Nortel

Optical Metro 5100/5200

Customer Acceptance Testing Procedures

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NORTEL

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About this document

This document describes the optional customer acceptance testing procedures for protocols supported by Nortel Optical Metro 5100/5200 (identified prior to Release 7 as as Nortel Networks OPTera Metro 5000-series Multiservice Platform).

This document contains the following information:

- ESCON long duration test procedures
- Fibre Channel long duration test procedures
- Gigabit ethernet long duration test procedures
- SONET/SDH long duration test procedures

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.

ESCON long duration test procedures

This chapter describes the Enterprise Systems Connection (ESCON) Long Duration Testing procedures for the Optical Metro 5100/5200. The ESCON long duration test performs a bit error rate (BER) test for an extended period of time, as defined by the customer.

ESCON long duration testing is an optional additional service that can be purchased. The Optical Metro 5100/5200 typically does not require long duration testing of the ESCON protocol. The requirement to perform long duration testing is at the customer's discretion.

In telecommunication transmission, the bit error rate (BER) is the percentage of bits that have errors relative to the total number of bits received in a transmission. The BER is an indication of how often a packet must be retransmitted because of an error, and is usually expressed as ten (10) to a negative power. The OCI SRM supports a performance BER of 10^{-12}. The OCI SRM ESCON supports a performance BER of 10^{-15}.

> **CAUTION**
> **Risk of service interruption**
> This activity can cause a service interruption if performed on an in-service network. This activity should only be performed on networks that are not in service.

Requirements

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

Table 1-1
Tools and materials required for ESCON long duration testing

Description	Quantity
ESCON Test-set	See Procedure 1-1 "Determining the number of test sets" on page 1-5 for details
Multimode fiber optic patch cords (FC-FC, FC-SC, and FC-LC)	4 (each)
Antistatic strap	1
Optical power meter (FC, SC, and LC adapters)	1
Optical fiber cleaning kit	1
5dB attenuators (FC, SC, and LC)	4 (each)

Before you begin

Before you begin these procedures:

- ensure you have detailed network diagrams that describe the Optical Metro 5100/5200 system, including all installed equipment, circuit packs, slot numbers, and connections

- ensure the Optical Metro 5100/5200 network elements have been installed according to the procedures in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

- ensure the Optical Metro 5100/5200 network elements have been commissioned according to the procedures in *Connecting and Commissioning Procedures*, 323-1701-220

- ensure the Optical Metro 5100/5200 network elements have been tested according to the procedures in *Testing and Equalization Procedures*, 323-1701-222

- for amplified networks, ensure all sites are equalized and connected. For more information about equalization, refer to *Testing and Equalization Procedures*, 323-1701-222

- ensure there are no alarms on the network. If there are alarms, they must be cleared before proceeding with the test. For more information about clearing alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542

- inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. For fiber cleaning procedures, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

Precautions

To prevent personal injury or equipment damage, observe and understand all safety guidelines described in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210.

Follow all precautionary messages found in the documentation and the safety procedures established by your company.

The following precautionary messages appear in the documentation.

	DANGER
	Risk of personal injury
	A precautionary message with this symbol indicates a risk of personal injury.

	DANGER
	Risk of electrical shock
	A precautionary message with this symbol indicates a risk of personal injury caused by an electrical hazard.

	CAUTION
	Risk of laser radiation exposure
	A precautionary message with this symbol indicates a risk of personal injury caused by exposure to laser beam.

	CAUTION
	Risk of interruption to service
	A precautionary message with this symbol indicates a risk of service interruption or equipment damage.

	CAUTION
	Risk of damage to circuit packs
	A precautionary message with this symbol indicates a risk of static damage to circuit packs. Use antistatic protection.

Procedure list

Table 1-2 lists the procedures in this chapter.

Table 1-2
ESCON long duration testing procedures

Procedure 1-1
Determining the number of test sets

To complete the procedures in this chapter, you will require an ESCON test set(s) capable of transmitting and receiving ESCON protocols, and supporting multimode transmission.

The number of test sets required depends on the number of channels being tested simultaneously. To maximize the number of channels tested at one time, a single test set using channel loop backs (daisy chaining) is permitted.

The OCI SRM ESCON circuit pack supports unlimited loop backs for bit error rate (BER) testing.

For ESCON BER testing on all other OCI SRM circuit packs, the number of loop backs is limited by the number of Jitter Contributing Units (JCU) in each optical span. To determine the JCU penalty in an optical span, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering,* 323-1701-110. If testing an OCI SRM, a maximum of eight JCU is permitted.

Requirements

Before you begin this procedure make sure you have a detailed network diagram.

Action

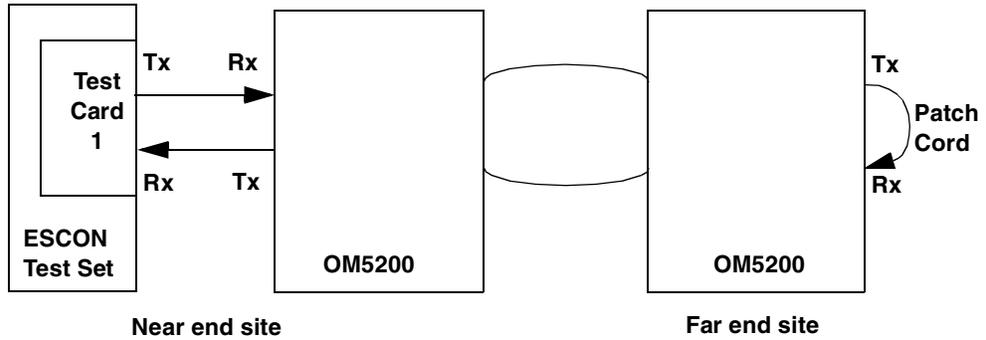| Step	Action
1	Review the network diagram, and count the number of JCU in the test path.
2	ESCON test sets cannot accommodate a head-to-head testing configuration. The receive test signal must be loop backed or daisy chained to the OCI SRM network element that transmitted the signal. See Figure 1-1 for more information.

—continued—

Procedure 1-1 (continued)
Determining the number of test sets

Step	Action

Figure 1-1
ESCON test setup

3	**If** you are testing	**Then**
	OCI SRM ESCON	unlimited loop backs are supported. One test set can be used to perform BER on unlimited channels.
	OCI SRM	the test path can contain a maximum of 8 JCU. For a description of JCU, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering*, 323-1701-110. If running several OCI SRM test paths simultaneously, one test set is required for each test path.

—end—

Procedure 1-2
Validating the test equipment

Use this procedure to record information about the test equipment used to perform the ESCON long duration tests, and to validate that the equipment is operating correctly before starting the tests.

Requirements

Before you begin this procedure make sure the test set optics match those of the circuit packs under test. Use 1310 nm optics test sets to test the OCI SRM ESCON 1310 nm or OTR circuit pack.

> **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Action

Step	Action
1	Locate the test set serial numbers and calibration date, and enter the information in Table 1-3 on page 1-9.
2	Locate the optical power meter serial numbers and the calibration date, and enter the information in Table 1-4 on page 1-9.
3	Set the ESCON test set transmit (Tx) settings as follows:

Setting	Value
Data Size	1K byte data
Test Data	2^{-23} -1
Data Rate	Full

Step	Action
4	Set the test set receive (Rx) setting to match the transmit (Tx) settings.

—**continued**—

Procedure 1-2 (continued)
Validating the test equipment

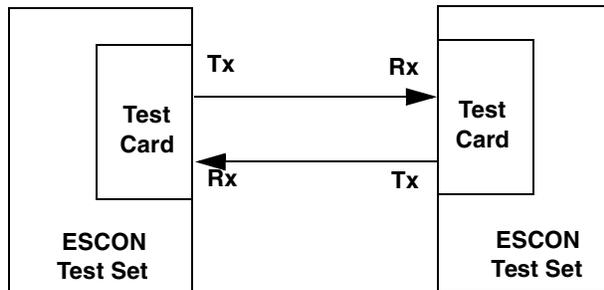| Step	Action

5	**If**	**Then** go to
	one test set is required for testing	step 6
	two test sets are required for testing	step 8

6   Use a fiber optic patch cord to connect the transmitter (Tx) output and the receiver (Rx) input on the test set. See Figure 1-2.

Figure 1-2
Single test set validation set up
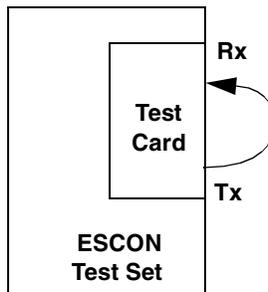
7   Go to step 10.

8   Use a fiber optic patch cord to connect the transmitter (Tx) output of test set 1 to the receiver (Rx) input of test set 2. See Figure 1-3.

9   Use a second fiber optic patch cord to connect the Tx output of test set 2 and the Rx input of test set 1.

Figure 1-3
Dual test set validation set up

—**continued**—

Procedure 1-2 (continued)
Validating the test equipment

Step	Action
10	Reset the test set and ensure that a signal is received. The test set displays zero errors and alarms.
11	Insert three errors and verify that the errors are received.

12	**If** the test-set	**Then** go to
	displays three errors, the test set is functioning correctly	step 14
	does not display three errors, the test set is not functioning correctly	step 13

13 Perform the following actions:

    a. check the test set settings. Return to step 5 to repeat the test.

    b. inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 5 to repeat the test.

    c. replace the fiber optic patch cord(s). Return to step 5 to repeat the test.

    d. if the problem is not resolved, contact your next level of support. Do not proceed until the problem is resolved.

14 Disconnect the fiber optic patch cord from the receive (Rx) input of the test set.

Table 1-3
Test set information

Manufacturer	Serial number	Calibration date

Table 1-4
Optical power meter information

Manufacturer	Serial number	Calibration date

—end—

Procedure 1-3
Setting up the test configuration

Use this procedure to provision the appropriate circuit packs, define the channel assignments to be tested, and to connect the test sets in the required configuration.

Requirements

Before you begin this procedure make sure

- the test set optics match those of the circuit packs under test. Use 1310 nm optics test sets to test the OCI SRM ESCON 1310 nm or OTR circuit pack.

- you use only multimode fiber patch cords for ESCON testing.

> **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Action

Step	Action

Channel assignments

Step	Action
1	Log in to System Manager. For information on how to log in to System Manager, refer to *Provisioning and Operating Procedures*, 323-1701-310.
2	Create the ESCON channel assignment (path) that is to be tested, and put the appropriate circuit pack in-service. For information on creating channel assignments and putting circuit packs in-service, refer to *Provisioning and Operating Procedures*, 323-1701-310.

3	**If** the path is	**Then**
	protected	perform a force switch at both ends of the connection to ensure that the traffic is on the path undergoing the test. For more information on how to perform a force switch, refer to *Provisioning and Operating Procedures*, 323-1701-310. Once the force switch is complete, go to step 4.
	unprotected	go to step 4.

—continued—

Procedure 1-3 (continued)
Setting up the test configuration

Step	Action

Check receive power levels

4   Determine the number of test sets required to test the ESCON signal path. For more information, see Procedure 1-1 "Determining the number of test sets" on page 1-5.

5

⚠ **CAUTION**
Risk of damage to receivers
Do not exceed the maximum acceptable optical power input on any of the OCI/OTR or test set receivers. Check the transmit power levels before connecting any test equipment.

Use an optical power meter to measure the transmit (Tx) power levels at the following points in the test path:

a.   near end OCI/OTR client side Tx output

b.   near end test set Tx output

c.   far end OCI/OTR client side Tx output

d.   far end test set Tx output (if used)

6   Compare the Tx power levels to the acceptable receive (Rx) power levels of the corresponding component.

To determine the acceptable OCI/OTR receive power levels, refer to *Technical Specifications*, 323-1701-180.

To determine the acceptable test set receive power levels, refer to the test set manufacturer documentation.

7

If	**Then** go to
all Tx power levels are within the corresponding Rx specifications	step 9
any Tx power levels exceed the corresponding Rx specifications	step 8

8   When connecting the test set to the OCI/OTR, 5dB attenuators must be connected between the transmitters and receivers, as shown in Figure 1-4.

