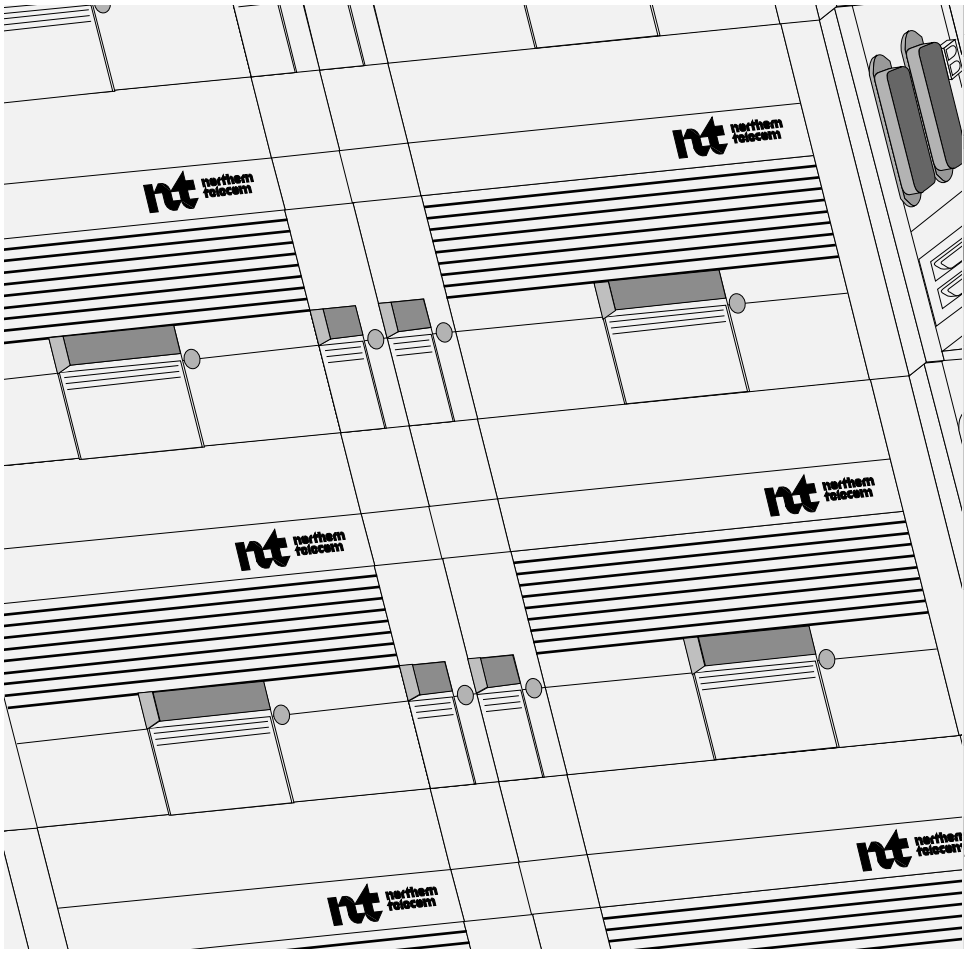
**NT4K00KA** **323-3001-222**

SONET Products

# AccessNode

## System Testing Procedures

Issue 1.0 February 1999



NORTEL NETWORKS™

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# Publication history

**February 1999**

AN16 standard release of the document 1.0.

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AN15 Standard 01.01 release of the document. AD2000-compliant screens added to Chapter 7.

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AN14 Standard 01.01 release of the document. Added STS-1 information.

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AN12 Standard 01.01 release of the document.

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AN11 standard release of the document with information on FST CI, DLM and OC-tributaries.

**April 1995**

Standard AN10 release of the document.

**December 1994**

Standard AN08 release of the document.

**November 1994**

Reissue of AN07 standard.

**April 1994**

Standard AN07 release of the document.

**May 1993**

Standard FWP06 release of the document.

# Contents

# About this document

This document has the procedures for system testing a system and applies to both the access bandwidth manager (ABM) shelf and the transport bandwidth manager (TBM) shelf. These procedures must be performed after the system is commissioned and site tested. To help provide an overall view of the process, flowcharts and document task lists are provided in Chapter 1.

## Audience

This document is for maintenance technicians and experienced installers from Nortel Networks or a telephone operating company.

## How to use this document

This document is intended to guide you through the following procedures. Perform these procedures after completion of commissioning and site tests at both network elements (NEs), prior to placing the system in service.

- Testing the facilities between two AccessNode network elements in a ring, point-to-point, or single-ended system.
- Verifying that the operations controller (OPC), fiber central office terminal (FCOT) or OPC shelf, and remote fiber terminal (RFT) are functioning as a system.

  ***Note 1:*** Detailed line card testing is described in *Line Card Testing Procedures*, 315-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

  ***Note 2:*** System testing of DS1-fed systems is described in *DS1 Feeder Testing Procedures*, 323-3001-225, in this volume.

## AD2000 Readiness

AN15 software and later releases ensure smooth transition to year 2000 for AccessNode and AccessNode Express products. Specifically:

- The transition from December 31, 1999 to January 1, 2000 is smooth and does not affect service or any equipment OAM&P activities.
- Year 2000 is recognized as a leap year.
- The system correctly interprets a “YY” date entry (for any date between 1995-1-1 and 2036-12-30). For example, a YY=25 entry is interpreted as 2025, not as 1925.

This book contains AD2000-compliant screen captures.

## Warnings and safety precautions

This section has the samples of the danger and caution warnings for proper handling and operation of equipment.

To avoid injury, follow all danger warnings provided with this product, as well as safety procedures established by your company.

To avoid damage to equipment or service interruptions, follow all caution warnings provided with this product, as well as procedures established by your company. Samples of danger and caution warnings follow.

**DANGER**
**Risk of personal injury**
A danger warning informs the reader of a risk of personal injury.

**CAUTION**
**Risk of service interruption or equipment damage**
A caution warning informs the reader of a risk of service interruption or equipment damage.

**DANGER**
**Risk of electric shock**
This warning advises you of a possible electrical hazard. When you see this warning, proceed with care, to avoid personal injury.

## OPC and NEUI command conventions

The OPC procedures in this document are based on a graphics terminal, but can also be performed from a character mode terminal (CMT). However, to do this you must substitute the CMT keystrokes for the graphic equivalents provided in the procedures. Refer to *OPC User Interface Description,* 323-3001-301 in *Operations, Administration, and Provisioning,* Volume 4A, or the Reference Card in the sleeve of this volume, for more information.

Information about how user interface commands are represented in documentation is provided in *Network Element User Interface Description,* 323-3001-300, *and OPC User Interface Description,* 323-3001-301. Both documents are in *Operations, Administration, and Provisioning,* Volume 4A.

## References in this document

This document has references to the following documents:

**Engineering, Configuration, and Ordering Guide, Volume 1**

- *Mapper Layouts Planning Guide,* 323-3001-154

**Description, Volume 2A**

- *Signal Flow and Circuit Pack Description,* 323-3001-102

**Description, Volume 2B**

- *System Specifications,* 323-3001-180

**Commissioning and Testing, Volume 3B**

- *Commissioning Procedures,* 323-3001-220
- *Site Testing Procedures,* 323-3001-221
- *DS1 Feeder Testing Procedures,* 323-3001-225

**Operations, Administration, and Provisioning, Volume 4A**

- *OPC User Interface Description,* 323-3001-301
- *System Administration Procedures,* 323-3001-302
- *Data Administration Procedures,* 323-3001-304

**Operations, Administration, and Provisioning, Volume 4B**

- *Provisioning and Operations Procedures,* 323-3001-310
- *Line Card Provisioning Procedures,* 323-3001-315
- *Line Card Testing Procedures,* 323-3001-316

**Operations, Administration, and Provisioning, Volume 4C**

- *System Expansion Procedures,* 323-3001-324

**Maintenance, Volume 5A**

- *Alarm and Trouble Clearing Procedures,* 323-3001-543

**Maintenance, Volume 5C**

- *Network Surveillance Procedures,* 323-3001-510
- *Performance Monitoring Procedures,* 323-3001-520
- *Routine Maintenance Procedures,* 323-3001-546
- *Module Replacement Procedures,* 323-3001-547

**Installation documents**

- *Bay in Central Office Installation Manual—ABM,* 323-3001-201
- *Bay in Central Office Installation Manual—TBM,* 323-3001-202
- *Modular Business Package Installation Manual,* 323-3001-206

# Overview of system testing

This chapter provides the flowcharts and task lists to explain the steps required for system testing a new fiber-fed system (ring, point-to-point, or single-ended). Perform end-to-end tests after completing the site tests for both network elements (NEs) in the system. System testing DS1-fed systems is described in *DS1 Feeder Testing Procedures*, 323-3001-225, in this volume.

## How to use this chapter

Use the flowcharts and task lists in this chapter as a roadmap for testing your system. The system test sequence depends on the system topology and on the DS1, DS3, STS-1, or OC-3 tributary equipment installed:

- configurations equipped with DS1s only are tested using DS1 and optical end-to-end tests
- configurations equipped with DS3s and STS-1s are tested using DS3, STS-1, and optical end-to-end tests
- configurations equipped with OC-3 tributaries are tested using OC-3 Tribs and optical end-to-end tests
- configurations equipped with DS1s, DS3s, and STS-1s are tested using DS3 or STS-1 test procedures first, followed by DS1 test procedures. Because optical tests are performed during DS3 or STS-1 testing, the optical tests in the DS1 test procedures can be omitted

Configurations not equipped with transport DS1s, DS3s, or STS-1s can be tested using temporary DS1, DS3, or STS-1 equipment. See additional advice for point-to-point systems in the section, “Testing the point-to-point system” on page 1-10.

## Equipment cautions and warnings

This section has the warnings and precautions for personal safety and for proper handling and operation of equipment.

## Radio-frequency emissions notice

The following regulatory notice applies to AccessNode equipment:

***Note:*** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the user will be required to correct the interference at his own expense.

## Static electricity

It is usual for static electrical charges to build up on the body if a person walks a short distance. This buildup of static electricity is sufficient to damage some circuit packs if it is not properly discharged first. Circuit packs that are sensitive to damage by static electricity should be packaged in antistatic material. The following precautions are recommended.

**CAUTION**
**Risk of equipment damage**
Wear a grounded antistatic wrist strap or equivalent protection when handling circuit packs, to avoid damaging electronic parts.

### Handling circuit packs

Units that are sensitive to static electricity are marked in their antistatic shipping bags with the following symbol:

ATTENTION
OBSERVER LES PRECAUTIONS POUR LA MANIPULATION DES DISPOSITIFS SENSIBLES AUX CHARGES STATIQUES

ATTENTION
OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES

To avoid static electrical damage when handling circuit packs, follow these rules:

- Do not remove circuit packs from their antistatic packages unless you are using antistatic protection, such as wearing an antistatic wrist strap. The wrist strap is attached to a long cord, which must terminate at a good ground source, so that static buildup is harmlessly discharged. Alternative antistatic methods include conductive carpet, conductive shoes, or heel grounders. Use the equipment recommended by your company.
- Handle each circuit pack by the faceplate or stiffener. Do not touch electrical connections, pins, or soldered surfaces.
- Protect optical connectors by covering them with clean dust caps.

### Storing and transporting circuit packs

When storing and transporting circuit packs, follow these rules:

- Never transport, stack or store circuit packs without first replacing them in their antistatic material and original shipping package. (Proper packaging is especially important for heavier, dual-card units like the IRTU.) This avoids physical damage and accumulation of dirt or dust on goldplated contacts. Be careful not to damage any parts when inserting the circuit pack into its packaging.
- Avoid storage in areas where the relative humidity can exceed 95% and where the temperature can exceed 70°C, because boards may warp or corrode.

## Laser radiation

AccessNode equipment and associated optical test sets use laser sources that emit light energy into fiber cables. This energy is within the red (visible) and infrared (invisible) regions of the electromagnetic spectrum.

Laser products are subject to federal and state or provincial regulations, and local practices. Regulation 21 CFR 1040 of the U.S. Bureau of Radiological Health requires manufacturers to certify each laser product as Class I, II, III, or IV, depending upon the characteristics of the laser radiation emitted. In terms of health and safety, Class I products present the least hazard (none at all), while Class IV products present the greatest hazard.

**DANGER**

**Risk of eye damage**

At all times when handling optical fibers, follow the safety procedures recommended by your company.

Read and follow the precautions below, to decrease the risk of exposure to laser radiation.

Although Nortel Networks optical products have a Class I certification, hazardous exposure to laser radiation could occur when fibers that interconnect system components are disconnected or broken. Certain procedures carried out during testing require the handling of optical fibers without dust caps, and therefore increase the risk of exposure. Exposure to either visible or invisible laser light could cause eye damage under certain conditions.

The caution label at the right appears on the optical interface card, near the optical connector, and should be complied with.

| **Caution** |
| --- |
| Avoid direct exposure to beam. Invisible light can blind. Keep all optical connectors capped. |

### Handling optical fibers

During service, maintenance, repair, or removal of cables or equipment, follow these rules:

- Avoid direct exposure to fiber ends or optical connector ends, where the laser signal can be accessed.
- Follow the manufacturer's instructions when using an optical test set. Incorrect calibration or control settings could result in hazardous levels of radiation.

### Splicing optical fibers

During the splicing of any fiber cable, you may be required to look at the fibers using an eye loupe (a small magnifier). Take the following precautions:

- Prior to starting, power off all laser sources related to those fibers, and ensure they remain off (whether located at the central office, subscriber premises, or remote location).
- Prior to starting, disconnect any optical test sets from the fibers (whether locally or remotely connected).
- Use only the optical instruments approved by your company.

### Repairing optical fibers

When there is an accidental break in the fiber feeder cable, take these steps:

- Notify both central-office personnel and field-repair personnel of the problem.
- Identify to central-office personnel which fibers have been damaged.
- Power off all laser sources related to the damaged fibers (whether located at the central office, subscriber premises, or remote location).

## Equipment warning label

The equipment label is located in the top left corner of the back cover. It reads as follows:

> To be installed only in restricted access areas
> (dedicated equipment rooms, equipment closets,
> or the like) in accordance with articles 110-16,
> 110-17, and 110-18 of the National Electrical Code,
> ANSI/NFPA No. 70.

## Placing an installed system into service

The following overviews the process of placing an installed system into service.

- The following procedures are described in *Commissioning Procedures*, 323-3001-220, and *Site Testing Procedures*, 323-3001-222. Both documents are in *Commissioning and Testing*, Volume 3B.
- Power up each NE.
  - — Commission each NE to provide it with a unique identity.
  - — Perform site tests, including optical and digital in-bay tests, on every commissioned NE to show that each NE is operational in isolation.
  - — Begin system integration.
  - — Connect the optical cables to each tested NE and download system software from the operations controller.
- Perform end-to-end tests on a new (not-in-service) system (OPC, FCOT or TN_BLSR, and RFT) to prove that the system is operational. System testing is described in this document. It does not include end-to-end testing of line cards and DS1 tandem services.
  - — Configurations equipped with DS1s only are tested using DS1 and optical end-to-end tests.
  - — Configurations equipped with DS3s and STS-1s are tested using DS3 tests, STS-1 tests, and optical end-to-end tests.
  - — Configurations equipped with OC-3 Tribs are tested using OC-3 Tribs and optical end-to-end tests.
  - — Configurations equipped with DS1s, DS3s, and STS-1s are tested using DS3 or STS-1 test procedures first, followed by DS1 test procedures. Because optical tests are performed during DS3 or STS-1 testing, the optical tests in the DS1 test procedures can be omitted.
  - — Configurations not equipped with transport DS1s, DS3s, or STS-1s can be tested using temporary DS1, DS3, STS-1 equipment.

### Integrated configurations

For integrated configurations, it is recommended that you use DS1 test procedures because testing is performed with the DS1/VT mapper allocated for digital multiplex switch (GR-303 DMS) and DS1 tandem services.

For integrated configurations without transport DS3s or STS-1s, it is recommended that you use DS1 test procedures. Testing can be performed with the DS1/VT mapper allocated for GR-303 DMS and DS1 tandem services.

## Universal configurations

Because GR-303 DMS and tandem DS1s do not exist, the NEs are not equipped with any mappers. As a result, it is recommended that system tests be performed using DS3 test procedures. This testing can be performed in a shorter period of time.

***Note:*** Protection switching and DS1/DS3 performance monitoring tests can be omitted if the system has no transport DS1s or DS3s. If spare mappers are not available, system continuity can be tested using line cards according to the task "Perform line card end-to-end continuity tests" in the task lists.

- To make the tested system ready for service, provision customer services and test line cards. Provisioning is described in *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B. Line card testing is described in *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

Other testing documents in the system library include:

- *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C, is used to test new functionality on an in-service system.
- *Routine Maintenance Procedures*, 323-3001-546, in *Maintenance*, Volume 5C is used to test equipment on a routine basis.

## Before starting

Before starting end-to-end testing, make sure that:

- outside plant installation personnel have completed acceptance tests on the fiber optic feeder cable
- site tests for NEs are completed according to the sequence of commissioning and testing tasks given in *Commissioning Procedures,* 323-3001-220, in *Commissioning and Testing*, Volume 3B

## Selecting the task list for your system

Select the task list for your system from the following choices:

| To perform system tests on a new | Refer to |
|---|---|
| VTBM ring system | page 1-7 |
| point-to-point system | page 1-10 |
| single-ended system | page 1-16 |
| DS1-fed system | 323-3001-225 |

### Testing the VTBM ring system

End-to-end tests for new VTBM rings consist of progressive end-to-end tests and end-to-end tests:

- The progressive end-to-end tests check the optical links between adjacent ADM nodes in the VTBM ring and the passthrough capabilities of nodes between the first node and the current node. The VTBM ring configuration is built as the testing team moves on to each new site.

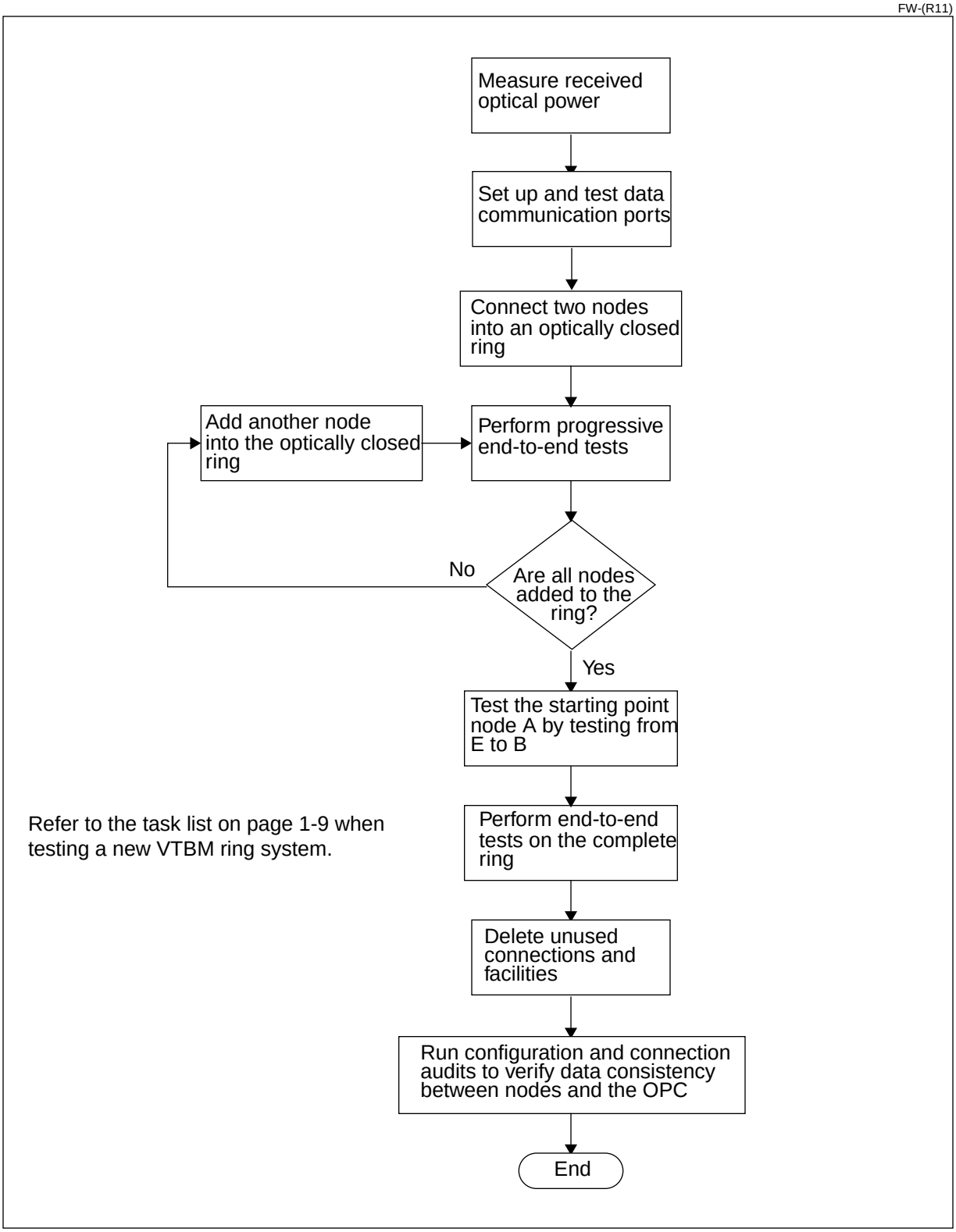
  ***Note:*** When VTBM ring nodes are first connected, AIS alarms are activated. When the node map is sent to the network elements, the alarms go away.

- End-to-end tests are done for the entire VTBM ring after the progressive end-to-end tests are completed. These test the high-speed switching features and the bit-error rate (BER) on the links using a long-term test.

The flowchart on page 1-8 and task list on page 1-9 describe end-to-end testing of a VTBM ring system. The flowchart provides a test overview, while the task list provides the sequence of required procedures.

**Figure 1-1**
**Testing a new VTBM ring system**

FW-(R11)




Refer to the task list on page 1-9 when testing a new VTBM ring system.

**Table 1-1**
**Task list for testing a new VTBM ring system**

| If you want to perform this task | Then perform these procedures | Found in the NTP or on the following page |
|---|---|---|
| Perform progressive end-to-end tests between nodes in the VTBM ring | Procedure 6-1<br>Querying the data communications ports | page 6-3 |
| | Procedure 6-2<br>Displaying the status of all data communications ports or channels | page 6-5 |
| | Procedure 6-3<br>Placing SONET data communications ports in or out of service | page 6-7 |
| | Set up the system configuration (ring) | 323-3001-310 |
| | Set up STS-1 connections between nodes in the ring | 323-3001-310 |
| | Procedure 5-4<br>Testing STS timeslot assignment and passthrough capabilities(if STS-1 is STS-managed) | page 5-18 |
| | Procedure 5-5<br>Testing VT1.5 timeslot assignment and passthrough capabilities(if STS-1 is VT-managed) | page 5-19 |
| | Procedure 5-6<br>Short-term bit-error rate (BER) tests | page 5-22 |
| | Procedure 7-2<br>Verifying communication between the primary and backup OPCs (perform once) | page 7-5 |
| | Procedure 7-3<br>Testing the orderwire feature | page 7-6 |
| | Procedure 7-4<br>Testing remote network telemetry | page 7-15 |
| Perform end-to-end tests on the complete VTBM ring | Procedure 5-7<br>Setting up for end-to-end tests for the whole ring | page 5-25 |
| | Procedure 5-8<br>Performing optical protection-switching tests | page 5-29 |
| | Procedure 5-9<br>Performing long-term bit-error rate (BER) tests | page 5-35 |
| | Delete unused STS-1 and VT1.5 connections, if any exist | 323-3001-310 |
| | Delete unused DS1, DS3, or STS-1 facilities, if any exist | 323-3001-310 |
| | Perform Configuration Manager audit on the ring | 323-3001-310 |
| | Perform Connection Manager audit on the ring | 323-3001-310 |
| | Transfer data from the primary to the backup OPC | 323-3001-220 |

## Testing the point-to-point system

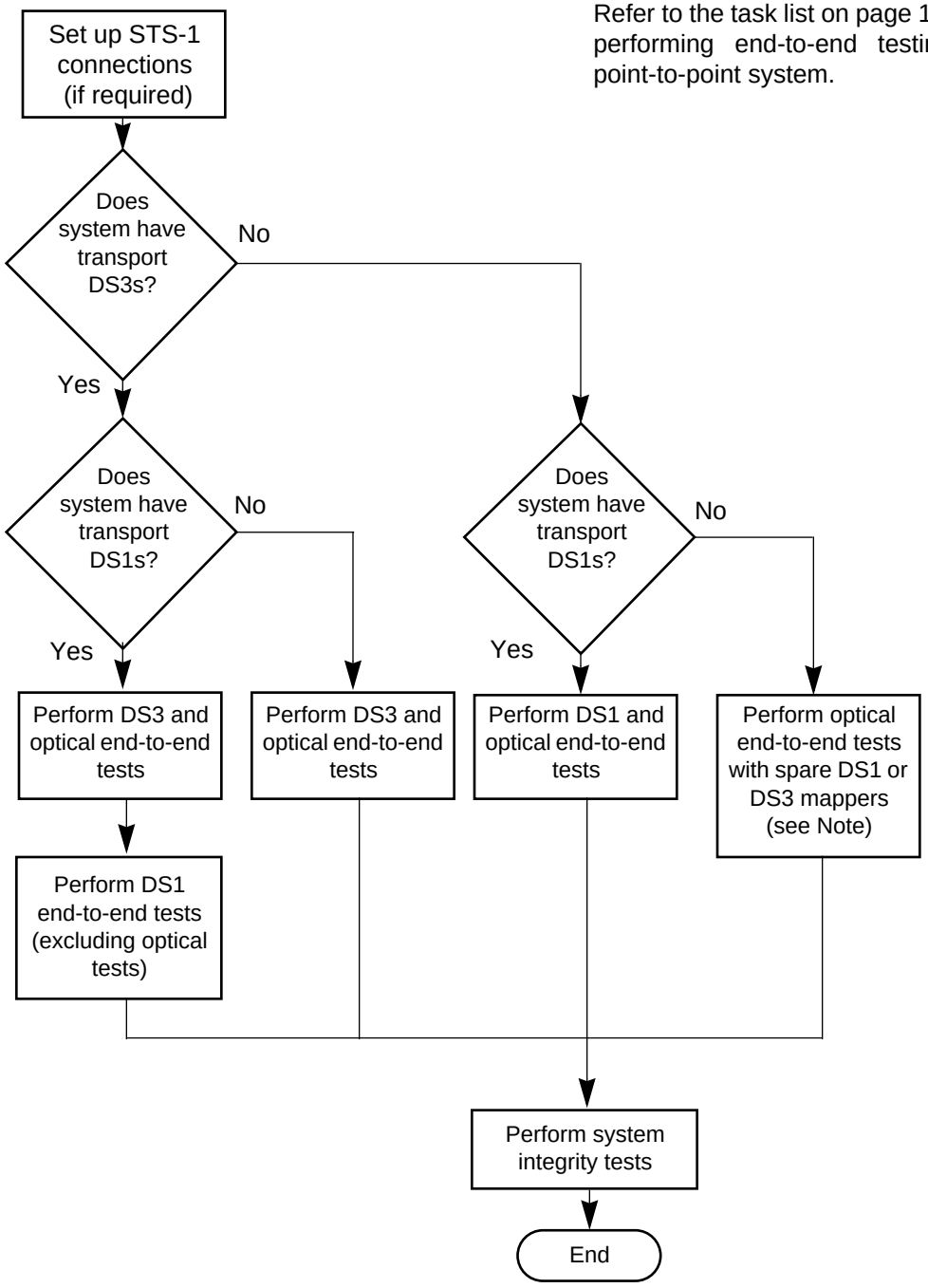
The end-to-end testing required in a point-to-point system depends on the equipment that is installed and available.

| If you have these tributaries | Then perform the following tests |
|---|---|
| DS1 | DS1 and optical end-to-end tests. |
| DS3 | DS3 and optical end-to-end tests. |
| STS-1 | STS-1 and optical end-to-end tests. |
| OC-3 | OC-3 and optical end-to-end tests. |
| a mix | all test for those types of tributaries and optical end-to-end tests. |

***Note:*** This set of tests is optional: DS1/DS3 continuity, DS1/DS3 protection switching and DS1/DS3 performance monitoring tests can be omitted when the system has no transport DS1s or DS3s and if spare mappers are not available.

If your system does not have DS1s or DS3s, and you are not performing the optical tests in this document (due to unavailable equipment), you can verify end-to-end signal continuity by performing line card tests, described in *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B. Line card tests are optional and can be performed now or after system provisioning is completed.

**Figure 1-2**
**Flowchart for end-to-end testing a point-to-point system**




***Note:*** This set of tests is optional. (DS1/DS3 continuity, DS1/DS3 protection switching, and DS1/DS3 performance monitoring tests can be omitted because the system has no transport DS1s or DS3s.) If spare mappers are not available, system continuity can be tested using line cards according to the task "Perform line card end-to-end continuity tests" in the following task list.

**Table 1-2**
**Task list for end-to-end testing of a point-to-point system**

| If you want to perform this task | Then perform these procedures | Found in the NTP or on the following page |
|---|---|---|
| Set up the system configuration (point-to-point) | | 323-3001-310 |
| Set up STS-1 connections | (Refer to Note 1 on page 1-14) | 323-3001-310 |
| Perform DS3 and optical end-to-end tests (if required) | Procedure 5-1<br>Measure the received optical power | page 5-2 |
| | Procedure 3-2<br>Set up synchronization end-to-end | page 3-9 |
| | Procedure 3-3<br>Verify DS3 transmission test set performance | page 3-11 |
| | Procedure 3-5<br>Verify DS3 signal continuity and measure BER | page 3-15 |
| | Procedure 3-6<br>Measure optical receiver sensitivity | page 3-23 |
| | Procedure 3-7<br>Test OC-3/OC-12 protection switching | page 3-31 |
| | Procedure 3-8<br>Test DS3 protection switching | page 3-43 |
| | Procedure 3-9<br>Verify OC-3/OC-12 performance monitoring | page 3-52 |
| | Procedure 3-10<br>Verify DS3 performance monitoring | page 3-54 |
| | Procedure 3-11<br>Using the protection exerciser | page 3-56 |
| Perform DS1 and optical end-to-end tests (if required) | Procedure 2-1<br>Measure the received optical power (omit if optical tests have already been performed during DS3 testing) | page 2-13 |
| | Procedure 2-3<br>Verify DS1 transmission test set performance | page 2-20 |
| | Procedure 2-2<br>Set up synchronization end-to-end | page 2-17 |
| | Procedure 2-4<br>Verify DS1 signal continuity and measure BER | page 2-22 |
| | Procedure 2-5<br>Measure optical receiver sensitivity (omit if optical tests have already been performed during DS3 testing) | page 2-29 |

**—continued—**

**Table 1-2 (continued)**
**Task list for end-to-end testing of a point-to-point system**

| If you want to perform this task | Then perform these procedures | Found in the NTP or on the following page |
|---|---|---|
| Perform DS1 and optical end-to-end tests (if required) | Procedure 3-7<br>Test OC-3/OC-12 protection switching (omit if optical tests have already been performed during DS3 testing) | page 3-31 |
| | Procedure 2-7<br>Test DS1 protection switching | page 2-49 |
| | Procedure 2-8<br>Verify OC-3/OC-12 performance monitoring (omit if optical tests have already been performed during DS3 testing) | page 2-57 |
| | Procedure 2-9<br>Verify DS1 performance monitoring | page 2-59 |
| | Procedure 2-10<br>Using the protection exerciser | page 2-61 |
| Perform line card end-to-end continuity tests | (Refer to Note 2 on page 1-14) | |
| | Test on a DS1 tandem circuit | 323-3001-316 |
| | Test on a universal circuit<br>(Refer to Table 1-4 on page 1-15) | 323-3001-315 |
| | Continue with the task “Perform system integrity tests” | Table 1-2 on page 1-14 |
| Perform OC-3 tributary testing | Procedure 4-1<br>Set up the OC-3 tributaries for the end-to-end tests | page 4-5 |
| | Procedure 4-2<br>Measure the DS1 bit-error rate (BER) for OC-3 tributaries (long term test) using an OC-3 NE | page 4-12 |
| | Procedure 4-3<br>Measure the DS3 end-to-end timed bit-error rate (BER) for OC-3 tributaries (long-term test) using an OC-3 NE | page 4-13 |

**—continued—**

**Table 1-2 (continued)**
**Task list for end-to-end testing of a point-to-point system**

| If you want to perform this task | Then perform these procedures | Found in the NTP or on the following page |
|---|---|---|
| Perform OC-3 tributary testing | Procedure 4-4<br>Measure the bit error rate (BER) for OC-3 tributaries (long-term test) using a SONET test set | page 4-15 |
| | Procedure 4-5<br>Deactivate and deleting OC-3 facilities not carrying traffic | page 4-17 |
| | Procedure 4-6<br>OC-3 tributary protection switching tests | page 4-19 |
| Perform system integrity tests | Procedure 7-1<br>Test backup and restoration of NE data | page 7-2 |
| | Procedure 7-2<br>Verify communication between primary and backup OPCs | page 7-5 |
| | Procedure 7-3<br>Test the orderwire operation | page 7-6 |
| | Procedure 7-4<br>Test remote network telemetry | page 7-15 |
| ***Note 1:*** Set up STS-1 connection services only if the default map does not fulfill your system requirements. The default map is described in Chapter 6 of this document. Engineering rules and procedures for setting up STS-1 connection services are described in *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.<br>***Note 2:*** If your system does not have DS1s or DS3s, and you are not performing the optical tests in this document (due to unavailable equipment), you can verify end-to-end signal continuity using line card tests. These tests are described in the task lists for testing end-to-end continuity on a DS1 tandem circuit and UDLC (universal) circuit in Table 1-3 and Table 1-4 on page 1-15. These tests are optional and can be performed now or after system provisioning is complete. | | |
| **—end—** | | |

**Table 1-3**
**Task list for testing end-to-end continuity on a DS1 tandem circuit**

| If you want to perform this task | Then perform these procedures | Found in the NTP or on the following page |
|---|---|---|
| Install a line card at the RFT | | 323-3001-316 |
| Add (provision) a DS1 tandem circuit | | 323-3001-315 |
| Test the circuit (see Note) | Test analog special services on a DS1 tandem, or<br>Test DDS (OCUDP) on a DS1 tandem | 323-3001-316<br>323-3001-316 |
| ***Note:*** The procedure used depends on the equipment available. | | |

**Table 1-4**
**Task list for testing end-to-end continuity on a UDLC (universal) circuit**

| If you want to perform this task | Then perform these procedures | Found in the NTP or on the following page |
|---|---|---|
| Install a line card at the FCOT and RFT | | 323-3001-316 |
| Add (provision) a universal circuit | | 323-3001-315 |
| Test the circuit | Perform an end-to-end DDS test (FCOT to RFT) | 323-3001-316 |
| ***Note:*** The procedure used depends on the equipment available. | | |

## Testing the single-ended system

The following task list shows the procedures required for the end-to-end testing of a single-ended system.

