Click on the **Close** button.

—**end**—

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Optical Metro 5100/5200
Testing and Equalization Procedures

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