—continued—

Procedure 1-3 (continued)
Setting up the test configuration

Step   Action

Figure 1-4
Adding attenuation to protect receive levels
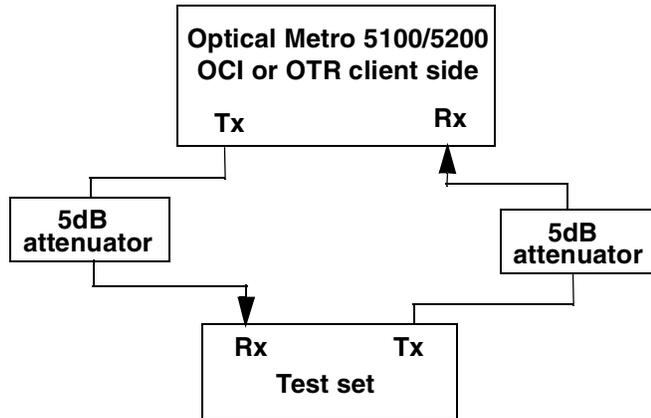
9   See Figure 1-5 for an illustration of the test configuration.
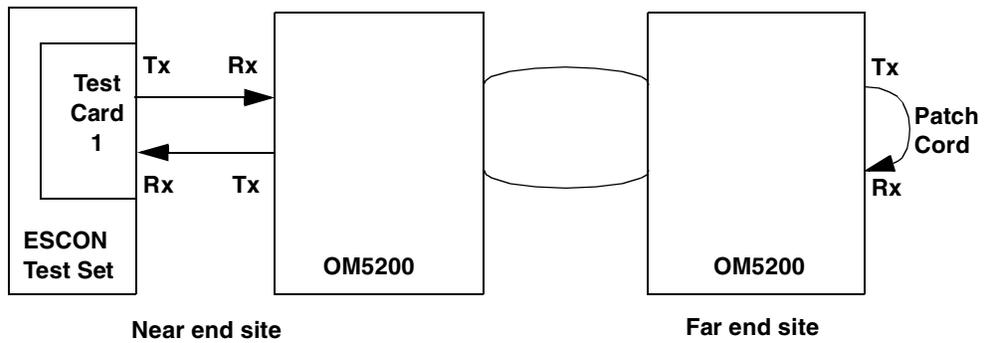
Figure 1-5
ESCON test set configuration

—continued—

Procedure 1-3 (continued)
Setting up the test configuration

Step	Action

10

> **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

At the near end, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI or OTR client-side receive (Rx) port that you are testing, as shown in Figure 1-5.

Note: Ensure that you have verified the optical signal power levels as described in step 5.

11 At the corresponding shelf in the far end site, connect an optical patch cord between the transmit (Tx) port of the OCI or OTR client-side transmit (Tx) port and the receive (Rx) port of the OCI or OTR client-side receive (Rx) port that you are testing, as shown in Figure 1-5.

Configure the test set

12 Set all test set transmit (Tx) settings as follows:

Tx settings	Value
Data Size	1K byte data
Test Data	$2^{-23} -1$
Data Rate	Full

Test the connections

13 Insert three errors on the test set.

14 Verify that the test set receives and displays three errors.

—**continued**—

Procedure 1-3 (continued)
Setting up the test configuration

Step	Action

15	**If** the test set	**Then** go to
	displays three errors	step 17
	does not display three errors	step 16

16   Perform the following:

    a.   check the test set settings. Return to step 12 to repeat the test.

    b.   inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 13 to repeat the test.

    c.   replace the fiber optic patch cord(s). Return to step 13 to repeat the test.

    d.   contact your next level of support. Do not proceed until the problem is resolved.

17   Reset all test sets.

The display on all test sets indicates zero bit errors.

18   Go to Procedure 1-4 "Running the ESCON long duration test" on page 1-15.

—**end**—

Procedure 1-4
Running the ESCON long duration test

Use this procedure to run the ESCON long duration test, and to record the test objectives and results.

Requirements

Before you begin this procedure make sure the test configuration has been set up and tested. See Procedure 1-3 on page 1-10.

	CAUTION
⚠	**Risk of test failure** Do not perform any equipment or path switches on the nodes under test for the duration of the test. If equipment or path switches are performed the test could fail.

Action

Step	Action
1	Record the ESCON test duration and test configuration in Table 1-5 on page 1-16.
2	Check for alarms on the system. If there are alarms, they must be cleared before proceeding with the test. For information on how to check and clear alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542.
3	Start the long duration test, and monitor the system for the duration identified in Table 1-5 on page 1-16.
4	Verify the error count does not exceed the objective for the duration specified in Table 1-6 on page 1-17.
5	At the end of the test duration, record the error count in Table 1-5 on page 1-16.

6	**If** the error count is	**Then** go to
	less than or equal to the objective stated in Table 1-6.	step 8
	greater than the objective stated in Table 1-6.	step 7

—continued—

Procedure 1-4 (continued)
Running the ESCON long duration test

Step	Action
7	Repeat the test beginning at step 2. If the error counts do not improve on the second test, contact your next level of support.
8	Record the test results in Table 1-5.
9	Remove the test sets and restore the network to its initial state.

Table 1-5
ESCON long duration test results

Test duration		Test configuration	Results	
Test start date	**Test duration**	**Number of JCU in path**	**Error count**	**Pass/Fail**

—continued—

Procedure 1-4 (continued)
Running the ESCON long duration test

Table 1-6
ESCON long duration test objectives

EOF Performance Guarantees:					
Circuit pack	BER Measurement				
OCI SRM ESCON	1×10^{-15}				
OCI 1.25 Gbit/s 1310 nm	1×10^{-12}				
OCI SRM 1310 nm	1×10^{-12}				
OCI SRM 1310 nm LC	1×10^{-12}				
OCI 622 Mbit/s 1310 nm	1×10^{-12}				
ESCON (200 Mbit/s)					
BER	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-15}	0	0	0	0	0
10^{-12}	4	9	17	35	52

—**end**—

Fibre Channel long duration test procedures

This chapter describes the Fibre Channel long duration testing requirements for the Optical Metro 5100/5200. The Fibre Channel long duration test performs a Bit Error Rate (BER) test for an extended period of time, as defined by the customer.

Fibre Channel long duration testing is an optional additional service that can be purchased. The Optical Metro 5100/5200 typically does not require long duration testing of the Fibre Channel protocol. The requirement to perform long duration testing is at the customer's discretion.

In telecommunication transmission, the bit error rate (BER) is the percentage of bits that have errors relative to the total number of bits received in a transmission. The BER is an indication of how often a packet must be retransmitted because of an error, and is usually expressed as ten (10) to a negative power. All OCI SRM and Muxponder circuit packs supporting the Fibre Channel protocol have a BER of 10^{-12}.

> **CAUTION**
> This activity can cause a service interruption if performed on an in-service network. This activity should only be performed on networks that are not in service.

Requirements

Table 2-1 lists the tools and materials required for procedures in this chapter.

Table 2-1
Tools and materials required for Fibre Channel long duration testing

Description	Quantity
Fibre Channel Test-set	See Procedure 2-1 "Determining the number of test sets" on page 2-5 for details
Multimode fiber optic patch cords (either FC-FC, FC-SC, and FC-LC or SC-SC and SC-LC [dependent on the test set])	4 (each)
Antistatic strap	1
Optical power meter (FC, SC, and LC adapters)	1
Optical fiber cleaning kit	1
5dB attenuators (FC, SC, and LC)	4 (each)

Before you begin

Before you begin these procedures:

- ensure you have detailed network diagrams that describe the Optical Metro 5100/5200 system, including all installed equipment, circuit packs, slot numbers, and connections

- ensure the Optical Metro 5100/5200 network elements have been installed according to the procedures in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

- ensure the Optical Metro 5100/5200 network elements have been commissioned according to the procedures in *Connecting and Commissioning Procedures*, 323-1701-220

- ensure the Optical Metro 5100/5200 network elements have been tested according to the procedures in *Testing and Equalization Procedures*, 323-1701-222

- for amplified networks, ensure all sites are equalized and connected. For more information about equalization, refer to *Testing and Equalization Procedures*, 323-1701-222

- ensure there are no alarms on the network. If there are alarms, they must be cleared before proceeding with the test. For more information about clearing alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542

- inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. For fiber cleaning procedures, see *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

Precautions

To prevent personal injury or equipment damage, observe and understand all safety guidelines described in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210.

Follow all precautionary messages found in the documentation and the safety procedures established by your company.

The following precautionary messages appear in the documentation.

DANGER
Risk of personal injury
A precautionary message with this symbol indicates a risk of personal injury.

DANGER
Risk of electrical shock
A precautionary message with this symbol indicates a risk of personal injury caused by an electrical hazard.

CAUTION
Risk of laser radiation exposure
A precautionary message with this symbol indicates a risk of personal injury caused by exposure to laser beam.

CAUTION
Risk of interruption to service
A precautionary message with this symbol indicates a risk of service interruption or equipment damage.

CAUTION
Risk of damage to circuit packs
A precautionary message with this symbol indicates a risk of static damage to circuit packs. Use antistatic protection.

Procedure list

Table 2-2 lists the procedures in this chapter.

Table 2-2
Fibre Channel long duration testing procedures

Procedure 2-1
Determining the number of test sets

To complete the procedures in this chapter, a Fibre Channel test set(s) capable of transmitting and receiving from 266 Mbit/s to 2.125 Gbit/s in Multimode or Single Mode optical wavelengths (850 nm or 1310 nm) is required.

The number of test sets required depends on the number of channels being tested simultaneously. Fibre Channel bit error rate (BER) testing will support a dual test set configuration (head to head). For head to head testing, two test sets are required for each channel tested. Fibre Channel BER testing also supports a single test set using loop backs (daisy-chaining). For the OCI SRM GbE/FC circuit pack, daisy chaining must be limited to the 2 ports of the circuit pack. For the Muxponder circuit pack, daisy chaining the client-side ports is not permitted.

For Fibre Channel BER testing on all other OCI SRM circuit packs, the number of loop backs is limited by the number of Jitter Contributing Units (JCU) in each optical span. To determine the JCU in an optical span, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering,* 323-1701-110. The maximum number of JCU permitted in the optical span OCI SRM circuit packs is eight.

Requirements

Before you begin this procedure make sure you have a detailed network diagram.

Action

Step	Action	
1	Review the network diagram, and count the number of JCU in the test path.	
2	**If** you are testing	**Then**
	OCI SRM GbE/FC	one test can be used to test the two ports of the circuit pack. Daisy-chaining of the two ports is allowed but you cannot daisy-chain the signal to another circuit pack.
	Muxponder	daisy-chaining of the client-side ports is not permitted. One test set can be used to test one client-side port.
	any other OCI SRM supporting Fibre Channel	the test path can contain a maximum of 8 JCU. For a description of JCU, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering*, 323-1701-110. If running several OCI SRM test paths simultaneously, one test set is required for each test path.

—end—

Procedure 2-2
Validating the test equipment

Use this procedure to record information about the test equipment used to perform the Fibre Channel long duration tests, and to validate that the equipment is operating correctly before starting the tests.

Requirements

Before you begin this procedure make sure the test set optics match those of the circuit packs under test. Use 1310nm optics test sets to test the OCI SRM GbE/FC 1310 nm, OTR or Muxponder circuit pack.

If you are testing extended reach on an OCI SRM GbE/FC circuit pack using the FC protocol, ensure that the test set supports the "FC R_RDY" flow control feature.

CAUTION
Risk of signal degradation or loss of signal
Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201 for connector cleaning procedures.

Action

Step	Action
1	Locate the test set serial numbers and calibration date, and enter the information in Table 2-3 on page 2-9.
2	Locate the optical power meter serial numbers and the calibration date, and enter the information in Table 2-4 on page 2-9.