***Note:*** Other end-to-end tests can be performed from the switch, however, those tests are not described in this document.

Refer to the task list on page 1-17 when performing end-to-end testing on a single-ended system.

**Figure 1-3**
**Flowchart for end-to-end testing of a single-ended system**

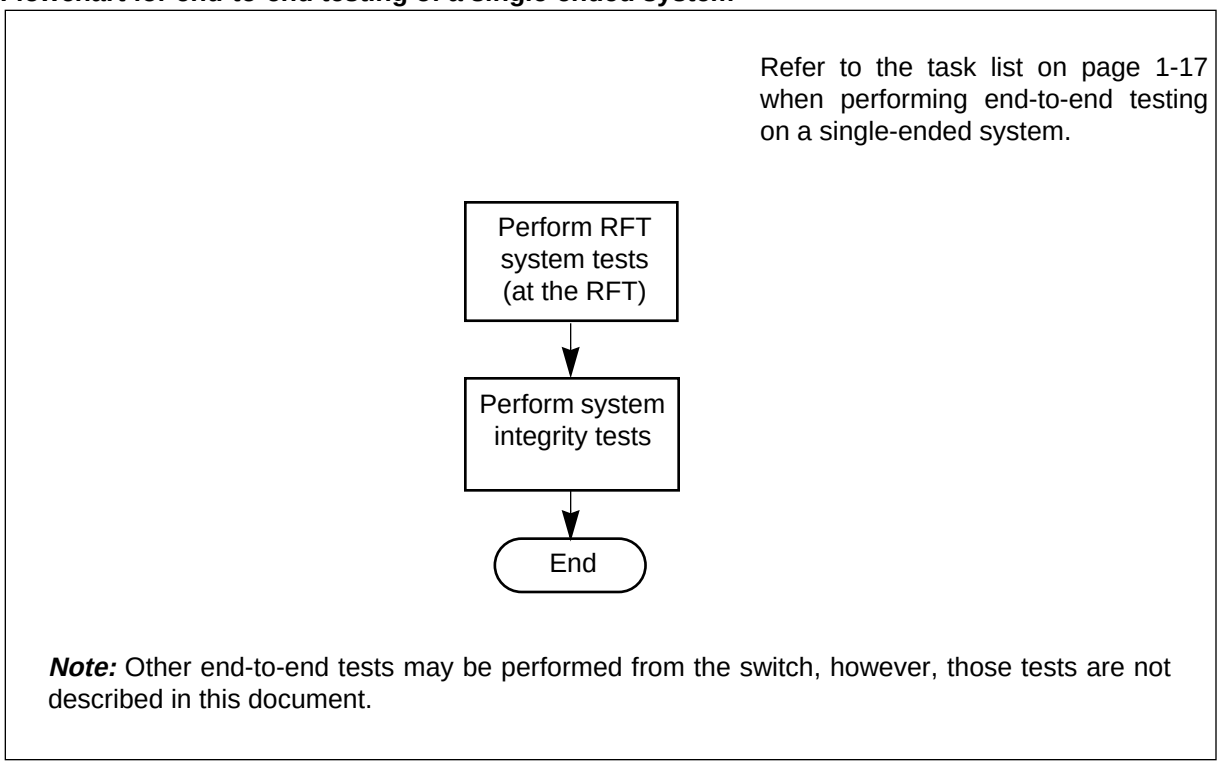


**Table 1-5**
**Task list for end-to-end testing of a single-ended system**

| If you want to perform this task | Then perform these procedures | Found in the NTP or on the following page |
|---|---|---|
| Perform RFT system tests (at the RFT) | Procedure 2-1<br>Measure the received optical power | page 2-13 |
| | Procedure 2-2<br>Set up synchronization end-to-end | page 2-17 |
| | Procedure 2-8 | page 2-57 |
| | Verify OC-3/OC-12 performance monitoring | |
| | Procedure 2-9<br>Verify DS1 performance monitoring | page 2-59 |
| | Procedure 2-10<br>Using the protection exerciser | page 2-61 |
| Perform system integrity tests | Procedure 7-1<br>Test backup and restoration of NE data | page 7-2 |
| | Procedure 7-2<br>Verify communication between primary and backup OPCs | page 7-5 |
| | Procedure 7-4<br>Test remote network telemetry | page 7-15 |

# DS1 and optical end-to-end tests

This chapter has the procedures for testing DS1 and optical equipment at a system network element (NE). Use these procedures to test systems carrying only DS1s.

## How to use this chapter

Refer to the flow charts and task lists in Chapter 1 when using this chapter. These flow charts and task lists identify the procedures that must be performed in this chapter.

### Chapter topics

The table below shows the information contained in this chapter for DS1 and optical end-to-end tests.



If you cannot successfully complete these procedures, contact your next level of support.

## System configurations and circuits

Optical system tests for configurations not equipped with transport DS1s, DS3s, or STS-1s can be performed using temporary DS1, DS3, or STS-1 equipment. It may be more convenient to use one set of procedures over the other.

In integrated configurations, it is recommended that tests be performed using DS1s because a DS1/VT mapper used for GR-303 DMS and DS1 tandem services already exists in slot 1 of the ABM shelf and slot 3 of the TBM shelf.

In universal configurations, since GR-303 DMS and tandem DS1s do not exist, the NEs are not equipped with any mappers. As a result, it is recommended that system tests be performed using DS3 test procedures, as DS3 testing can be performed in a shorter period of time than DS1 testing.

| **Configuration type** | **Configuration type description** |
|---|---|
| Universal | has UDLC and DS1 tandem circuits, or both, and requires an ABM shelf at both the fiber central office terminal (FCOT) and the remote fiber terminal (RFT) |
| Integrated | has GR-303 DMS and DS1 tandem circuits, or both, and can exist on either an ABM or a TBM shelf at the FCOT (and requires an ABM shelf at the RFT) |
| Combined | has GR-303 DMS and UDLC circuits and can have DS1 tandem circuits. Requires an ABM shelf at both the FCOT and RFT. |
| TR-08 | has TR-08 circuits. It has an ABM or TBM shelf at the FCOT, and an ABM shelf at the RFT. |

| Circuit type | Circuit type description |
|---|---|
| Transport DS1s | can exist on any configuration (if the slots are available), and require a DS1/VT mapper at both the FCOT and the RFT |
| Transport DS3s | can exist on any configuration (except a combined configuration having an OPC at the FCOT) and require a DS3 mapper at both the FCOT and RFT |
| Transport STS-1s | can exist on a TN_BLSR configuration and require an STS-1 interface card at the other end (TN_BLSR) for end-to-end testing |
| DS1 tandem circuits | are DS0s from the RFT that exit the FCOT on DS1s and are non-locally switched or non-switched. They require a DS1/VT mapper at the FCOT and terminate on line cards at the RFT. |
| GR-303 DMS (digital multiplex switch) circuits | are DS0s from the RFT that exit the FCOT on DS1s and terminate on a digital switch. Requires a DS1/VT mapper at the FCOT (GR-303 DMS and DS1 tandem circuits use the same mapper) and terminate on line cards at the RFT. |
| UDLC (universal digital loop carrier) circuits | exit the FCOT at the voice frequency level and require line cards at both the FCOT and the RFT |
| TR-08 circuits | are DS0s from the RFT that exit the FCOT on DS1s and terminate on a digital switch. They require a TR-08 DS1/VT mapper at the FCOT and terminate on line cards at the RFT. |

## Test equipment

The following table lists the test equipment required for testing DS1 and optical equipment.

| Qty | Equipment | Details | Use for |
|---|---|---|---|
| 1 | network element user terminal, Digital Equipment Corporation VT100 or equivalent | includes a keyboard and display, power supply cord, and RS-232C cable with a 25-pin D-subminiature male connector | many procedures |
| 1 | optical power meter | single-mode 1310/1550 nm unit<br>–50 to +5 dB range | optical power tests |
| 2 | optical test cords,<br>use NT7E46AA<br>or NT7E46BA<br>or NT7E46CA<br>or NT7E46FA | single-mode, 5 m (16 ft) long<br>with biconic SPA connectors<br>with FC connectors<br>with ST connectors<br>with SC connectors | optical power tests |
| 2 | optical patch cords with mini-Variable Optical Attenuator (mVOA),<br>use NT7E47AA<br>or NT7E47BA<br>or NT7E47CA<br>or NT7E47FA | single-mode, 25 dB attenuation, 5 m (16 ft)<br>with biconic SPA connectors<br>with FC connectors<br>with ST connectors<br>with SC connectors | optical loopback tests |
| 1 | variable optical attenuator (VOA) | single-mode,1310/1550 nm, equipped with 2 HP8110 optical test cords with biconic connectors | optical receiver sensitivity test |
| 1 | TBOS (E2A) test set,<br>KS-22828 L1 or equivalent | includes a cable with a 25-pin D-subminiature male connector for connection to the shelf | serial telemetry test |
| 1 | VF transmission test set<br>Hewlett-Packard HP3551 | | orderwire test |
| 1 | VF cable of appropriate length | NT4K85FA (100 ft)<br>NT4K85FB (200 ft)<br>NT4K85FC (300 ft) | orderwire test |
| 1 | DS1 transmission test set,<br>Tau-Tron S5104 (Tx-Rx) | DS1 signal transmitter/receiver | DS1 and optical in-bay tests |
| 3 | electrical test cords, P3Q3B | bantam-to-310 connectors, 2 m (6 ft) | connection to the DS1 test set |
| 13 | electrical test cords | bantam-to-bantam connectors, 1 m (3 ft) | DS1 continuity test (at DSX-1) |

**—continued—**

| Qty | Equipment | Details | Use for |
|---|---|---|---|
| 1<br><br>2<br>1<br>1<br>1<br>1 | NT4K85YA DS1 chaining test cable<br>NT7E04 DS1/VT mapper<br>NT4K32 DS1 input card<br>NT4K33 DS1 output card<br>flat-head (slotted) screwdriver<br>electrically-safe stepladder (or step-stool)<br>(Note: TR-08 services require the NT7E04CA DS1/VT mapper.) | 14 DS1s daisychained, with two Bantam plugs (to the input and output of the test set) | Optical receiver sensitivity test for network elements that are not equipped with a DS1/VT mapper used for transport DS1s |
| **—end—** | | | |

## Group and slot associations for DS1, DS3, STS-1, OC-3, and OC-12

The group number you enter in a command string depends on the shelf type and function, the mapper type, and its slot location. Table 2-1 on page 2-6 summarizes the group and slot associations for the different mappers and shelves.

***Note:*** The following tables do not imply that all slots are available for your configuration. For details about the capacity for each configuration, refer to the *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide*, Volume 1.

**Table 2-1**
**Group and slot association matrix**

| Mapper and shelf function | | Mapper slot | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** |
| **DS1** | DS1-fed ABM | G1 | G2 | P | G4 | G5 | G6 | | | | | | | | | | | | | |
| | ABM FCOT or FCOT_BLSR | G1 | G2 | P | G4 | G5 | G6 | G7 | G8 | | | | | | | | | | | |
| | TBM FCOT | | | G3 | G4 | | | | | | | G5 | G6 | P | G8 | G9 | G10 | G11 | G12 | |
| | TBM FCOT_BLSR | G1 | G2 | G3 | G4 | | | | | | | G5 | G6 | P | G8 | G9 | G10 | G11 | G12 | |
| | TBM TN_BLSR | G1 | G2 | G3 | G4 | | | | | | | G5 | G6 | G7 | G8 | G9 | G10 | G11 | G12 | P |
| **DS3** | ABM | P | S | G1 | | G2 | | G3 | | | | | | | | | | | | |
| | TBM FCOT | P | S | | | | | | | | | G1 | | - | | G3 | | G4 | | |
| | TBM FCOT_BLSR or TN_BLSR | P | S | | | | | | | | | G1 | | G2* | | G3 | | G4 | | |
| **STS-1** | TN_BLSR | | S | P | | | | | | | | G1 | | G2 | | G3 | | G4 | | |
| **OC-3** | ABM tributary | G3 | | G4 | | G1S | | G2S | | | | | | | | | | | | |
| | TBM tributary | G3 | | G4 | | G1S | | G2S | | | | G5 | | G6 | | G7 | | G8 | | |
| | Feeder | | | | | | | | | G1 | G2 | | | | | | | | | |
| **OC-12** | Feeder | | | | | | | | | G1 | G2 | | | | | | | | | |
| **OC-12 VTBM** | Feeder | | | | | | | | | G1 | G2 | | | | | | | | | |
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** |

***Note:*** * For DS3 TBM FCOT_BLSR fiber-fed shelves, this group is available only if no DS1s are provisioned for that shelf.

## Group and slot associations for DS1, DS3, and STS-1 I/O cards

For some tasks, you must also know the slot numbers of the input and output cards. Refer to the following tables to determine which the I/O slot(s) for the mapper you need.

| If you are provisioning this equipment | For this shelf type | Then refer to |
|---|---|---|
| DS1 equipment | ABM | Table 2-2 |
| | TBM | Table 2-3 |
| DS3 equipment | ABM | Table 2-4 |
| | TBM | Table 2-5 |
| STS-1 equipment | TBM | Table 2-5 |

For DS1 and DS3 circuit packs, Table 2-2 and Table 2-3 show the association between mappers in the lower level of the common equipment shelf and input/output cards in the upper level.

For example, DS1 circuit pack group G1 refers to the group of modules including the working DS1/VT mapper circuit pack in slot 1 and its corresponding DS1 input and output cards in slots 30 and 32, respectively. Similarly, DS1 circuit pack group P refers to the group of modules including the protection DS1/VT mapper circuit pack in slot 3 and the DS1 protection bridge cards in slots 34 and 36.

## DS1 I/O numbers

Table 2-2 lists the DS1 circuit pack groups for the ABM shelf functions. It also shows the association between mappers in the lower level of the shelf, and input cards and output cards in the upper level.

**Table 2-2**
**ABM DS1 mapper, group, and I/O numbers**

| Shelf function | Group or I/O slot | Mapper slot | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | - |
| RFT<br>RFT_BLSR<br>FCOT<br>FCOT_BLSR | Group | g1* | g2* | P* | g4* | g5* | g6* | g7 | g8 | | | | | | | | | | | |
| | Input slot | 30* | 31* | 34p* | 35* | 38 | 39 | 42 | 43 | | | | | | | | | | | |
| | Output slot | 32* | 33* | 36p* | 37* | 40 | 41 | 44 | 45 | | | | | | | | | | | |

***Note 1:*** * DS1 equipment allowed in a DS1-fed ABM shelf.

***Note 2:*** The symbol “p” in the DS1 input and output slots denotes a protection bridge card.

***Note 3:*** The feeder occupies slots 9 and 10. If an OPC is installed, it occupies slots 5 through 8.

Table 2-3 lists the DS1 circuit pack groups for the different TBM shelf functions. It also shows the association between mappers in the lower level of the shelf, and input cards and output cards in the upper level.

**Table 2-3**
**TBM DS1 mapper, group, and I/O numbers**

| Shelf function | Group or I/O slot | Mapper slot | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| FCOT | Group | | | g3 | g4 | | | | | | | g5 | g6 | P | g8 | g9 | g10 | g11 | g12 | |
| | Input slot | | | 34 | 35 | | | | | | | 38 | 39 | 42p | 43 | 46 | 47 | 50 | 51 | |
| | Output slot | | | 36 | 37 | | | | | | | 40 | 41 | 44p | 45 | 48 | 49 | 52 | 53 | |
| FCOT_BLSR | Group | g1* | g2* | g3 | g4 | | | | | | | g5 | g6 | P | g8 | g9 | g10 | g11 | g12 | |
| | Input slot | 30* | 31* | 34 | 35 | | | | | | | 38 | 39 | 42p | 43 | 46 | 47 | 50 | 51 | |
| | Output slot | 32* | 33* | 36 | 37 | | | | | | | 40 | 41 | 44p | 45 | 48 | 49 | 52 | 53 | |
| TN_BLSR | Group | g1* | g2* | g3 | g4 | | | | | | | g5 | g6 | g7 | g8 | g9 | g10 | g11 | g12 | P |
| | Input slot | 30* | 31* | 34 | 35 | | | | | | | 38 | 39 | 42 | 43 | 46 | 47 | 50 | 51 | - |
| | Output slot | 32* | 33* | 36 | 37 | | | | | | | 40 | 41 | 44 | 45 | 48 | 49 | 52 | 53 | - |

***Note 1:*** * FCOT_BLSR and TN_BLSR shelves can contain two additional DS1 working groups (compared to an FCOT) when DS3 protection mappers are not used in slots 1 and 2. The two additional DS1 working groups are g1 (slots 1, 30, 32) and g2 (slots 2, 31, 33).

***Note 2:*** The symbol “p” in the DS1 input and output slots denotes a protection bridge card.

***Note 3:*** The feeder occupies slots 9 and 10. If an OPC is installed, it occupies slots 5 through 8.

## DS3 I/O numbers

Table 2-4 lists the DS3 circuit pack groups for the ABM shelf functions. It also shows the association between mappers in the lower level of the shelf, and input cards and output cards in the upper level.

**Table 2-4**
**ABM DS3 mapper, group, and I/O numbers**

| Shelf function | Group or I/O slot | Mapper slot | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | - |
| RFT | Group | P | S | g1 | — | g2 | — | g3 | — | | | | | | | | | | | |
| RFT_BLSR<br>FCOT<br>FCOT_BLSR | I/O slots | —<br>—<br>— | —<br>—<br>— | 34<br>35<br>36 | | 38<br>39<br>40 | | 42<br>43<br>44 | | | | | | | | | | | | |

***Note 1:*** The feeder occupies slots 9 and 10. If an OPC is installed, it occupies slots 5 through 8.

***Note 2:*** The symbol “P” in slot 1 denotes a protection mapper; the symbol “S” in slot 2 denotes a protection switch card.

Table 2-5 lists the DS3 circuit pack groups for the TBM shelf functions. It also shows the association between mappers in the lower level of the shelf, and input/output cards in the upper level.

**Table 2-5**
**TBM DS3 mapper, group, and I/O numbers**

| Shelf function | Group or I/O slot | Mapper slot | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| FCOT | Group | P | S | — | — | | | | | | | g1 | — | g2* | — | g3 | — | g4 | — | — |
| FCOT_BLSR<br>TN_BLSR | I/O slots | —<br>—<br>— | —<br>—<br>— | | | | | | | | | 38<br>39<br>40 | | 42*<br>43*<br>44* | | 46<br>47<br>48 | | 50<br>51<br>52 | | |

***Note 1:*** * This group is available for FCOT_BLSR shelves that have no DS1s provisioned.

***Note 2:*** The feeder occupies slots 9 and 10. If an OPC is installed, it occupies slots 5 through 8.

***Note 3:*** The symbol “P” in slot 1 denotes a protection mapper; the symbol “S” in slot 2 denotes a protection switch card.

## STS-1 I/O numbers

Table 2-5 lists the STS-1 circuit pack groups for the TBM shelf functions. It also shows the association between mappers in the lower level of the shelf, and input/output cards in the upper level.

**Table 2-6**
**TBM STS-1 interface, group, and I/O numbers**

| Shelf function | Group or I/O slot | Mapper slot | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| TN_BLSR | Group | | S | P | — | | | | | | | g1 | — | g2 | — | g3 | — | g4 | — | — |
| | I/O slots | —<br>—<br>— | —<br>—<br>— | | | | | | | | | 38<br>39<br>40 | | 42<br>43<br>44 | | 46<br>47<br>48 | | 50<br>51<br>52 | | |

***Note 1:*** The feeder occupies slots 9 and 10. If an OPC is installed, it occupies slots 5 through 8.

***Note 2:*** The symbol “P” in slot 3 denotes a protection mapper; the symbol “S” in slot 2 denotes a protection switch card.

## Shelf functions for OC-3 point-to-point systems

Table 2-7 shows the ABM and TBM shelf functions for OC-3 point-to-point systems. These include the following shelf functions: ABM RFT, ABM FCOT, TBM FCOT.

**Table 2-7**
**OC-3 signal capacity (point-to-point systems only)**

| DS1/DS3 Configuration | DS1 tandem (FCOT only) | DS1 transport (FCOT/RFT) | DS3 transport (FCOT/RFT) |
|---|---|---|---|
| **ABM–ABM combined configurations without an OPC** | | | |
| DS1 | 28 | 28 | 0 |
| DS1/DS3 | 28 | 0 | 1 |
| **ABM–ABM universal configurations without an OPC** | | | |
| DS1 | 0 | 56 | 0 |
| | 28 | 28 | 0 |
| DS1/DS3 | 0 | 28 | 1 |
| | 28 | 0 | 1 |
| DS3 | 0 | 0 | 2 |
| **ABM–ABM universal configurations with an OPC** | | | |
| DS1 | 0 | 42 | 0 |
| | 28 | 14 | 0 |
| DS3 | 0 | 0 | 2 |
| **TBM–ABM integrated configurations, with or without an OPC** | | | |
| DS1 | 28 | 56 | 0 |
| DS1/DS3 | 28 | 28 | 1 |
| DS3 | 28 | 0 | 2 |
| **TBM–ABM multiplexer configurations, with or without an OPC** | | | |
| DS1 | 0 | 56 | 0 |
| DS1/DS3 | 0 | 28 | 1 |
| DS3 | 0 | 0 | 2 |
| ***Note:*** The DS1 tandem capacity includes the combined total of Integrated (GR-303 DMS) DS1s and Tandem DS1s. | | | |

In point-to-point ABM–ABM configurations, the default map at the FCOT (FCOT) supports GR-303 DMS and DS1 tandem services on DS1/VT mappers in slots 1 and 2 of OC-3-fed combined configurations, or slots 7 and 8 in OC-12-fed combined configurations.

***Note:*** For TBM to ABM configurations, make sure that the TBM shelf configuration you choose can be supported by the ABM shelf at the other end.

# Procedure 2-1
# Measuring the received optical power

Use this procedure to verify that a signal transmitted from one network element (NE) is received at the second NE.

***Note 1:*** This procedure does not apply to the OPC shelf in single-ended systems. There are no optical cards in the shelf.

***Note 2:*** For proper electromagnetic interface (EMI) protection, the shelf cover must be replaced after completion of testing.

One technician can do this procedure. Repeat this procedure at each NE in the system.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- optical power meters must be calibrated using the manufacturer's instructions
- optical power meter, Photodyne 17XTA or equivalent (one at each end)
- telephone link between the two NEs under test
- two (2) VT100-compatible terminals, one at each NE, connected to the NE
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 is required

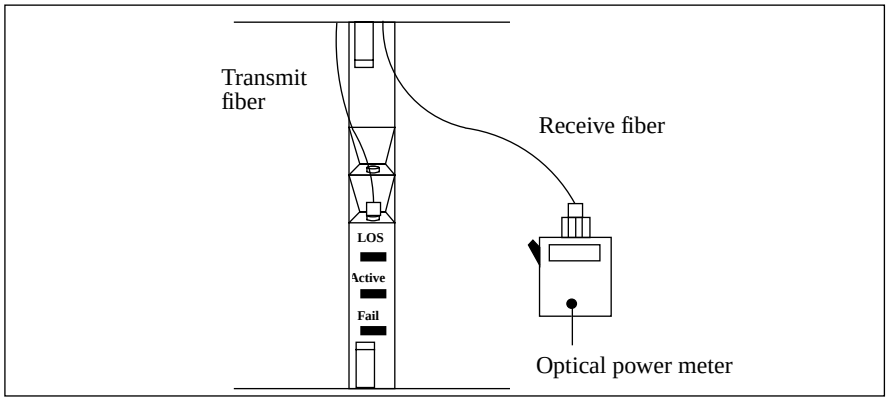
**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**—continued—**

Procedure 2-1 (continued)
**Measuring the received optical power**

## Action

| Step | Action |
|---|---|
| **1** | Log in to the network element user interface (NEUI) and operate a lockout on the OC-3/OC-12 optical channels by entering:<br>**pr;dtlprot <oc-n>** ↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>**lockout op** ↵<br>**yes** ↵<br>*The symbols in the Lckt column on the OC-3/OC-12 Protection screen and in the Lckt field in the Alarm Banner change from a period (.) to an asterisk (*) at the local NE and to (*R) at the remote NE, indicating that a lockout is active.* |
| **2** | Remove the cover of the common-equipment shelf by turning the right locking fastener one-quarter turn to the right, and the left fastener one-quarter turn to the left. Open both latches and pull the cover to remove it. |
| **3** | Disconnect the receive patch cord from the OC-3/OC-12 circuit pack under test and connect it to the optical power meter as shown below. |




**—continued—**

Procedure 2-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|

**4** Measure the receive optical power and record the value on the System Test Results Form.

*The measured value must be greater than or equal to the following:*

| PEC | Module | Minimum receiver power ($P_{R\ min}$) |
|---|---|---|
| NT7E01CA/CB/CC/CD | OC-3 LR | – 34.0 dBm |
| NT7E01DA/DB/DC/DD | OC-3 IR | – 28.0 dBm |
| NT7E02KA/KB/KC/KD | OC-12 LR | – 32.0 dBm |
| NT7E02LA/LB/LC/LD | OC-12 IR | – 24.5 dBm |

***Note:*** Only OC-3 values apply for single-ended RFTs since these feed off OC-3 tributaries only.

**CAUTION**
**Risk of connector damage**
Make sure the optical connections are clean and correctly connected. Follow the procedure for cleaning and assembling connectors in *Site Testing Procedures*, 323-3001-221, in *Commissioning and Testing*, Volume 3B.

**5** If the requirement is not met, clean the fiber connectors using the regular cleaning procedure. Verify the optical meter calibration, the fiber pigtail connections, the fiber link, and the OC-3/OC-12 transmitter at the other end.

**6** Repeat steps 3 through 5 for the second optical channel.

**CAUTION**
**Risk of receiver damage**
Insert sufficient attenuation between the optical transmitter and receiver to prevent overload of the optical receiver. Optical power must not exceed –10.0 dBm and –6.0 dBm for the OC-3 and OC-12 long-reach (LR) interfaces respectively and -8.0 dBm and -2.0 dBm for the OC-3 and OC-12 intermediate-reach (IR) interfaces.

**7** Reconnect the fiber pigtails to the OC-3/OC-12 optical interfaces.

**—continued—**

Procedure 2-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|
| **8** | Release the lockout on the optical channels at the NE where the lockout was performed.<br>**lockout re** ↵<br>*You are prompted to confirm the release of the lockout.*<br>**y** ↵<br>*The symbols in the Lckt column on the OC-3/OC-12 Protection screen and in the Lckt field in the Alarm Banner change to a period (.), indicating that the lockout is released.* |
| **9** | Repeat this procedure for the second NE. |
| **10** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 2-2
# Setting up synchronization end-to-end

Use this procedure to set up the synchronization at the remote fiber terminal (RFT). The external synchronization interface (ESI) is installed at the fiber central office terminal (FCOT) where the Building Integrated Timing Supply (BITS) is located. The RFT is usually dependent on the FCOT for synchronization. Only one of the network elements (NEs) in a subnetwork can interface to the external synchronization source; the other NE is looptimed to the first.

**CAUTION**
**Risk of service loss**
Set the RFT clock source to looptimed. If you do not perform this procedure, service could be affected by insufficient synchronization. This procedure must be done even if there is no external synchronization source connected at the FCOT.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- you have installed and tested the ESI cards as described in *Site Testing Procedures*, 323-3001-221, in *Commissioning and Testing*, Volume 3B
- the ESI cable is installed as described in the procedure “Installing the external synchronization cable” in the *Bay in Central Office Installation Manual—ABM*, 323-3001-201, or *Bay in Central Office Installation Manual—TBM*, 323-3001-202
- a VT100-compatible user terminal connected to the NE
- a copy of the System Test Results Form, located in “Appendix A: System Test Results Form” on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**—continued—**

Procedure 2-2 (continued)
**Setting up synchronization end-to-end**

## Action

| Step | Action |
|---|---|
| **1** | Log in to the network element user interface (NEUI) at the RFT.<br>*The Network Element Status screen is displayed.* |
| **2** | Lockout the OC-3/OC-12 circuit pack so that optical protection switching does not occur while setting the synchronization options. Enter the following:<br>**pr;dtlprot <oc-n>**↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>*The OC-3/OC-12 Protection screen is displayed.*<br>**lockout op** ↵<br>*A message indicates that traffic is forced to the G1 OC-3/OC-12 unit. Confirmation of the lockout is requested.*<br>**y** ↵<br>*An asterisk is displayed in the Lockout field for the G1 unit.* |
| **3** | Set the shelf clock source to looptimed mode:<br>**eq sh** ↵<br>*The Shelf Equipment screen is displayed.*<br>**edit** ↵<br>*The Edit Shelf menu is displayed.*<br>**clocksrc looptimed** ↵<br>*A confirmation is requested.*<br>**y** ↵<br>*The Clock Source field changes to looptimed.* |

**—continued—**

Procedure 2-2 (continued)
**Setting up synchronization end-to-end**

| Step | Action |
|---|---|
| **4** | Remove the lockout on the OC-3/OC-12 circuit pack. Enter the following:<br>**quit** ↵<br>**pr;dtlprot <oc-n>**↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>**lockout re** ↵<br>**y** ↵<br>*A dot is displayed in the Lockout field for the G1 OC-3/OC-12 unit.* |
| **5** | Log out of the NEUI. |
| **6** | Note the completion of this test on the System Test Results Form.<br>**—end—** |

# Procedure 2-3
# Verifying DS1 transmission test set performance

Use this procedure to verify digital transmission test set performance. This is necessary so that reliable results can be obtained when carrying out tests.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- DS1 transmit-receive test set, Tau-Tron S5104 (Tx-Rx)
- an electrical test cord, bantam-to-bantam, 1 m (3 ft)
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

This procedure describes settings for Tau-Tron test sets. Other brands of test sets use similar settings.

## Action

| Step | Action |
|---|---|
| **1** | Set the Power switch to ON. |
| **2** | Set the Transmitter Out controls as follows:<br>Frame: Frame<br>Pattern: PRBS<br>DS: DSX1 |
| **3** | Set the Error Inject controls as follows:<br>Type: Bit<br>Mode: Err free |
| **4** | Connect the bantam-to-bantam test cord between input and output. |

**—continued—**

Procedure 2-3 (continued)
**Verifying DS1 transmission test set performance**

| Step | Action |
|---|---|
| **5** | Set the Measurement Time controls as follows:<br>Mode: Untimed<br>Start/Stop: In Process |
| **6** | Set the Measurements controls as follows:<br>Type: Bit |
| **7** | Set the Receiver Input controls as follows:<br>Frame: Frame<br>Pattern: PRBS<br>Channel: CH1<br>DS: DSX1 |
| **8** | At the rear of the test set, set the DS1 Output switch to Bipolar. |
| **9** | Press the Start/Stop button on the test set twice, to reset the error count.<br>*The DS1 test set indicates "in process", and displays an error count of 0.* |
| **10** | Press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process", and displays an error count of 3.* |
| **11** | If you did not obtain the required results, check the settings and repeat the test. If necessary, replace the test set. |
| **12** | Disconnect the test cord and you are ready to perform tests. |
| **13** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 2-4
# Verifying DS1 signal continuity and measuring BER

Use this procedure to check end-to-end signal continuity and measure the bit-error rate (BER) of all DS1s on a DS1/VT mapper. This procedure only applies to DS1/VT mappers carrying transport DS1s. If your system does not have any DS1/VT mappers carrying transport DS1s, skip to Procedure 2-5 on page 2-29.