Procedure 2-2 (continued)
Validating the test equipment

Step	Action

3   Set the Fibre Channel test set transmit (Tx) settings as follows:

| Setting	Value
Protocol	Fibre Channel
Clock Rate	1.0625 Gbit/s for FC-100 or 2.125 Gbit/s for FC-200
Pattern	CRPAT or any other pattern allowed on the test set

4   Set the test set receive (Rx) setting to match the transmit (Tx) settings.

5

If	**Then** go to
one test set is required for testing	step 6
two test sets are required for testing	step 8

6   Use a fiber optic patch cord to connect the transmitter (Tx) output and the receiver (Rx) input on the test set. See Figure 2-1.

Figure 2-1
Single test set validation set up
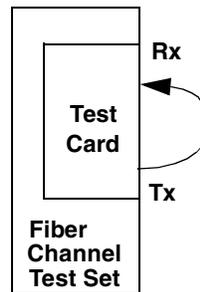
7   Go to step 10.

8   Use a fiber optic patch cord to connect the transmitter (Tx) output of test set 1 to the receiver (Rx) input of test set 2. See Figure 2-2.

9   Use a second fiber optic patch cord to connect the Tx output of test set 2 and the Rx input of test set 1.
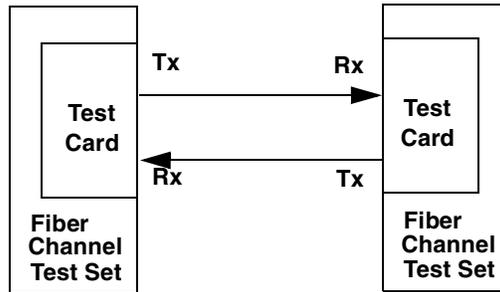
—continued—

Procedure 2-2 (continued)
Validating the test equipment

Step	Action

Figure 2-2
Dual test set validation set up

10 Reset the test set and ensure that a signal is received. The test set displays zero errors and alarms.

11 Insert three errors and verify that the errors are received.

12

If the test-set	**Then** go to
displays three errors, the test set is functioning correctly	step 14
does not display three errors, the test set is not functioning correctly	step 13

13 Perform the following actions:

    a. check the test set settings. Return to step 5 to repeat the test.

    b. inspect and clean all fiber optic cables and component connectors. See *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210 for connector cleaning procedures. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 5 to repeat the test.

    c. replace the fiber optic patch cord(s). Return to step 5 to repeat the test.

    d. if the problem is not resolved, contact your next level of support. Do not proceed until the problem is resolved.

14 Disconnect the fiber optic patch cord from the receive (Rx) input of the test set.

—continued—

Procedure 2-2 (continued)
Validating the test equipment

Table 2-3
Test set information

Manufacturer	Serial number	Calibration date

Table 2-4
Optical power meter information

Manufacturer	Serial number	Calibration date

—**end**—

Procedure 2-3
Setting up the test configuration

Use this procedure to provision the appropriate circuit packs, define the channel assignments to be tested, and to connect the test sets in the required configuration.

Requirements

Before you begin this procedure make sure the test set optics match those of the circuit packs under test. Use 1310 nm optics test sets to test the OCI SRM GbE/FC 1310 nm, OCI SRM GbE 1310 nm, OTR or Muxponder circuit pack.

> **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201 for connector cleaning procedures.

Action

Step	Action

Channel assignments

1	Log in to System Manager. For information on how to log in to System Manager, refer to *Provisioning and Operating Procedures*, 323-1701-310.
2	Create the Fibre Channel channel assignment (path) that is to be tested, and put the appropriate circuit pack in-service. For information on creating channel assignments and putting circuit packs in-service, refer to *Provisioning and Operating Procedures*, 323-1701-310.
3	If you are testing extended reach on an OCI SRM GbE/FC using the FC protocol, provision the extended reach details by following Procedure 3-20 "Provisioning subrate and extended reach details" in *Provisioning and Operating Procedures*, 323-1701-310.

Procedure 2-3 (continued)
Setting up the test configuration

Step	Action
4	**If** the path is · **Then**

	If the path is	Then
	protected	perform a force switch at both ends of the connection to ensure that the traffic is on the path undergoing the test. For more information on how to perform a force switch, refer to *Provisioning and Operating Procedures*, 323-1701-310. Once the force switch is complete, go to step 5.
	unprotected	go to step 5.

5 Determine the number of test sets required to test the Fibre Channel signal path. For more information, see Procedure 2-1 "Determining the number of test sets" on page 2-5.

Check receive power levels

6

> **CAUTION**
> **Risk of damage to receivers**
> Do not exceed the maximum acceptable optical power input on any of the OCI/OTR/Muxponder or test set receivers. Check the transmit power levels before connecting any test equipment.

Use an optical power meter to measure the transmit (Tx) power levels at the following points in the test path:

a. near end OCI/OTR/Muxponder client side Tx output

b. near end test set Tx output

c. far end OCI/OTR/Muxponder client side Tx output

d. far end test set Tx output (if used)

7 Compare the Tx power levels to the acceptable receive (Rx) power levels of the corresponding component.

To determine the acceptable OCI/OTR/Muxponder receive power levels, refer to *Technical Specifications*, 323-1701-180.

To determine the acceptable test set receive power levels, refer to the test set manufacturer documentation.

—**continued**—

Procedure 2-3 (continued)
Setting up the test configuration

Step	Action	
8	**If**	**Then** go to
	all Tx power levels are within the corresponding Rx specifications	step 10
	any Tx power levels exceed the corresponding Rx specifications	step 9

9   When connecting the test set to the OCI/OTR/Muxponder, 5dB attenuators must be connected between the transmitters and receivers, as shown in Figure 2-3.

Figure 2-3
Adding attenuation to protect receive levels
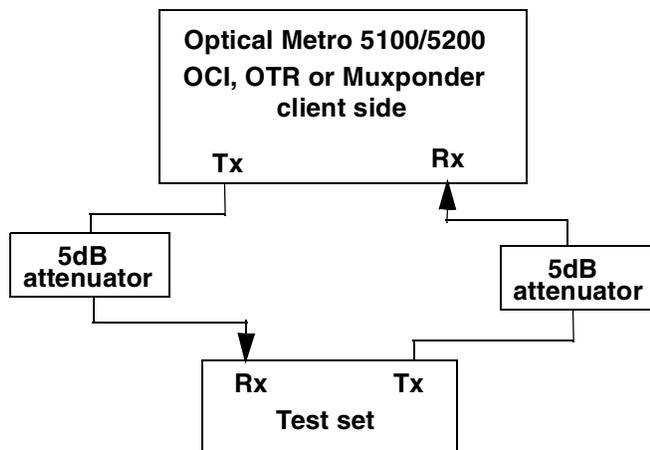
Step	Action	
10	**If**	**Then** go to
	one test set is required	step 11
	two test sets are required	step 15

Single test set configuration

11   See Figure 2-4 for an illustration of the test configuration using one test set.

—**continued**—

Procedure 2-3 (continued)
Setting up the test configuration

Step	Action

Figure 2-4
Single test set configuration
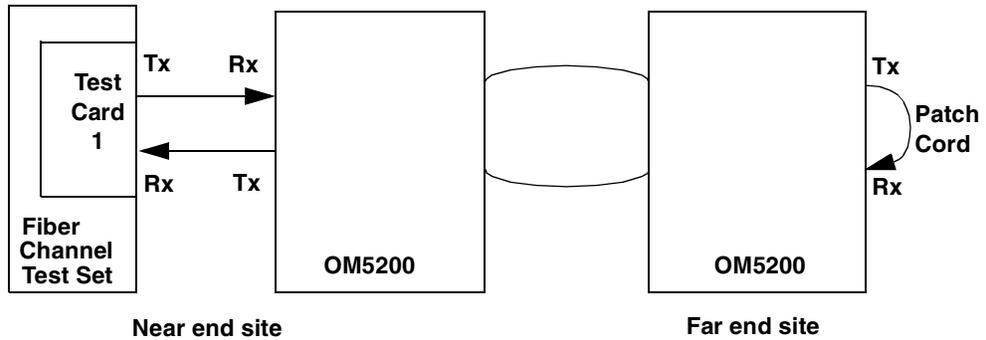
12

⚠️ **CAUTION**
Risk of signal degradation or loss of signal
Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201 for connector cleanong procedures.

At the near end, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 2-4.

Note: Ensure that you have verified the optical signal power levels as described in step 6.

13 At the corresponding shelf in the far end site, connect an optical patch cord between the transmit (Tx) port of the OCI, OTR or Muxponder client-side transmit (Tx) port and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 2-4.

14 Go to step 18.

Dual test set configuration

15 See Figure 2-5 for an illustration of the test configuration using two test sets.

—continued—

Procedure 2-3 (continued)
Setting up the test configuration

Step	Action

Figure 2-5
Dual test set configuration
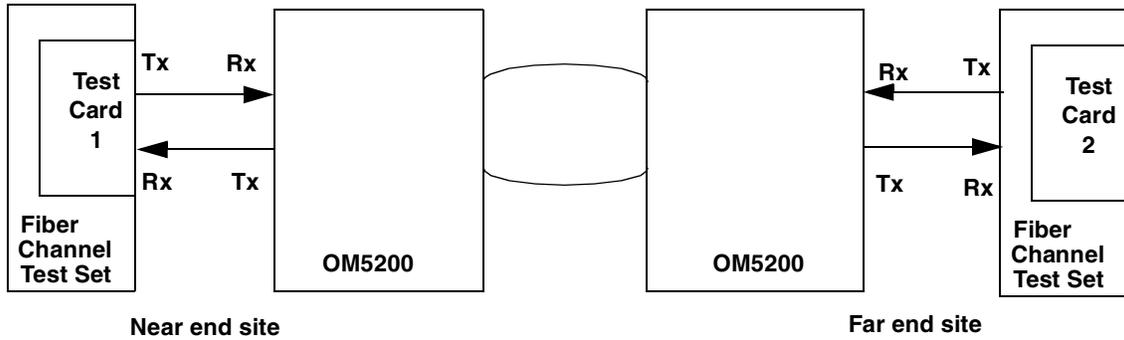
16

⚠ **CAUTION**
Risk of signal degradation or loss of signal
Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201 for connector cleaning procedures.

At the near end, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 2-5.

Note: Ensure that you have verified the optical signal power levels as described in step 6.

17   At the corresponding shelf in the far end site, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 2-5.

—continued—

Procedure 2-3 (continued)
Setting up the test configuration

Step	Action

Configure the test set

18   Set the Fibre Channel test set transmit (Tx) settings as follows:

Setting	Value
Protocol	Fibre Channel
Clock Rate	1.0625 Gbit/s for FC-100 or 2.125 Gbit/s for FC-200
Pattern	CRPAT or any other pattern allowed on the test set

19   Set all test set receive (Rx) setting to match the transmit (Tx) settings.

Test the connections

20

If	**Then** go to
a single test set is being used	step 21
dual test sets are being used	step 26

21   Reset the near end test set.

The display on all test set indicates zero bit errors.

22   Insert three errors on the near end test set.

23   Verify that the near end test set receives and displays three errors.

24

If the near end test set	**Then** go to
displays three errors	step 34
does not display three errors	step 25

25   Perform the following:

   a.   check the test set settings. Return to step 18 to repeat the test.

   b.   inspect and clean all fiber optic cables and component connectors. See *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210 for connector cleaning procedures. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 21 to repeat the test.

   c.   replace the fiber optic patch cord(s). Return to step 21 to repeat the test.

   d.   contact your next level of support. Do not proceed until the problem is resolved.

—continued—

Procedure 2-3 (continued)
Setting up the test configuration

Step	Action
26	Reset the near end and far end test sets.
	The display on both test sets indicates zero bit errors.
27	Insert three errors on the near end test set.
28	Verify that the far end test set receives and displays three errors.

29	**If** the far end test set	**Then** go to
	displays three errors	step 30
	does not display three errors	step 33

30	Insert three errors on the far end test set.
31	Verify that the near end test set receives and displays three errors.

32	**If** the near end test set	**Then** go to
	displays three errors	step 34
	does not display three errors	step 33

33	Perform the following:
	a. check the test set settings. Return to step 18 to repeat the test.
	b. inspect and clean all fiber optic cables and component connectors. See *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 26 to repeat the test.
	c. replace the fiber optic patch cord(s). Return to step 26 to repeat the test.
	d. contact your next level of support. Do not proceed until the problem is resolved.
34	Reset all test sets.
	The display on all test sets indicates zero bit errors.
35	Go to Procedure 2-4 "Running the Fibre Channel long duration test" on page 2-17.

—**end**—

Procedure 2-4
Running the Fibre Channel long duration test

Use this procedure to run the Fibre Channel long duration test, and to record the test objectives and results.

Requirements

Before you begin this procedure make sure the test configuration has been set up and tested. See Procedure 2-3 on page 2-10.

⚠ **CAUTION**
Risk of test failure
Do not perform any equipment or path switches on the nodes under test for the duration of the test. If equipment or path switches are performed the test could fail.

Action

Step	Action
1	Record the Fibre Channel test duration and test configuration in Table 2-5 on page 2-18.
2	Check for alarms on the system. If there are alarms, they must be cleared before proceeding with the test.
	For information on how to check and clear alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542.
3	Start the long duration test, and monitor the system for the duration identified in Table 2-5 on page 2-18.
4	Verify the error count does not exceed the objective for the duration specified in Table 2-6 on page 2-19.
5	At the end of the test duration, record the error count in Table 2-5 on page 2-18.

6	**If** the error count is	**Then** go to
	less than or equal to the objective stated in Table 2-6.	step 8
	greater than the objective stated in Table 2-6.	step 7

—continued—

Procedure 2-4 (continued)
Running the Fibre Channel long duration test

Step	Action
7	Repeat the test beginning at step 2. If the error counts do not improve on the second test, contact your next level of support.
8	Record the test results in Table 2-5.
9	Remove the test sets and restore the network to its initial state.

Table 2-5
Fibre Channel long duration test results

Test duration		Test configuration	Results	
Test start date	Test duration	Number of JCU in path	Error count	Pass/Fail

—continued—

Procedure 2-4 (continued)
Running the Fibre Channel long duration test

Table 2-6
Fibre Channel long duration test objectives

FC-25 (266 Mbit/s)					
	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	6	11	23	46	69
10^{-11}	57	115	230	460	689
10^{-10}	575	1149	2298	4696	6895
10^{-9}	5746	11491	22982	45965	68947
FC-50 (531 Mbit/s)					
	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	11	23	46	92	138
10^{-11}	115	229	459	918	1376
10^{-10}	1147	2294	4588	9176	13764
10^{-9}	11470	22939	45878	91757	137635
FC-100 (1063 Mbit/s)					
	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	23	46	92	184	276
10^{-11}	230	459	918	1837	2755
10^{-10}	2296	4592	9184	18369	27553
10^{-9}	22961	45922	91843	183686	275530
FC-200 (2125 Mbit/s)					
	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	46	92	184	368	552
10^{-11}	460	918	1836	3674	5510
10^{-10}	4592	9184	18368	36738	55106
10^{-9}	45922	91844	183686	367372	551060

—**end**—

Gigabit Ethernet long duration test procedures

This chapter describes the Gigabit Ethernet long duration testing requirements for the Optical Metro 5100/5200. The Gigabit Ethernet long duration test performs a Bit Error Rate (BER) test for an extended period of time, as defined by the customer.

Gigabit Ethernet long duration testing is an optional additional service that can be purchased. The Optical Metro 5100/5200 typically does not require long duration testing of the Gigabit Ethernet protocol. The requirement to perform long duration testing is at the customer's discretion.

In telecommunication transmission, the bit error rate (BER) is the percentage of bits that have errors relative to the total number of bits received in a transmission. The BER is an indication of how often a packet must be retransmitted because of an error, and is usually expressed as ten (10) to a negative power. The OCI SRM GbE/FC, OCI SRM GbE, and Muxponder circuit packs supporting the Gigabit Ethernet protocol have a BER of 10^{-12}.

> **CAUTION**
> This activity can cause a service interruption if performed on an in-service network. This activity should only be performed on networks that are not in service.

Requirements

Table 3-1 lists the tools and materials required for procedures in this chapter.

Table 3-1
Tools and materials required for Gigabit Ethernet long duration testing

Description	Quantity
Gigabit Ethernet Test-set	See Procedure 3-1 "Determining the number of test sets" on page 3-5 for details
Fiber optic patch cords (either FC-FC, FC-SC, and FC-LC or SC-SC and SC-LC [dependent on the test set])	4 (each)
Antistatic strap	1
Optical power meter (FC, SC, and LC adapters)	1
Optical fiber cleaning kit	1
5dB attenuators (FC, SC, and LC)	4 (each)

Before you begin

Before you begin these procedures:

- ensure you have detailed network diagrams that describe the Optical Metro 5100/5200 system, including all installed equipment, circuit packs, slot numbers, and connections

- ensure the Optical Metro 5100/5200 network elements have been installed according to the procedures in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

- ensure the Optical Metro 5100/5200 network elements have been commissioned according to the procedures in *Connecting and Commissioning Procedures*, 323-1701-220

- ensure the Optical Metro 5100/5200 network elements have been tested according to the procedures in *Testing and Equalization Procedures*, 323-1701-222

- for amplified networks, ensure all sites are equalized and connected. For more information about equalization, refer to *Testing and Equalization Procedures*, 323-1701-222

- ensure there are no alarms on the network. If there are alarms, they must be cleared before proceeding with the test. For more information about clearing alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542

- inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. For fiber cleaning procedures, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

Precautions

To prevent personal injury or equipment damage, observe and understand all safety guidelines described in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210.

Follow all precautionary messages found in the documentation and the safety procedures established by your company.

The following precautionary messages appear in the documentation.

	DANGER **Risk of personal injury** A precautionary message with this symbol indicates a risk of personal injury.

	DANGER **Risk of electrical shock** A precautionary message with this symbol indicates a risk of personal injury caused by an electrical hazard.

	CAUTION **Risk of laser radiation exposure** A precautionary message with this symbol indicates a risk of personal injury caused by exposure to laser beam.

	CAUTION **Risk of interruption to service** A precautionary message with this symbol indicates a risk of service interruption or equipment damage.

	CAUTION **Risk of damage to circuit packs** A precautionary message with this symbol indicates a risk of static damage to circuit packs. Use antistatic protection.

Procedure list

Table 3-2 lists the procedures in this chapter.

Table 3-2
Gigabit Ethernet long duration testing procedures

Procedure 3-1
Determining the number of test sets

To complete the procedures in this chapter, you will require a Gigabit Ethernet test set(s) capable of transmitting and receiving Gigabit Ethernet protocols, and supporting multimode transmission.

The number of test sets required depends on the number of channels being tested simultaneously. Gigabit Ethernet bit error rate (BER) testing will support a dual test set configuration (head to head). For head to head testing, two test sets are required for each channel tested. Gigabit Ethernet BER testing also supports a single test set using loop backs (daisy chaining). For the OCI SRM GbE/FC and OCI SRM GbE circuit packs, daisy chaining must be limited to the 2 ports of the circuit pack. For the Muxponder circuit pack, daisy chaining the client-side ports is not permitted.

For Gigabit Ethernet BER testing on all other OCI SRM circuit packs, the number of loop backs is limited by the number of Jitter Contributing Units (JCU) in each optical span. To determine the JCU penalty in an optical span, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering,* 323-1701-110. If testing an OCI SRM, a maximum of eight JCU is permitted.

Requirements

Before you begin this procedure make sure you have a detailed network diagram.

Action

Step	Action	
1	Review the network diagram, and count the number of JCU in the test path.	
2	**If** you are testing	**Then**
	OCI SRM GbE/FC or OCI SRM GbE	one test can be used to test the two ports of the circuit pack. That is, daisy-chaining of the two ports is allowed but you cannot daisy-chain the signal to another circuit pack.
	Muxponder	daisy-chaining of the client-side ports is not permitted. One test set can be used to test one client-side port.
	any other OCI SRM supporting Fibre Channel	the test path can contain a maximum of 8 JCU. For a description of JCU, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering*, 323-1701-110. If running several OCI SRM test paths simultaneously, one test set is required for each test path.
		—end—

Procedure 3-2
Validating the test equipment

Use this procedure to record information about the test equipment used to perform the Gigabit Ethernet long duration tests, and to validate that the equipment is operating correctly before starting the tests.

Requirements

Before you begin this procedure make sure the test set optics match those of the circuit packs under test. Use 1310nm optics test sets to test the OCI GbE 1310 nm, OCI SRM GbE 1310 nm, OCI SRM GbE/FC 1310 nm, OCI SRM GbE/FC Enhanced 1310 nm, OTR or Muxponder circuit pack.

⚠️ **CAUTION**
Risk of signal degradation or loss of signal
Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Action

Step	Action
1	Locate the test set serial numbers and calibration date, and enter the information in Table 3-3 on page 3-9.
2	Locate the optical power meter serial numbers and the calibration date, and enter the information in Table 3-4 on page 3-9.
3	Set the Gigabit Ethernet test set transmit (Tx) settings as follows:

Setting	Value
BERT	Pattern - CRPAT or any other pattern allowed on the test set
Frame length	64 bytes
Background	Random
Interpacket gap	0.096 µsec or 100% utilization
MAC source and destination	set to off

|	
4	Set the test set receive (Rx) setting to match the transmit (Tx) settings.

—continued—

Procedure 3-2 (continued)
Validating the test equipment

Step	Action	
5	**If**	**Then** go to
	one test set is required for testing	step 6
	two test sets are required for testing	step 8

6   Use a fiber optic patch cord to connect the transmitter (Tx) output and the receiver (Rx) input on the test set. See Figure 3-1.

Figure 3-1
Single test set validation set up
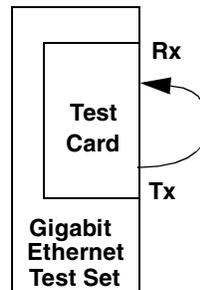
7   Go to step 10.

8   Use a fiber optic patch cord to connect the transmitter (Tx) output of test set 1 to the receiver (Rx) input of test set 2. See Figure 3-2.

9   Use a second fiber optic patch cord to connect the Tx output of test set 2 and the Rx input of test set 1.
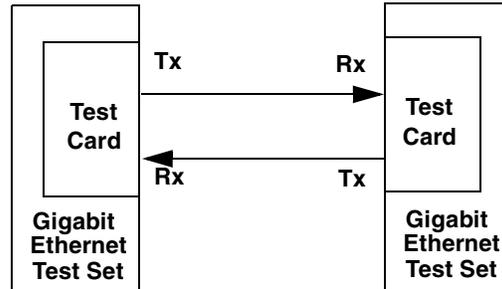
—continued—

Procedure 3-2 (continued)
Validating the test equipment

Step	Action

Figure 3-2
Dual test set validation set up

10   Reset the test set and ensure that a signal is received. The test set displays zero errors and alarms.

11   Insert three errors and verify that the errors are received.

12

If the test-set	**Then** go to
displays three errors, the test set is functioning correctly	step 14
does not display three errors, the test set is not functioning correctly	step 13

13   Perform the following actions:

    a. check the test set settings. Return to step 5 to repeat the test.

    b. inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 5 to repeat the test.

    c. replace the fiber optic patch cord(s). Return to step 5 to repeat the test.

    d. if the problem is not resolved, contact your next level of support. Do not proceed until the problem is resolved.

14   Disconnect the fiber optic patch cord from the receive (Rx) input of the test set.

—continued—

Procedure 3-2 (continued)
Validating the test equipment

Table 3-3
Test set information

Manufacturer	Serial number	Calibration date

Table 3-4
Optical power meter information

Manufacturer	Serial number	Calibration date

—**end**—

Procedure 3-3
Setting up the test configuration

Use this procedure to provision the appropriate circuit packs, define the channel assignments to be tested, and to connect the test sets in the required configuration.

Requirements

Before you begin this procedure make sure the test set optics match those of the circuit packs under test. Use 1310 nm optics test sets to test the OCI GbE 1310 nm, OCI SRM GbE 1310 nm, OCI SRM GbE/FC 1310 nm, OCI SRM GbE/FC Enhanced 1310 nm, OTR or Muxponder circuit pack.