All DS1s on a DS1/VT mapper are daisy-chained at the DSX-1 cross-connect panel at the central office (CO) so the DS1s can be tested in one operation. This procedure requires only one technician, who sets up a local session on one network element (NE), and a remote session on the other NE. Use the internal loopback feature of the DS1/VT mapper for this procedure. It is not necessary to physically loopback at the remote-end DSX-1 cross-connect panel, because DS1 continuity is already tested at each site.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- STS connections set up for your specific configuration if you are not using the default map (See *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning,* Volume 4B.)
- a VT100-compatible terminal, connected to the NE
- DS1 transmission test set, Tau-Tron S5104
- two electrical test cords, P3Q3B
- thirteen electrical test cords, bantam-to-bantam connectors, 1 m (3 ft)
- two attenuated optical test cords, NT7E47AA/BA/CA/FA
- a copy of the System Test Results Form, in “Appendix A: System Test Results Form” on page 8-1,

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**—continued—**

Procedure 2-4 (continued)
**Verifying DS1 signal continuity and measuring BER**

You must know how to log in to the far-end NE. If the local NE has an OPC, connect your terminal to the OPC and log in to both NEs. Refer to *Network Element User Interface Description,* 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

Basic provisioning of all DS1 equipment and facilities is completed while performing site procedures. Refer to the document *Site Testing Procedures*, 323-3001-221, in *Commissioning and Testing*, Volume 3B.

## Action

| Step | Action |
|---|---|

**Set up the OC-3/OC-12 lockout**

**1** Log in to the user interface at the FCOT and display the OC-3/OC-12 Protection screen, by entering the following:

**pr;dtlprot <oc-n>**↵

where

<oc-n> is the type of optical carrier: **oc3** or **oc12**

*The OC-3/OC-12 Protection screen is displayed.*

**2** Impose a lockout on the G1 OC-3/OC-12 interface circuit pack by entering:

**lockout op** ↵

*The screen displays a message warning that the command forces all traffic to the OC-3/OC-12 G1 unit and asks you to confirm the command.*

**y** ↵

*The OC-3/OC-12 protection screen displays an asterisk (*) in the Lockout field for the G1 unit.*

**Set up the DS1 loopbacks**

**3** Log in to the RFT user interface and display the DS1 Facility screen, by entering:

**facility ds1 all** ↵

*The DS1 Facility screen for all DS1 facilities is displayed.*

**—continued—**

Procedure 2-4 (continued)
**Verifying DS1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| **4** | Take the DS1 facilities out of service. On the DS1 Facility screen, enter:<br>**chgstate oos** ↵<br>*The following message is displayed: "Traffic WILL BE LOST if this command is confirmed." Confirm the command by entering:*<br>**y** ↵<br>*A screen message reports that the command is in progress. A major alarm is generated for each DS1 taken out of service. A second message reports that the command is successfully completed in all cases.*<br>***Note:*** The DS1 facilities are placed back in service at the end of the Procedure 2-8 on page 2-57 or Procedure 2-7 on page 2-49 as appropriate. |
| **5** | At the RFT, set up a terminal loopback for the DS1s under test, by entering:<br>**loopback op term** ↵<br>*This performs the terminal loopback for all optical DS1s at the RFT.*<br>***Note:*** A terminal loopback redirects a DS1 received from the RFT over the Rx fiber, back to the remote terminal over the Tx fiber. A facility loopback redirects a DS1 received at the local digital input port, to the digital output port. |
| **6** | At the RFT, impose a lockout on the DS1/VT mapper circuit pack under test by entering:<br>**dtlprot ds1** ↵<br>*The DS1 Protection screen is displayed.*<br>**lockout op <circuit pack group>**↵<br>where<br><circuit pack group> is the circuit pack group under test<br>***Note:*** Refer to "Group and slot associations for DS1, DS3, and STS-1 I/O cards" on page 2-7 for the DS1/VT mappers (and their associated slots and group numbers) used for transport DS1 service in your configuration.<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*The DS1 protection screen displays an asterisk (*) in the Lockout field for the mapper under test.* |
| **7** | At the FCOT, repeat step 6. |

**—continued—**

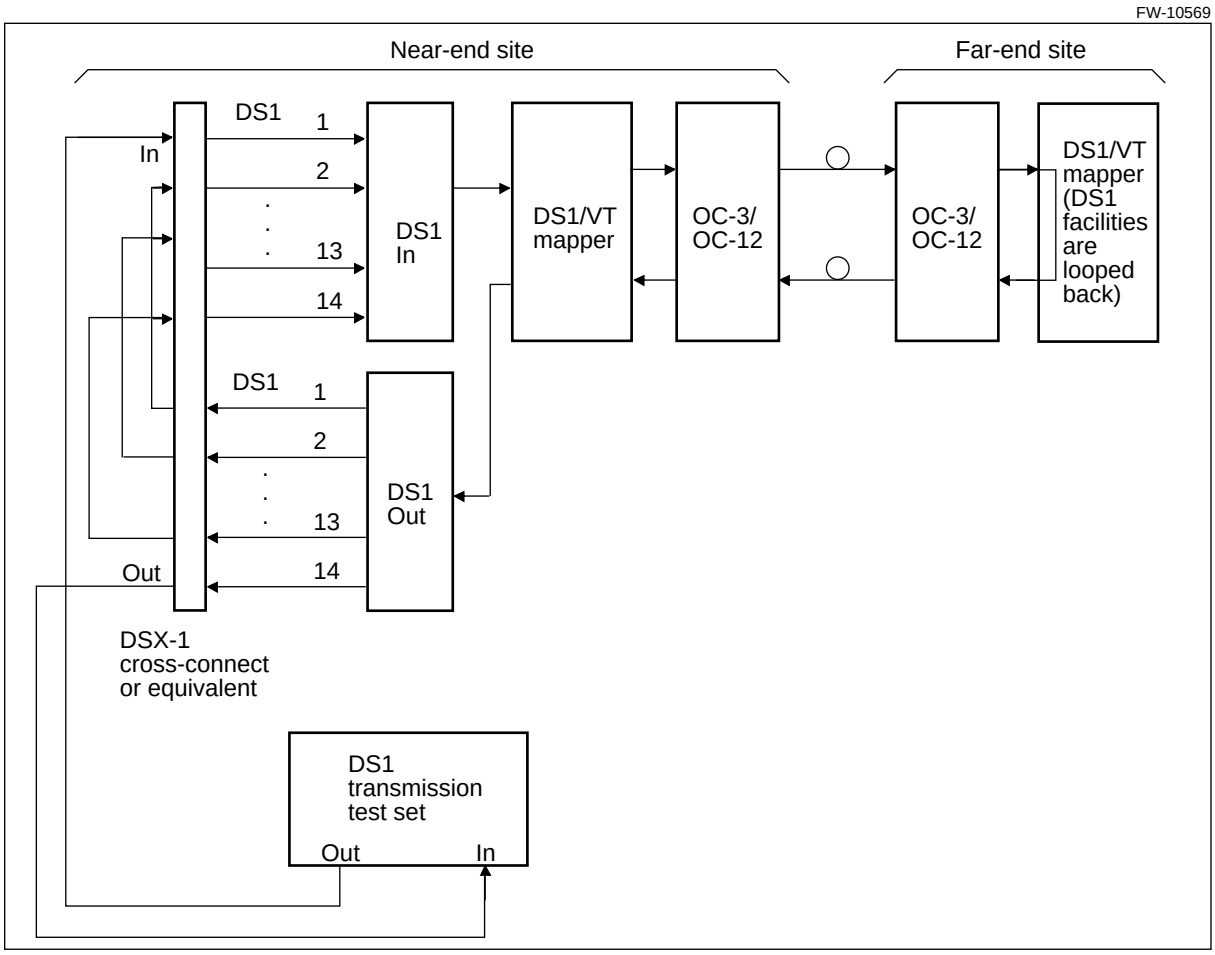
Procedure 2-4 (continued)
**Verifying DS1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| | **Set up the DS1 daisy-chain** |
| **8** | At the FCOT, daisy-chain all DS1 circuits of the DS1/VT mapper circuit pack under test, as shown on the following page.<br>• At the DSX-1 cross-connect panel, use a test cord to loop the output of the first DS1 to the input of the next DS1.<br>• Daisy-chain as explained above until all DS1s on the circuit pack are included.<br>• Connect the output of the DS1 transmission test set to the input of the first DS1. Connect the input of the DS1 test set to the output of the last DS1. |
| **9** | Press the Start/Stop button on the DS1 test set twice to reset the error count to zero.<br>*The DS1 receiver test set indicates "in process" and displays 0 error.* |
| **10** | Press the Single Bit Error Inject button three times on the DS1 test set.<br>*The DS1 test set indicates "in process" and displays 3 bit errors.* |
| **11** | If the continuity requirement is not met, do one or more of the following and repeat steps 9 and 10.<br>• Make sure the daisy-chain of DS1s is set up at the FCOT and the terminal loopback is setup at the RFT.<br>• Break the daisy chain into two chains. Isolate and fix any problems you encountered and re-build the daisy chain.<br>• Check the digital test set and the connections from the DSX-1 cross-connect to the DS1 input card and DS1 output card.<br>• Replace any faulty DS1 input card or DS1 output card at the near end. Installation of cards in the I/O section is described in *Bay in Central Office Installation Manual—ABM*, 323-3001-201.<br>• Replace the DS1/VT mapper circuit pack at the near end. Installation of these circuit packs is described in *Commissioning Procedures*, 323-3001-220, *Commissioning and Testing*, Volume 3B.<br>• Replace the DS1/VT mapper circuit pack at the far end. |

**—continued—**

Procedure 2-4 (continued)
**Verifying DS1 signal continuity and measuring BER**

| Step | Action |
|---|---|




**—continued—**

Procedure 2-4 (continued)
**Verifying DS1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| **12** | Press the Start/Stop button on the DS1 test set twice, to reset the error count to zero once again. Monitor the error count for 1 hour and record the result in the System Test Results Form.<br>*The DS1 test set should display 0 error.*<br>If the requirement is not met, replace the DS1/VT mapper circuit pack at the FCOT, or at the RFT, or both, and repeat step 12. |
| **13** | At the FCOT, release the lockout of the DS1/VT mapper under test by entering:<br>**lockout re <circuit pack group>**↵<br>where<br><circuit pack group> is the circuit pack group under test<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*The DS1 protection screen displays a dot (.) in the Lockout field for the equipment under test.* |
| **14** | Repeat step 13 at the RFT. |
| **15** | Repeat steps 6 through 14 for each working DS1/VT mapper circuit pack. |
| **16** | You can also test the protection DS1/VT mapper. |

| If your configuration has | Then go to |
|---|---|
| a protection DS1/VT mapper | step 17 |
| no protection DS1/VT mapper | step 22 |

***Note:*** In steps 17 and 22, use the DS1 circuit pack group where the daisy chain remains connected.

**Testing the protection mapper (if equipped)**

| | |
|---|---|
| **17** | Force the traffic normally handled by a working DS1/VT mapper to switch to the protection mapper by entering:<br>**forced op <circuit pack group>**↵<br>where<br><circuit pack group> is the circuit pack group of the last tested mapper |

**—continued—**

Procedure 2-4 (continued)
**Verifying DS1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| | ***Note:*** Refer to "Group and slot associations for DS1, DS3, and STS-1 I/O cards" on page 2-7 for the group numbers of DS1/VT mappers used for transport DS1 service in your configuration.<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*The DS1 protection screen displays an asterisk (*) in the forced field for the specified mapper. The DS1s normally handled by this working mapper are rerouted to the protection mapper.* |
| **18** | Repeat step 17 at the other NE. |
| **19** | Press the Start/Stop button on the DS1 test set twice, to reset the error count to zero once again. Then, monitor the error count for one hour and record the result in the System Test Results Form.<br>*The DS1 test set displays 0 error.*<br>Problem areas could be the protection DS1/VT mapper, the backplane of the shelf, and the protection bridge input/output card. Isolate and fix any problems you encountered and rebuild the daisy chain. |
| **20** | When you complete testing the protection DS1/VT mapper, release the forced switch on the DS1/VT mapper under test.<br>**forced re <circuit pack group>**↵<br>where<br><circuit pack group> is the group specified in step 16<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*The DS1 protection screen displays a dot (.) in the forced field for the G1 mapper.* |
| **21** | Repeat step 20 at the other NE. |
| **22** | Leave in place the OC-3/OC-12 lockouts at both locations, the DS1 daisy chain at the FCOT and the DS1 loopbacks at the RFT for the next procedure. Also leave the DS1 facilities out of service. |
| **23** | Note the completion of this procedure on the System Test Results Form.<br>**—end—** |

# Procedure 2-5
# Measuring optical receiver sensitivity

Use this procedure to verify OC-3/OC-12 receiver operation at minimum and maximum receiver input levels.

This procedure verifies that the network element (NE) receives error-free digital signals when the OC-3/OC-12 input level is adjusted to the minimum value and the maximum value guaranteed for the product.

This procedure can be performed by one technician but must be repeated for each site.

***Note:*** You can omit this procedure if you have already performed the DS3 or STS-1 based optical tests.

## Requirements

The following requirements must be met and materials are needed before starting this procedure.

- the system must not be in service
- calibrate the optical power meter using the manufacturer's instructions.
- a VT100-compatible terminal connected to the local craft access panel (LCAP) at the fiber central office terminal (FCOT)
- a variable optical attenuator, (VOA)
- two (2) optical test cords, to match your optical connector type
- optical power meter, 1310/1550 nm range –50 dB to +5 dB
- DS1 transmission test set, Tau-Tron S5104 (Tx-Rx)
- two (2) electrical test cords, P3Q3B
- thirteen (13) electrical test cords, bantam-to-bantam, 1 m (3 ft) (only if this system has transport DS1s)
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

If this system has transport DS1s, then you have already verified DS1 continuity in the previous procedure. The OC-3/OC-12 lockout, DS1 daisy chain at the FCOT, and DS1 loopbacks at the RFT, remain connected.

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

For instructions on how to set up the OC-3/OC-12 lockout, see steps 1 and 2, beginning on page 2-23. To set up the DS1 daisy chain at the FCOT, see step 8 on page 2-25. To set up the DS1 loopbacks at the RFT, see steps 3 to 5, on page 2-23.

#### System without transport DS1s

If your system has no transport DS1s, you need to install temporary DS1 equipment for testing. After you install the temporary DS1 equipment, you then perform the following tasks:

- set up STS connections (if you are not using the default map),
- provision the DS1 facilities
- set up an OC-3/OC-12 lockout
- set up a DS1 loopback at the RFT, and
- test DS1 continuity in the first part of this procedure. In this case, the electrical test cords in the previous list are not required.

If your system has no transport DS1s and you want to perform this test, then you need the following additional equipment:

- one (1) DS1 chaining test cable, NT4K85YA
- two (2) DS1/VT mappers, NT7E04 (for TR-08 services, the NT7E04CA DS1/VT mapper is required for both the working and protection mappers)
- one (1) DS1 input card, NT4K32 (for the FCOT)
- one (1) DS1 output card, NT4K33 (for the FCOT)
- a flat-head (slotted) screwdriver
- an electronically-safe stepstool

***Note:*** If you have only one spare DS1/VT mapper, the spare mapper required at the FCOT can be replaced by the DS1/VT mapper allocated for GR-303 DMS and DS1 tandem, or TR-08 services.

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**CAUTION**
**Risk of signal attenuation**
Clean optical connectors to minimize signal attenuation and test error caused by impurities.

**CAUTION**
**Risk of equipment damage**
Wear a grounded antistatic wrist strap or equivalent protection when handling circuit packs, to avoid damaging electronic parts.

| If this system | Then start procedure at |
|---|---|
| does not have transport DS1s | step 1 |
| has transport DS1s | step 12 |

## Action

| Step | Action |
|---|---|

**Preparations for systems without transport DS1s**

**1** Install the additional equipment (DS1/VT mapper, DS1 input card, and DS1 output card) in the slots specified for transport DS1s for your configuration. Install the I/O cards at the NE where the measurements are done. If you are using the default map or your customized map, refer to the DS1/VT Mapper Layout Form you filled out in the *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide,* Volume 1.

***Note 1:*** If you have only one spare DS1/VT mapper at the FCOT, you can temporarily move a mapper (and its corresponding input/output cards) used for GR-303 DMS or tandem DS1s or TR-08 DS1s into a transport DS1 slot.

***Note 2:*** If you are using the default map, mappers used for GR-303 DMS, Tandem, or TR-08 DS1s are located in slots 1 and 2 in an ABM shelf and slots 3 and 4 in a TBM shelf. To avoid alarms, you must first force DS1 facilities to protection and place the DS1/VT mapper out of service. To do this, use the procedure for replacing the DS1/VT mapper circuit pack in *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C.

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

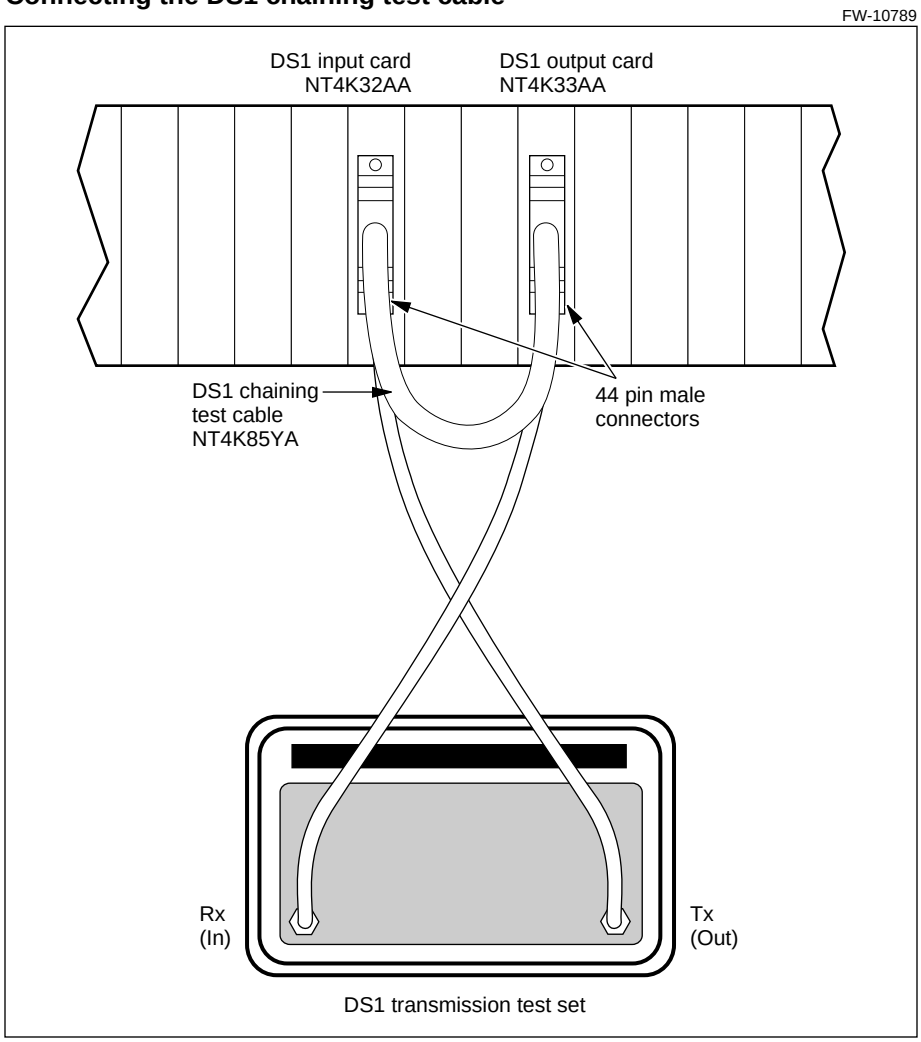
| Step | Action |
|---|---|
| **2** | Fully engage each circuit pack in its backplane connector. Store blank I/O faceplates. |
| **3** | Use a slotted screwdriver to turn the locking screw on the DS1 input and DS1 output cards. |
| **4** | At the FCOT, provision the DS1s according to the procedures in *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning,* Volume 4B. Also refer to *Line Card Provisioning Procedures,* 323-3001-315, in *Operations, Administration, and Provisioning,* Volume 4B. |
| **5** | Repeat DS1 provisioning at the RFT. |
| **6** | Set up the OC-3/OC-12 lockout as in steps 1 and 2, beginning on page 2-23. |
| **7** | Set up the DS1 loopback at the RFT as in steps 5 and 6, beginning on page 2-24. |
| **8** | Connect the DS1 chaining test cable to the DS1 I/O cards in the upper section of the ABM shelf at the measurement end as follows:<br>• the cable connector labeled DS1 Input Card to the DS1 Input card<br>• the cable connector labeled DS1 Output Card to the DS1 Output card<br>Be sure that the cable is correctly connected, as shown in Figure 2-1 on page 2-33. |

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|

**Figure 2-1**
**Connecting the DS1 chaining test cable**




**9** Connect the DS1 chaining test cable to the transmission test set as follows:

- the plug labeled Test Set (Tx) Out to the transmit side of the test set
- the plug labeled Test Set (Rx) In to the receiver side of the test set.

***Note:*** Be sure that the cable is connected properly.

**10** Verify the DS1 continuity. On the DS1 test set, press Start/Stop twice to reset the error count to zero.

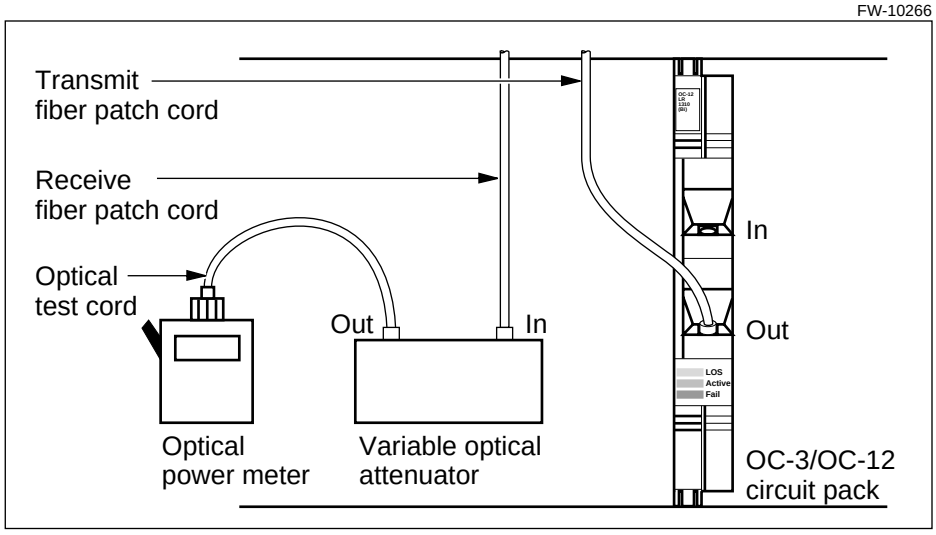
*The DS1 test set indicates "in process" and displays 0 error.*

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|
| **11** | Press the Single Bit Error Inject button three times.<br>*The digital receiver test set indicates 3 bit errors received.*<br>If the requirement is not met, there could be a fault in the DS1 test set settings, in the chaining test cable, or in the DS1 circuit pack group equipment. Locate and rectify the problem and retest for DS1 continuity. |
| | **Preparations for systems with transport DS1s** |
| **12** | Log in to the near-end NE and impose a lockout on the DS1/VT mapper used in this test.<br>**pr; dtlprot ds1** ↵<br>*The DS1 Protection screen is displayed.*<br>**lockout op <circuit pack group>**↵<br>where<br><circuit pack group> is the DS1 group that is daisy-chained<br>**y** ↵<br>*An asterisk is displayed in the Lockout field for the DS1 group under test.* |
| | **Setting up optical equipment** |
| **13** | As shown in the following illustration, use an optical test cord to connect the output of the VOA to the optical power meter. |

FW-10266




| | |
|---|---|
| **14** | Disconnect the receive fiber patch cord from the OC-3/OC-12 receive connector and connect it to the input of the variable optical attenuator. |
| **15** | Set the VOA for single-mode, proper wavelength operation. |

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|

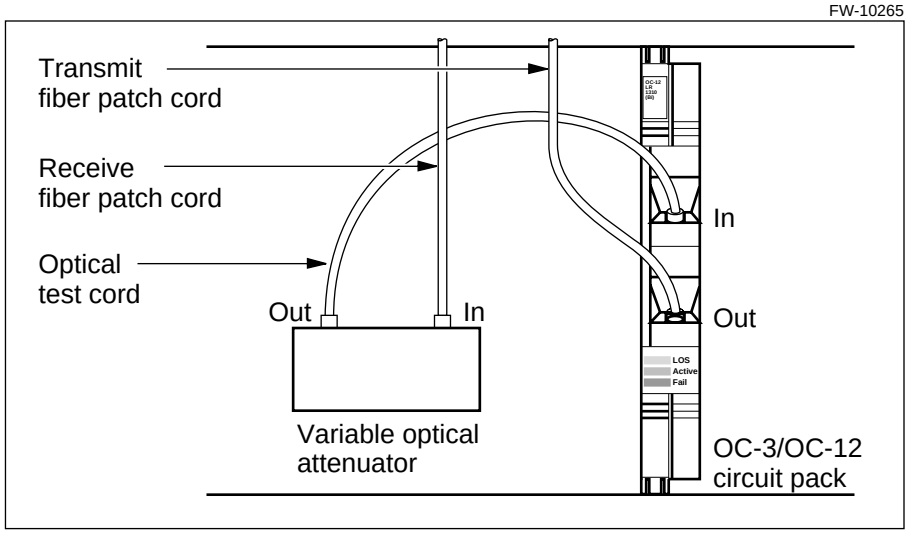
**Measuring BER at minimum optical receive level**

**16** Adjust the variable optical attenuator to obtain the following reading on the optical power meter:

| PEC | Module | Minimum receiver power ($P_{R\ min}$) |
|---|---|---|
| NT7E01CA/CB/CC/CD | OC-3 long reach (LR) | – 34.0 dBm |
| NT7E01DA/DB/DC/DD | OC-3 intermediate reach (IR) | – 28.0 dBm |
| NT7E02KA/KB/KC/KD | OC-12 LR | – 32.0 dBm |
| NT7E02LA/LB/LC/LD | OC-12 IR | – 24.5 dBm |

**17** Disconnect the optical test cord from the optical power meter and connect it to the OC-3/OC-12 receive connector, as shown below.

FW-10265




**18** On the DS1 test set, press Start/Stop twice to reset the error count to zero.

*The DS1 test set indicates "in process" and displays 0 error.*

**19** Press the Single Bit Error Inject button three times.

*The digital receiver test set indicates 3 bit errors received.*

**20** Reset the DS1 receiver test set and monitor for 1 hour.

*The test set displays 0 error.*

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|

**21** If the requirement is not met, the OC-3/OC-12 interface circuit pack could be faulty. Repeat steps 13 to 20, using a different OC-3/OC-12 interface circuit pack.

**22** Record the receiver sensitivity results on the System Test Results Form.

**Set up for normal operation**

**23** Adjust the attenuation so that the receive level is within the following required range. Adjustment may not be necessary if this requirement is already met:

| Module | Requirement |
|---|---|
| OC-3 LR interface circuit pack | –34.0 ≤ normal power ≤ –10.0 dBm |
| OC-3 IR interface circuit pack | –28.0 ≤ normal power ≤ –8.0 dBm |
| OC-12 LR interface circuit pack | –32.0 ≤ normal power ≤ –7.0 dBm |
| OC-12 IR interface circuit pack | –24.5 ≤ normal power ≤ –4.0 dBm |

**CAUTION**
**Risk of attenuator damage**
If the attenuation does not change after 1 full turn of the adjustment screw, stop turning in that direction. Instead, turn the screw in the opposite direction to restore the unit to within the operating range.

**24** Enter the normal optical power setting on the System Test Results Form.

**25** Reconnect the receive fiber patch cord to the receive connector of the G1 OC-3/OC-12 interface circuit pack.

**26** Release the lockout on the G1 OC-3/OC-12 interface circuit pack, by entering:

**pr;dtlprot <oc-n>**↵

where

<oc-n> is the type of optical carrier: **oc3** or **oc12**

**lockout re** ↵

**y** ↵

*A dot is displayed in the lockout column for optical interface unit G1.*

**—continued—**

Procedure 2-5 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|
| **27** | Repeat step 26 for the lockout on the G1 OC-3/OC-12 interface circuit pack at the other NE. |
| **28** | Force the traffic to switch to the G2 OC-3/OC-12 unit, by entering:<br>**forced op g1** ↵<br>**y** ↵<br>*Traffic switches to the G2 unit. On the OC-3/OC-12 Protection screen, an asterisk is displayed in the Forced field for optical interface unit G1.* |
| **29** | Repeat steps 13 through 25 for the G2 OC-3/OC-12 interface circuit pack. |
| **30** | Release the forced switch, by entering:<br>**forced re g1** ↵<br>**y** ↵<br>*A dot is displayed in the forced column for optical interface unit G1.* |
| **31** | If this system has no transport DS1s, end the procedure here. Do not remove the DS1 chaining test cable, DS1/VT mappers, DS1 input/output cards, or DS1 test set. If this system has transport DS1s, continue at step 32. |
| **32** | Remove the daisy chain at the DSX-1 cross-connect. Leave the DS1 loopbacks in place at the RFT, for the next procedure. Also, leave DS1 facilities out of service. |
| **33** | Release the lockout on the DS1 circuit pack group, by entering:<br>**dtlprot ds1** ↵<br>**lockout re <circuit pack group>**↵<br>where<br><circuit pack group> is the DS1 group with the lockout<br>**y** ↵<br>*A dot is displayed in the lockout column for the DS1 circuit pack group.* |
| **34** | Repeat step 33 for the DS1 lockout at the other NE. |

**—end—**

# Procedure 2-6
# Testing OC-3/OC-12 protection switching

Use this procedure to test OC-3/OC-12 protection switching: manual, forced, and automatic due to signal degradation or signal failure. Also, use it to test lockout from automatic switching.

This procedure can be conducted by one technician, who can set up two user interface sessions, a local session to one network element (NE), and a remote session to the other NE through the operations controller (OPC). If necessary, see the procedure for logging in to a network element from the OPC and logging out in *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

> ***Note:*** If the system is equipped with DS1s, DS3s, and STS-1s, then you have already performed STS-1 or DS3-based optical tests, so this procedure can be omitted.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- the DS1s remain looped back at the far end, as described in steps 3 to 5, beginning on page 2-23 in Procedure 2-4
- keep the DS1 chaining test cable connected if the DS1 chaining test cable was connected in step 8 of Procedure 2-5 on page 2-29

You need the following materials for this procedure.

- a VT100-compatible terminal, already connected and logged in to the OPC
- a variable optical attenuator (VOA) and two (2) optical test cords, Hewlett-Packard 8110
- one (1) optical test cord, NT3E42AA
- a DS1 transmission test set, Tau-Tron S5104 (Tx-Rx), and two (2) electrical test cords, P3Q3B
- a copy of the System Test Results Form, located in “Appendix A: System Test Results Form” on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

## Action

| Step | Action |
|---|---|

| If this system | Then start procedure at |
|---|---|
| has transport DS1s | step 1 |
| does not have transport DS1s | step 2 |

**1** Connect the DS1 test set to one DS1 terminated at the DSX-1 cross-connect, as shown in the illustration on page 2-40.

**2** Set the DS1 test set to read total errors. On the DS1 test set, press the Reset button to reset the error counter.

*The DS1 test set displays 0 error.*

**3** Check optical and DS1 continuity by pressing the Single Bit Error Inject button three times on the DS1 test set.

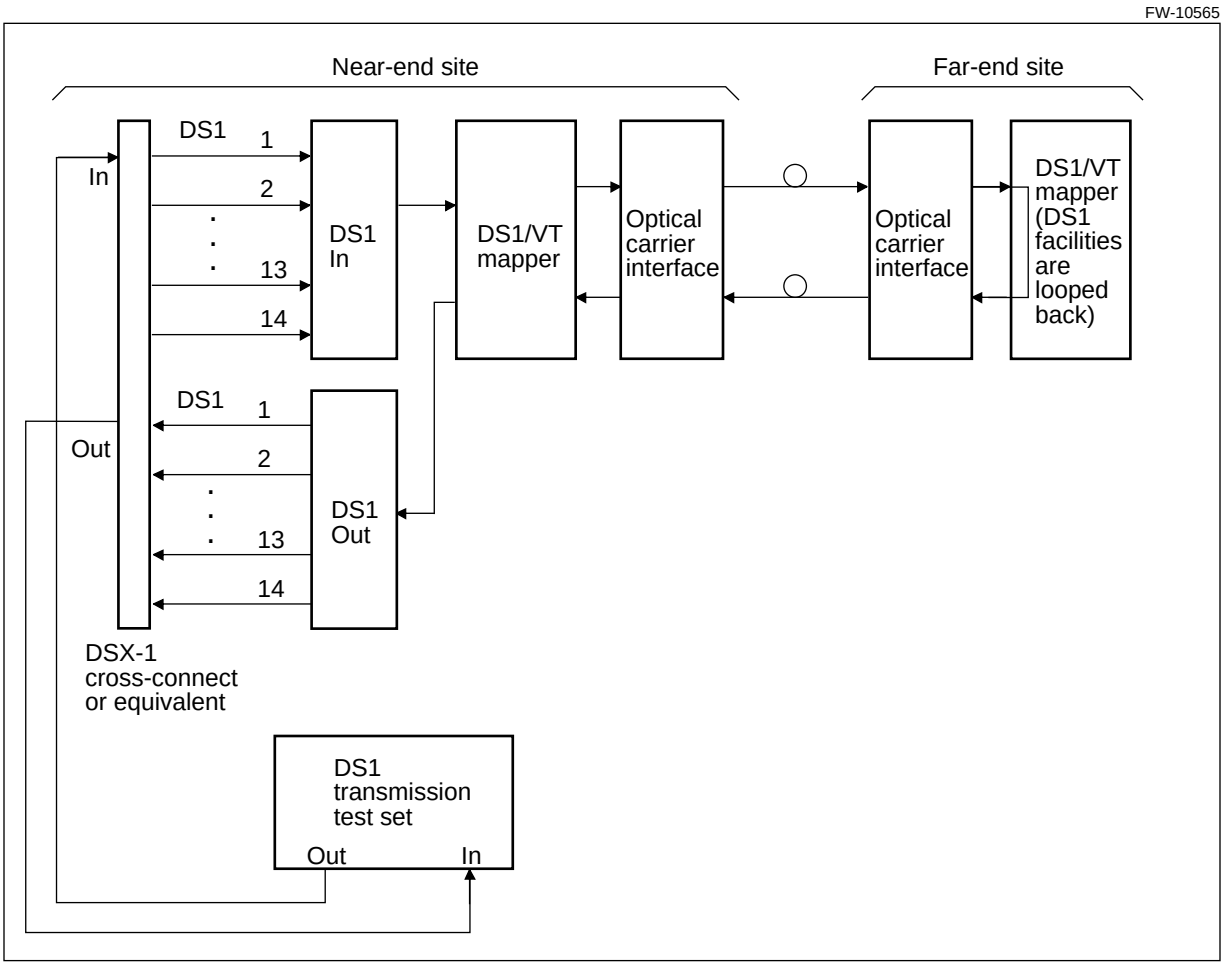
*The DS1 test set displays 3 bit errors.*

**4** Log in to the user interface of the FCOT.

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

**Step Action**




**Testing manual switching**

**5** Log in to the NE and display the protection status of the OC-3/OC-12 circuit packs, by entering:

**pr; dtlprot <oc-n>** ↵

where

<oc-n> is the type of optical carrier: oc3 or oc12

***Note 1:*** The OC-3/OC-12 Protection screen is displayed, showing two circuit packs in service: G1 and G2. G1 corresponds to OC-3/OC-12 the circuit pack in slot 9, and G2 corresponds to the circuit pack in slot 10.