> ⚠ **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Action

Step	Action

Channel assignments

Step	Action
1	Log in to System Manager. For information on how to log in to System Manager, refer to *Provisioning and Operating Procedures*, 323-1701-310.
2	Create the Gigabit Ethernet channel assignment (path) that is to be tested, and put the appropriate circuit pack in-service.
	For information on creating channel assignments and putting circuit packs in-service, refer to *Provisioning and Operating Procedures*, 323-1701-310.

Step	**If** the path is	**Then**
3	protected	perform a force switch at both ends of the connection to ensure that the traffic is on the path undergoing the test. For more information on how to perform a force switch, refer to *Provisioning and Operating Procedures*, 323-1701-310.
		Once the force switch is complete, go to step 4.
	unprotected	go to step 4.

—**continued**—

Procedure 3-3 (continued)
Setting up the test configuration

Step	Action
4	Determine the number of test sets required to test the Gigabit Ethernet signal path. For more information, see Procedure 3-1 "Determining the number of test sets" on page 3-5.

Check receive power levels

5

⚠ **CAUTION**
Risk of damage to receivers
Do not exceed the maximum acceptable optical power input on any of the OCI/OTR/Muxponder or test set receivers. Check the transmit power levels before connecting any test equipment.

Use an optical power meter to measure the transmit (Tx) power levels at the following points in the test path:

a.   near end OCI/OTR/Muxponder client side Tx output

b.   near end test set Tx output

c.   far end OCI/OTR/Muxponder client side Tx output

d.   far end test set Tx output (if used)

6   Compare the Tx power levels to the acceptable receive (Rx) power levels of the corresponding component.

To determine the acceptable OCI/OTR/Muxponder receive power levels, refer to *Technical Specifications*, 323-1701-180.

To determine the acceptable test set receive power levels, refer to the test set manufacturer documentation.

7	**If**	**Then** go to
	all Tx power levels are within the corresponding Rx specifications	step 9
	any Tx power levels exceed the corresponding Rx specifications	step 8

8   When connecting the test set to the OCI/OTR/Muxponder, 5dB attenuators must be connected between the transmitters and receivers, as shown in Figure 3-3.

—**continued**—

Procedure 3-3 (continued)
Setting up the test configuration

Step	Action

Figure 3-3
Adding attenuation to protect receive levels
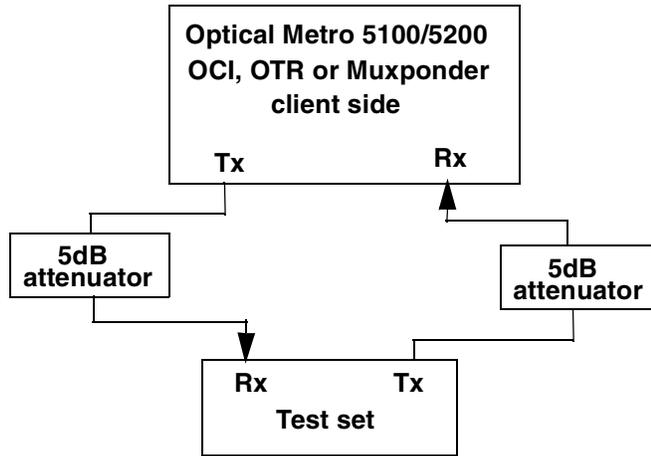
9	**If**	**Then** go to
	one test set is required	step 10
	two test sets are required	step 14

Single test set configuration

10   See Figure 3-4 for an illustration of the test configuration using one test set.

Figure 3-4
Single test set configuration

—continued—

Procedure 3-3 (continued)
Setting up the test configuration

Step	Action

11

⚠ **CAUTION**
Risk of signal degradation or loss of signal
Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

At the near end, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 3-4.

Note: Ensure that you have verified the optical signal power levels as described in step 5.

12   At the corresponding shelf in the far end site, connect an optical patch cord between the transmit (Tx) port of the OCI, OTR or Muxponder client-side transmit (Tx) port and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 3-4.

13   Go to step 17.

Dual test set configuration

14   See Figure 3-5 for an illustration of the test configuration using two test sets.

Figure 3-5
Dual test set configuration
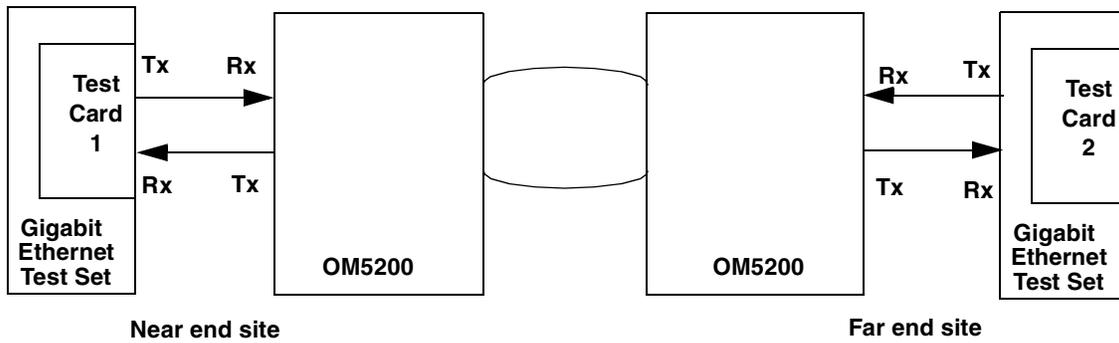
—continued—

Procedure 3-3 (continued)
Setting up the test configuration

Step	Action

15

> **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

At the near end, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 3-5.

*Note:* Ensure that you have verified the optical signal power levels as described in step 5.

16 At the corresponding shelf in the far end site, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI, OTR or Muxponder client-side receive (Rx) port that you are testing, as shown in Figure 3-5.

Configure the test set

17 Set the Gigabit Ethernet test set transmit (Tx) settings as follows:

Setting	Value
BERT	Pattern - CRPAT or any other pattern allowed on the test set
Frame length	64 bytes
Background	Random
Interpacket gap	0.096 µsec or 100% utilization
MAC source and destination	set to off

18 Set all test set receive (Rx) setting to match the transmit (Tx) settings.

Test the connections

19

If	**Then** go to
a single test set is being used	step 20
dual test sets are being used	step 25

20 Reset the near end test set.

The display on all test set indicates zero bit errors.

—**continued**—

Procedure 3-3 (continued)
Setting up the test configuration

Step	Action

21 Insert three errors on the near end test set.

22 Verify that the near end test set receives and displays three errors.

23

If the near end test set	**Then** go to
displays three errors	step 33
does not display three errors	step 24

24 Perform the following:

    a. check the test set settings. Return to step 17 to repeat the test.

    b. inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 20 to repeat the test.

    c. replace the fiber optic patch cord(s). Return to step 20 to repeat the test.

    d. contact your next level of support. Do not proceed until the problem is resolved.

25 Reset the near end and far end test sets.

The display on both test sets indicates zero bit errors.

26 Insert three errors on the near end test set.

27 Verify that the far end test set receives and displays three errors.

28

If the far end test set	**Then** go to
displays three errors	step 29
does not display three errors	step 32

29 Insert three errors on the far end test set.

30 Verify that the near end test set receives and displays three errors.

31

the near end test set	go to
displays three errors	step 33
does not display three errors	step 32

—continued—

Procedure 3-3 (continued)
Setting up the test configuration

Step	Action
32	Perform the following:
	a. check the test set settings. Return to step 17 to repeat the test.
	b. inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 25 to repeat the test.
	c. replace the fiber optic patch cord(s). Return to step 25 to repeat the test.
	d. contact your next level of support. Do not proceed until the problem is resolved.
33	Reset all test sets.
	The display on all test sets indicates zero bit errors.
34	Go to Procedure 3-4 "Running the Gigabit Ethernet long duration test" on page 3-17.

—**end**—

Procedure 3-4
Running the Gigabit Ethernet long duration test

Use this procedure to run the Gigabit Ethernet long duration test, and to record the test objectives and results.

Requirements

Before you begin this procedure make sure the test configuration has been set up and tested. See Procedure 3-3 on page 3-10.

> ⚠ **CAUTION**
> **Risk of test failure**
> Do not perform any equipment or path switches on the nodes under test for the duration of the test. If equipment or path switches are performed the test could fail.

Action

Step	Action
1	Record the Gigabit Ethernet test duration and test configuration in Table 3-5 on page 3-18.
2	Check for alarms on the system. If there are alarms, they must be cleared before proceeding with the test.
	For information on how to check and clear alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542.
3	Start the long duration test, and monitor the system for the duration identified in Table 3-5 on page 3-18.
4	Verify the error count does not exceed the objective for the duration specified in Table 3-6 on page 3-18.
5	At the end of the test duration, record the error count in Table 3-5 on page 3-18.

6	**If** the error count is	**Then** go to
	less than or equal to the objective stated in Table 3-6.	step 8
	greater than the objective stated in Table 3-6.	step 7

Step	Action
7	Repeat the test beginning at step 2. If the error counts do not improve on the second test, contact your next level of support.
8	Record the test results in Table 3-5 on page 3-18.
9	Remove the test sets and restore the network to its initial state.

—**continued**—

Procedure 3-4 (continued)
Running the Gigabit Ethernet long duration test

Table 3-5
Gigabit Ethernet long duration test results

Test duration		Test configuration	Results	
Test start date	Test duration	Number of JCU in path	Error count	Pass/Fail

Table 3-6
Gigabit Ethernet long duration test objectives

Gigabit Ethernet (1000Mbit/s)					
Count/Duration	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	22	43	86	173	259
10^{-11}	216	432	864	1728	2592
10^{-10}	2160	4320	8640	17280	25920
10^{-9}	21600	43200	86400	172800	259200
10 Gigabit Ethernet LAN (10 Gbit/s)					
Count/Duration	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	216	432	864	1730	2590
10^{-11}	2160	4320	8640	17300	25900
10^{-10}	21600	43200	86400	173000	259000
10^{-9}	216000	432000	864000	1730000	2590000
10 Gigabit Ethernet WAN (9.95 Gbit/s)					
Count/Duration	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	215	430	860	1720	2580
10^{-11}	2150	4300	8600	17200	25800
10^{-10}	21500	43000	86000	172000	258000
10^{-9}	215000	430000	860000	1720000	2580000

—**end**—

SONET/SDH long duration test procedures

This chapter describes the SONET/SDH long duration testing requirements for the Optical Metro 5100/5200. The SONET/SDH long duration test performs a Bit Error Rate (BER) test for an extended period of time, as defined by the customer.

SONET/SDH long duration testing is an optional additional service that can be purchased. The Optical Metro 5100/5200 typically does not require long duration testing of the SONET/SDH protocol. The requirement to perform long duration testing is at the customer's discretion.

In telecommunication transmission, the bit error rate (BER) is the percentage of bits that have errors relative to the total number of bits received in a transmission. The BER is an indication of how often a packet must be retransmitted because of an error, and is usually expressed as ten (10) to a negative power. The OCI SRM SONET/SDH circuit packs supporting the SONET/SDH protocol have a BER of 10^{-12}.

	CAUTION
	This activity can cause a service interruption if performed on an in-service network. This activity should only be performed on networks that are not in service.

Requirements

Table 4-1 lists the tools and materials required for procedures in this chapter.

Table 4-1
Tools and materials required for SONET long duration testing

Description	Quantity
SONET/SDH Test-set	See Procedure 4-1 "Determining the number of test sets" on page 4-5 for details
Fiber optic patch cords (FC-FC, FC-SC, and FC-LC)	4 (each)
Antistatic strap	1
Optical power meter (FC, SC, and LC adapters)	1
Optical fiber cleaning kit	1
5dB attenuators (FC, SC, and LC)	4 (each)

Before you begin

Before you begin these procedures:

- ensure you have detailed network diagrams that describe the Optical Metro 5100/5200 system, including all installed equipment, circuit packs, slot numbers, and connections

- ensure the Optical Metro 5100/5200 network elements have been installed according to the procedures in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

- ensure the Optical Metro 5100/5200 network elements have been commissioned according to the procedures in *Connecting and Commissioning Procedures*, 323-1701-220

- ensure the Optical Metro 5100/5200 network elements have been tested according to the procedures in *Testing and Equalization Procedures*, 323-1701-222

- for amplified networks, ensure all sites are equalized and connected. For more information about equalization, refer to *Testing and Equalization Procedures*, 323-1701-222

- ensure there are no alarms on the network. If there are alarms, they must be cleared before proceeding with the test. For more information about clearing alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542

- inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. For fiber cleaning procedures, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

Precautions

To prevent personal injury or equipment damage, observe and understand all safety guidelines described in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210.