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|
| | ***Note 2:*** One circuit pack is active and the other is standby. The green (Active) LED is on for the active circuit pack. Note that in the case of NT7E05 OC-12 VTBM circuit packs, both circuit packs are active.<br><br>***Note 3:*** f a circuit pack is locked out, forced to protection, or automatically or manually switched to protection, an asterisk (*) is displayed in the appropriate field. A dot (.) indicates no special activity, that is, normal operation. A dash (-) indicates not applicable. |
| **6** | Make sure G2 is the only active circuit pack.<br><br>***Note:*** In the case of OC-12 VTBM circuit packs, both circuit packs are initially active.<br><br>If G1 is active, operate a manual switch, by entering:<br><br>**manual op g1** ↵<br><br>*You are prompted to confirm the command.*<br><br>**y** ↵<br><br>*For OC-12 VTBM, both cards remain active and have green LEDs.*<br><br>*For other OC-3/OC-12, the green (Active) LED turns off at OC-3/OC-12 G1 and lights on G2.* |
| **7** | On the DS1 transmission test set, press the Start/Stop button twice to reset the error count to zero.<br><br>*The DS1 test set indicates "in process" and displays 0 bit error.* |
| **8** | To verify DS1 continuity, press the Single Bit Error Inject button three times on the DS1 test set.<br><br>*The DS1 transmission test set displays 3 bit errors received.* |
| **Testing forced switching** | |
| **9** | Force a switch to G1 by entering:<br><br>**forced op g2** ↵<br><br>*You are prompted to confirm the command.*<br><br>**y** ↵<br><br>*For both OC-12 VTBM and other OC-3/OC-12, the green (Active) LED on the G1 OC-3/OC-12 interface circuit pack turns on and the green (Active) LED on the G2 circuit pack turns off.* |
| **10** | To verify DS1 continuity, press the Single Bit Error Inject button three times on the DS1 test set.<br><br>*The DS1 transmission test set displays 3 bit errors received.* |

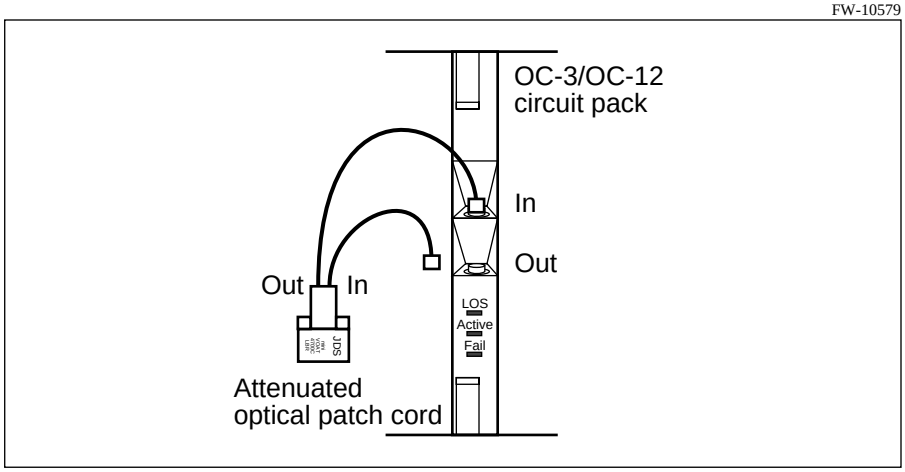
**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**11** Disconnect the optical patch cord from the transmit (Out) connector on the G1 OC-3/OC-12 interface circuit pack as shown below.

FW-10579




*For OC-12 VTBM, G1 and G2 are both active with green LEDs. The OC-12 Protection screen displays an R in the Forced field of G2.*

*For other OC-3/OC-12, the G1 OC-3/OC-12 interface circuit pack remains active due to the forced switch. As a result, DS1 signal continuity is lost.*

*The OC-3/OC-12 Protection screen displays an asterisk (*) in the Auto (automatic switch) field of G2. On G2, the yellow loss-of-signal (LOS) LED turns on. The green (Active) LED on the G1 OC-3/OC-12 interface circuit pack indicates that it is now active.*

**12** To verify DS1 signal continuity is lost, press the Start/Stop button on the DS1 transmission test set twice, to reset the error count.

*The DS1 transmission test set indicates "in process" and shows a high error count.*

**13** Release the forced switch, by entering:

**forced re g2** ↵

**y** ↵

*For OC-12 VTBM, G1 autoswitches to G2. The OC-12 Protection screen displays an asterisk (*) in the Auto field of G1. G1 active LED light is turned off, and G2 active LED remains on.*

*For other OC-3/OC12, you make it possible for an automatic switch to occur (from G1 to G2) by releasing the forced switch. G2 becomes active. The green (Active) LED on G2 turns on.*

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|
| **14** | Reconnect the optical patch cord to the transmit (Out) connector on OC-3/OC-12 G1.<br>*OC-3/OC-12 G2 remains active.* |
| **15** | On the DS1 transmission test set, press the Start/Stop button twice to reset the error count to zero.<br>*The DS1 test set indicates "in process" and displays 0 bit error.* |
| **16** | To verify DS1 continuity, press the Single Bit Error Inject button three times on the DS1 test set.<br>*The DS1 transmission test set displays 3 bit errors received.* |
| **Testing automatic switching due to loss of optical signal** | |
| **17** | To cause an AutoSw (automatic switch) of the optical facility, remove the optical patch cord from the transmit (Out) connector on the G2 OC-3/OC-12 interface circuit pack.<br>*For OC-12 VTBM, the OC-12 Protection screen displays an *R in the Auto field of G2. G2 active LED is off.* |
| **18** | On the DS1 receiver test set, press the Start/Stop button twice to reset the error count to zero.<br>*The DS1 test set indicates "in process" and displays 0 bit error.* |
| **19** | To verify DS1 continuity, press the Single Bit Error Inject button three times on the DS1 test set.<br>*The DS1 receiver test set displays 3 bit errors received.* |
| **20** | Reconnect the optical patch cord to the transmit (Out) connector of OC-3/OC-12 G2.<br>*For OC-12 VTBM, the OC-12 Protection screen displays a (WR) in the Auto field of G2. Once the wait-to-restore period expires, the G2 active LED is lit.*<br>*For other OC-3/OC12, the yellow LOS LED goes off on the G2 OC-3/OC-12 interface. The screen displays a dot (.) in the AutoSw (automatic switch) field for the G2.* |

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**Testing lockout**

**21** Operate a lockout on the OC-3/OC-12 interface circuit packs by entering:

| For OC-12 VTBM | For other OC-3/OC-12 |
|---|---|
| **lockout op** <**work/prot> <unit>** ↵<br>for example:<br>lockout op prot g1 | **lockout op** ↵ |

*The screen displays a message warning that the command will affect service and asks you to confirm the command. Enter:*

**y** ↵

*For OC-12 VTBM, the OC-12 Protection screen displays an asterisk (*) in the LcktP field for G1. The lockout (LckOut) LED is lit on the maintenance interface card (MIC).*

*For other OC-3/OC-12, the OC-3/OC-12 Protection screen displays an asterisk in the Lockout field for optical interface G1. A hyphen (-) in the Lockout field for G2 indicates that the lockout does not apply. The lockout (Lck Out) LED is lit on the maintenance interface card (MIC).*

**22** Simulate a loss of signal by removing the optical patch cord from the transmit (Out) connector of the OC-3/OC-12 G2 (for OC-12 VTBM) or G1 (for other OC-3/OC12).

*For OC-12 VTBM, the OC-12 Protection screen remains the same. G1 and G2 both remain active with green LEDs turned on. Traffic does not switch to G1.*

*For other OC-3/OC-12, the yellow loss-of-signal (LOS) LED on G1 turns on. Traffic does not switch to G1.*

**23** To verify that DS1 signal continuity is lost, press the Start/Stop button on the DS1 receiver test set twice, to reset the error count.

*The DS1 receiver test set indicates “in process” and shows a high error count.*

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**24** Release the lockout on the OC-3/OC-12 interface circuit packs, allowing the automatic switch by entering:

| For OC-12 VTBM | For other OC-3/OC-12 |
|---|---|
| **lockout re <work/prot> <unit>** ↵<br>for example:<br>lockout re prot g1 | **lockout re** ↵ |

*You are prompted to confirm the command.*

**y** ↵

*For OC-12, VTBM, the OC-12 Protection screen displays a dot (.) in all protection columns. G1 and G2 both remain active with green LEDs turned on.*

*For other OC-3/OC-12, the OC-3/OC-12 G2 becomes active and the green (Active) LED turns on. The OC-3/OC-12 Protection screen displays an asterisk (*) in the Auto (automatic switch) field for the G1. The screen displays a dot (.) in the Lockout field for interface circuit pack G2.*

**25** On the DS1 receiver test set, press the Start/Stop button twice to reset the error count to zero.

*For OC-12 VTBM, the DS1 test set indicates a high error count.*

*For other OC-3/OC-12, the DS1 test set indicates "in process" and displays 0 bit error.*

**26** To verify that DS1 continuity is restored, press the Single Bit Error Inject button three times on the DS1 test set.

*For OC-12 VTBM, the DS1 test set indicates a high error count.*

*For other OC-3/OC-12, the DS1 receiver test set displays 3 bit errors received.*

**27** Reconnect the optical patch cord to the transmit (Out) connector of OC-3/OC-12 G2 (for OC-12 VTBM) or G1 (for other OC-3/OC-12).

*For OC-12 VTBM, the DS1 test set indicates "in process" and displays 0 bit error. The OC-12 Protection screen displays a dot (.) in all protection columns. G1 and G2 both remain active with green LEDs turned on.*

*For other OC-3/OC-12, the yellow loss-of-signal (LOS) LED goes off. The screen displays a dot (.) in the Auto (automatic switch) field for the G1.*

**—continued—**

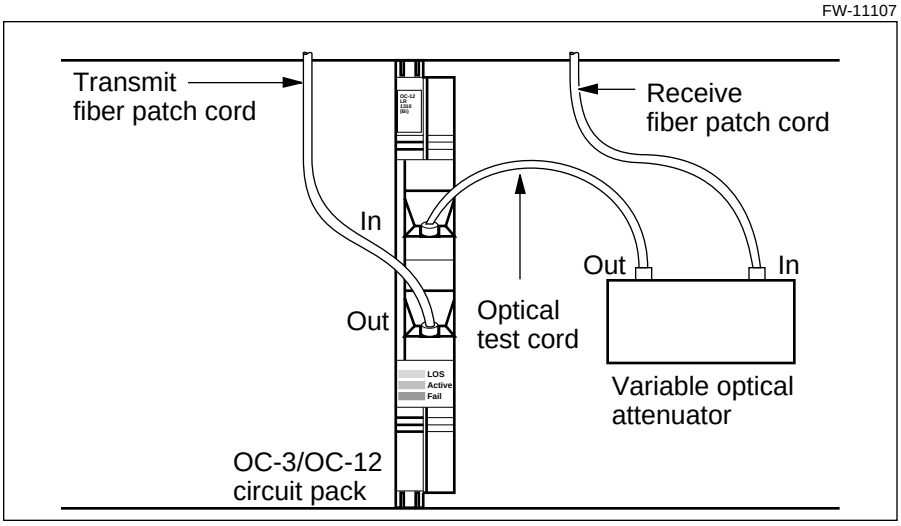
Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**Testing automatic switching due to signal degradation**

**28** Disconnect the receive fiber pigtail from the G2 OC-3/OC-12 interface circuit pack and connect it to the input of the variable optical attenuator as shown below.

FW-11107




**29** Use a test cord to connect the output of the VOA to the receive connector on the G2 OC-3/OC-12 interface circuit pack.

**30** Adjust the DS1 test set to read the bit error rate (BER).

**31** Switch traffic to the G2 OC-3/OC-12 interface circuit pack, by entering:

**manual op g1** ↵

*The OC-3/OC-12 Protection screen indicates G2 is active and G1 is standby.*

**32** Slowly increase the attenuation on the VOA until a BER of $10^{-6}$ is displayed on the DS1 test set. This is the default DS1 signal degradation threshold.

*The OC-3/OC-12 Protection screen shows that the G2 unit is off and the G1 unit is on, and displays an asterisk (*) in the AutoSw field for the G2 unit.*

**33** Press the Start/Stop button on the test set twice, to reset the error count.

*The DS1 test set indicates "in process", and displays an error count of 0.*

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**34** To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.

*The DS1 test set indicates "in process", and displays an error count of 3.*

**35** Adjust the VOA to slightly increase the received signal level; that is, to remove about 1 dB attenuation.

*The signal degradation alarm clears after a few seconds.*

| If this system | Then go to |
|---|---|
| has transport DS1s | step 36 |
| does not have transport DS1s | step 37 |

**36** When testing is complete, remove the VOA, and reconnect the fiber pigtail to the receive connector on the G2 OC-3/OC-12 interface circuit pack. Maintain the DS1 test set arrangements and the far end loopbacks. These are used in the next procedure. DS1 facilities remain out of service. Make sure the alarms you caused have cleared.

**37** You are finished testing. Before removing the temporary DS1/VT mapper card, delete the DS1 facilities and DS1 equipment. The DS1 facilities are already OOS.

To delete the facilities at the FCOT:

**quit** ↵

**fa ds1 <circuit pack group> all** ↵

**where**

<circuit pack group> is the circuit pack installed in step 1 of the previous procedure

**delete** ↵

**y** ↵

*The DS1 facilities are deleted.*

To delete the equipment:

**eq ds1 <circuit pack group>**↵

**delete** ↵

**y** ↵

*The DS1 equipment is deleted.*

**—continued—**

Procedure 2-6 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|
| **38** | If, at the FCOT, you installed spare DS1 equipment, then do the following:<br>• remove the DS1 test set, DS1 chaining test cable, DS1 input card and DS1 output card, and the temporary DS1/VT mapper card<br>• reinstall the blank I/O faceplates previously removed. Go to step 40. |
| **39** | If, at the FCOT, you borrowed DS1 equipment from another slot, then return the cards to their correct slots now. Use the procedure for replacing the DS1/VT mapper in *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C. |
| **40** | At the remote NE, remove the DS1 loopback, delete the DS1 facilities, and delete the DS1 equipment:<br>To release the loopback and delete the facilities:<br>**quit** ↵<br>**fa ds1 <circuit pack group> all** ↵<br>**loopback re** ↵<br>where<br><circuit pack group> is the circuit pack installed in step 1 of Procedure 2-5<br>*The loopback is removed.*<br>**delete** ↵<br>**y** ↵<br>*The DS1 facilities are deleted.*<br>To delete the DS1 equipment:<br>**eq ds1 <circuit pack group>**↵<br>**delete** ↵<br>**y** ↵<br>*The DS1 equipment is deleted.* |
| **41** | Remove the temporary DS1/VT mapper card at the RFT.<br>**—end—** |

# Procedure 2-7
# Testing DS1 protection switching

Use this procedure to test DS1 protection switching: manual, automatic, forced, and priority. Also use it to test lockout from automatic switching. This procedure applies only to systems equipped with permanent DS1/VT mappers carrying transport DS1s.

***Note:*** For proper electromagnetic interference (EMI) protection, the shelf cover must be replaced after completion of testing.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

- for this procedure use the same DS1 test set arrangements and far end loopbacks as used in the previous procedure, "Testing OC-3/OC-12 protection switching".

If you need instructions on the DS1 test set arrangements, see step 1 in Procedure 2-6 on page 2-38. If you need instructions on how to set up the loopbacks, see steps 3 to 5 in Procedure 2-4 on page 2-22. You do not need the variable optical attenuator (VOA) for this procedure.

- you must know how to log into the far-end network element (NE)

Alternatively, if the local network element (NE) has an operations controller (OPC), you can connect your terminal to it and log in to both NEs at the same time. If necessary, refer to the procedure "Logging in to the far-end NE from the local NE" in *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

- two DS1/VT mappers are required to test priority DS1 switching. One mapper is required to test manual, automatic, forced switching, and lockout

**—continued—**

Procedure 2-7 (continued)
**Testing DS1 protection switching**

## Action

| Step | Action |
|---|---|
| **1** | Press the Start/Stop button on the test set twice, to reset the error count.<br>*The DS1 test set indicates "in process", and displays an error count of 0.* |
| **2** | To verify that optical continuity exists, press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays an error count of 3.* |
| **3** | Log in to the Network Element Status screen. |
| **4** | Make sure the DS1 protection status is not fail, lockout, or active, by entering:<br>**pr;dtlprot ds1** ↵<br>*The DS1 Protection screen is displayed. The protection status of the DS1 circuit packs is displayed as a dot (.) in each field, not an asterisk.* |
| **Testing manual switching** | |
| | ***Note:*** When you force protection switching, do so at one site only. To monitor the activity, you can log on to the RFT through the OPC. For instructions on how to do this, see the procedure for logging in to a network element from the OPC and logging out in *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A. |
| **5** | Perform manual switching of traffic from the working DS1/VT mapper circuit pack to the protection circuit pack.<br>***Note:*** For simplicity in this procedure, the working mapper is assumed to be mapper G1 (even though it may not be designated for transport DS1s). If you are using the default map, the location and availability of DS1/VT mappers carrying transport DS1s can be found in the *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide,* Volume 1. If you are not using the default map, refer to the DS1/VT Mapper Layout Form you filled out in *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide,* Volume 1.<br>Enter the following:<br>**manual op g1** ↵<br>*The DS1 Protection screen displays an asterisk (*) in the Manual field for the G1 unit, indicating that the manual switch is active.* |
| **6** | Press the Start/Stop button on the test set twice, to reset the error count.<br>*The DS1 test set indicates "in process", and displays an error count of 0.* |
| **7** | To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays an error count of 3.* |

**—continued—**

Procedure 2-7 (continued)
**Testing DS1 protection switching**

| Step | Action |
|---|---|
| **8** | Release the manual switch to protection by entering:<br>**manual re g1** ↵<br>*The DS1 traffic reverts to the G1 unit from the protection unit. The DS1 Protection screen displays a dot (.) in the Manual field for the G1 unit.* |
| **9** | Press the Start/Stop button on the test set twice to reset the error count.<br>*The DS1 test set indicates "in process" and displays an error count of 0.* |
| **10** | To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays an error count of 3.* |
| **Testing forced switching** | |
| **11** | Force the traffic from the G1 DS1/VT mapper circuit pack to the protection unit, by entering:<br>**forced op g1** ↵<br>*A prompt is displayed, asking you to confirm the action.*<br>**y** ↵<br>*The DS1 Protection screen displays an asterisk (*) in the Forced field for the G1 unit indicating that a forced switch is active.* |
| **12** | Press the Start/Stop button on the test set twice to reset the error count.<br>*The DS1 test set indicates "in process" and displays an error count of 0.* |
| **13** | To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays an error count of 3.* |
| **14** | Release the forced switch to protection by entering:<br>**forced re g1** ↵<br>*You are prompted to confirm the action.*<br>**y** ↵<br>*DS1 traffic transfers back to the working DS1 circuit pack. The DS1 Protection screen displays a dot (.) in the Forced field for the G1 unit.* |
| **15** | Press the Start/Stop button on the test set twice to reset the error count.<br>*The DS1 test set indicates "in process" and displays an error count of 0.* |
| **16** | To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays an error count of 3.* |

**—continued—**

Procedure 2-7 (continued)
**Testing DS1 protection switching**

| Step | Action |
|---|---|
| | **Testing lockout from switching and automatic switching** |
| | ***Note:*** This test also verifies that automatic switching works. |
| **17** | Operate a lockout on one DS1/VT mapper, by entering:<br>**lockout op g1** ↵<br>*You are prompted to confirm the action.*<br>**y** ↵<br>*The DS1 Protection screen displays an asterisk (*) in the Lockout field for unit G1.* |
| **18** | To simulate the loss of signal, remove the G1 DS1/VT mapper circuit pack from its backplane connector.<br>*Because the G1 unit is locked out, no switch to protection occurs. The indicators on the system indicate critical and major alarms. The user interface also indicates these alarms.* |
| **19** | To verify that the DS1s are lost, press the Start/Stop button on the test set twice to reset the error count.<br>*The DS1 test set indicates "in process" and displays a high error count.* |
| **20** | Release the lockout by entering:<br>**lockout re g1** ↵<br>*You are prompted to confirm the action.*<br>**y** ↵<br>*Because the G1 unit is no longer locked out, an automatic switch to protection occurs. The DS1 Protection screen displays a dot (.) in the Lockout field for the G1 unit, and displays an asterisk (*) in the AutoSw field for the unit. The critical and major alarms clear. A minor alarm is raised to indicate the switch to protection.* |
| **21** | Press the Start/Stop button on the test set twice to reset the error count.<br>*The DS1 test set indicates "in process" and displays an error count of 0.* |
| **22** | To verify that continuity is restored, press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays an error count of 3.* |
| **23** | Reinstall the G1 DS1/VT mapper circuit pack.<br>*The DS1 Protection screen displays a WTR (wait-to-restore) in the AutoSw field for the G1 unit. Alarms clear. After five minutes, the DS1s revert to the G1 DS1/VT mapper and the DS1 Protection screen displays a dot (.) in the AutoSw field for the G1 unit.* |

**—continued—**

Procedure 2-7 (continued)
**Testing DS1 protection switching**

| Step | Action |
|---|---|

**24** If the shelf has one or more additional working DS1/VT mappers that are not yet tested, remove the DS1 test set from the mapper you have just tested and connect it to the next working mapper.

**25** Repeat steps 5 to 24 for any remaining working DS1/VT mappers carrying transport DS1s.

**26** You can test priority switching only if your system is equipped with more than one working DS1/VT mapper.

| If you have | Then go to |
|---|---|
| one working DS1/VT mapper | step 42 |
| more than one DS1/VT mapper | step 27 |

**Testing priority DS1 switching**

**27** Review the priorities assigned to the DS1 groups on the DS1 Protection screen. If necessary, provision circuit pack priority as follows:

**a.** Display the DS1 Protection Provisioning screen and enter:

**protprov** ↵

**b.** On the DS1 Protection Provisioning screen, assign a high priority to the G1 DS1 circuit pack, by entering:

**priority g1 high** ↵

**c.** Assign a low priority to the G2 circuit pack, by entering:

**priority g2 low** ↵

**d.** Review the assigned priorities by entering:

**quit** ↵

*Two working DS1/VT mappers should be provisioned, one with low priority and one with high priority.*

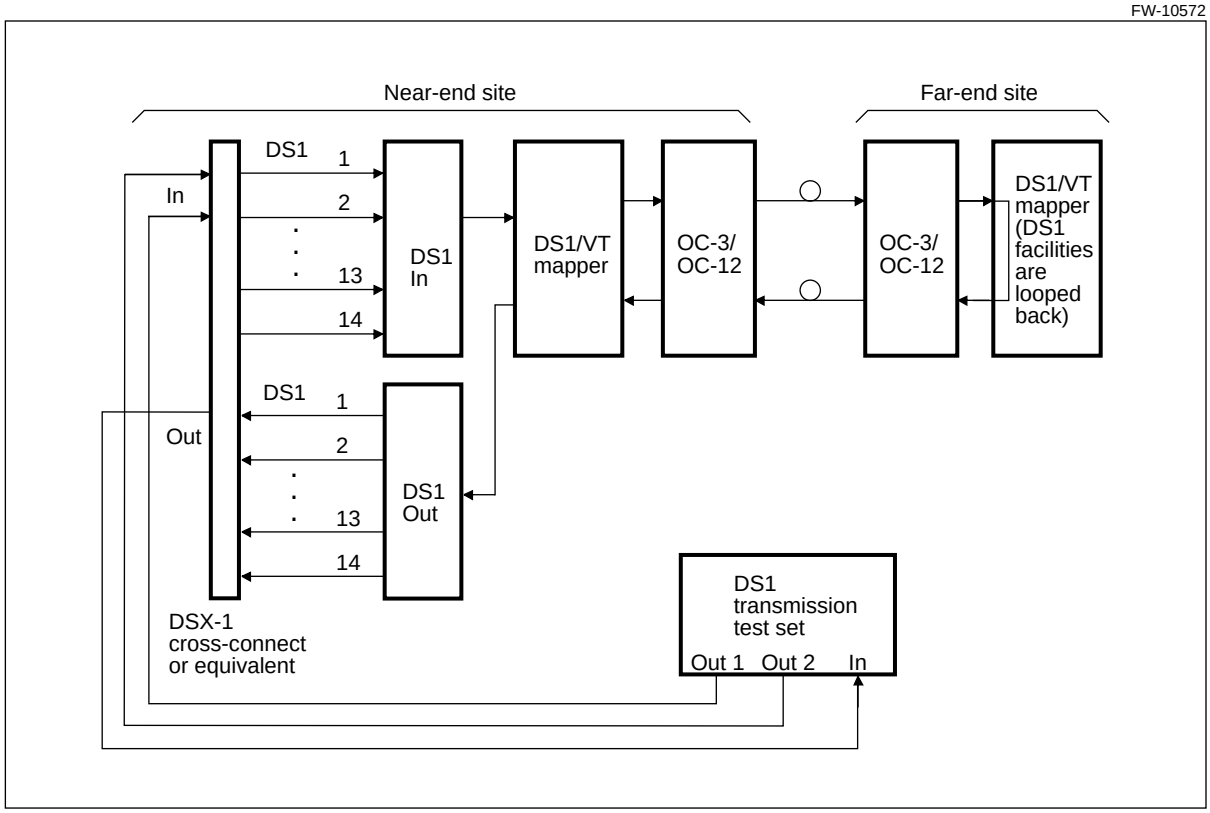
**—continued—**

Procedure 2-7 (continued)
**Testing DS1 protection switching**

| Step | Action |
|---|---|

**28** Set up the DS1 test set to transmit to both DS1/VT mappers.

FW-10572




**29** Connect the input of the test set to the low-priority unit.

**30** Wearing antistatic protection, pull the low-priority DS1/VT mapper (G2) out of its backplane connector.

*The DS1 traffic automatically switches to the protection mapper. The DS1 Protection screen displays an asterisk in the AutoSw field for the low-priority mapper.*

**31** Press the Start/Stop button on the test set twice to reset the error count.

*The DS1 test set indicates “in process” and displays an error count of 0.*

**32** To verify that continuity is maintained, press the Single Bit Error Inject button three times.

*The DS1 test set indicates “in process”, and displays an error count of 3.*

**—continued—**

Procedure 2-7 (continued)
**Testing DS1 protection switching**

| Step | Action |
|---|---|
| **33** | Wearing antistatic protection, pull the high-priority DS1/VT mapper (G1) out of its backplane connector.<br>*The DS1 traffic from the high-priority mapper automatically switches to the protection mapper, displacing the traffic from the low-priority mapper. The low-priority traffic is lost. Alarms are generated.* |
| **34** | Press the Start/Stop button on the test set twice to reset the error count.<br>*The DS1 test set indicates "in process" and displays an error count of 0.* |
| **35** | To verify that DS1 continuity is lost for the low-priority mapper, press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays a high error count.* |
| **36** | At the DSX-1 cross-connect panel, disconnect the DS1 test set from the low-priority DS1/VT mapper and connect it to the high-priority mapper. |
| **37** | Press the Start/Stop button on the test set twice to reset the error count.<br>*The DS1 test set indicates "in process" and displays an error count of 0.* |
| **38** | To verify that DS1 continuity exists for the high-priority mapper press the Single Bit Error Inject button three times.<br>*The DS1 test set indicates "in process" and displays an error count of 3.* |
| **39** | Reinsert the low-priority mapper into its backplane connector.<br>*DS1 traffic is restored to the low-priority mapper. Alarms clear. The DS1 Protection screen displays a dot (.) in the AutoSw field for the low-priority mapper, indicating that lost DS1 facilities are restored on that mapper.* |
| **40** | Reinsert the high-priority mapper into its backplane connector.<br>*The DS1 Protection screen displays a WTR (wait-to-restore) in the AutoSw field for the high-priority mapper. Alarms clear. After five minutes, the DS1 Protection screen displays a dot (.) in the AutoSw field for the high-priority mapper indicating that DS1 facilities are restored on that mapper.* |
| **41** | When testing is completed, go to the DS1 Protection Provisioning screen and assign low priority to the high priority protection group by entering the following commands:<br>**protprov** ↵<br>*The DS1 Protection Provisioning screen is displayed.*<br>**priority g1 low** ↵ |

**—continued—**

Procedure 2-7 (continued)
**Testing DS1 protection switching**

| Step | Action |
|---|---|
| **42** | At the RFT, remove the loopbacks on all DS1 facilities and place the facilities back in service by entering:<br>**facility ds1 all** ↵<br>**loopback re** ↵<br>*A prompt is displayed, asking you to confirm the action.*<br>**y** ↵<br>**chgstate is** ↵ |
| **43** | Log out of the RFT. |
| **44** | At the FCOT, return the facilities to service by entering:<br>**facility ds1 all** ↵<br>**chgstate is** ↵ |
| **45** | Log out of the FCOT. |
| **46** | Remove all test equipment and test cords. Make sure all circuit packs are fully inserted, fiber pigtails are connected, and critical or major alarms are cleared. |
| **47** | Replace the cover of the common-equipment shelf by pushing the cover into place and closing both latches. Secure the cover by turning the right locking fastener one-quarter turn to the left, and the left fastener one-quarter turn to the right.<br>***Note:*** When testing is completed and the system is ready for service, you can avoid DS1 alarms by deleting unused DS1 facilities, or by changing the state of the facility to out-of-service. The procedure for deleting a facility is in *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B. |
| **48** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 2-8
# Verifying OC-3/OC-12 performance monitoring

Use this procedure to query the performance of OC-3/OC-12 facilities. This procedure includes starting a performance monitoring interval for OC-3/OC-12 on the shelf at the same time.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- user interface terminal is connected to the network element (NE) directly or through a remote OPC session
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

## Action

| Step | Action |
|---|---|
| **1** | Log in to the Network Element Status screen. |
| **2** | Display the performance statistics screen for both OC-3/OC-12 circuit packs by entering:<br>**pm fp <oc-n> all** ↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>*The OC-3/OC-12 Performance Statistics screen is displayed.* |
| **3** | If you are not concerned with performance history up to this point, clear both the Statistics and History screens. |
| **4** | Start an untimed interval for both OC-3/OC-12 facilities on the shelf by entering:<br>**startunt** ↵ |

**—continued—**

Procedure 2-8 (continued)
**Verifying OC-3/OC-12 performance monitoring**

| Step | Action |
|---|---|
| **5** | After five minutes, check if any errors were recorded in the Untimed column. Enter the following command to see the performance statistics screen for the first facility:<br>**select <circuit pack group>** ↵<br>where<br><circuit pack group> is **g1** or **g2** |
| **6** | If there is an error count in the Untimed column, investigate the source of the errors. See *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. |
| **7** | Repeat steps 5 and 6 for the second OC-3/OC-12 unit. |
| **8** | Log out of the user interface. |
| **9** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 2-9
# Verifying DS1 performance monitoring

Use this procedure to verify that all new DS1 facilities can be queried. Verify this procedure by starting a performance monitoring interval for all DS1s on the shelf at the same time.

***Note:*** Performance monitoring is not supported for DS1 facilities that terminate on a GR-303 switch.

## Requirements

The following requirements must be met before starting this procedure.