Follow all precautionary messages found in the documentation and the safety procedures established by your company.

The following precautionary messages appear in the documentation.

DANGER
Risk of personal injury
A precautionary message with this symbol indicates a risk of personal injury.

DANGER
Risk of electrical shock
A precautionary message with this symbol indicates a risk of personal injury caused by an electrical hazard.

CAUTION
Risk of laser radiation exposure
A precautionary message with this symbol indicates a risk of personal injury caused by exposure to laser beam.

CAUTION
Risk of interruption to service
A precautionary message with this symbol indicates a risk of service interruption or equipment damage.

CAUTION
Risk of damage to circuit packs
A precautionary message with this symbol indicates a risk of static damage to circuit packs. Use antistatic protection.

Procedure list

Table 4-2 lists the procedures in this chapter.

Table 4-2
SONET/SDH long duration testing procedures

Procedure 4-1
Determining the number of test sets

To complete the procedures in this chapter, you will require a SONET/SDH test set(s) capable of transmitting and receiving SONET/SDH protocols.

The number of test sets required depends on the number of channels being tested simultaneously. SONET/SDH bit error rate (BER) testing will support a dual test set configuration (head to head). For head to head testing, two test sets are required for each channel tested. SONET/SDH BER testing also supports a single test set using loop backs (daisy chaining).

For SONET/SDH BER testing on all other OCI SRM circuit packs, the number of loop backs is limited by the number of Jitter Contributing Units (JCU) in each optical span. To determine the JCU penalty in an optical span, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering,* 323-1701-110.

Requirements

Before you begin this procedure make sure you have a detailed network diagram.

Action

Step	Action
1	Review the network diagram, and count the number of JCU in the test path.
	A test path can contain a maximum of 8 JCU. For a description of JCU, see Table 7-11 on page 7-25 in *Network Planning and Link Engineering*, 323-1701-110. If running several test paths simultaneously, one test set is required for each test path.

—end—

Procedure 4-2
Validating the test equipment

Use this procedure to record information about the test equipment used to perform the SONET/SDH long duration tests, and to validate that the equipment is operating correctly before starting the tests.

Requirements

Before you begin this procedure make sure the test set optics match those of the circuit packs under test. Use 1310 nm optics test sets to test the OCI SONET/SDH 1310 nm or OTR circuit pack.

> ⚠ **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Action

Step	Action
1	Locate the test set serial numbers and calibration date, and enter the information in Table 4-3 on page 4-8.
2	Locate the optical power meter serial numbers and the calibration date, and enter the information in Table 4-4 on page 4-8.
3	Set the SONET/SDH test set transmit (Tx) settings as follows:

Setting	Value
Frame	OC48c/OC12c/OC3c
Pattern	Random
Payload	2^{23} - 1 if possible, otherwise 2^{15} -1
Clock Tx	Internal
Clock Rx	Line

Step	Action
4	Set the test set receive (Rx) setting to match the transmit (Tx) settings.

—**continued**—

Procedure 4-2 (continued)
Validating the test equipment

Step	Action

5	**If**	**Then** go to
	one test set is required for testing	step 6
	two test sets are required for testing	step 8

6 Use a fiber optic patch cord to connect the transmitter (Tx) output and the receiver (Rx) input on the test set. See Figure 4-1.

Figure 4-1
Single test set validation set up
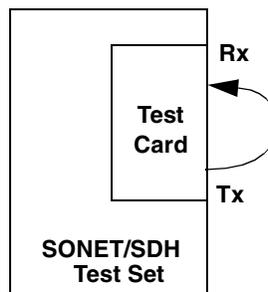
7 Go to step 10.

8 Use a fiber optic patch cord to connect the transmitter (Tx) output of test set 1 to the receiver (Rx) input of test set 2. See Figure 4-2.

9 Use a second fiber optic patch cord to connect the Tx output of test set 2 and the Rx input of test set 1.
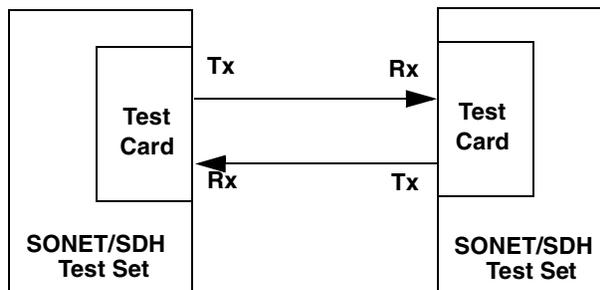
Figure 4-2
Dual test set validation set up

—**continued**—

Procedure 4-2 (continued)
Validating the test equipment

Step	Action

10 Reset the test set and ensure that a signal is received. The test set displays zero errors and alarms.

11 Insert three errors and verify that the errors are received.

12

If the test-set	**Then** go to
displays three errors, the test set is functioning correctly	step 14
does not display three errors, the test set is not functioning correctly	step 13

13 Perform the following actions:

    a. check the test set settings. Return to step 5 to repeat the test.

    b. inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 5 to repeat the test.

    c. replace the fiber optic patch cord(s). Return to step 5 to repeat the test.

    d. if the problem is not resolved, contact your next level of support. Do not proceed until the problem is resolved.

14 Disconnect the fiber optic patch cord from the receive (Rx) input of the test set.

Table 4-3
Test set information

Manufacturer	Serial number	Calibration date

Table 4-4
Optical power meter information

Manufacturer	Serial number	Calibration date

—end—

Procedure 4-3
Setting up the test configuration

Use this procedure to provision the appropriate circuit packs, define the channel assignments to be tested, and to connect the test sets in the required configuration.

Requirements

Before you begin this procedure make sure the test set optics match those of the circuit packs under test. Use 1310 nm optics test sets to test the OCI SONET/SDH1310 nm or OTR circuit pack.

> **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Action

Step	Action

Channel assignments

1	Log in to System Manager. For information on how to log in to System Manager, refer to *Provisioning and Operating Procedures*, 323-1701-310.
2	Create the SONET/SDH channel assignment (path) that is to be tested, and put the appropriate circuit pack in-service.
	For information on creating channel assignments and putting circuit packs in-service, refer to *Provisioning and Operating Procedures*, 323-1701-310.

3	**If** the path is	**Then**
	protected	perform a force switch at both ends of the connection to ensure that the traffic is on the path undergoing the test. For more information on how to perform a force switch, refer to *Provisioning and Operating Procedures*, 323-1701-310.
		Once the force switch is complete, go to step 6.
	unprotected	go to step 6.

—**continued**—

Procedure 4-3 (continued)
Setting up the test configuration

Step	Action
4	If using the OCI SRM SONET/SDH or the OCI SRM SONET/SDH LTE circuit pack, then go to step 5, otherwise go to step 6.
5	Provision the timing references by performing Procedure 3-61 "Provisioning primary and secondary clock references for an OCI SRM SONET/SDH or OCI SRM SONET/SDH LTE" in *Provisioning and Operating Procedures*, 323-1701-310.

Note: For details on the available timing reference configurations, see "Clock synchronization" in *Network Planning and Link Engineering*, 323-1701-110.

|	
6	Determine the number of test sets required to test the SONET/SDH signal path. For more information, see Procedure 4-1 "Determining the number of test sets" on page 4-5.

Check receive power levels

7	

⚠ **CAUTION**
Risk of damage to receivers
Do not exceed the maximum acceptable optical power input on any of the OCI/OTR or test set receivers. Check the transmit power levels before connecting any test equipment.

Use an optical power meter to measure the transmit (Tx) power levels at the following points in the test path:

a. near end OCI/OTR client side Tx output

b. near end test set Tx output

c. far end OCI/OTR client side Tx output

d. far end test set Tx output (if used)

8	Compare the Tx power levels to the acceptable receive (Rx) power levels of the corresponding component.

To determine the acceptable OCI/OTR receive power levels, refer to *Technical Specifications*, 323-1701-180.

To determine the acceptable test set receive power levels, refer to the test set manufacturer documentation.

9	**If**	**Then** go to
	all Tx power levels are within the corresponding Rx specifications	step 11
	any Tx power levels exceed the corresponding Rx specifications	step 10

—continued—

Procedure 4-3 (continued)
Setting up the test configuration

Step	Action
10	When connecting the test set to the OCI/OTR, 5dB attenuators must be connected between the transmitters and receivers, as shown in Figure 4-3.

Figure 4-3
Adding attenuation to protect receive levels
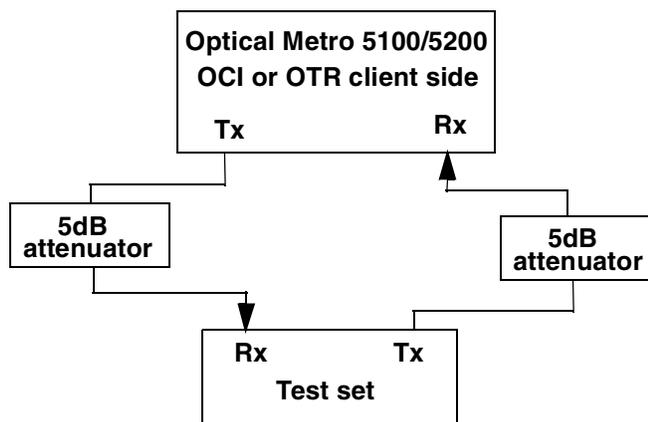
11	**If**	**Then** go to
	one test set is required	step 12
	two test sets are required	step 16

Single test set configuration

12	See Figure 4-4 for an illustration of the test configuration using one test set.

Figure 4-4
Single test set configuration
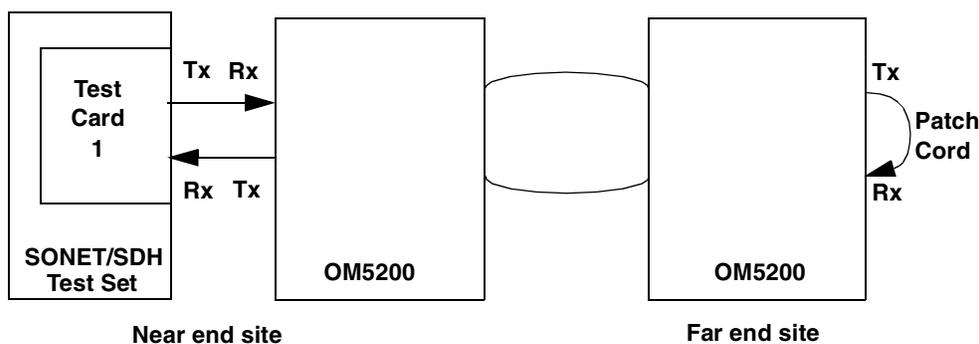
—continued—

Procedure 4-3 (continued)
Setting up the test configuration

Step	Action

13

⚠️ **CAUTION**
Risk of signal degradation or loss of signal
Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

At the near end, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI or OTR client-side receive (Rx) port that you are testing, as shown in Figure 4-4.

Note: Ensure that you have verified the optical signal power levels as described in step 7.

14 At the corresponding shelf in the far end site, connect an optical patch cord between the transmit (Tx) port of the OCI or OTR client-side transmit (Tx) port and the receive (Rx) port of the OCI or OTR client-side receive (Rx) port that you are testing, as shown in Figure 4-4.

15 Go to step 19.

Dual test set configuration

16 See Figure 4-5 for an illustration of the test configuration using two test sets.

Figure 4-5
Dual test set configuration
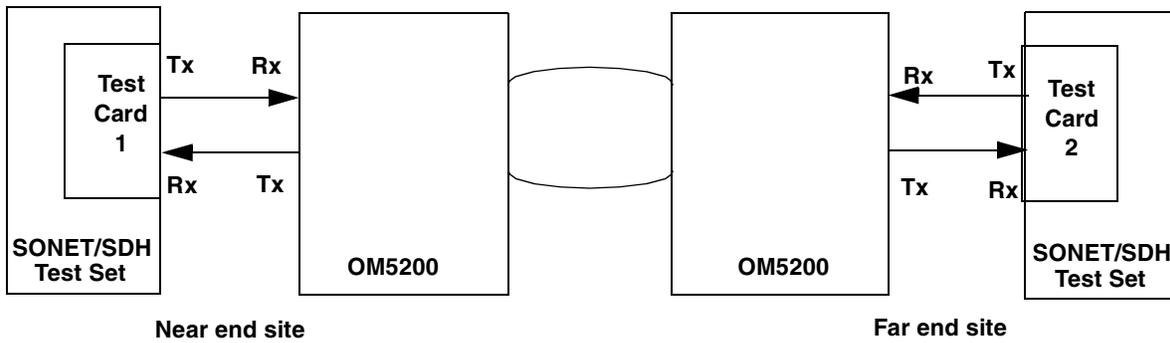
—continued—

Procedure 4-3 (continued)
Setting up the test configuration

Step	Action

17

> ⚠ **CAUTION**
> **Risk of signal degradation or loss of signal**
> Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

At the near end, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI or OTR client-side receive (Rx) port that you are testing, as shown in Figure 4-5.

*Note:* Ensure that you have verified the optical signal power levels as described in step 7.

18 At the corresponding shelf in the far end site, connect an optical patch cord between the transmit (Tx) port of the optical test set and the receive (Rx) port of the OCI or OTR client-side receive (Rx) port that you are testing, as shown in Figure 4-5.

Configure the test set

19 Set the SONET/SDH test set transmit (Tx) settings as follows:

Setting	Value
Frame	OC48c/OC12c/OC3c
Pattern	Random
Payload	$2^{23} - 1$ if possible, otherwise $2^{15} -1$
Clock Tx	Internal
Clock Rx	Line

20 Set all test set receive (Rx) setting to match the transmit (Tx) settings.

Test the connections

21

If	**Then** go to
a single test set is being used	step 22
dual test sets are being used	step 27

22 Reset the near end test set.

The display on all test set indicates zero bit errors.

23 Insert three errors on the near end test set.

24 Verify that the near end test set receives and displays three errors.

—continued—

Procedure 4-3 (continued)
Setting up the test configuration

Step	Action

25	**If** the near end test set	**Then** go to
	displays three errors	step 35
	does not display three errors	step 26

26   Perform the following:

        a.   check the test set settings. Return to step 19 to repeat the test.

        b.   inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 22 to repeat the test.

        c.   replace the fiber optic patch cord(s). Return to step 22 to repeat the test.

        d.   contact your next level of support. Do not proceed until the problem is resolved.

27   Reset the near end and far end test sets.

     The display on both test sets indicates zero bit errors.

28   Insert three errors on the near end test set.

29   Verify that the far end test set receives and displays three errors.

30	**If** the far end test set	**Then** go to
	displays three errors	step 31
	does not display three errors	step 34

31   Insert three errors on the far end test set.

32   Verify that the near end test set receives and displays three errors.

33	**If** the near end test set	**Then** go to
	displays three errors	step 35
	does not display three errors	step 34

—continued—

Procedure 4-3 (continued)
Setting up the test configuration

Step	Action
34	Perform the following:
	a. check the test set settings. Return to step 19 to repeat the test.
	b. inspect and clean all fiber optic cables and component connectors. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210. Ensure that the connectors are connected correctly. See *Connecting and Commissioning Procedures*, 323-1701-220. Return to step 27 to repeat the test.
	c. replace the fiber optic patch cord(s). Return to step 27 to repeat the test.
	d. contact your next level of support. Do not proceed until the problem is resolved.
35	Reset all test sets.
	The display on all test sets indicates zero bit errors.
36	Go to Procedure 4-4 "Running the SONET/SDH long duration test" on page 4-16.

—**end**—

Procedure 4-4
Running the SONET/SDH long duration test

Use this procedure to run the SONET/SDH long duration test, and to record the test objectives and results.

Requirements

Before you begin this procedure make sure the test configuration has been set up and tested. See Procedure 4-3 on page 4-9.

⚠ **CAUTION**
Risk of test failure
Do not perform any equipment or path switches on the nodes under test for the duration of the test. If equipment or path switches are performed the test could fail.

Action

Step	Action
1	Record the SONET/SDH test duration and test configuration in Table 4-5 on page 4-17.
2	Check for alarms on the system. If there are alarms, they must be cleared before proceeding with the test.
	For information on how to check and clear alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542.
3	Start the long duration test, and monitor the system for the duration identified in Table 4-5 on page 4-17.
4	Verify the error count does not exceed the objective for the duration specified in Table 4-6 on page 4-18.
5	At the end of the test duration, record the error count in Table 4-5 on page 4-17.

Step	If the error count is	Then go to
6	less than or equal to the objective stated in Table 4-6.	step 8
	greater than the objective stated in Table 4-6.	step 7

—continued—

Procedure 4-4 (continued)
Running the SONET/SDH long duration test

Step	Action
7	Repeat the test beginning at step 2. If the error counts do not improve on the second test, contact your next level of support.
8	Record the test results in Table 4-5 on page 4-17.
9	Remove the test sets and restore the network to its initial state.

Table 4-5
SONET/SDH long duration test results

Test duration		Test configuration	Results	
Test start date	Test duration	Number of JCU in path	Error count	Pass/Fail

—continued—

Procedure 4-4 (continued)
Running the SONET/SDH long duration test

Table 4-6
SONET/SDH long duration test objectives

SONET/SDH - OC-48					
	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	54	108	215	430	645
10^{-11}	537	1075	2150	4300	6450
10^{-10}	5375	10750	21499	42998	64497
10^{-9}	53748	107495	214991	429982	644973
SONET/SDH - OC-192					
	6 hr	12 hr	24 hr	48 hr	72 hr
10^{-12}	214	430	860	1720	2580
10^{-11}	2150	4300	8600	17199	25799
10^{-10}	21499	42998	85996	171993	257989
10^{-9}	214991	429982	859963	1719927	2579890

—**end**—

MPEG transmission over a Muxponder link test procedures

This chapter describes testing MPEG-2 video transmission over a 10 Gbit/s Muxponder link for the Optical Metro 5100/5200. The MPEG video transmission test provides data on end to end jitter and video streaming performance through an Optical Metro 5100/5200 and Common Photonic Layer network.

The MPEG-2 video transmission acceptance consists of two parts:

1 back-to-back MPEG-2 video transmission testing without a Muxponder link

2 MPEG-2 video transmission testing over a Muxponder link

Packet delay and packet delay variation of MPEG-2 video is highly dependant upon the MPEG-2 transport stream used and its data rate. Therefore, the back-to-back testing is required to establish a reference benchmark of the video transmission of the particular MPEG-2 transport stream over the Muxponder link.

MPEG video transmission testing is an optional additional service that can be purchased. The requirement to perform this testing is at the customer's discretion.

Requirements

Table 5-1 lists the tools and materials required for procedures in this chapter.

Table 5-1
Tools and materials required for MPEG video transmission over Muxponder link testing

Description	Quantity
MPEG-2 transport stream generator (see Note 1)	1
MPEG-2 transport stream analyzer (see Note 1)	1
Smartbit modules (SMB) with Gigabit Ethernet interface	2 or more
MPEG-2 decoder with a DVB asynchronous serial interface (DVB-ASI). See Note 2.	1
Video monitor that has composite video interface	1
RF cables with BNC connectors	
Fiber multi-mode and single mode optic patch cords (either FC-FC, FC-SC, and FC-LC or SC-SC and SC-LC [dependent on the test set])	as required
MPEG-2 transport stream file (*.trp)	1
Antistatic strap	1
Optical power meter (FC, SC, and LC adapters)	1
Optical fiber cleaning kit	1
Note 1: For example, two IneoQuest Singulus G1-T can be used as the MPEG-2 transport stream generator /analyzer pair. One of the Singulus G1-T can be configured as an MPEG-2 transport stream source and the other Singulus G1-T configured as an MPEG-2 transport packet analyzer. **Note 2:** For example, a Videotek DDM-540 Decoder.	

Before you begin

Before you begin these procedures:

- ensure you have detailed network diagrams that describe the Optical Metro 5100/5200 system, including all installed equipment, circuit packs, slot numbers, and connections

- ensure the Optical Metro 5100/5200 network elements have been installed according to the procedures in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

- ensure the Optical Metro 5100/5200 network elements have been commissioned according to the procedures in *Commissioning Procedures*, 323-1701-220

- ensure the Optical Metro 5100/5200 network elements have been tested according to the procedures in *Testing and Equalization Procedures*, 323-1701-222

- for amplified networks, ensure all sites are equalized and connected. For more information about equalization, refer to *Testing and Equalization Procedures*, 323-1701-222

- ensure there are no alarms on the network. If there are alarms, they must be cleared before proceeding with the test. For more information about clearing alarms, refer to *Trouble Clearing and Alarm Reference Guide*, 323-1701-542

- inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. For fiber cleaning procedures, see "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, or *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210

Precautions

To prevent personal injury or equipment damage, observe and understand all safety guidelines described in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201, and *Installing Optical Metro 5100 Shelves and Components*, 323-1701-210.

Follow all precautionary messages found in the documentation and the safety procedures established by your company.

The following precautionary messages appear in the documentation.

	DANGER **Risk of personal injury** A precautionary message with this symbol indicates a risk of personal injury.

	DANGER **Risk of electrical shock** A precautionary message with this symbol indicates a risk of personal injury caused by an electrical hazard.

	CAUTION **Risk of laser radiation exposure** A precautionary message with this symbol indicates a risk of personal injury caused by exposure to laser beam.

> **CAUTION**
> **Risk of interruption to service**
> A precautionary message with this symbol indicates a risk of service interruption or equipment damage.

> **CAUTION**
> **Risk of damage to circuit packs**
> A precautionary message with this symbol indicates a risk of static damage to circuit packs. Use antistatic protection.

Procedure list

Table 5-2 lists the procedures in this chapter.

> **CAUTION**
> The procedures in this section can cause a service interruption if performed on an in-service network. This activity should only be performed on networks that are not in service.

Table 5-2
Gigabit Ethernet long duration testing procedures

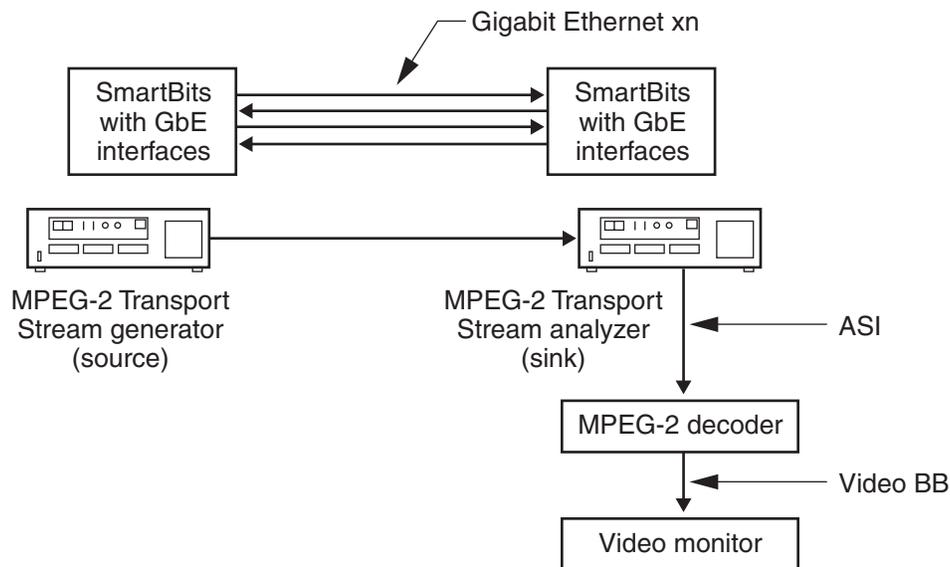| Procedure	Page
5-1 Setting up back-to-back testing and configuring test equipment	5-23
5-2 Testing MPEG video transmission over a Muxponder link	5-26

Procedure 5-1
Setting up back-to-back testing and configuring test equipment

Use this procedure set up back-to-back testing and to configure the test equipment for this test.