- make sure the user interface terminal is connected to the network element (NE) directly or through a remote login session
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

## Action

| Step | Action |
|---|---|
| **1** | Log in to the Network Element main menu. |
| **2** | Display the Performance Statistics screen for all DS1s by entering:<br>**pm fp ds1 all** ↵<br>*The DS1Performance Statistics screen is displayed.* |
| **3** | Start an untimed interval for all DS1s on the shelf. Enter:<br>**startunt** ↵<br>Wait five minutes. |

**—continued—**

Procedure 2-9 (continued)
**Verifying DS1 performance monitoring**

| Step | Action |
|---|---|
| **4** | Enter the following to see the Performance Statistics screen for each DS1 facility:<br>**select <circuit pack group> <port>** ↵<br>where<br><circuit pack group> is the circuit pack group number of the DS1 facility<br><port> is one of **1** to **14** |
| **5** | If there is an error count in the Untimed column, investigate the source of the errors. See *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. |
| **6** | Repeat steps 4 and 5 for each port until all ports are checked. |
| **7** | Repeat steps 4 through 6 for each DS1 circuit pack on the shelf. |
| **8** | Quit to the main menu.<br>**quit** ↵<br>*The Network Element Status screen is displayed.* |
| **9** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 2-10
# Using the protection exerciser

Use this procedure to test the protection switching capability of optical equipment. Because out-of-service protection switching tests are already complete, this procedure is optional.

The protection exerciser can be used while a system is in service because it does not risk dropping traffic or inserting switching errors. The exerciser proves that switching is operational by bridging to the protection equipment, without actually switching traffic.

***Note 1:*** If desired, you can schedule the equipment exerciser to run automatically over a specific time period. For details, see the procedure "Changing a scheduled shelf event or exercise" in *System Administration Procedures*, 323-3001-302, in *Operations, Administration, and Provisioning*, Volume 4A.

***Note 2:*** For proper EMI protection, the shelf cover must be replaced after you have finished testing.

## Requirements

The following requirement must be met before starting this procedure.

- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, is required

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**—continued—**

Procedure 2-10 (continued)
**Using the protection exerciser**

## Action

| Step | Action |
|---|---|
| **1** | Log in to the network element user interface (NEUI) and display the protection status of the OC-3/OC-12 circuit packs by entering:<br>**pr;dtlprot <oc-n>** ↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>*The OC-3/OC-12 detailed protection screen is displayed.*<br>***Note:*** The screen displays the list of equipment groups and their service status. The screen shows whether a group is locked out, forced to protection, or manually switched to protection. |
| **2** | If it is not already removed, remove the cover of the common-equipment shelf by turning the right locking fastener one-quarter turn to the right, and the left fastener one-quarter turn to the left. Open both latches, and pull the cover to remove it. Refer to *Routine Maintenance Procedures*, 323-3001-546, in *Maintenance*, Volume 5C for details. |
| **3** | Start the protection switch exerciser on the desired shelf by entering:<br>**equipmnt sh** ↵<br>**exercise** ↵<br>*During the exerciser sequence, the value displayed in the Exerciser field on the Shelf Equipment screen is "On", and the Test Run LED on the maintenance interface card (MIC) is lit. The following message is displayed on the Shelf Equipment screen:*<br>`The shelf exerciser has been initiated. Please refer to the EQP logs for results.`<br>*When the exercise is completed, the following message is displayed:*<br>`OC3/OC12: pass` |
| **4** | If the Test Fail LED on the maintenance interface card (MIC) comes on, it indicates an exerciser failure. Investigate the failure using the Protection and Alarm screens and make any necessary repairs. |
| **5** | To install the cover of the common-equipment shelf, refer to *Routine Maintenance Procedures*, 323-3001-546, in *Maintenance*, Volume 5C. |
| **6** | Note the completion of this procedure on the System Test Results Form.<br>**—end—** |

# DS3 tests, STS-1 tests, and optical end-to-end tests

Use this chapter for testing DS3s, STS-1s, and optical equipment at a system network element (NE) that is only equipped with transport DS3s or transport STS-1s.

> ***Note:*** In this chapter a near-end terminal can be either a TN_BLSR shelf or an FCOT shelf. A remote fiber terminal (RFT) is called a far-end terminal.

## How to use this chapter

Refer to the flow charts and task lists in Chapter 1 when using this chapter. These flow charts and task lists identify the procedures that must be performed for system testing.

### Chapter topics

The table below shows the information contained in this chapter for DS3 tests, STS-1 tests, and optical end-to-end tests.

If you cannot successfully complete these procedures, contact your next level of support.

## Rules for system configurations and circuits

To follow the procedures for installing and testing circuit packs, it is important to know something about the different configurations and different circuit types:

- a universal configuration has universal digital loop carrier (UDLC) and DS1 tandem circuits, or both, and requires an ABM shelf at both the near-end and the far-end
- an integrated configuration has GR-303 DMS and DS1 tandem circuits, or both, and can exist on either an ABM or a TBM shelf at the near-end (and requires an ABM shelf at the far-end)
- a combined configuration has GR-303 DMS and UDLC circuits, and can have DS1 tandem circuits. It requires an ABM shelf at both the near-end and far-end.
- transport DS1s can exist on any configuration (if the slots are available), and require a DS1/VT mapper at both the near-end and the far-end
- transport DS3s can exist on any configuration (except a combined configuration having an OPC at the near-end), and require a DS3 mapper at both the near-end and far-end
- transport STS-1s can exist on a TN_BLSR configuration and require a STS-1 interface card at the other end (TN_BLSR) for end-to-end testing
- DS1 tandem circuits are DS0s from the far-end, which exit the near-end on DS1s, and are non-locally switched or non-switched. They require a DS1/VT mapper at the near-end and terminate on line cards at the far-end.
- GR-303 DMS circuits are DS0s from the far-end that exit the near-end on DS1s and terminate on a digital switch. They require a DS1/VT mapper at the near-end (GR-303 DMS and DS1 tandem circuits use the same mapper) and terminate on line cards at the far-end.
- UDLC circuits exit the near-end at the voice frequency level and require line cards at both the near-end and the far-end.
- Only point-to-point systems support UDLC services.

### Test recommendations

In integrated configurations, it is recommended that tests be performed using DS1s since a DS1/VT mapper used for digital multiplex switch (GR-303 DMS) and DS1 tandem services already exists in slot 1 of the access bandwidth manager (ABM) shelf and slot 3 of transport bandwidth manager (TBM) shelf.

Optical system tests for configurations not equipped with transport DS1s, DS3s, or STS-1s can be performed using temporary DS1, DS3, or STS-1 equipment. You may find it easier to use one set of procedures over the other.

In universal configurations, since GR-303 DMS and tandem DS1s do not exist, the NEs will not be equipped with any mappers. As a result, it is recommended that system tests be performed using DS3 test procedures, as DS3 testing can be performed in a shorter period of time than DS1 testing.

## Test equipment

The following table lists the test equipment required for testing DS3s, STS-1s, and optical equipment.

| Qty | Equipment | Details | Use for |
|---|---|---|---|
| 1 | network element user terminal, Digital Equipment Corporation VT100 or equivalent | includes a keyboard and display, power supply cord, and RS-232C cable with a 25-pin D-subminiature male connector | many procedures |
| 1 | optical power meter | single-mode 1310/1550 nm unit –50 dB to +5 dB range | optical power tests |
| 2 | optical test cords,<br>use NT7E46AA<br>or NT7E46BA<br>or NT7E46CA<br>or NT7E46FA | single-mode, 5 m (16 ft) long<br>with biconic SPA connectors<br>with FC connectors<br>with ST connectors<br>with SC connectors | optical power tests |
| 2 | optical patch cords with mVOA (mini-Variable Optical Attenuator),<br>use NT7E47AA<br>or NT7E47BA<br>or NT7E47CA<br>or NT7E47FA | single-mode, 25 dB attenuation, 5 m (16 ft)<br>with biconic SPA connectors<br>with FC connectors<br>with ST connectors<br>with SC connectors | optical loopback tests |
| 1 | variable optical attenuator, Hewlett-Packard 8158B | single-mode,1310/1550 nm, equipped with 2 HP8110 optical test cords with biconic connectors | optical receiver sensitivity test |
| 1 | TBOS (E2A) test set, KS-22828 L1 or equivalent | includes a cable with a 25-pin D-subminiature male connector for connection to the shelf | serial telemetry test |

**—continued—**

| Qty | Equipment | Details | Use for |
|---|---|---|---|
| 1 | VF transmission test set<br>Hewlett-Packard HP3551 | | orderwire test |
| 1 | VF cable of appropriate length | NT4K85FA (100 ft)<br>NT4K85FB (200 ft)<br>NT4K85FC (300 ft) | orderwire test |
| 1 | DS3 transmitter test set,<br>Tau-Tron S5200 or equivalent | DS3 signal transmitter | DS3 and optical in-bay tests |
| 1 | DS3 receiver test set,<br>Tau-Tron S5200 or equivalent | DS3 signal receiver | DS3 and optical in-bay tests |
| 1 | STS-1 transmitter test set,<br>HP 37704A or equivalent | STS-1 signal transmitter | STS-1 and optical in-bay tests |
| 1 | STS-1 receiver test set,<br>HP 37704A or equivalent | STS-1 signal receiver | STS-1 and optical in-bay tests |
| 1 | STS-1 SONET transmitter/receiver test set, HP 156 MTS (Cerjac) or equivalent | STS-1 signal transmitter/receiver | STS-1 and optical in-bay tests |
| 2 | electrical test cords, P3Q3B | bantam-to-310 connectors,<br>2 m (6 ft) | connection to the DS3 or STS-1 test set |
| 2 | electrical test cords | bantam-to-bantam connectors,<br>1 m (3 ft) | DS3 or STS-1 continuity test (at DSX-3) |
| 2<br>2<br>2<br>1 | NT7E08 DS3 mappers<br>NT7E09 STS-1 interface card<br>NT4K30 BNC I/O cards<br>flat-bladed screwdriver<br>stepladder | 1 DS3 or STS-1 with two Bantam plugs (to the input and output of the test set) | optical receiver sensitivity test for network elements that are not equipped with a DS3 mapper or STS-1 interface card used for transport DS3s or STS-1s |
| | **—end—** | | |

## Group and slot associations

For group and slot associations for mappers and their corresponding input and output cards, see *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide*, Volume 1.

For a general description of group and slot associations for various mappers and shelf functions, see “Group and slot associations for DS1, DS3, STS-1, OC-3, and OC-12” on page 2-5.

# Procedure 3-1
# Measuring the received optical power

Use this procedure to verify that a signal transmitted at one network element (NE) is received at the second NE. This procedure can be performed by one technician. Repeat this procedure at each NE in the system.

***Note:*** For proper electromagnetic interference (EMI) protection, the shelf cover must be replaced after you have finished testing.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- the optical power meters must be calibrated using the manufacturer's instructions

The following equipment is required:

- optical power meter, Photodyne 17XTA or equivalent (one at each end)
- telephone link between the two NEs under test
- two (2) VT100-compatible terminals (one at each NE)
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 to record testing information

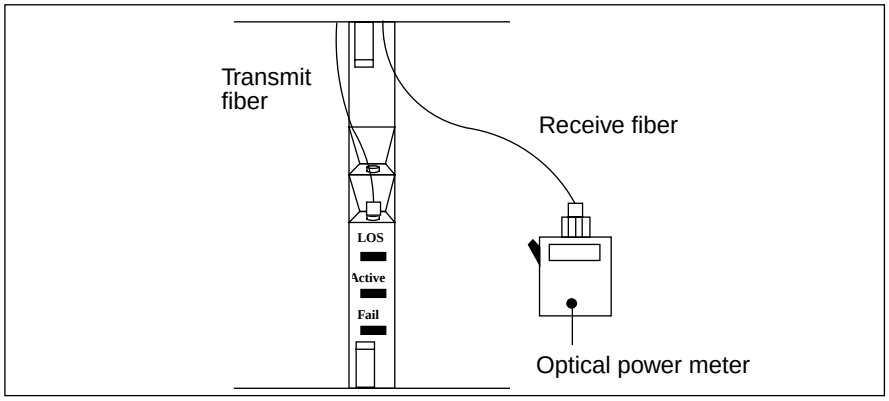
**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**—continued—**

Procedure 3-1 (continued)
**Measuring the received optical power**

## Action

| Step | Action |
|---|---|
| **1** | Log in to the network element user interface (NEUI) and operate a lockout on the OC-3/OC-12 optical channels, by entering:<br>**pr;dtlprot <oc-n>**↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>**lockout op** ↵<br>**yes** ↵<br>*The symbols in the Lckt column on the OC-3/OC-12 Protection screen and in the Lckt field in the Alarm Banner change from a period (.) to an asterisk (*) at the local NE and to (*R) at the remote NE, indicating that a lockout is active.* |
| **2** | Remove the cover of the common-equipment shelf by turning the right locking fastener one-quarter turn to the right, and the left fastener one-quarter turn to the left. Open both latches and pull the cover to remove it. |
| **3** | Disconnect the receive patch cord from the OC-3/OC-12 circuit pack under test and connect it to the optical power meter, as shown below. |




**—continued—**

Procedure 3-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|

**4** Measure the receive optical power and record the value on the System Test Results Form.

*The measured value must be greater than or equal to the following:*

| PEC | Module | Minimum receiver power ($P_{R\ min}$) |
|---|---|---|
| NT7E01CA/CB/CC/CD | OC-3 LR | – 34.0 dBm |
| NT7E01DA/DB/DC/DD | OC-3 IR | – 28.0 dBm |
| NT7E02KA/KB/KC/KD | OC-12 LR | – 32.0 dBm |
| NT7E02LA/LB/LC/LD | OC-12 IR | – 24.5 dBm |

**CAUTION**
**Risk of connector damage**
Make sure optical connections are clean and properly connected. Follow the procedure for cleaning and assembling connectors, found in *Site Testing Procedures*, 323-3001-221, in *Commissioning and Testing*, Volume 3B.

**5** If the requirement is not met, clean the fiber connectors using the regular cleaning procedure. If necessary, verify the optical meter calibration, the fiber pigtail connections, the fiber link, and the OC-3/OC-12 transmitter at the other end.

**6** Repeat steps 3 through 5 for the second optical channel.

**CAUTION**
**Risk of receiver damage**
Insert sufficient attenuation between the optical transmitter and receiver to prevent overload of the optical receiver. Optical power must not exceed –10.0 dBm and –6.0 dBm for the OC-3 and OC-12 long-reach (LR) interfaces respectively, and -8.0 dBm and -2.0 dBm for the OC-3 and OC-12 intermediate-reach (IR) interfaces respectively.

**7** Reconnect the fiber pigtails to the OC-3/OC-12 optical interfaces.

**—continued—**

Procedure 3-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|
| **8** | Release the lockout on the optical channels at the NE where the lockout was performed.<br>**lockout re** ↵<br>*You are prompted to confirm the release of the lockout.*<br>**y** ↵<br>*The symbols in the Lckt column on the OC-3/OC-12 Protection screen and in the Lckt field in the Alarm Banner change to a period (.), indicating that the lockout is released.* |
| **9** | Repeat this procedure at the other NE. |
| **10** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 3-2
# Setting up synchronization end-to-end

Use this procedure to set up the synchronization at the far-end. The external synchronization interface (ESI) is installed at the near-end where the Building Integrated Timing Supply (BITS) is located. The far-end is usually dependent on the near-end for synchronization. Only one of the network elements (NEs) in a sub-network can interface to the external synchronization source; the other NE is then looptimed to the first.

**CAUTION**
**Risk of service loss**
Set the far-end clock source to looptimed. If you do not perform this procedure, service could be affected by insufficient synchronization. This procedure must be performed even if there is no external synchronization source connected at the near-end.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service

You have used the procedure "Setting up the external synchronization interface" in *Site Testing Procedures*, 323-3001-221, in *Commissioning and Testing*, Volume 3B. This procedure installs and tests the ESI cards.

- the ESI cable is installed as described in the procedure "Installing the external synchronization cable" in *Bay in Central Office Installation Manual—ABM*, 323-3001-201, or *Bay in Central Office Installation Manual—TBM*, 323-3001-202
- a VT100-compatible user terminal, connected to the NE
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 to record testing information

## Action

| Step | Action |
|---|---|
| **1** | Log into the Network Element User Interface (NEUI) at the far-end.<br>*The Network Element Status screen is displayed.* |

**—continued—**

Procedure 3-2 (continued)
**Setting up synchronization end-to-end**

| Step | Action |
|---|---|
| **2** | Lockout the OC-3/OC-12 circuit pack so that optical protection switching will not occur while setting the synchronization options. Enter:<br>**pr;dtlprot <oc-n>**↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>*The OC-3/OC-12 Protection screen is displayed.*<br>**lockout op** ↵<br>*A message indicates that the all traffic will be forced to the G1 OC-3/OC-12 unit. Confirmation of the lockout is requested.*<br>**y** ↵<br>*An asterisk is displayed in the Lockout field for the G1 unit.* |
| **3** | Set the shelf clock source to looptimed mode:<br>**eq sh** ↵<br>*The Shelf Equipment screen is displayed.*<br>**edit** ↵<br>*The Edit Shelf menu is displayed.*<br>**clocksrc looptimed** ↵<br>*A confirmation is requested.*<br>**y** ↵<br>*The Clock Source field changes to looptimed.* |
| **4** | Remove the lockout on the OC-3/OC-12 circuit pack. Enter:<br>**quit** ↵<br>**pr;dtlprot <oc-n>**↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>**lockout re** ↵<br>**y** ↵<br>*A dot is displayed in the Lockout field for the G1 OC-3/OC-12 unit.* |
| **5** | Log out of the NEUI. |
| **6** | Note the completion of this test on the System Test Results Form.<br>**—end—** |

# Procedure 3-3
# Verifying DS3 transmission test set performance

This procedure describes how to verify digital transmission test set performance. This is necessary so that reliable results are obtained when testing.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service

The following materials are required:

- DS3 transmitter test set, Tau-Tron S5200 or equivalent
- DS3 receiver test set, Tau-Tron S5200 or equivalent
- two (2) coaxial cable test cord with WECO NE-358 connectors
- a copy of the System Test Results Form, located in “Appendix A: System Test Results Form” on page 8-1 to record testing information

This procedure describes settings for Tau-Tron test sets. Other brands of test sets use similar settings.

## Action

| Step | Action |
|---|---|
| | **DS3 transmitter test set** |
| **1** | Set the Power switch to ON. |
| **2** | Press and hold the Reset button. Verify that all lamps on the test set are lit. |
| **3** | Release the Reset button. Verify that the Remote and Power OFF lamps are not lit. |
| **4** | Set the Error Mode controls as follows:<br>Mode Select Error free |
| **5** | Set the DS3 Output controls, as follows:<br>Frame Framed<br>Pattern PRBS<br>Level DSX |

**—continued—**

Procedure 3-3 (continued)
**Verifying DS3 transmission test set performance**

| Step | Action |
|---|---|
| | **DS3 receiver test set** |
| **6** | Set the Power switch to ON. |
| **7** | Set the Volume control to the proper level. |
| **8** | Set the DS3 Input controls, as follows:<br>Frame: Frame<br>Pattern: PRBS<br>Level: DSX-3 |
| **9** | Set the Measurements controls, as follows:<br>Category: Bit-error measurements<br>Function: Bit-error rate, total bit errors<br>Time: Untimed |
| | **Verify test set performance** |
| **10** | Connect the test cord between the transmitter test set output and the receiver test set input. |
| **11** | On the DS3 receiver test set, press the Reset button.<br>*The DS3/STS-1 test set displays 0 error and zero bit-error rate.* |
| **12** | On the DS3 transmitter test set, press the Single Bit Error Inject button three times.<br>*The DS3 receiver test set displays three bit errors.* |
| **13** | If you did not obtain the required results, check the settings and the test cord, then repeat the test. If necessary, replace the test set or the test cord. |
| **14** | Verify all inputs on the receiver test set, and all outputs on the transmitter test set. |
| **15** | Disconnect the test cord. |
| **16** | Connect the DS3 transmitter test set to a free DS3 input port at the OC-3/OC-12 shelf or at the DSX-3 cross-connect panel, and the DS3 receiver test set to the corresponding DS3 output port. |
| **17** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 3-4
# Verifying STS-1 tributary SONET test set performance

Use this procedure to verify STS-1 SONET test set performance. This verification is necessary to obtain reliable results when performing tests on a system equipped with STS-1 tributaries.

This procedure describes settings for HP test sets. Other brands of test sets use similar settings.

## Requirements

The following tools and materials are required:

- one (1) HP 37704A SONET test sets or equivalent
- one (1) electrical test cords

## Action

| Step | Action |
|---|---|
| | **SONET transmitter test set** |
| **1** | Set the Power switch to ON. |
| **2** | Set the Transmit Out settings as follows: |

| | |
|---|---|
| Transmit signal | STS-1 |
| Clock sync | Internal or External BITS (as appropriate) |
| STS SPE under test | 1 |

| | |
|---|---|
| **3** | Set the Error Inject controls as follows: |

| | |
|---|---|
| Type | Line CV |
| Error Rate | OFF |

**—continued—**

Procedure 3-4 (continued)
**Verifying STS-1 tributary SONET test set performance**

| Step | Action |
|---|---|
| | **STS-1 receiver test set** |
| **4** | Set the receive settings to match the transmit settings. |
| **5** | Connect the electrical patchcord between input and output. |
| | **Verify test set performance** |
| **6** | Press **Restart** on the receiver test set.<br>*The test set displays zero errors and alarms.* |
| **7** | On the transmitter test set, press the **Single Bit Error Inject** button 3 times.<br>*The STS-1 receiver test set displays 3 errors.* |
| **8** | If you did not obtain the required results, check the settings and repeat the test. If necessary, replace the test set or the patchcords.<br>***Note:*** Clean the STS-1 connectors and ensure proper mating of the connectors. |
| **9** | Disconnect the electrical patchcord. |
| | **Verify the STS-1 circuit pack** |
| **10** | Connect the SONET test set to the STS-1 input port of the circuit pack under test. |
| **11** | Connect the output from the test set to the corresponding output port of the STS-1 circuit pack.<br>***Note:*** If you have more than one STS-1 interface card, you can daisy-chain them together by connecting the Transmit of the first STS-1 circuit pack to the Receive of the next. If the shelf is fully equipped with STS-1 tributaries, do this for all circuit packs. At the last circuit pack of the daisy-chain, connect the Transmit of the STS-1 circuit pack to the input of the test set. |

**—end—**

# Procedure 3-5
# Verifying DS3 or STS-1 signal continuity and measuring BER

Use this procedure to check end-to-end signal continuity and measure the bit-error rate (BER) on all DS3s or STS-1s on a DS3 mapper or STS-1 interface card.

All DS3s on a DS3 mapper or STS-1 interface card are daisy-chained at the DSX-3/STS-1 cross-connect panel at the central office (CO) so that they can be tested in one operation. This procedure can be conducted by one technician, using the internal loopback feature of the DS3 mapper or STS-1 interface card. It is not necessary to physically loopback at the remote-end DSX-3/STS-1 cross-connect panel because DS3 or STS-1 continuity is already tested at each site.

This procedure can be conducted by one technician, who can set up a local session to one network element (NE) and a remote session to the other NE.

> ***Note:*** If this system is not equipped with transport DS3s or STS-1s, there will be no connections to a DSX-3/STS-1 cross-connect panel, therefore this procedure can be omitted.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- STS connections are set up for your specific configuration (if you are not using the default map). If you have not done this, see *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.

The following equipment is required:

- a VT100-compatible terminal, connected to the network element (NE)
- two (2) DS3 or STS-1 coaxial test cords with proper connectors
- two (2) electrical test cords, bantam-to-bantam, 1 m (3 ft) used as DSX-3/STS-1 jumpers, if this NE has working DS3 mappers or STS-1 interface cards
- two (2) optical patch cords with MVOA, NT7E47AA/BA/CA/FA, 5 m long
- a copy of the System Test Results Form, located in “Appendix A: System Test Results Form” on page 8-1 to record testing information

**—continued—**

Procedure 3-5 (continued)
**Verifying DS3 or STS-1 signal continuity and measuring BER**

You must know how to log into the far-end NE. If the local NE has an operations controller (OPC), you can connect your terminal to it and log in to both NEs at the same time. If required, refer to *Network Element User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

Basic provisioning of all DS3 or STS-1 equipment and facilities was completed while performing site procedures. If necessary, refer to the document *Site Testing Procedures*, 323-3001-221, in *Commissioning and Testing*, Volume 3B.

## Action

| Step | Action |
|---|---|
| **1** | Log in to the user interface at the near-end and display the OC-3/OC-12 Protection screen, by entering:<br>**pr;dtlprot <oc-n>**↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>*The OC-3/OC-12 Protection screen is displayed.* |
| **2** | Impose a lockout on the G1 OC-3/OC-12 interface circuit pack by entering:<br>**lockout op** ↵<br>*The screen displays a message warning that the command will force all traffic to the OC-3/OC-12 G1 unit, and asks you to confirm the command.*<br>**y** ↵<br>*The OC-3/OC-12 protection screen displays an asterisk (*) in the Lockout field for the G1 unit.* |

**—continued—**

Procedure 3-5 (continued)
**Verifying DS3 or STS-1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| **3** | Log in to the far-end user interface and display the appropriate facility screen by entering:<br>**facility <type> all** ↵<br>**where**<br><type> **ds3** or **sts1**<br>*The appropriate facility screen for all DS3 or STS-1 facilities is displayed.* |
| **4** | Take the DS3 or STS-1 facilities out of service. On the appropriate facility screen, enter:<br>**chgstate oos** ↵<br>*A warning indicates "Traffic WILL BE LOST if this command is confirmed."*<br>Confirm the command:<br>**y** ↵<br>*A screen message reports that the command is in progress. A major alarm is generated for each DS3 or STS-1 taken out of service. A second message reports that the command is successfully completed in all cases.*<br>***Note:*** The DS3 or STS-1 facilities are put back in service at the end of the procedure "Testing OC-3/OC-12 protection switching" or "Testing DS3 or STS-1 protection switching", as appropriate. |
| **5** | Depending on the circuit pack you are using, perform either step a or step b.<br>**a.** If you are working with a DS3 mapper at the far-end, set up a terminal loopback for the DS3s under test by entering:<br>**loopback op term** ↵<br>*This performs the terminal loopback for all optical DS3s at the far-end.*<br>***Note 1:*** A terminal loopback redirects a DS3 received from the far-end over the Rx fiber back to the remote terminal over the Tx fiber.<br>**b.** If you are working with a STS-1 interface card at the far-end, perform a physical loopback by connecting the input to output using a coaxial test cord. |

**—continued—**

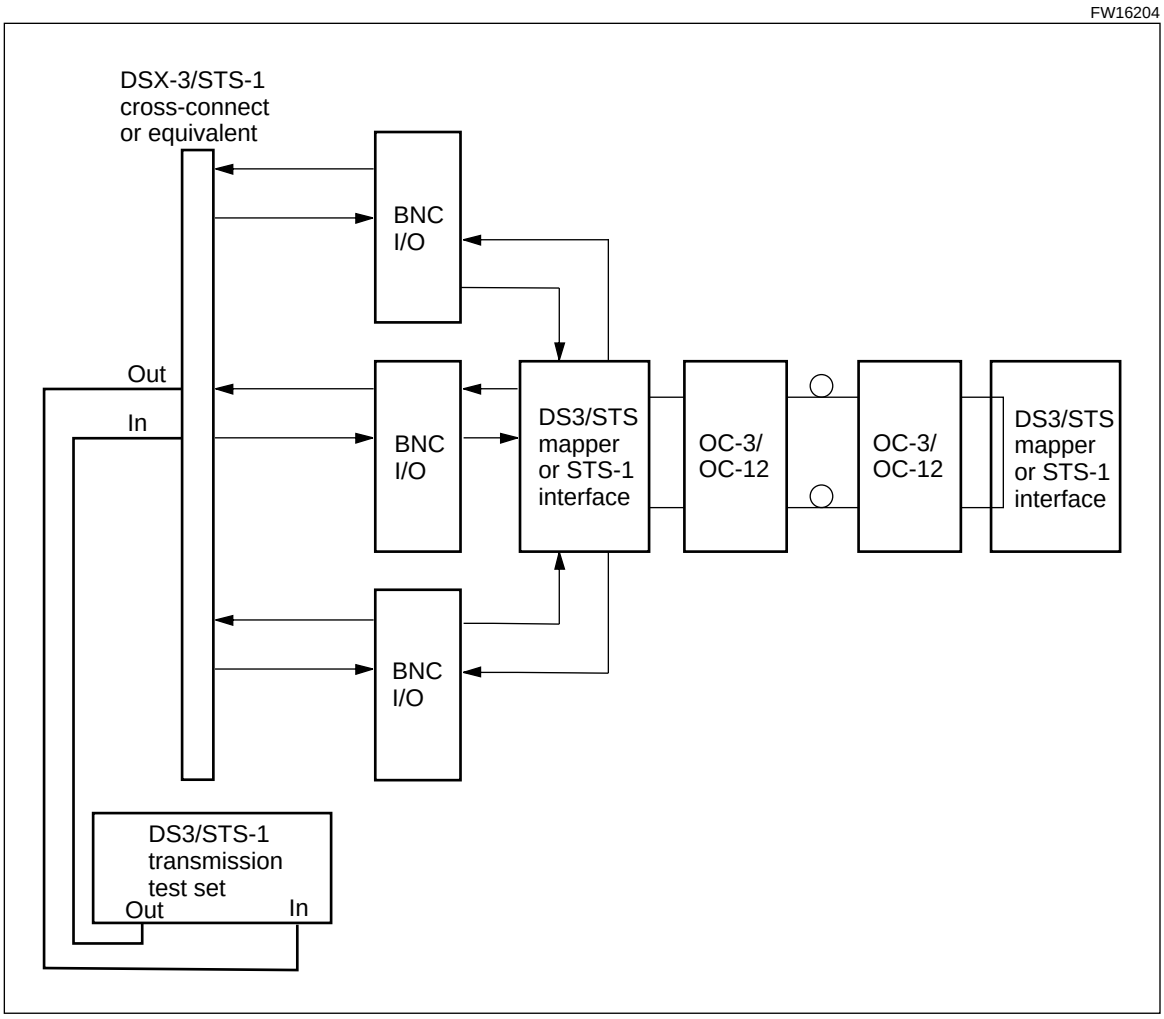
Procedure 3-5 (continued)
**Verifying DS3 or STS-1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| **6** | At the far-end, impose a lockout on the DS3 mapper or STS-1 interface card under test, by entering:<br>**dtlprot <type>** ↵<br>**where**<br><type> **ds3** or **sts1**<br>*The appropriate protection screen is displayed.*<br>**lockout op <circuit pack group>**↵<br>where<br><circuit pack group> is the circuit pack group number of the mapper under test<br>***Note:*** If you are not using the default map, refer to the Tributary Equipment Layout Form you filled out in *Mapper Layouts Planning Guide*, 323-3001-154, in *Engineering, Configuration, and Ordering Guide*, Volume 1.<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*The DS3 or STS-1 protection screen displays an asterisk (*) in the Lockout field for the mapper under test.* |
| **7** | At the near-end, repeat step 6. |
| **8** | At the near-end, daisy-chain all DS3 or STS-1 circuits of the DS3 mapper or STS-1 interface card under test, as shown in the illustration on page 3-19.<br>• At the DSX-3 or STS-1 cross-connect panel, use a test cord to loop the output of the first DS3 or STS-1 to the input of the next DS3 or STS-1.<br>• Daisy-chain in this manner until all DS3s on the circuit pack are included.<br>• Connect the transmitter of the DS3 or STS-1 transmission test set to the input of the first DS3 or STS-1. Connect the receiver of the DS334 test set to the output of the last DS3 or STS-1. |

**—continued—**

Procedure 3-5 (continued)
**Verifying DS3 or STS-1 signal continuity and measuring BER**

**Step** **Action**




**9** Press the Start/Stop button on the DS3/STS-1 test set twice, to reset the error count to zero.

*The DS3/STS-1 test set indicates "in process" and displays 0 error.*

**10** Press the Single Bit Error Inject button three times on the DS3/STS-1 test set.

*The DS3/STS-1 test set indicates "in process" and displays 3 bit errors.*

**—continued—**

Procedure 3-5 (continued)
**Verifying DS3 or STS-1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| **11** | If the continuity requirement is not met, do one or more of the following and repeat steps 9 and 10.<br>• Make sure the daisy-chain of DS3s is setup at the near-end and the terminal loopback is setup at the far-end.<br>• Break the daisy chain into two chains. Isolate and fix any problems you encountered and rebuild the daisy chain.<br>• Check the digital test set and the connections from the DSX-3/STS-1 cross-connect to the BNC I/O cards.<br>• Replace any faulty BNC I/O card at the near end. Installation of cards in the I/O section is described in *Bay in Central Office Installation Manual—ABM*, 323-3001-201.<br>• Replace the DS3 mapper or STS-1 interface card at the near end. Installation of these circuit packs is described in *Commissioning Procedures*, 323-3001-220, in *Commissioning and Testing*, Volume 3B.<br>• Replace the DS3 mapper or STS-1 interface card at the far end. |
| **12** | Press the Start/Stop button on the DS3/STS-1 test set twice, to reset the error count to zero once again. Monitor the error count for one hour, and record the result in the System Test Results Form.<br>*The DS3/STS-1 test set should display 0 error.*<br>If the requirement is not met, replace the DS3 mapper or STS-1 interface card at the near end, or at the far end, or both, and repeat step 12. |
| **13** | At the near-end, release the lockout of the DS3 mapper or STS-1 interface card under test by entering:<br>**lockout re <circuit pack group>**↵<br>where<br><circuit pack group> is the circuit pack group number of the mapper under test<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*The appropriate protection screen displays a dot (.) in the Lockout field for the equipment under test.* |
| **14** | Repeat step 13 at the far-end. |

**—continued—**

Procedure 3-5 (continued)
**Verifying DS3 or STS-1 signal continuity and measuring BER**

| Step | Action |
|---|---|

**15** Repeat steps 6 through 14 for each working DS3 mapper or STS-1 interface card.

**16** You can also test the protection DS3 mapper or STS-1 interface card.

| If your configuration has | Then go to |
|---|---|
| a protection DS3 mapper or STS-1 interface card | step 17 |
| no protection DS3 mapper or STS-1 interface card | step 22 |

***Note:*** In steps 17 and 20, use the DS3 or STS-1 circuit pack group to which the daisy chain remains connected.

**Testing the protection mapper (if equipped)**

**17** Force the traffic normally handled by a working DS3 mapper or STS-1 interface card to switch to the protection mapper, by entering:

**forced op <circuit pack group>↵**

where

<circuit pack group> is the circuit pack group number of the mapper under test

*You are prompted to confirm the command.*

**y ↵**

*The appropriate protection screen displays an asterisk (*) in the forced field for the specified mapper. The DS3s normally handled by this working mapper are rerouted to the protection mapper.*

**18** Repeat step 17 at the other NE.

**19** Press the Start/Stop button on the DS3/STS-1 test set twice, to reset the error count to zero once again, and then monitor the error count for one hour, and record the result in the System Test Results Form.

*The DS3/STS-1 test set displays 0 error.*

Problem areas could be the protection DS3 mapper or STS-1 interface card, the backplane of the shelf, and the protection switcher card. Isolate and fix any problems you encountered and rebuild the daisy chain.

**—continued—**

Procedure 3-5 (continued)
**Verifying DS3 or STS-1 signal continuity and measuring BER**

| Step | Action |
|---|---|
| **20** | When testing of the protection DS3 mapper or STS-1 interface card is complete, release the forced switch on the DS3 mapper or STS-1 interface card under test.<br>**forced re <circuit pack group>**↵<br>where<br><circuit pack group> is the group specified in step 17<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*The appropriate protection screen displays a dot (.) in the forced field for the DS3 mapper or STS-1 interface card.* |
| **21** | Repeat step 20 at the other NE. |
| **22** | Leave in place the OC-3/OC-12 lockouts at both locations, the DS3 or STS-1 daisy chain at the near-end, and the DS3 or STS-1 loopbacks at the far-end for the next procedure. Also leave the DS3 or STS-1 facilities out of service. |
| **23** | Note the completion of this procedure on the System Test Results Form.<br>**—end—** |

# Procedure 3-6
# Measuring optical receiver sensitivity

Use this procedure to verify OC-3/OC-12 receiver operation at minimum and maximum receiver input levels.

This procedure verifies that the network element (NE) receives error-free digital signals when the OC-3/OC-12 input level has been adjusted to the minimum value and then the maximum value guaranteed for the product.

If the system is not equipped with DS3 mappers or STS-1 interface cards, then a temporary mapper must be added and provisioned at each NE. The DS3 or STS-1 test set is then connected to a temporary BNC I/O card at the NE where the tests are conducted.

This procedure can be performed by one technician, but it must be repeated for each site.

> ***Note:*** If the system has mixed tributaries, perform the test on the higher rate tributaries.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service

The following equipment is required:

- a VT100-compatible terminal connected to the local craft access panel (LCAP) at the near-end
- a variable optical attenuator (VOA)
- two (2) HP8110 optical test cords, to match your optical connector type
- an optical power meter, 1310/1550 nm with range –50 dB to +5 dB
- DS3 transmitter/receiver test set (Tx-Rx), Tau-Tron S5200 or equivalent
- STS-1 SONET transmitter/receiver test set, HP 156 MTS (Cerjac) or equivalent
- two (2) electrical test cords, P3Q3B
- two (2) electrical test cords, bantam-to-bantam, 1 m (3 ft) (only if this system has transport DS3s or STS-1s)
- a copy of the System Test Results Form, located in “Appendix A: System Test Results Form” on page 8-1 to record testing information

**—continued—**

Procedure 3-6 (continued)
**Measuring optical receiver sensitivity**

Calibrate the optical power meter using the manufacturer's instructions.

If this system has transport DS3s or STS-1s, then you have already verified DS3 or STS-1 continuity in the previous procedure. The OC-3/OC-12 lockout, DS3 or STS-1 daisy chain at the near-end terminal, and DS3 or STS-1 loopbacks at the far-end terminal, remain connected. If you need instructions on how to set up the OC-3/OC-12 lockout, see steps 1 and 2, beginning on page 3-16. To set up the DS3 or STS-1 loopbacks, see steps 3 to 5, beginning on page 3-17. To set up the DS3 or STS-1 daisy chain, see step 8 on page 3-18.

If this system is not equipped with transport DS3s or STS-1s, you will be installing DS3 or STS-1 equipment for testing. You will then be setting up STS connection services (if you are not using the default map), provisioning DS3 or STS-1 facilities, setting up an OC-3/OC-12 lockout, setting up a DS3 or STS-1 loopback at the far-end, and testing DS3 or STS-1 continuity in the first part of this procedure. In this case, the electrical test cords in the previous list are not required.

If your system is not equipped with transport DS3s or STS-1s, then you need the following additional equipment depending on whether you are testing DS3 or STS-1 tributaries:

- two (2) DS3 mappers, NT7E08
- two (2) STS-1 interface cards, NT7E09
- one (1) BNC I/O card, NT4K30 (for near-end)
- flat-bladed screwdriver
- stepstool

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**CAUTION**
**Risk of connector damage**
Clean optical connectors to minimize signal attenuation and test error caused by impurities.

**—continued—**

Procedure 3-6 (continued)
**Measuring optical receiver sensitivity**

**CAUTION**
**Risk of equipment damage**
Wear a grounded antistatic wrist strap or equivalent protection when handling circuit packs, to avoid damaging electronic parts.

## Action

| Step | Action |
|---|---|

| If this system | Then |
|---|---|
| does not have transport DS3s | go to step 1 |
| has transport DS3s or STS-1s | skip to step 3 |

**Preparations for systems without transport DS3s**

**1** Install the temporary equipment (DS3 mappers or STS-1 interface cards and BNC I/O card) in to slots specified for transport DS3s for your configuration. Install the BNC I/O cards at the NE where measurements are being made. If you are using the default map, refer to "Group and slot associations" on page 3-4. If you are not using the default map, refer to the DS3 Mapper or STS-1 interface Layout Form you filled out in the *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide,* Volume 1.

**2** Fully engage each circuit pack in its backplane connector. Store blank I/O faceplates.

**3** Use a slotted screwdriver to turn the locking screw on the BNC I/O cards.

**4** At the near-end, provision the DS3s according to the procedure "Initial DS3 or STS-1 Provisioning" in *Site Testing Procedures*, 323-3001-221, in *Commissioning and Testing*, Volume 3B.

**5** Repeat DS3 or STS-1 provisioning at the far-end.

**6** Set up the OC-3/OC-12 lockout as in steps 1 and 2, beginning on page 3-16.

**7** Set up the DS3 or STS-1 loopback at the far-end as in steps 5 to 6, beginning on page 3-17.

**8** Connect the DS3/STS-1 test set to the temporary BNC I/O card at the measurement end, as follows:

- connect the DS3 transmitter test set to the BNC IN port on the BNC I/O card
- connect the DS3 receiver test set to the BNC OUT port on the BNC I/O card

Refer to Figure 3-1 on page 3-26.

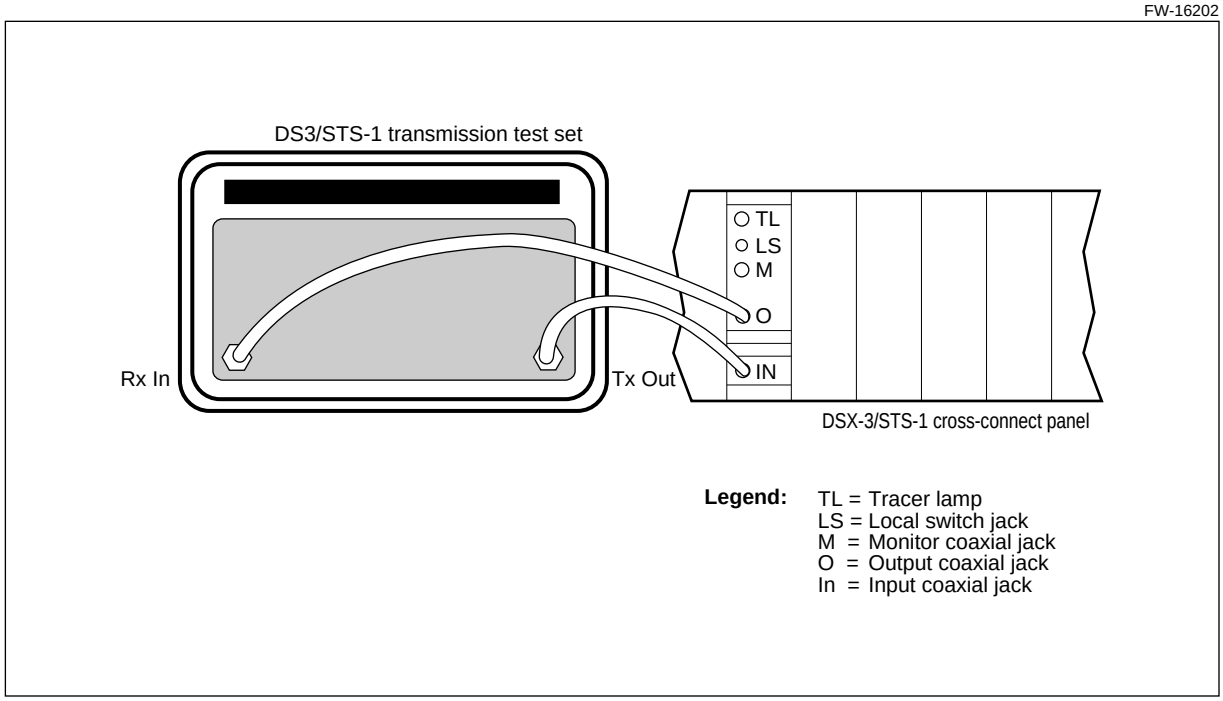
**—continued—**

Procedure 3-6 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|

**Figure 3-1**
**Connecting the DS3/STS-1 test set to the BNC I/O card**

FW-16202




**1** Verify the DS3 or STS-1 continuity. On the DS3/STS-1 test set, press Start/Stop twice to reset the error count to zero.

*The DS3/STS-1 test set indicates "in process" and displays 0 error.*

**2** Press the Single Bit Error Inject button three times.

*The digital receiver test set indicates 3 bit errors received.*

If the requirement is not met, there could be a fault in the DS3/STS-1 test set settings, coaxial cables, or in the DS3 or STS-1 circuit pack group equipment. Locate and rectify the problem and retest for DS3 or STS-1 continuity.

Skip to step 4.

**—continued—**

Procedure 3-6 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|

**Preparations for systems with transport DS3s and STS-1s**

**3** Log in to the near-end network element and impose a lockout on the DS3 mapper or STS-1 interface card used in this test.

**pr;dtlprot <type>** ↵

where

<type> is **ds3** or **sts1**

*The appropriate protection screen is displayed.*

**lockout op <circuit pack group>**↵

where

<circuit pack group> is the DS3 or STS-1 group that is daisy-chained

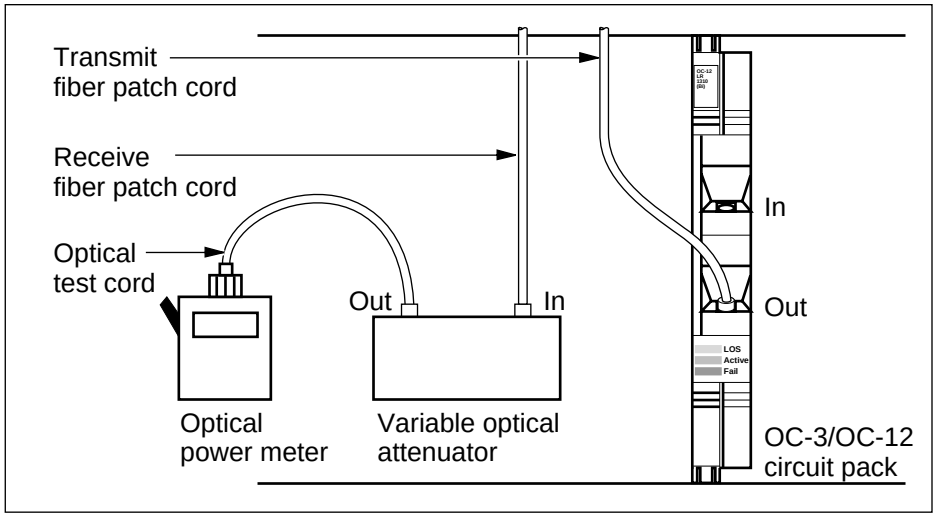
**y** ↵

*An asterisk is displayed in the Lockout field for the DS3 or STS-1 group under test.*

**Set up optical equipment**

**4** As shown below, use an optical test cord to connect the output of the variable optical attenuator to the optical power meter.

FW-10266




**5** Disconnect the receive fiber patch cord from the OC-3/OC-12 receive connector and connect it to the input of the variable optical attenuator.

**—continued—**

Procedure 3-6 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|

**6** Set the variable optical attenuator for single-mode, proper wavelength operation.

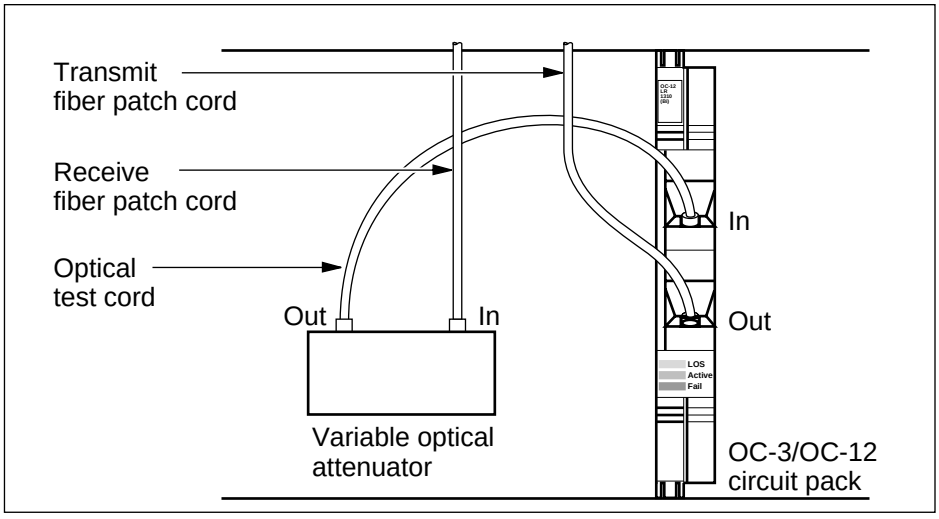
**Measure optical bit error rate (BER) at minimum optical receive level**

**7** Adjust the variable optical attenuator to obtain the following reading on the optical power meter:

| PEC | Module | Minimum receiver power ($P_{R\ min}$) |
|---|---|---|
| NT7E01CA/CB/CC/CD | OC-3 LR | – 34.0 dBm |
| NT7E01DA/DB/DC/DD | OC-3 IR | – 28.0 dBm |
| NT7E02KA/KB/KC/KD | OC-12 LR | – 32.0 dBm |
| NT7E02LA/LB/LC/LD | OC-12 IR | – 24.5 dBm |

**8** Disconnect the optical test cord from the optical power meter and connect it to the OC-3/OC-12 receive connector, as shown below.

FW-10265




**9** On the DS3/STS-1 test set, press Start/Stop twice to reset the error count to zero.

*The DS3/STS-1 test set indicates "in process" and displays 0 error.*

**10** Press the Single Bit Error Inject button three times.

*The digital receiver test set indicates 3 bit errors received.*

**11** Reset the DS3 receiver test set and monitor for 15 minutes.

*The test set displays 0 error.*

**—continued—**

Procedure 3-6 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|

**12** If the requirement is not met, the OC-3/OC-12 interface circuit pack could be faulty. Repeat steps 4 to 11, using a different OC-3/OC-12 interface circuit pack.

**13** Record the receiver sensitivity results on the System Test Results Form.

**Set up for normal operation**

**CAUTION**
**Risk of damage to attenuator**
If the attenuation does not change after 1 full turn of the adjustment screw, stop turning in that direction. Instead, turn the screw in the opposite direction to restore the unit to within the operating range.

**14** Adjust the attenuation so that the receive optical level is within the following required range (adjustment may not be necessary if this requirement is already met):

| Module | Requirement |
|---|---|
| Long-reach (LR) OC-3 interface circuit pack | –34.0 ≤ normal power ≤ –10.0 dBm |
| Intermediate-reach (IR) OC-3 interface circuit pack | –28.0 ≤ normal power ≤ –8.0 dBm |
| Long-reach (LR) OC-12 interface circuit pack | –32.0 ≤ normal power ≤ –7.0 dBm |
| Intermediate-reach (IR) OC-12 interface circuit pack | –24.5 ≤ normal power ≤ –4.0 dBm |

**15** Enter the normal optical power setting on the System Test Results Form.

**16** Reconnect the receive fiber patch cord to the receive connector of the G1 OC-3/OC-12 interface circuit pack.

**17** Release the lockout on the G1 OC-3/OC-12 interface circuit pack, by entering:

**pr;dtlprot <oc-n>**↵

where

<oc-n> is the type of optical carrier: **oc3** or **oc12**

**lockout re** ↵

**y** ↵

**—continued—**

Procedure 3-6 (continued)
**Measuring optical receiver sensitivity**

| Step | Action |
|---|---|
| | *A dot is displayed in the lockout column for optical interface unit G1.* |
| **18** | Repeat step 17 for the lockout on the G1OC-3/OC-12 interface circuit pack at the other NE. |
| **19** | Force the traffic to switch to the G2 OC-3/OC-12 unit, by entering:<br>**forced op g1** ↵<br>**y** ↵<br>*Traffic switches to the G2 unit. On the OC-3/OC-12 Protection screen, an asterisk is displayed in the Forced field for optical interface unit G1.* |
| **20** | Repeat steps 4 through 16 for the G2 OC-3/OC-12 interface circuit pack. |
| **21** | Release the forced switch, by entering:<br>**forced re g1** ↵<br>**y** ↵<br>*A dot is displayed in the forced column for optical interface unit G1.* |
| **22** | If this system has a temporary DS3 mapper or STS-1 interface card, end the procedure here. Do not disconnect the DS3 or STS-1 interfaces, BNC I/O cards, or DS3/STS-1 test set. If this system has transport DS3s, continue at step 23. |
| **23** | Remove the daisy chain at the DSX-3/STS-1 cross-connect. Leave the DS3 or STS-1 loopbacks in place at the far-end for the next procedure. Also, leave DS3 or STS-1 facilities out of service. |
| **24** | Release the lockout on the DS3 or STS-1 circuit pack group by entering:<br>**dtlprot <type>**↵<br>**lockout re <circuit pack group>**↵<br>where<br><type> is **ds3** or **sts1**<br><circuit pack group> is the DS3 or STS-1 group with the lockout<br>**y** ↵<br>*A dot is displayed in the lockout column for the DS3 or STS-1 circuit pack group.* |
| **25** | Repeat step 24 for the DS3 or STS-1 lockout at the other NE. |

**—end—**

# Procedure 3-7
# Testing OC-3/OC-12 protection switching

Use this procedure to test OC-3/OC-12 protection switching: manual, forced, and automatic due to signal degradation or signal failure. Also use it to test lockout from automatic switching.

This procedure can be conducted by one technician, who can set up two user interface sessions, a local session to one network element (NE), and a remote session to the other NE through the operations controller (OPC). If necessary, see the procedure for logging in to a network element from the OPC and logging out in *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

> ***Note:*** If the system has mixed tributaries, perform the test on the higher rate tributaries.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service

The DS3s remain looped back at the far end, as in Procedure 3-5 on page 3-15. If you need instructions on how to set up the loopbacks, see step 5, beginning on page 3-17.

If temporary DS3 or STS-1 equipment is connected to the DS3/STS-1 test set, then it remains connected.

The following equipment is required:

- a VT100-compatible terminal, already connected and logged in to the OPC
- a variable optical attenuator (VOA) and two (2) optical test cords, Hewlett-Packard 8110
- one (1) optical test cord, NT3E42AA
- DS3 transmission test set, Tau-Tron S5200 (Tx-Rx) or equivalent and two (2) electrical test cords, P3Q3B
- STS-1 SONET transmitter/receiver test set, HP 156 MTS (Cerjac) or equivalent
- a copy of the System Test Results Form, located in “Appendix A: System Test Results Form” on page 8-1 to record testing information

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

## Action

| Step | Action |
|---|---|

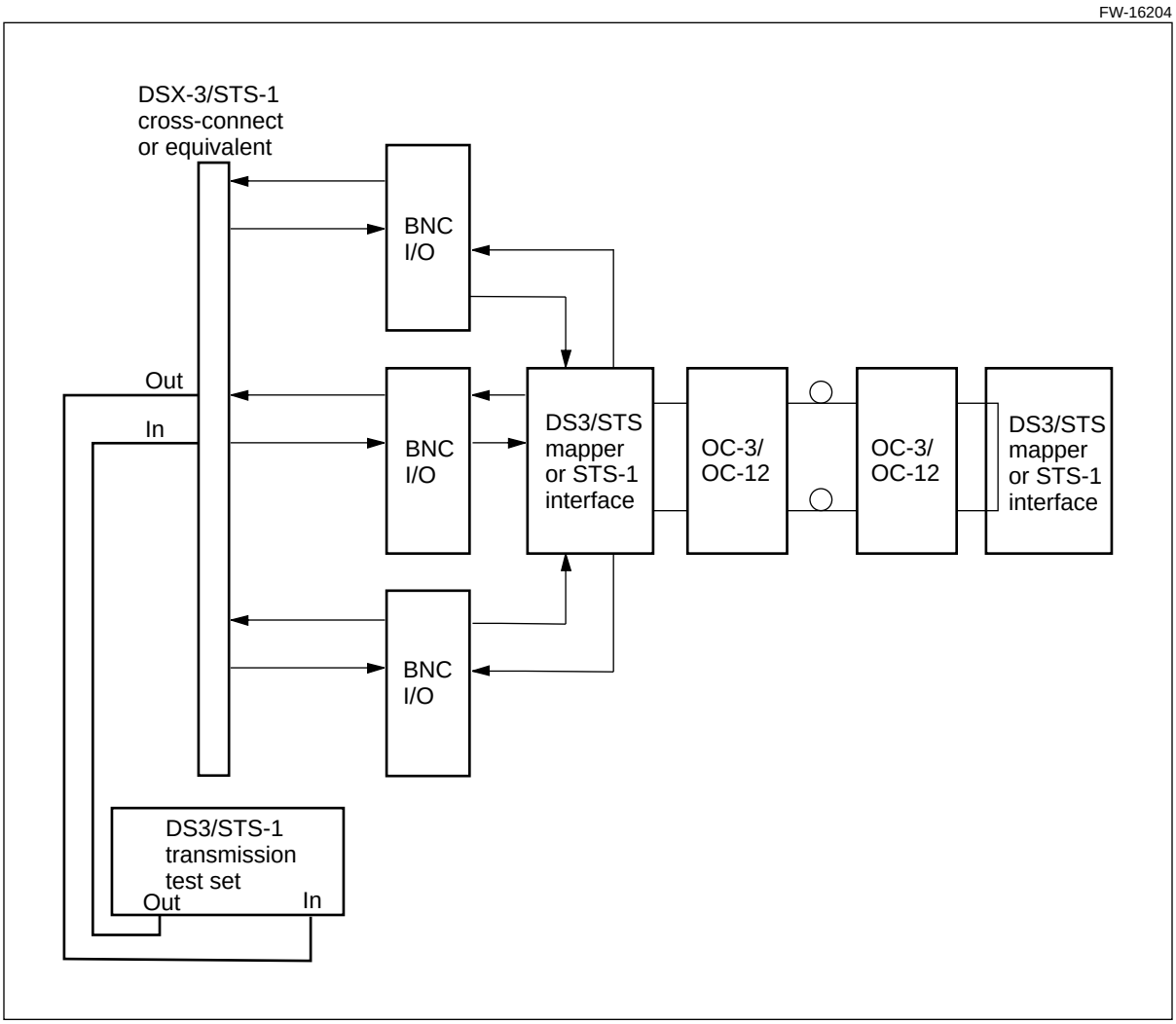
| If this system | Then start procedure at |
|---|---|
| has transport DS3s | step 1 |
| does not yet have transport DS3s | step 2 |

**1** Connect the DS3/STS-1 test set to one DS3 or STS-1 terminated at the DSX-3/STS-1 cross-connect, as shown in the following illustration. Continue at step 2.

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

**Step** **Action**




**2** Set the DS3/STS-1 test set to read total errors. On the DS3/STS-1 test set, press the Reset button to reset the error counter.

*The DS3/STS-1 test set displays 0 error.*

**3** Check optical and DS3 or STS-1 continuity by pressing the Single Bit Error Inject button three times on the DS3/STS-1 test set.

*The DS3/STS-1 test set displays 3 bit errors.*

**4** Log in to the user interface of the near-end terminal.

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

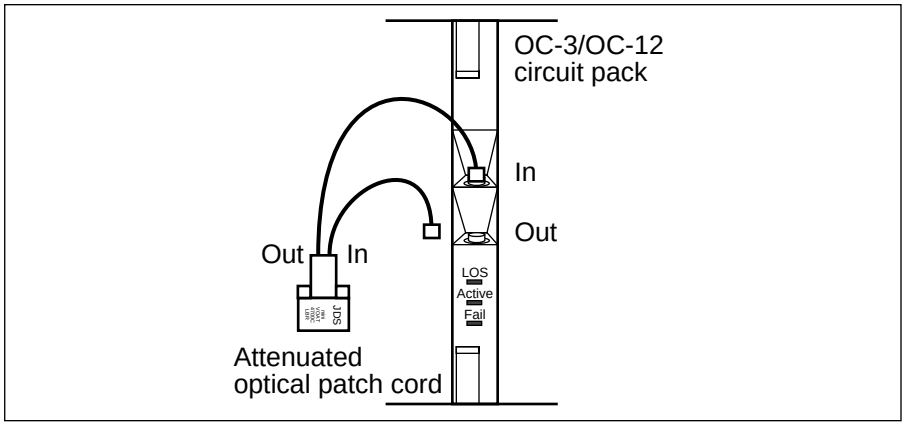
| Step | Action |
|---|---|
| **5** | Log in to the NE and display the protection status of the OC-3/OC-12 circuit packs by entering:<br>**pr;dtlprot <oc3 or oc12>** ↵<br>*The OC-3/OC-12 Protection screen is displayed, showing two circuit packs in service.*<br>***Note 1:*** G1 corresponds to OC-3/OC-12 circuit pack in slot 9. G2 corresponds to OC-3/OC-12 circuit pack in slot 10.<br>***Note 2:*** One circuit pack is active and the other is standby. The green (Active) LED is on for the active circuit pack. In the case of NT7E05 OC-12 VTBM circuit packs, however, both circuit packs are active.<br>***Note 3:*** If a circuit pack is locked out, forced to protection, or automatically or manually switched to protection, an asterisk (*) is displayed in the appropriate field. A dot (.) indicates normal operation. A dash (-) indicates not applicable. |
| **6** | Make sure G2 is the active circuit pack. If G1 is active, operate a manual switch, by entering:<br>**manual op g1** ↵<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*For OC-12 VTBM, both cards remain active with the green LEDs turned on.*<br>*For other OC-3/OC-12, the green (Active) LED turns off at OC-3/OC-12 G1 and lights on G2.* |
| **7** | On the DS3/STS-1 test set, press the Start/Stop button twice to reset the error count to zero.<br>*The DS3/STS-1 test set indicates in process and displays 0 bit error.* |
| **8** | To verify DS3 continuity, press the Single Bit Error Inject button three times on the DS3/STS-1 test set.<br>*The DS3/STS-1 test set displays 3 bit errors received.* |
| **Testing forced switching** | |
| **9** | Force a switch to G1 by entering:<br>**forced op g2** ↵<br>*You are prompted to confirm the command.*<br>**y** ↵<br>*For both OC-12 VTBM and other OC-3/OC-12, the green (Active) LED on OC-3/OC-12 G1 turns on and the green (Active) LED on the OC-3/OC-12 G2 turns off.* |

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|
| **10** | To verify the DS3 or STS-1 signal continuity, press the Single Bit Error Inject button on the DS3/STS-1 test set three times.<br>*The DS3/STS-1 test set displays 3 bit errors received.* |
| **11** | Disconnect the optical test cord from the transmit (Out) connector on G1 OC-3/OC-12.<br>*For OC-12 VTBM, G1 and G2 are both active with green LEDs. The OC-12 Protection screen displays an R in the Forced field of G2.*<br>*For other OC-3/OC-12, the yellow loss-of-signal (LOS) LED on the G2 circuit pack turns on. G1 OC-3/OC-12 remains active due to the forced switch. As a result, DS3 signal continuity is lost.* |

FW-10579




| | |
|---|---|
| **12** | To verify that DS3 or STS-1 signal continuity is lost, press the Start/Stop button twice, to reset the error count to zero.<br>*The DS3/STS-1 test set indicates in process and displays a high error count.* |
| **13** | Release the forced switch by entering:<br>**forced re g2** ↵<br>**y** ↵<br>*For OC-12 VTBM, G1 autoswitches to G2. The OC-12 Protection screen displays an asterisk (*) in the Auto field of G1. G1 active LED light is turned off, and G2 active LED remains on.*<br>*For other OC-3/OC-12, by releasing the forced switch, you make it possible for an automatic switch to occur (from G1 to G2). G2 becomes active. The green (Active) LED on G2 turns on.* |
| **14** | Reconnect the optical test cord to the transmit (Out) connector on G1 OC-3/OC-12.<br>*G2 OC-3/OC-12 remains active.* |

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|
| **15** | On the DS3/STS-1 test set, press the Start/Stop button twice to reset the error count to zero.<br>*The DS3/STS-1 test set indicates in process and displays 0 bit error.* |
| **16** | To verify DS3 or STS-1 continuity, press the single bit error inject button three times on the DS3/STS-1 test set.<br>*The DS3/STS-1 test set displays 3 bit errors received.* |
| | **Testing automatic switching due to loss of optical signal** |
| **17** | To cause an automatic switch of the optical facility, remove the optical test cord from the transmit (Out) connector of G2 OC-3/OC-12, as shown in the figure in step 11.<br>*For OC-12 VTBM, the OC-12 Protection screen displays an (*R) in the Auto field of G2. G2 active LED is turned off.*<br>*For other OC-3/OC-12, the OC-3/OC-12 Protection screen displays an asterisk (*) in the AutoSw field of G2. On the G2 OC-3/OC-12 circuit pack, the yellow loss-of-signal (LOS) LED turns on. The green (Active) LED on the G1 OC-3/OC-12 circuit pack indicates that circuit pack is now active.* |
| **18** | On the DS3/STS-1 test set, press the Start/Stop button twice to reset the error count to zero.<br>*The DS3/STS-1 test set indicates in process and displays 0 bit error.* |
| **19** | To verify DS3 or STS-1 continuity, press the Single Bit Error Inject button three times on the DS3/STS-1 test set.<br>*The DS3/STS-1 test set displays 3 bit errors received.* |
| **20** | Reconnect the optical test cord to the transmit (Out) connector of the G2 OC-3/OC-12 circuit pack.<br>*For OC-12 VTBM, the OC-12 Protection screen displays a (WR) in the Auto field of G2. Once the wait-to-restore period expires, the G2 active LED is lit.*<br>*For other OC-3/OC-12, the yellow loss-of-signal (LOS) LED goes off on the G2 circuit pack. The screen displays a dot (.) in the AutoSw field for the G2 circuit pack.* |

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**Testing lockout from switching**

**21** Operate a lockout on the OC-3/OC-12 interface circuit packs by entering:

| For OC-12 VTBM | For other OC-3/OC-12 |
|---|---|
| **lockout op <work/prot> <unit>** ↵<br>for example:<br>lockout op prot g1 | **lockout op** ↵ |

*The screen displays a message warning that the command will affect service and asks you to confirm the command. Enter:*

**y** ↵

*For OC-12 VTBM, the OC-12 Protection screen displays an asterisk (*) in the LcktP field for G1. The lockout (LckOut) LED is lit on the maintenance interface card (MIC).*

*For other OC-3/OC-12, the OC-3/OC-12 Protection screen displays an asterisk in the Lockout field for optical interface G1. A hyphen (-) in the Lockout field for G2 indicates that the lockout does not apply. The lockout (Lck Out) LED is lit on the maintenance interface card (MIC).*

**22** Simulate a loss of signal by removing the optical patch cord from the transmit (Out) connector of the OC-3/OC-12 G2 (for OC-12 VTBM) or G1 (for other OC-3/OC12).

*For OC-12 VTBM, the OC-12 Protection screen remains the same. G1 and G2 both remain active with green LEDs turned on. Traffic does not switch to G1.*

*For other OC-3/OC-12, the yellow loss-of-signal (LOS) LED on G1 turns on. Traffic does not switch to G1.*

**23** To verify that DS3 or STS-1 signal continuity is lost, press the Start/Stop button on the DS3/STS-1 test set twice to reset the error count.