Figure 5-1 illustrates the MPEG video transmission back-to-back setup.

Figure 5-1
MPEG video transmission back-to-back setup

om2839p

Requirements

Before you begin this procedure make sure you have:

- 1 MPEG-2 transport stream generator and 1 MPEG-2 transport stream analyzer pair

- 2 or more Smartbit modules with Gigabit Ethernet interface

- an MPEG-2 decoder with a DVB asynchronous serial interface (DVB-ASI)

- a video monitor that has composite video interface

- RF cables with BNC connectors

- MM and SM fiber patch cords

- an MPEG-2 transport stream file (*.trp)

—**continued**—

Procedure 5-1 (continued)
Setting up back-to-back testing and configuring test equipment

Action

Step	Action

Configure the SmartBits test equipment

> *Note:* Two or more sets of Smartbit modules with Gigabit Ethernet interface are required. The first set is used as a test signal to measure the performance of one of the Gigabit Ethernet channels of the Muxponder. The other set(s) are used to fully load the other Gigabit Ethernet channels of the Muxponder. For the back-to-back test and the MPEG-2 video test, only the test results of the first set of Smartbit are recorded.

1   Configure all of the Smartbit modules as follows:

> — packet size 1364 bytes
>
> — 100% utilization
>
> — auto-negotiation disable
>
> — no flow control

Configure the MPEG-2 transport stream generator and analyzer test equipment

> *Note:* This procedure assumes that IneoQuest Singulus G1-T test equipment is assumed to be used as the transport stream generator and analyzer.

2   Load a previously captured MPEG-2 transport stream file (*.trp) to Singulus G1-T #1 using the IneoQuest IQ Controller software.

> *Note:* Singulus G1-T can be set up to capture transport file from any MPEG-2 stream device such as a Video-on-Demand server. It is important to capture an MPEG-2 file with the appropriate data rate relevant to the specific transport application. For CATV Video-on-Demand application, the suggested transport stream data rate for a standard definition television should be around 3.5 Mbit/s.

3   Configure the Singulus G1-T #1 as a stimulus (source).

4   Configure the Singulus G1-T #2 as an MPEG analyzer end point (sink) with DVB-ASI output.

5   Connect the DVB-ASI port of Singulus G1-T #2 to the MPEG decoder.

6   Connect the NTSC output of the MPEG decoder to a video monitor.

7   Connect the test equipment in the back-to-back configuration (see Figure 5-1) to do this connect:

> — Smartbit modules to Smartbit modules
>
> — Singulus G1-T (source) to Singulus G1-T (sink)

> **—continued—**

Procedure 5-1 (continued)
Setting up back-to-back testing and configuring test equipment

Step	Action

Back-to-back test execution

8	Set up the equipment as illustrated in Figure 5-1, MPEG video transmission back-to-back setup.
9	Ensure the test equipment is functioning and performing correctly.
10	Start the test on Smartbit modules and on the Singulus G1-T.
11	Run for 15 minutes.
12	Observe and record the Media Delivery Index displayed on Singulus G1-T #2 over the 15 minutes test duration.
13	Observe the video quality on the video monitor over the 15 minutes duration.
14	Stop the test.
15	Capture graphically the Arrival Time Histogram on Singulus G1-T #2.
16	Record the test results of the Smartbit module in Table 5-3.

Table 5-3
Back-to-back test results

| Smartbit module results		
Expected packets/unit time	**Actual packets/unit time**	**Pass/Fail**

—end—

Procedure 5-2
Testing MPEG video transmission over a Muxponder link

Use this procedure to test MPEG-2 video transmission over a Muxponder link.

Figure 5-2 illustrates the MPEG video transmission over a Muxponder link test setup. Figure 5-3 is an example using 10-ports of the Muxponder link with two Smartbit modules and three Gigabit Ethernet interface modules.
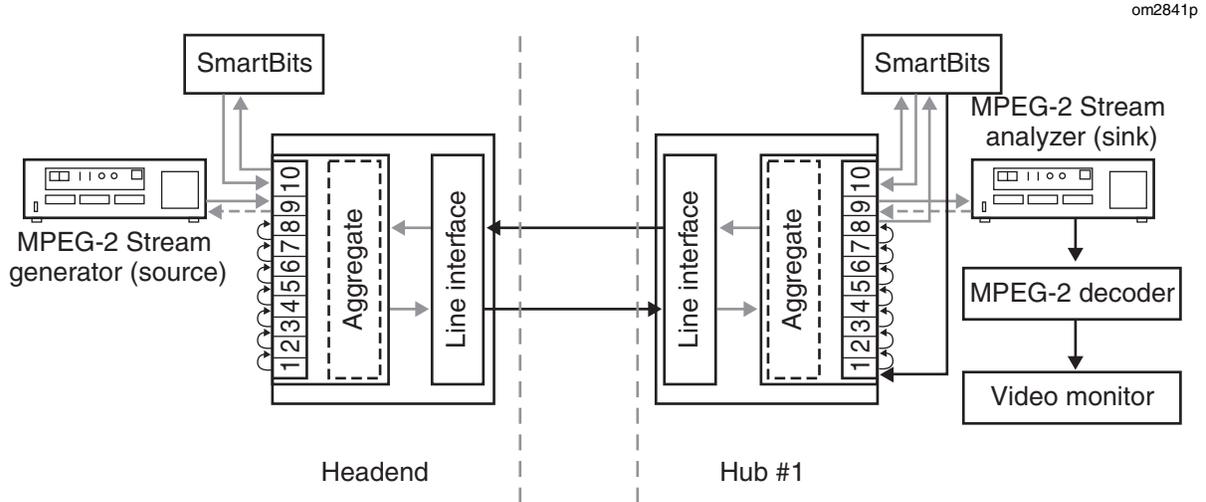
Figure 5-2
MPEG video transmission over a Muxponder link test setup

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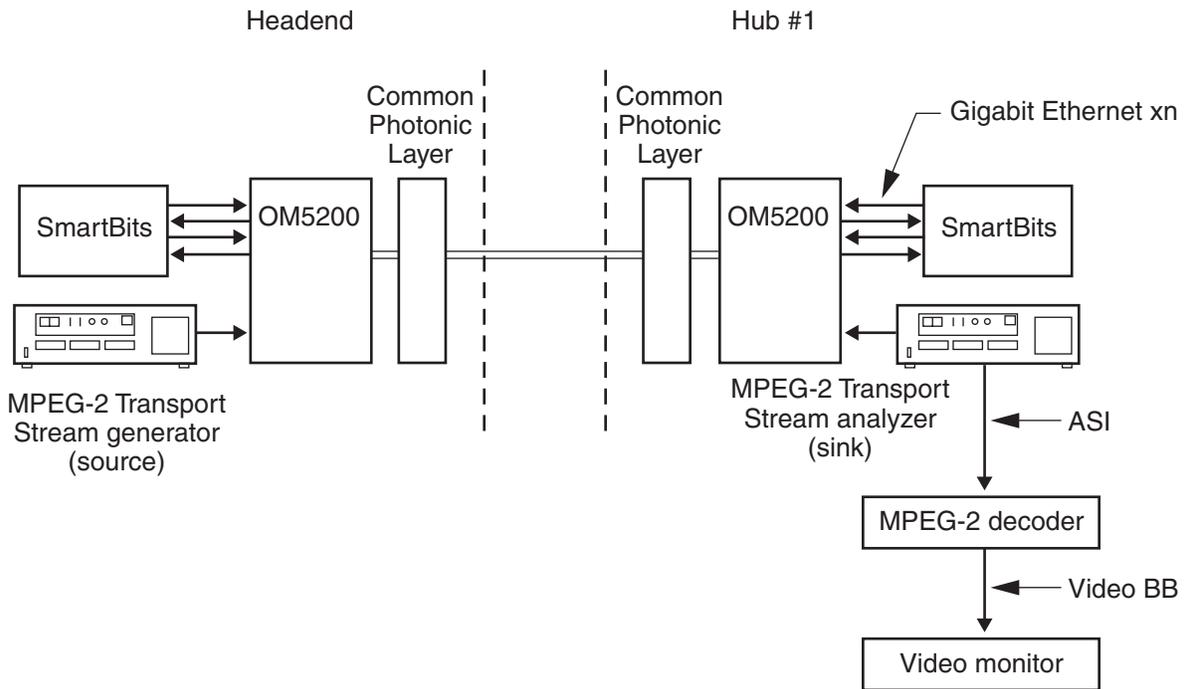
—continued—

Procedure 5-2 (continued)
Testing MPEG video transmission over a Muxponder link

Figure 5-3
10-port Muxponder link with 2x SMB and 3x GbE modules example

om2841p

Requirements

Before you begin this procedure make sure that you:

- have completed Procedure 5-1, Setting up back-to-back testing and configuring test equipment and that all tests were passed.

- have 1 MPEG-2 transport stream generator and 1 MPEG-2 transport stream analyzer pair

- have 2 or more Smartbit modules with Gigabit Ethernet interface

- have an MPEG-2 decoder with a DVB asynchronous serial interface (DVB-ASI)

- have a video monitor that has composite video interface

- have RF cables with BNC connectors

- have MM and SM fiber patch cords

- use the same MPEG-2 transport stream file (*.trp) Procedure 5-1.

—continued—

Procedure 5-2 (continued)
Testing MPEG video transmission over a Muxponder link

⚠ **CAUTION**
Risk of signal degradation or loss of signal
Inspect and clean all fiber optic cables and component connectors. Dirty fiber optic connections can cause signal degradation, or even loss of signal. See "Cleaning connectors" in *Installing Optical Metro 5200 Shelves and Components*, 323-1701-201.

Expected outcomes

1 The captured histograms in the 15-minute back-to-back test and the 15-minute test over the Muxponder link should have approximately equal average arrival-time. The delay variation of MPEG-2 packets should have similar statistical distribution.

2 The MDI should be approximately the same as the back-to-back test with no sudden change in MDI value over the 15-minute duration.

3 The video quality between the back-to-back and through the Muxponder link should have the same video quality with no noticeable difference. The video picture displayed on the monitor should be free from block or slice errors or other digital artifacts except at the wrap around point.

4 The performance metrics on the Smartbit between the back-to-back and through the Muxponder link should have the same packet throughput with no packet lost or packet out-of-sequence.

—continued—

Procedure 5-2 (continued)
Testing MPEG video transmission over a Muxponder link

Action

Step	Action
1	Connect the Singulus G1-T #1 (source) to one of the client interfaces (in the example, Figure 5-3 the interface is port 7) of the Muxponder at the headend.
2	Connect Singulus G1-T #2 (sink) to the corresponding client interface (for example port 7) of the Muxponder in Hub #1.
3	Verify the Singulus G1-T #1 is configured as a stimulus and re-load the MPEG MPEG-2 transport stream file (*.trp) on Singulus G1-T #1.
4	Verify the Singulus G1-T #2 is configured as an MPEG analyzer end point with DVB-ASI output.
5	Connect the DVB-ASI port of Singulus G1-T #2 to the MPEG-2 decoder.
6	Connect the NTSC output of the MPEG-2 decoder to the video monitor.
7	Depending on the number of SmartBits modules available, load the other Muxponder sub-channels of the Muxponder link with Ethernet traffic. See Figure 5-3 for an example of loading the sub-channels with two Smartbit modules and three Gigabit Ethernet interface modules.
8	Start the test on SMB and on the Singulus G1-T.
9	Run for 15 minutes.
10	Stop the test.
11	Capture graphically the Arrival Time Histogram on Singulus G1-T #2.
12	Record the test results of the SmartBits in Table 5-4.

Table 5-4
Test results

Smartbit module results		
Expected packets/unit time	**Actual packets/unit time**	**Pass/Fail**

—end—

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Optical Metro 5100/5200
Customer Acceptance Testing Procedures

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