*The DS3/STS-1 test set indicates in process and shows a high error count.*

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**24** Release the lockout on the OC-3/OC-12 interface circuit packs, allowing the automatic switch by entering:

| For OC-12 VTBM | For other OC-3/OC-12 |
|---|---|
| **lockout re <work/prot> <unit>** ↵<br>for example:<br>lockout re prot g1 | **lockout re** ↵ |

*You are prompted to confirm the command.*

**y** ↵

*For OC-12, VTBM, the OC-12 Protection screen displays a dot (.) in all protection columns. G1 and G2 both remain active with green LEDs turned on.*

*For other OC-3/OC-12, the OC-3/OC-12 G2 becomes active and the green (Active) LED turns on. The OC-3/OC-12 Protection screen displays an asterisk (*) in the Auto (automatic switch) field for the G1. The screen displays a dot (.) in the Lockout field for interface circuit pack G2.*

**25** On the DS3 receiver test set, press the Start/Stop button twice to reset the error count to zero.

*For OC-12 VTBM, the DS3/STS-1 test set indicates a high error count.*

*For other OC-3/OC-12, the DS3/STS-1 test set indicates "in process" and displays 0 bit error.*

**26** To verify that DS3 or STS-1 continuity is restored, press the Single Bit Error Inject button three times on the DS3/STS-1 test set.

*For OC-12 VTBM, the DS3/STS-1 test set indicates a high error count.*

*For other OC-3/OC-12, the DS3 receiver test set displays 3 bit errors received.*

**27** Reconnect the optical patch cord to the transmit (Out) connector of OC-3/OC-12 G2 (for OC-12 VTBM) or G1 (for other OC-3/OC-12).

*For OC-12 VTBM, the DS3/STS-1 test set indicates "in process" and displays 0 bit error. The OC-12 Protection screen displays a dot (.) in all protection columns. G1 and G2 both remain active with green LEDs turned on.*

*For other OC-3/OC-12, the yellow loss-of-signal (LOS) LED goes off. The screen displays a dot (.) in the Auto (automatic switch) field for the G1.*

**—continued—**

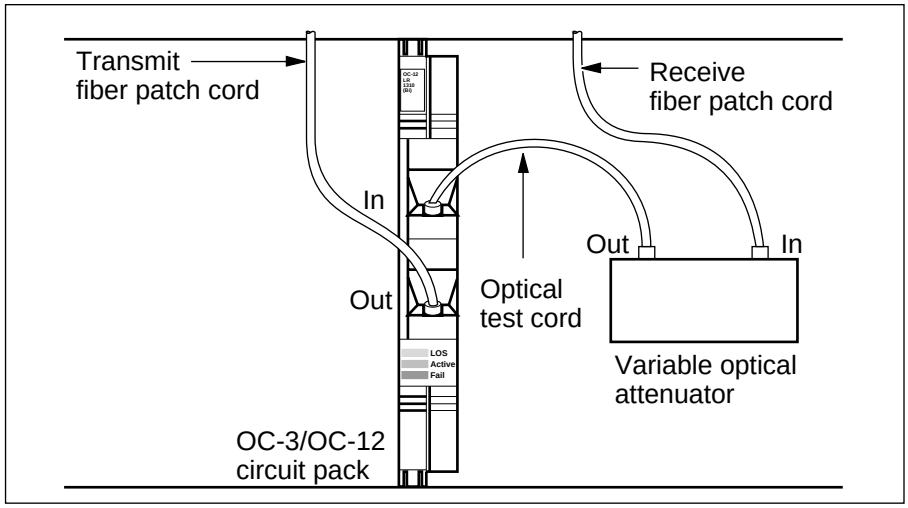
Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**Testing automatic switching due to signal degradation**

**28** Disconnect the receive fiber pigtail from the G2 OC-3/OC-12 interface circuit pack, and connect it to the input of the variable optical attenuator, as shown in the following illustration.

FW-11107




**29** Use a test cord to connect the output of the variable optical attenuator to the receive connector on the G2 OC-3/OC-12 interface circuit pack.

**30** Adjust the DS3/STS-1 test set to read the bit error rate.

**31** Switch traffic to the G2 OC-3/OC-12 interface circuit pack, by entering:

**manual op g1** ↵

*The OC-3/OC-12 Protection screen indicates G2 is active and G1 is standby.*

**32** Slowly increase the attenuation on the variable optical attenuator until a bit error rate of $10^{-6}$ is displayed on the DS3/STS-1 test set. This is the default DS3 or STS-1 signal degradation threshold.

*On the G2 OC-3/OC-12 interface circuit pack, the LOS LED lights up. The OC-3/OC-12 Protection screen shows that the G2 unit is off and the G1 unit is on, and displays an asterisk (*) in the AutoSw field for the G2 unit.*

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

**33** Press the Start/Stop button on the test set twice, to reset the error count.

*The DS3/STS-1 test set indicates "in process", and displays an error count of 0.*

**34** To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.

*The DS3/STS-1 test set indicates "in process", and displays an error count of 3.*

**35** Adjust the variable optical attenuator to slightly increase the received signal level (that is, to remove about 1 dB attenuation).

*The signal degradation alarm clears after a few seconds.*

| If this system | Then go to |
|---|---|
| has transport DS3s | step 36 |
| does not yet have transport DS3s | step 37 |

**36** When testing is complete, remove the optical attenuator, and reconnect the fiber pigtail to the receive connector on the G2 OC-3/OC-12 interface circuit pack. Maintain the DS3/STS-1 test set arrangements and the far end loopbacks because they are used in the next procedure. DS3 or STS-1 facilities remain out of service. Make sure the alarms you caused have cleared. You have finished this procedure.

**37** You are finished testing. Before removing the temporary DS3 mapper or STS-1 interface card, delete the DS3 or STS-1 facilities and DS3 or STS-1 equipment. The DS3 or STS-1 facilities are already OOS.

To delete the facilities at the near-end, first quit out of the protection screen and then enter the facility screen:

**quit** ↵

**fa <type> <circuit pack group> all** ↵

**where**

| | |
|---|---|
| <type> | is **ds3** or **sts1** |
| <circuit pack group> | is the circuit pack installed in step 1 of the previous procedure |

**delete** ↵

**y** ↵

*The DS3 or STS-1 facilities are deleted.*

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|

To delete the equipment:

**eq <type> <circuit pack group>**↵

where

| | |
|---|---|
| <type> | is **ds3** or **sts1** |
| <circuit pack group> | is the installed circuit pack as described in step 1 of Procedure 3-6 on page 3-23 |

**delete** ↵

**y** ↵

*The DS3 or STS-1 equipment is deleted.*

**38** At the near-end terminal, remove the DS3/STS-1 test set, coaxial cables, BNC I/O cards, and the temporary DS3 mapper or STS-1 interface card.

**39** Reinstall the blank I/O faceplates previously removed.

**40** At the remote NE, remove the DS3 or STS-1 loopback, delete the DS3 or STS-1 facilities, and delete the DS3 or STS-1 equipment. Depending on the circuit pack you are using, perform either step a. or step a.

**a.** If you have DS3 facilities, quit out of the protection screen and enter the facility screen:

**quit** ↵

**fa ds3 <circuit pack group> all** ↵

where

| | |
|---|---|
| <circuit pack group> | is the installed circuit pack as described in step 1 of Procedure 3-6 on page 3-23 |

**loopback re** ↵

*The loopback is removed.*

**—continued—**

Procedure 3-7 (continued)
**Testing OC-3/OC-12 protection switching**

| Step | Action |
|---|---|
| | **a.** If you have STS-1 facilities, remove the physical loopback and take the facilities out of service by:<br>**fa sts1 <circuit pack group> all** ↵<br>where<br><circuit pack group> is the installed circuit pack as described in step 1 of Procedure 3-6 on page 3-23<br>**chgstate oos** ↵<br>*The loopback is removed and the facilities are taken out of service.*<br>**delete** ↵<br>**y** ↵<br>*The DS3 or STS-1 facilities are deleted.*<br>To delete the DS3 or STS-1 equipment:<br>**eq <ds3** or **sts1> <circuit pack group>**↵<br>**delete** ↵<br>**y** ↵<br>*The DS3 or STS-1 equipment is deleted.* |
| **41** | Remove the temporary DS3 mapper or STS-1 interface card at the far-end terminal.<br>**—end—** |

# Procedure 3-8
# Testing DS3 or STS-1 protection switching

Use this procedure to test DS3 or STS-1 protection switching: manual, automatic, forced, and priority. Also use it to test lockout from automatic switching. This procedure only applies for systems equipped with permanent DS3 mappers or STS-1 interface cards carrying transport DS3s.

> ***Note:*** For proper electromagnetic interference (EMI) protection, the shelf cover must be replaced after you have finished testing.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 to record testing information

For this procedure, use the same DS3/STS-1 test set arrangements and far end loopbacks as used in Procedure 3-7 on page 3-31. You do not need the variable optical attenuator for this procedure.

| If you need instructions on | Then go to |
|---|---|
| the DS3/STS-1 test set arrangements | step 1 in Procedure 3-6 on page 3-25 |
| how to set up the loopbacks | steps 3 to 5 in Procedure 3-5 on page 3-17 |

You must know how to log into the far-end network element (NE). If necessary, refer to the procedure "Logging in to the far-end NE from the local NE" in *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

If the local NE has an operations controller (OPC), you can connect your terminal to it and log in to both NEs at the same time. Refer to the procedure "Logging into a network element from the OPC and logging out" in *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

Two DS3 or STS-1 circuit packs and two DS3test sets are required to test priority DS3 or STS-1 switching. One mapper is required to test manual, automatic, and forced switching, and lockout.

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

## Action

| Step | Action |
|---|---|

**1** Press the Start/Stop button on the test set twice, to reset the error count.

*The DS3/STS-1 test set indicates "in process", and displays an error count of 0.*

**2** To verify that optical continuity exists, press the Single Bit Error Inject button three times.

*The DS3/STS-1 test set indicates "in process", and displays an error count of 3.*

**3** Log in to the Network Element Status screen.

**4** Make sure the DS3 or STS-1 protection status is not fail, lockout, or active, by entering:

**pr;dtlprot <type>** ↵

**where**

<type> **ds3** or **sts1**

*The appropriate protection screen is displayed. The protection status of the DS3 or STS-1 circuit packs is displayed as a dot (.) in each field, not an asterisk.*

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|

**Testing manual switching**

***Note:*** When you cause protection switching, do so at only one site. To monitor the activity, you can log on to the far-end through the OPC. For instructions on how to do so, refer to *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

**5** Perform manual switching of traffic from the working DS3 mapper or STS-1 interface card to the protection circuit pack.

***Note:*** For simplicity in this procedure, the working mapper is assumed to be mapper G1. If you are using the default map, see "Group and slot associations for DS1, DS3, and STS-1 I/O cards" on page 2-7. If you are not using the default map, refer to the Tributary Equipment Layout Form you filled out in the *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide,* Volume 1.

Enter:

**manual op g1** ↵

*You are asked for confirmation.*

**y** ↵

*The DS3 or STS-1 protection screen displays an asterisk (*) in the Manual field for the G1 unit, indicating that a manual switch is active.*

**6** Press the Start/Stop button on the test set twice, to reset the error count.

*The DS3/STS-1 test set indicates "in process", and displays an error count of 0.*

**7** To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.

*The DS3/STS-1 test set indicates "in process", and displays an error count of 3.*

**8** Release the manual switch to protection, by entering:

**manual re g1** ↵

*You are asked for confirmation.*

**y** ↵

*The DS3 or STS-1 traffic reverts to the G1 unit from the protection unit. The DS3 or STS-1 protection screen displays a dot (.) in the Manual field for the G1 unit.*

**9** Press the Start/Stop button on the test set twice, to reset the error count.

*The DS3/STS-1 test set indicates "in process," and displays an error count of 0.*

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|
| **10** | To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.<br>*The DS3/STS-1 test set indicates "in process", and displays an error count of 3.* |
| | **Testing forced switching** |
| **11** | Force the traffic from the G1 DS3 mapper or STS-1 interface card to the protection unit, by entering:<br>**forced op g1** ↵<br>*You are prompted to confirm the action.*<br>**y** ↵<br>*The DS3 or STS-1 protection screen displays an asterisk (*) in the Forced field for the G1 unit, indicating that a forced switch is active.* |
| **12** | Press the Start/Stop button on the test set twice, to reset the error count.<br>*The DS3/STS-1 test set indicates "in process", and displays an error count of 0.* |
| **13** | To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.<br>*The DS3/STS-1 test set indicates "in process", and displays an error count of 3.* |
| **14** | Release the forced switch to protection, by entering:<br>**forced re g1** ↵<br>*You are prompted to confirm the action.*<br>**y** ↵<br>*DS3 or STS-1 traffic transfers back to the working DS3 or STS-1 circuit pack. The DS3 or STS-1 protection screen displays a dot (.) in the Forced field for the G1 unit.* |
| **15** | Press the Start/Stop button on the test set twice, to reset the error count.<br>*The DS3/STS-1 test set indicates "in process", and displays an error count of 0.* |
| **16** | To verify that optical continuity is maintained, press the Single Bit Error Inject button three times.<br>*The DS3/STS-1 test set indicates "in process," and displays an error count of 3.* |

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|
| | **Testing lockout from switching and automatic switching** |
| | ***Note:*** This test also verifies that automatic switching works. |
| **17** | Operate a lockout on one DS3 mapper or STS-1 interface card by entering:<br>**lockout op g1** ↵<br>*You are prompted to confirm the action.*<br>**y** ↵<br>*The DS3 or STS-1 protection screen displays an asterisk (*) in the Lockout field for unit G1.* |
| **18** | To simulate the loss of signal, remove the G1 DS3 mapper or STS-1 interface card from its backplane connector.<br>*Because the G1 unit is locked out, no switch to protection occurs.* |
| **19** | To verify that the DS3s are lost, press the Start/Stop button on the test set twice, to reset the error count.<br>*The DS3/STS-1 test set indicates "in process", and displays a high error count.* |
| **20** | Release the lockout, by entering:<br>**lockout re g1** ↵<br>*You are prompted to confirm the action.*<br>**y** ↵<br>*Because the G1 unit is no longer locked out, an automatic switch to protection occurs. The DS3 or STS-1 protection screen displays a dot (.) in the Lockout field for the G1 unit, and displays an asterisk (*) in the AutoSw field for the unit. The critical and major alarms clear. A minor alarm is raised to indicate the switch to protection.* |
| **21** | Press the Start/Stop button on the test set twice, to reset the error count.<br>*The DS3/STS-1 test set indicates "in process", and displays an error count of 0.* |
| **22** | To verify that continuity is restored, press the Single Bit Error Inject button three times.<br>*The DS3/STS-1 test set indicates "in process," and displays an error count of 3.* |

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|

**23** Reinstall the G1 DS3 mapper or STS-1 interface card.

*The DS3 or STS-1 protection screen displays a WTR (wait-to-restore) in the AutoSw field for the G1 unit. Alarms clear. After five minutes, the DS3s revert to the G1* DS3 mapper *or STS-1 interface card, and the DS3 or STS-1 protection screen displays a dot (.) in the AutoSw field for the G1 unit.*

**24** If the shelf has one or more additional working DS3 mappers or STS-1 interface cards that are not yet tested, remove the DS3/STS-1 test set from the mapper you tested, and connect the DS3/STS-1 test set to the next working mapper.

**25** Repeat steps 5 to 24 for any remaining working DS3 mappers or STS-1 interface cards.

**26** You can test priority switching only if your system is equipped with more than one working DS3 mapper or STS-1 interface card.

| If you have | Then go to |
|---|---|
| one working DS3 mapper or STS-1 interface card | step 39 |
| more than one DS3 mapper or STS-1 interface card | step 27 |

**Testing priority DS3 or STS-1 switching**

**27** Review the priorities assigned to the DS3 or STS-1 groups on the DS3 or STS-1 protection screen. If necessary, provision circuit pack priority as follows:

**a.** Display the DS3 or STS-1 protection provisioning screen. On the appropriate protection screen, enter:

**protprov** ↵

**b.** On the DS3 or STS-1 protection provisioning screen, assign a high priority to the G1 DS3 or STS-1 circuit pack by entering:

**priority g1 high** ↵

**c.** Assign a low priority to the G2 circuit pack by entering:

**priority g2 low** ↵

**d.** Return to the DS3 or STS-1 protection screen and review the priorities assigned by entering:

**quit** ↵

*Two working* DS3 mapper*s or STS-1 interface cards should be provisioned, one with low priority and one with high priority.*

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|
| **28** | As shown below, set up the two DS3/STS-1 test sets to transmit to both DS3 mappers or STS-1 interface cards. Connect the one test set to the I/O cards for the low-priority unit (G2) and the other to the I/O cards for the high priority unit (G1). |

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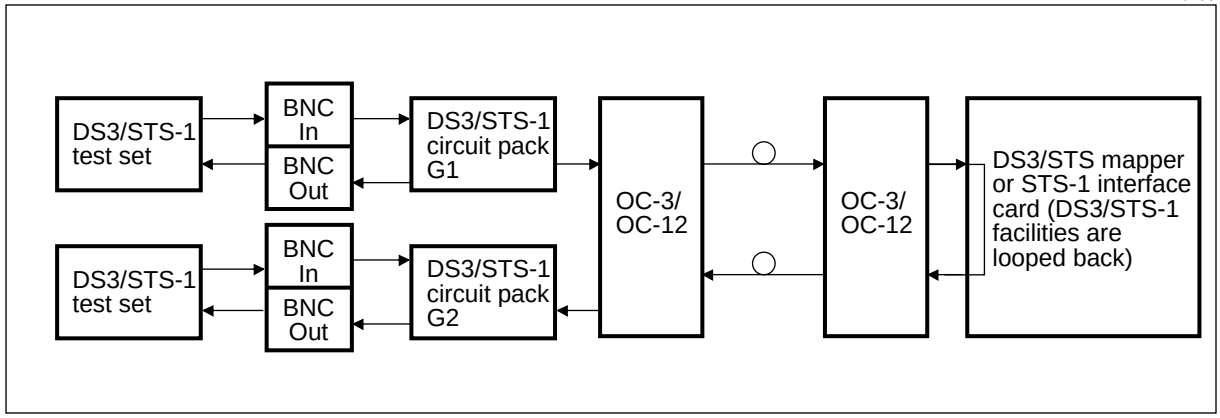


**29** Wearing antistatic protection, pull the low-priority DS3 mapper or STS-1 interface card (G2) out of its backplane connector.

*The DS3 or STS-1 traffic automatically switches to the protection mapper. The DS3 or STS-1 protection screen displays an asterisk in the AutoSw field for the low-priority mapper.*

**30** Press the Start/Stop button on the test set connected to the low priority unit (G2) twice, to reset the error count.

*The DS3/STS-1 test set indicates “in process”, and displays an error count of 0.*

**31** To verify that continuity is maintained, press the Single Bit Error Inject button three times.

*The DS3/STS-1 test set indicates “in process”, and displays an error count of 3.*

**32** Wearing antistatic protection, pull the high-priority DS3 mapper or STS-1 interface card (G1) out of its backplane connector.

*The DS3 or STS-1 traffic from the high-priority mapper automatically switches to the protection mapper, displacing the traffic from the low-priority mapper. The low-priority traffic is lost. Alarms are generated.*

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|
| **33** | Press the Start/Stop button on the test set connected to the low priority unit (G2) twice to reset the error count.<br>*The DS3/STS-1 test set indicates "in process", and shows a high error count.* |
| **34** | Press the Start/Stop button on the test set connected to the high priority unit (G1) twice to reset the error count.<br>*The DS3/STS-1 test set indicates "in process", and displays an error count of 0.* |
| **35** | To verify that DS3 or STS-1 continuity exists for the high-priority mapper, press the Single Bit Error Inject button on the test set connected to the high priority unit (G1) three times.<br>*The DS3/STS-1 test set indicates "in process," and displays an error count of 3.* |
| **36** | Reinsert the low-priority mapper into its backplane connector.<br>*DS3 or STS-1 traffic is restored on the low-priority mapper. Alarms clear. The DS3 or STS-1 protection screen displays a dot (.) in the AutoSw field for the low-priority mapper, indicating that lost DS3 or STS-1 facilities are restored on that mapper.* |
| **37** | Reinsert the high-priority mapper into its backplane connector.<br>*The DS3 or STS-1 protection screen displays a WTR (wait-to-restore) in the AutoSw field for the high-priority mapper. Alarms clear. After five minutes, the DS3 or STS-1 protection screen displays a dot (.) in the AutoSw field for the high-priority mapper, indicating that DS3 or STS-1 facilities are restored on that mapper.* |
| **38** | When you finish testing, go to the DS3 or STS-1 protection provisioning screen, and assign low priority to the high priority protection group, by entering the following commands:<br>**protprov** ↵<br>*The DS3 or STS-1 protection provisioning screen is displayed.*<br>**priority g1 low** ↵ |
| **39** | At the far-end terminal, remove the loopbacks on all DS3 or STS-1 facilities and place the facilities back in service, by entering:<br>**facility ds3 all** ↵<br>**loopback re** ↵<br>**chgstate is** ↵<br>***Note:*** If an STS-1 facility was in loopback, then remove the physical loopback at the far-end. |

**—continued—**

Procedure 3-8 (continued)
**Testing DS3 or STS-1 protection switching**

| Step | Action |
|---|---|
| **40** | Log out of the far-end network element. |
| **41** | Log out of the near-end network element. |
| **42** | Remove all test equipment and test cords. Make sure all circuit packs are fully inserted, fiber pigtails are connected, and critical or major alarms are cleared. |
| **43** | Replace the cover of the common-equipment shelf by pushing the cover into place and closing both latches. Secure the cover by turning the right locking fastener one-quarter turn to the left, and the left fastener one-quarter turn to the right.<br><br>***Note:*** When you finish testing and the system is ready for service, you can avoid DS3 or STS-1 alarms by deleting unused DS3 or STS-1 facilities, or by changing the state of the facility to out-of-service. The procedure for deleting a facility is in *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B. |
| **44** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 3-9
# Verifying OC-3/OC-12 performance monitoring

Use this procedure to verify that the performance of OC-3/OC-12 facilities can be queried. Verification includes starting a performance monitoring interval for both OC-3s/OC-12s on the shelf at the same time.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- user interface terminal is connected to the network element (NE) directly or through a remote operations controller (OPC) session
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, to record testing information

## Action

| Step | Action |
|---|---|
| **1** | Log in to the Network Element Status screen. |
| **2** | Display the performance statistics screen for both OC-3/ OC-12 circuit packs, by entering:<br>**pm fp <oc-n> all** ↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>*The OC-3/OC-12 Performance Statistics screen is displayed.* |

**—continued—**

Procedure 3-9 (continued)
**Verifying OC-3/OC-12 performance monitoring**

| Step | Action |
|---|---|
| **3** | If you are not concerned with performance history up to this point, clear both the Statistics and History screens. |
| **4** | Start an untimed interval for both OC-3/OC-12 facilities on the shelf, by entering:<br>**startunt** ↵ |
| **5** | After five minutes, check if any errors were recorded in the Untimed column. Enter the following command to see the performance statistics screen for the first facility:<br>**select <circuit pack group>**↵<br>where<br><circuit pack group> is **g1** or **g2** |
| **6** | If there is an error count in the Untimed column, investigate the source of the errors. See *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance,* Volume 5A. |
| **7** | Repeat steps 5 to 6 for the second OC-3/OC-12 unit. |
| **8** | Log out from the user interface. |
| **9** | Note the completion of this procedure on the System Test Results Form.<br>**—end—** |

# Procedure 3-10
# Verifying DS3 or STS-1 performance monitoring

Use this procedure to verify that the performance of all new DS3 or STS-1 facilities can be queried. Verification is quickly performed by starting a performance monitoring interval for all DS3s on the shelf at the same time.

## Requirements

The following requirements must be met before starting this procedure.

- make sure the user interface terminal is connected to the network element (NE) directly or through a remote login session
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, to record testing information

## Action

| Step | Action |
|---|---|
| **1** | Log in to the NE main menu. |
| **2** | Display the performance statistics screen for all DS3s. Enter:<br>**pm fp <type> all** ↵<br>**where**<br><type> **ds3** or **sts1**<br>*The DS3 or STS-1 performance statistics screen is displayed.* |
| **3** | Start an untimed interval for all DS3s on the shelf. Enter:<br>**startunt** ↵ |
| **4** | Enter the following for the performance statistics screen for each DS3 or STS-1 facility:<br>**select <circuit pack group> <port>**↵<br>where<br><circuit pack group> is the circuit pack group number of the DS3 or STS-1 facility<br><port > is **1**, **2**, or **3** |
| **5** | If there is an error count in the Untimed column, investigate the source of the errors. See *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance,* Volume 5A. |
| **6** | Repeat steps 4 and 5 for each port until all ports are checked. |

**—continued—**

Procedure 3-10 (continued)
**Verifying DS3 or STS-1 performance monitoring**

| Step | Action |
|---|---|
| **7** | Repeat steps 4 through 6 for each DS3 or STS-1 circuit pack on the shelf. |
| **8** | Quit to the main menu.<br>**quit ↵**<br>*The Network Element Status screen is displayed.* |
| **9** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 3-11
# Using the protection exerciser

Use this procedure to test the protection switching capability of optical equipment. Because out-of-service protection switching tests have already been completed, this procedure is optional.

The protection exerciser can be used while a system is in service because it does not risk dropping traffic or inserting switching errors. The exerciser proves that switching is operational by bridging to the protection equipment, without actually switching traffic.

***Note 1:*** You can schedule the equipment exerciser to run automatically over a specific time period. For information on this, see the procedure "Changing a scheduled shelf event or exercise" in *System Administration Procedures*, 323-3001-302, in *Operations, Administration, and Provisioning*, Volume 4A.

***Note 2:*** For proper electromagnetic interference (EMI) protection, replace the shelf cover after completion of testing.

## Requirements

- A copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1, to record testing information

## Action

| Step | Action |
|---|---|
| **1** | Log in to the network element user interface (NEUI) and display the protection status of the OC-3/OC-12 circuit packs by entering:<br>**pr;dtlprot <oc-n>**↵<br>where<br><oc-n> is the type of optical carrier: **oc3** or **oc12**<br>*The OC-3/OC-12 detailed protection screen is displayed.*<br>***Note:*** The screen displays the list of equipment groups, and their service status. The screen shows whether a group is locked out, forced to protection, or manually switched to protection.<br>**—continued—** |

Procedure 3-11 (continued)
**Using the protection exerciser**

| Step | Action |
|---|---|
| **2** | If it is not already removed, remove the cover of the common-equipment shelf by turning the right locking fastener one-quarter turn to the right, and the left fastener one-quarter turn to the left. Open both latches, and pull the cover to remove it. Refer to *Routine Maintenance Procedures*, 323-3001-546, in *Maintenance*, Volume 5C for details. |
| **3** | Start the protection switch exerciser on the desired shelf, by entering:<br>**equipmnt sh** ↵<br>**exercise** ↵<br>*During the exerciser sequence, the value displayed in the Exerciser field on the Shelf Equipment screen is "On", and the Test Run LED on the maintenance interface card (MIC) is lit. The following message is displayed on the Shelf Equipment screen:*<br>`The shelf exerciser has been initiated. Please refer to the EQP logs for results.`<br>*When the exercise is completed, the following message is displayed:*<br>`OC3/OC12: pass` |
| **4** | If the Test Fail LED on the maintenance interface card (MIC) comes on, it indicates an exerciser failure. Investigate the failure using the Protection and Alarm screens, and make any necessary repairs. |
| **5** | To install the cover of the common-equipment shelf, refer to *Routine Maintenance Procedures*, 323-3001-546, in *Maintenance*, Volume 5C. |
| **6** | Note the completion of this procedure on the System Test Results Form.<br>**—end—** |

# Testing OC-3 tributaries

If the system is equipped with OC-3 tributaries, the tests in this chapter must be completed.

## How to use this chapter

Refer to the flow charts and task lists in Chapter 1 when using this chapter. These flow charts and task lists identify the procedures that must be performed in this chapter.

### Chapter topics

The table below shows the information contained in this chapter for testing OC-3 tributaries.



If you cannot successfully complete these procedures, contact your next level of support.

## Testing recommendations for OC-3 tributaries

There are a number of possible configurations involving OC-3 tributaries for testing purposes, depending on the type of test set being used and the loopback configuration chosen.

The tests are applied where the signal originates and terminates, at the OC-3, DS1, DS3, or STS-1 rate. Listed below are two possible configurations where a signal can originate and terminate.

- OC-3 equipment connected to an OC-12 with an OC-3 tributary
- customer premises equipment (for example, ATM MUX [asynchronous transfer mode multiplexer]) connected to an OC-12 with OC-3 tributaries

These configurations can be combined in a single subnetwork, as shown in Figure 4-1 on page 4-4. To test the configurations, you must select a test setup at the near end and a loopback configuration at the far end. The system tests can be done using any combination of the originating and terminating signal listed above. For simplicity of testing, the test procedures assume the same signal is used at both the originating end (near end) and the terminating end (far end).

Consequently, if the tests are done using an OC-3/OC-12 SONET test set to supply an OC-3 originating signal at the near end, the loopbacks are shown at the OC-3 level at the far end. Similarly, if a DS1, DS3, or STS-1 test set is used to supply a signal by way of the near-end OC-3 equipment (for example, at an OC-3 Transport Bandwidth Manager shelf), the procedures show a loopback at the DS1, DS3, or STS-1 level.

Procedure 4-1 on page 4-5 describes how to set up the system for the end-to-end tests.

## Support of OC3c Concatenated Tribs with VTBM

The following table shows the optical circuit packs that support the OC3c tributaries:

**Table 4-1**
**Hardware Supporting OC3c Tributaries**

| Circuit pack name | Product Code (PEC) | Connector Type |
|---|---|---|
| OC-12 VTBM Enhanced LR | NT7E05 AF | FC |
| | NT7E05 AG | ST |
| | NT7E05 AH | SC |
| OC-12 VTBM Enhanced IR | NT7E05 BF | FC |
| | NT7E05 BG | ST |
| | NT7E05 BH | SC |

The PEC codes listed in the table above are backward compatible with the existing PEC codes as listed on the following table. Additionally, in order to support OC3c concatenated tributaries, the optical circuit packs are required to be equipped on the BLSR ring at the network element where the OC3c tributary originates as well as at the network element where the OC3c tributary terminates.

The initial VTBM optical circuit packs listed in the following table, shows those circuit packs that do not support concatenated OC3c tributaries but can be upgraded to support the OC3c tribs.

**Table 4-2**
**Hardware NOT Supporting OC3c Tributaries**

| Circuit pack name | Product Code (PEC) | Connector Type |
|---|---|---|
| OC-12 VTBM LR | NT7E05 AB | FC |
| | NT7E05 AC | ST |
| | NT7E05 AD | SC |
| OC-12 VTBM IR | NT7E05 BB | FC |
| | NT7E05 BC | ST |
| | NT7E05 BD | SC |

## OC-3 facilities not carrying traffic

When all the end-to-end tests have been completed, any OC-3 facilities not carrying traffic must be deactivated and deleted. To deactivate or delete one or more of the OC-3 facilities, perform Procedure 4-5 on page 4-17.

**Figure 4-1**
**Configurations of OC-3 tributaries**

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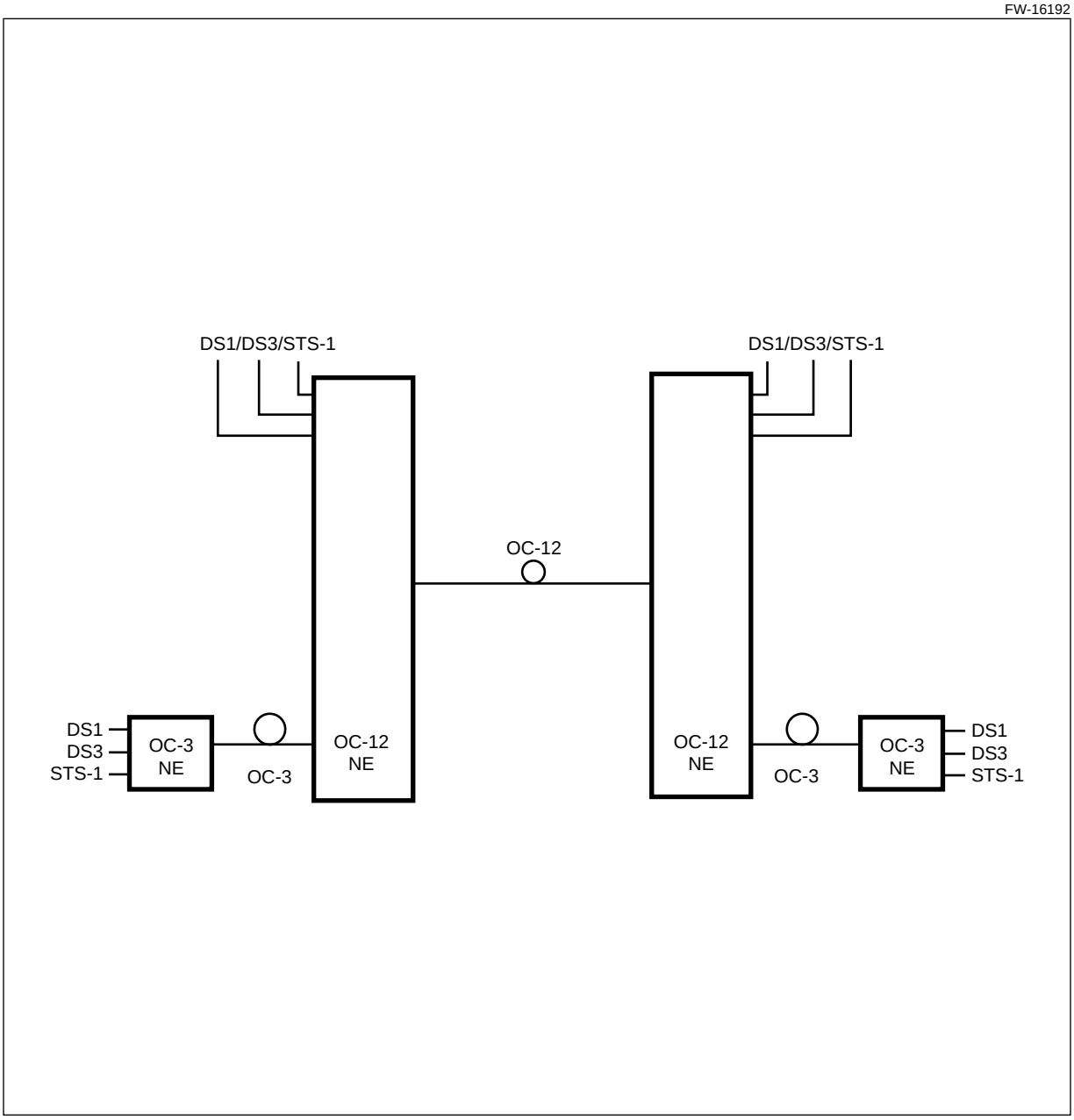


# Procedure 4-1
# Setting up the OC-3 tributaries for the end-to-end tests

Use this procedure to set up the OC-3 tributaries for the end-to-end tests. The configuration you choose depends on the type of test set you are using at the near-end, that is, an OC-3/OC-12 SONET test set at the near-end, a DS3/STS-1 test set at the near-end, a DS1 test set at the near-end, or an STS-1 test set at the near-end.

Figure 4-2 on page 4-11 shows the setup when using an OC-3/OC-12 SONET test set.

## Requirements

Before starting this procedure, the following requirements must be met.

- OC-12 system is fully commissioned and site tested according to *Commissioning Procedures*, 323-3001-220, and *Site Testing Procedures*, 323-3001-221. Both are in *Commissioning and Testing*, Volume 3B.
- high-speed (OC-12 rate) protection-switching tests are completed and the OC-12 line is in place
- external synchronization interface (ESI) tests are completed
- you are logged on to the network element user interface (NEUI) and are at the main menu level.

  ***Note 1:*** Use single-mode patchcords and optical attenuators in all applications or tests.

  ***Note 2:*** For accurate results, clean the optical connectors and verify the optical meter calibration. Be sure the fibers in the optical connectors are correctly mated.

  ***Note 3:*** If you are using an in-line mini-variable optical attenuator (mVOA), take care not to apply too much pressure when adjusting the attenuator screw as damage can result.

  ***Note 4:*** Two technicians are required to perform this procedure. One technician at the near-end site and one at the far end.

  ***Note 5:*** STS-1 connections must be provisioned in the Connection Manager tool if traffic is to be carried by low-speed tributaries.

**—continued—**

Procedure 4-1 (continued)
**Setting up the OC-3 tributaries for the end-to-end tests**

### Tools and materials (required for all test setups)

High precision variable optical attenuators (VOA) (for example, HP8158B) with single-mode optical test cords or in-line mini variable optical attenuator (mVOA)—as required

- one (1) optical meter (for 1310 nm and 1550 nm optics)
- one (1) VT100-compatible terminal with user interface cable

### Tools and materials for test setups using an OC-3/OC-12 SONET test set

- one (1) OC-3/OC-12 SONET test set (for example, the HP 37704A, or HP-75000 for STS-3C tests)
- two (2) attenuated optical test cords equipped with proper connectors

### Tools and materials for test setups using DS3/STS-1 test sets connected to OC-3 NE

- one (1) DS3 digital transmission test set (Tx), such as the Tau-Tron S5200D
- one (1) DS3 digital transmission test set (Rx), such as the Tau-Tron S5200E
- two (2) DS3 coaxial test cords equipped with proper connectors

### Tools and materials for test setups using STS-1 test sets connected to OC-3 NE

- one (1) STS-1 digital transmission test set (Tx and Rx), such as the HP 3770A SONET test set or equivalent
- two (2) STS-1 coaxial test cords equipped with proper connectors (to connect test sets to STS-1 termination panel)
- STS-1 coaxial cables (BNC-to-BNC or WECO-to-WECO) as required

### Tools and materials for test setups using DS1 test sets connected to OC-3 NE

- one (1) DS1 Tx-Rx test set, such as the Tau-Tron S5104 (Tx-Rx)
- two (2) DS1 coaxial test cords, NE-310-to-bantam connectors
- thirteen (13) DS1 bantam-to-bantam connectors (optional)

**—continued—**

Procedure 4-1 (continued)
**Setting up the OC-3 tributaries for the end-to-end tests**

# Action

| Step | Action |
|---|---|

**Test setup**

**1** The test setup depends on the type of test set you choose to use.

| If you are using an | Then go to |
|---|---|
| OC-3/OC-12 SONET test set | step 2 |
| DS1, DS3, or STS-1 test set at the OC-3 TBM | step 14 |

***Note:*** For OC-3 transport bandwidth manager (TBM) systems equipped for a mix of DS1, DS3, or STS-1 signals, you can perform the test using either the DS1, DS3, or STS-1 arrangement. It is not necessary to connect to a DS1, DS3, or STS-1. For a DS3, feed DS3 input signals to a DS3 mapper. The DS1s and DS3s should not be placed in a daisy chain. For an STS-1, feed the STS-1 input signals to an STS-1 interface card.

**Feeder Test**

**2** If an OC-3/OC-12 SONET test set is being used for these tests, set the following parameters or set the equivalent parameters of other types of OC-3/OC-12 test set:

**Receiver**

| | |
|---|---|
| Receive signal | OC-3 or STS-3C (not supported on test set HP 37704A for HP75000 only) |
| STS-1 SPE under test | 1 to 3 (according to which STS-1 signal of the available 3 is to be used for the test |
| Payload | DS1/DS3 |
| Framing | M13 |
| Pattern | 223-1 (this is a PRBS signal -Pseudo-random binary sequence) |

**—continued—**

Procedure 4-1 (continued)
**Setting up the OC-3 tributaries for the end-to-end tests**

| Step | Action | |
|---|---|---|
| | **Transmitter** | |
| | Transmit signal | OC-3 or STS-3C (not supported on test set HP37704A for HP75000 only or equivalent) |
| | Clock synchronization | External or looptimed |
| | STS-1 SPE under test | 1 to 3 (same setting as for the receiver) |
| | Payload | DS1/DS3 |
| | Framing | M13 |
| | Pattern | 223-1 (this is a PRBS signal) |

**3** Set up the test set to run in looptimed mode. If not possible, then connect the OC-3/OC-12 SONET test set to the building-integrated timing source (BITS).

**CAUTION**
**Risk of damaging the mini variable optical attenuator (mVOA)**
When using an mVOA, take care not to apply too much pressure when adjusting the attenuator screw, as damage may result.

**4** Connect a test cable with a VOA or in-line mVOA to the transmitter (OUT) of the SONET test set as shown in Figure 4-2 on page 4-11. Connect the other end to the optical power meter.

**5** Adjust the VOA/mVOA so that the level indicated by the following requirement is read on the optical power meter (a nominal value of -20 dBm is recommended):

| OC-3 circuit packs | Requirement |
|---|---|
| NT7E01 CA/CB/CC/CD | –32.0 dBm |
| NT7E01 DA/DB/DC/DD | –24.5 dBm |

**6** Disconnect the test cable from the optical power meter and connect it to the receiver of an OC-3 tributary for example, OC-3 tributary G3.

**—continued—**

Procedure 4-1 (continued)
**Setting up the OC-3 tributaries for the end-to-end tests**

| Step | Action |
|---|---|

**CAUTION**
**Risk of damaging the mini variable optical attenuator (mVOA)**
When using an mVOA, take care not to apply too much pressure when adjusting the attenuator screw, as damage may result.

**7** Connect a test cable with an mVOA to the transmitter (out) of the OC-3 tributary as shown in Figure 4-2 on page 4-11.

**8** Adjust the VOA/mVOA so that the level indicated by the following requirement is read on the optical power meter (a nominal value of -20 dBm is recommended):

| PEC | Module | Minimum receiver power ($P_{R\ min}$) |
|---|---|---|
| NT7E01CA/CB/CC/CD | OC-3 LR | –34.0 dBm |
| NT7E01DA/DB/DC/DD | OC-3 IR | –28.0 dBm |
| NT7E02KA/KB/KC/KD | OC-12 LR | –32.0 dBm |
| NT7E02LA/LB/LC/LD | OC-12 IR | –24.5 dBm |

**9** Disconnect the test cable from the optical power meter and connect it to the receiver of the SONET test set.

**10** Connect loopback connections as shown in Figure 4-2 on page 4-11 on the far end OC-3 circuit pack. Measure the optical power as described in steps 4 and 5.

**11** Reset the OC-3/OC-12 SONET test set at the near-end TBM.

*The test set displays 0 error, indicating traffic continuity.*

**12** Make sure the OC-3 tributaries to be tested are active.

**13** Proceed to Procedure 4-4 on page 4-15.

**—continued—**

Procedure 4-1 (continued)
**Setting up the OC-3 tributaries for the end-to-end tests**

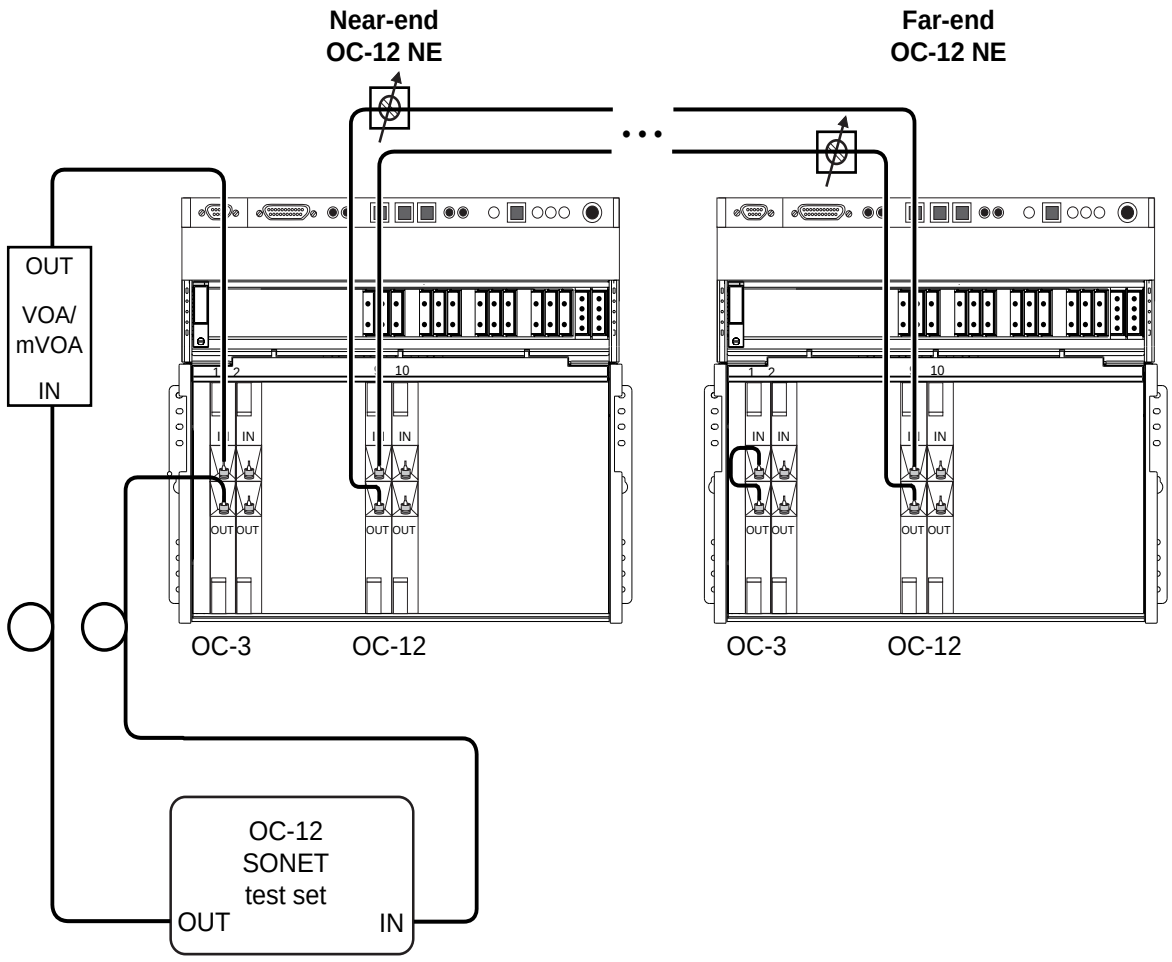
| Step | Action |
|---|---|
| | **OC3 Trib Test** |
| **14** | If the OC-3 tributary is connected to an OC-3 NE and tested in this configuration, connect an optical fiber with mVOA to the transmitter (OUT) of the OC-3 NE. Connect the other end of the fiber to the optical power meter. |
| **15** | Adjust the mVOA so the level is about -20dBm (see step 5). |
| **16** | Disconnect the optical fiber from the optical power meter and connect it to the receiver of the OC-3 tributary. |
| **17** | Connect an optical fiber with mVOA to the transmitter (OUT) of the OC-3 tributary. Connect the other end of the fiber to the optical power meter. |
| **18** | Adjust the VOA so the level is about -20 dBm (see step 5). |
| **19** | Disconnect the optical fiber from optical power meters and connect it to the receiver of the OC-3 NE. |
| **20** | Perform steps 10 to 12 and connect the DS1, DS3, or STS-1 test set to the OC-3 NE. |
| **21** | Go to Procedure 4-2 on page 4-12 or Procedure 4-3 on page 4-13. |

**—continued—**

Procedure 4-1 (continued)
**Setting up the OC-3 tributaries for the end-to-end tests**

**Figure 4-2**
**OC-3/OC-12 SONET test set connected to the near-end OC-3 tributary and looped back at the OC-3 level at the far end.**

FW-15302




***Note 1:*** If many OC-3 tributary cards are present in the OC-12 shelves, the OC-3 signal can be daisy-chained and looped back so all cards can be tested at the same time.
At one end, a daisy-chain can be done for OC-3 tributaries and at the other end, loopbacks can be done for OC-3 tributaries.

***Note 2:*** Loopbacks and daisy-chaining should not be done for protected pairs of OC-3 tributary circuit packs. For example, OC-3 G3 should not be daisy-chained to OC-3 G4.

**—end—**

# Procedure 4-2
# Measuring the DS1 bit-error rate (BER) for OC-3 tributaries (long-term test) using an OC-3 NE

Use this procedure to determine the DS1 bit error rate (BER) for a path involving an OC-3 tributary and to confirm that the operation is within specifications. For OC-3 tributaries that support mixed DS1, DS3, or STS-1 signals, only one signal (either a DS1, DS3, or STS-1) needs to be tested.

## Requirement

Before starting this procedure, set up the system according to Procedure 4-1 on page 4-5.

## Action

| Step | Action |
|---|---|

**1** Before performing this procedure, make sure the system is set up according to the configurations shown in Procedure 4-1 on page 4-5.

**2** Make sure the OC-3 tributary you are testing is active.

**3** Press the DS1 receiver test set Reset push-button.

*The display indicates 0 error.*

**4** Press the Single-Bit Inject Error button three times.

*Three total bit errors are displayed on the DS1 receiver test set.*

**5** Reset the DS1 receiver test set and monitor for 1 hour. There should be no errors for 14 DS1s monitored for an hour to be equivalent to a BER of $10^{-10}$.

| If the requirement | Then |
|---|---|
| is met | record the BER reading on the system testing form |
| is not met | sectionalize the daisy chain until the troubled line is found. This is achieved by halving the daisy chain and determining which half has the fault, and halving again until the faulty DS1 is found. |

**6** Clear the trouble and repeat steps 3 to 5. If further resolution is required, monitor at each LTE NE. This provides for transmission performance statistics for each direction of the OC-3 signal.

**7** Repeat steps 1 to 6 for each OC-3 tributary that includes DS1s.

***Note:*** If the tributary carries mixed DS1s, DS3s, and STS-1s, you only need to test either one DS1, DS3, or STS-1, not all rates. Procedure 4-3 must be done for tributaries that carry only DS3.

**8** After this test is completed, return equipment to its original state.

**—end—**

# Procedure 4-3
# Measuring the DS3 or STS-1 end-to-end timed BER for OC-3 tributaries (long-term test) using an OC-3 NE

Use this procedure to determine the DS3 or STS-1 bit error rate (BER) for a path involving an OC-3 tributary and to confirm that the operation is within specification. For OC-3 tributaries that support mixed DS1, DS3, and STS-1 signals, only one signal (either a DS1, DS3, or STS-1) needs to be tested.

## Requirement

Before starting this procedure, you must set up the system according to Procedure 4-1.

## Action

| Step | Action |
|---|---|
| **1** | Before performing this procedure, make sure the system is set up according to the configurations shown in Procedure 4-1. |
| **2** | Press the DS3/STS-1 receiver test set Reset push-button.<br>*The display indicates 0 error.* |
| **3** | Press the Single-Bit Inject Error button three times.<br>*Three total bit errors are displayed on the DS3/STS-1 receiver test set.* |
| **4** | Reset the DS3/STS-1 receiver test set and monitor for 1 hour. No errors should occur for one DS3 or STS-1 monitored for an hour, equivalent to a BER of $10^{-10}$. |

| If the requirement | Then |
|---|---|
| is met | record the BER reading on the system testing form. |
| is not met | sectionalize the daisy chain until the troubled line is found. This is achieved by halving the daisy chain and determining which half has the fault, and halving again until the faulty DS3 or STS-1 is found. |

| | |
|---|---|
| **5** | Clear the trouble and repeat steps 2 to 4. If further resolution is required, monitor at each LTE NE. This provides transmission performance statistics for both directions of the OC-3 tributary. |

**—continued—**

Procedure 4-3 (continued)
**Measuring the DS3 or STS-1 end-to-end timed BER for OC-3 tributaries (long-term test) using an OC-3 NE**

| Step | Action |
|---|---|
| **6** | Repeat steps 1 to 5 for each OC-3 tributary that includes a DS3 or STS-1. If the tributary carries mixed DS1s, DS3s, and STS-1s you only need to test either one DS1, DS3, or STS-1, not all rates. Procedure 4-2 must be done for tributaries that carry only DS1s. |
| **7** | After completing this test, return equipment to its original state. |

**—end—**

# Procedure 4-4
# Measuring the bit error rate (BER) for OC-3 tributaries (long-term test) using a SONET test set

Use this procedure to determine the OC-3 bit error rate (BER) for a path involving an OC-3 tributary and to confirm that the operation is within specifications. An OC-3/OC-12 SONET test set is used. All the STSs for a given OC-3 tributary can be tested by looping them back as shown in Figure 4-2 on page 4-11.

## Requirement

Before starting this procedure, set up the system according to Procedure 4-1.

## Action

| Step | Action |
|---|---|
| **1** | Before performing this procedure, make sure the system is set up according to the configurations shown in Procedure 4-1. |
| **2** | Make sure the OC-3 tributary you are testing is active. |
| **3** | Clear all error counts on the SONET test set.<br>*The display indicates 0 error.* |
| **4** | Inject three single bit errors on the path payload.<br>*Three total bit errors are displayed on the SONET test set.* |
| **5** | Repeat step 3. Use the SONET test set to monitor the line, section, and path errors. Make sure no errors are counted. Monitor for one hour. Make sure the BER (bits in error) is not greater than $10^{-10}$. |

| If the requirement | Then |
|---|---|
| is met | record the BER reading on the system testing form |
| is not met | sectionalize the fault by moving the optical loopback closer to the near end OC-3 circuit pack. This is achieved by looping back the transport optic path starting at the far end NE and moving one hop at a time towards the near end NE. |

| | |
|---|---|
| **6** | Repeat steps 3 to 5 until the fault is isolated. Correct the fault and repeat steps 3 to 5. |
| **7** | Repeat steps 1 to 6 for each OC-3 tributary. |

**—continued—**

Procedure 4-4 (continued)
**Measuring the bit error rate (BER) for OC-3 tributaries (long-term test) using a SONET test set**

**Step** **Action**

| If the tributary carries | Then |
|---|---|
| traffic originating from an OC-3 NE | perform Procedure 4-2 on page 4-12 or Procedure 4-3 on page 4-13 depending on the payload being carried on the OC-3 signal |
| mixed DS1s, DS3s, and STS-1s | you only need to test either one DS1, DS3, or STS-1 and not both rates. Procedure 4-3 on page 4-13 must be done for tributaries that carry only DS3. |

**8** After the test is completed, return the equipment to its original state.

**—end—**

# Procedure 4-5
# Deactivating and deleting OC-3 facilities not carrying traffic

Use this procedure to put the selected OC-3 facility out of service (deactivated) and null (deleted). In this state, no alarms are reported for the facility. Performance monitoring is also disabled. A confirmation is required to complete this operation.

When a facility is deleted, the state of that facility becomes “null”. The corresponding work area for the facility is not updated in real time and cannot be accessed again from another screen until the facility is added back into the system and selected again.

## Requirements

Before starting this procedure, you must:

- be logged in to the network element user interface (NEUI) and at the main menu level
- be familiar with the VT100-type NEUI. See *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.
- make sure no STS-1 connections are assigned to this OC-3 tributary. If some STS connections are assigned, it is not possible to put it out of service (OOS).
- Make sure for protected OC-3 tributaries that the OC-3 tributary facilities are deleted in pairs. For example, G1S and G2S, G3 and G4, G5 and G6, G7 and G8. In some cases, just the “protection” member of the pair is deleted. For example, G2S; G4; G6; or G8. You should not delete just the working member of a pair, for example, G1S; G3; G5; or G7 with the protection OC-3 remaining.

**—continued—**

Procedure 4-5 (continued)
**Deactivating and deleting OC-3 facilities not carrying traffic**

## Action

| Step | Action |
|---|---|
| **1** | Access the facility screen and select the facility. Enter:<br>**facility oc3 <circuit pack group>** ↵<br>where<br><circuit pack group> is g1s, g2s, g3, g4, g5, g6, g7, g8 or all for OC-3 tributaries on an OC-12 terminal or g3, g4, g5, g6, g7, g8 or all for OC-3 tributaries on a linear or ring ADM. |
| **2** | Deactivate the facility. Enter:<br>**chgstate oos** ↵<br>where<br>oos is out of service<br>*When prompted to confirm the command, enter:*<br>**yes** ↵<br>*When the selected OC-3 facility is deactivated, the OC3 Facility screen appears.* |
| **3** | Delete the facility from the system. Enter:<br>**delete** ↵<br>*When prompted to confirm the command, enter:*<br>**yes** ↵<br>*The OC3 Facility screen is displayed when an OC-3 facility is deleted from an OC-12 terminal shelf.* |

**—end—**

# Procedure 4-6
# OC-3 tributary protection switching tests

Use this procedure to test the protection-switching capabilities for the OC-3 tributaries on the OC-12 network element (NE). These tests must be performed for one OC-3 tributary at each terminal or ADM or ring-ADM site equipped with OC-3 tributaries.

These tests make sure the protection OC-3 switches of the OC-3 tributaries do not affect the other OC-3 tributaries, the OC-12 optical circuit pack groups, or the DS1, DS3, or STS-1tributaries on the NE.

> ***Note:*** If you are using an OC-12 SONET test set for the OC-3 tributary site tests, this procedure cannot be performed.

If the tributary under test is configured for unidirectional switching, you must also perform the protection-switching tests at the OC-3 terminal equipment. For example, if the tributary is connected to an OC-3 TBM shelf, perform the TBM OC-12 protection-switching tests according to Chapter 2 or Chapter 3 of this document.

## Requirements

Before starting this procedure, make sure the system is set up according to Figure 4-3 on page 4-26 or Figure 4-4 on page 4-27.

> ***Note:*** To speed up this test, two technicians with appropriate test equipment are needed (one technician at each switching end).

## Action

| Step | Action |
|---|---|
| **1** | Make sure the system is set up according to Figure 4-3 on page 4-26 or Figure 4-4 on page 4-27 and that traffic is on the odd-numbered group G1S, G3, G5, or G7 for the OC-3 tributary under test. |
| **2** | Make sure the OC-3 protection screen does not have a fail (F), request (R), active switch (*) or remote active switch (*R) indication on any of the `Lockout`, `Forced`, or `AutoSw` fields. |

**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

| Step | Action |
|---|---|
| **3** | Reset the error detector on the DS1, DS3, or STS-1 receiver test set. Ensure that the receiver test set monitors an error free signal. |
| | **OC-3 tributary manual switch** |
| **4** | Operate a manual switch from the active tributary to the protection tributary for the OC-3 under test by entering the following command:<br>**manual op <circuit pack group>** ↵<br>**yes** ↵<br>where<br><**circuit pack group**> is **g1s**, **g3**, **g5**, or **g7** (active tributaries)<br>*The traffic transfers to the standby circuit pack corresponding to the circuit pack under test; for example, if the circuit pack being tested is G3, enter G3 to switch to G4. The green LED for the standby circuit pack is lit. For bidirectional switching, the green LED on the originally active circuit pack is not lit. For unidirectional switching, the green LED on the originally active circuit pack is lit.*<br>*The traffic is error free except for an expected burst of errors at the moment of the protection switch. For OC-3 tributaries, the errors show up on the DS1 or DS3/STS-1 test sets. Reset all test sets.*<br>*The DS1, DS3, or STS-1 traffic is unaffected.* |
| **5** | Operate a manual switch from the protection tributary back to the active tributary for the OC-3 tributary under test by entering the following command:<br>**manual op <circuit pack group>** ↵<br>**yes** ↵<br>where<br><circuit pack group> is **g2s**, **g4**, **g6**, or **g8** (protection tributaries). For example, to switch from G4 to G3, enter G4.<br>*The traffic transfers back to the circuit pack group originally active in step 4.* |
| | **OC-3 tributary forced switch** |
| **6** | Make sure the channel under test is alarm free and that there are no active lockouts. Verify that the DS1, DS3, STS-1 error detector (as equipped) monitors an error free signal. |

**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

| Step | Action |
|---|---|
| **7** | Operate a forced switch by entering the following command:<br>**forced op <circuit pack group>** ↵<br>**yes** ↵<br>where<br><circuit pack group> is g1s, g3, g5, or g7 (active tributaries). For example, to switch from G3 to G4, enter G3.<br>*The traffic transfers to the protection circuit pack corresponding to the circuit pack under test. The green LED for the protection circuit pack is lit. For bidirectional switching, the green LED on the originally active circuit pack is not lit. For unidirectional switching, the green LED on the originally active circuit pack is lit.*<br>*The traffic is error free except for an expected burst of errors at the moment of the switch. For OC-3 tributaries, the errors show up on the DS1 or DS3/STS-1 test sets. Reset all test sets.*<br>*The DS1, DS3, or STS-1 traffic is unaffected.*<br>*The user interface protection screen has an asterisk (*) under the Forced switch field (active) for the working circuit pack (for example, G3).* |
| **8** | Release the forced switch by entering the following command:<br>**forced re <circuit pack group>** ↵<br>**yes** ↵<br>where<br><circuit pack group> is g1s, g3, g5, or g7 (active tributaries) as entered in the previous step<br>*The traffic does not revert to the originally active tributary (for example, G3).*<br>*The asterisk (*) is replaced by a dot (.) under the Forced switch field for the working circuit pack, for example, G3.*<br>*The DS1, DS3, or STS-1 continuity is maintained as measured at the test set.*<br>*The DS1, DS3, or STS-1 traffic being measured on any other OC-3 tributary is unaffected.* |

**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

| Step | Action |
|---|---|
| | **OC-3 tributary lockout** |
| **9** | Make sure the channel under test is alarm free and that there are no active lockouts. Verify that the DS1, DS3, or STS-1 error detector (as equipped) monitors an error free signal. |
| **10** | Operate a lockout by entering the following command. OC-3 lockouts only apply to the working, or odd-numbered, circuit pack groups:<br>**lockout op** ↵<br>**yes** ↵<br>*The traffic transfers back to the working circuit pack; for example, to G3 from G4. The green LED from that circuit pack is lit and the green LED on the other circuit pack is not lit.*<br>*The user interface protection screen has an asterisk (*) under the Lockout field (active).*<br>*The Maintenance Interface LckOut LED is lit.*<br>*The DS1, DS3, or STS-1 traffic is unaffected.* |
| **11** | Disconnect the receive fiber on the working (odd-numbered) circuit pack group; for example, G3.<br>*No protection switch takes place.*<br>*The OC-3 traffic is lost.*<br>*The shelf and bay indicate critical alarms. Alarm indications are displayed on the user interface screen.*<br>*The DS1, DS3, or STS-1 traffic is unaffected.* |
| **12** | Release the lockout by entering the following command:<br>**lockout re** ↵<br>**yes** ↵<br>*The traffic should switch to the protection circuit pack, for example, G4, thereby reestablishing continuity.*<br>*The critical alarm indications for the shelf and bay remain because of the loss of signal on G3.*<br>*The user interface screen shows an "Rx loss of signal" alarm for the protection channel.* |
| **13** | Reconnect the optical fiber.<br>*The alarms should clear, except for any performance alarms.*<br>*The traffic should not revert to the odd numbered circuit pack; for example, G3.* |

**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

| Step | Action |
|---|---|
| | **OC-3 tributary automatic switch (signal fail)** |
| **14** | Make sure the channel under test is alarm free and that there are no active lockouts. Verify that the DS1, DS3, or STS-1 error detector (as equipped) monitors an error free signal. |
| **15** | Perform a manual switch from the standby (even-numbered) channel to the working (odd-numbered) channel (for example, G3) by entering the following commands:<br>**manual op <circuit pack group>** ↵<br>**yes** ↵<br>where<br><circuit pack group> is g2s, g4, g6, or g8 (protection tributaries). For example, to switch from G4 to G3, enter G4. |
| **16** | Disconnect the receive fiber on the active OC-3 circuit pack; for example, G3. Verify that the traffic switches to the standby circuit pack.<br>*The traffic is restored.*<br>*The OC-3 circuit pack's loss of signal (LOS) LED is lit.*<br>*The user interface protection screen has an asterisk (*) under the AutoSw field (active).*<br>*Alarm indications are displayed on the user interface screen.* |
| **17** | Reconnect the receive fiber.<br>*All alarms clear, except for the performance monitoring alarms that may be raised because of surpassed threshold values.*<br>*The traffic does not revert to the original working channel.*<br>*The traffic is error free (except for an expected burst of errors at the moment of the switch). For OC-3 tributaries, the errors show up on the DS1, DS3, STS-1 test sets. Reset all test sets.* |
| | **OC-3 tributary automatic switch (signal degrade)** |
| **18** | Make sure the channel under test is alarm free and that there are no active lockouts. Verify that the DS1, DS3, or STS-1 error detector (as equipped) monitors an error free signal. |

**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

| Step | Action |
|---|---|
| **19** | Perform a manual switch from the protection (even-numbered) channel to the working (odd-numbered) channel (for example, G3) by entering the following commands:<br>**manual op <circuit pack group>** ↵<br>**yes** ↵<br>where<br><circuit pack group> is g2s, g4, g6, or g8 (protection tributaries). For example, to switch from G4 to G3, enter G4.<br>*The OC-3 protection screen indicates that the odd numbered circuit pack; for example G3, is active and the even numbered circuit pack, for example G4, is the standby.* |
| **20** | Verify the signal degrade threshold value by entering the following commands:<br>**facility oc3 <circuit pack group>** ↵<br>**query** ↵<br>where<br><circuit pack group> is g1s, g3, g5, or g7 (working tributaries) as entered in the previous step (you can enter g1s, g2s, g3, to g8, to verify the thresholds for any of the OC-3 tributaries equipped on the system or all to verify the thresholds of all OC-3 tributaries. |
| **21** | While monitoring the BER reading on the DS1, DS3, or STS-1 error detector (as equipped), slowly increase the attenuation by adjusting the mVOA (turn the screw clockwise) of the patch cord connected to the tributary under test (for example, G3) until an OC-3 protection switch occurs.<br>*The BER reading on the DS1, DS3, or STS-1 error detector (as equipped) should read approximately the same value as shown on the network element user interface (NEUI) just before the switch occurred.*<br>*Reset the test set for the tributary and verify that it is monitoring an error free signal.*<br>*The user interface screen indicates the signal degrade condition and the automatic switch.*<br>*A minor alarm should be active.* |

**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

| Step | Action |
|---|---|

**22** Adjust the mVOA by turning screw counterclockwise (decreasing the attenuation) to return it to its original position. Check attenuation is -20db with optical power meter.

**23** The signal degrade alarm condition should clear after a few seconds. The OC-3 protection switch should not revert.

**24** Operate a manual switch to restore the equipment to its original setup (for example, from G4 to G3) by entering the following command:

**manual op <circuit pack group>** ↵
**yes** ↵

where

| | |
|---|---|
| <circuit pack group> | is g2s, g4, g6, or g8 (protection tributaries). For example, to switch from G4 to G3, enter G4. |

*The OC-3 protection screen indicates that the odd numbered circuit pack (for example, G3) is active and the even numbered circuit pack (for example, G4) is the standby.*

**25** Using a VOA or mVOA, set the optical receive level for permanent operation meeting the following requirements:

| OC-3 modules | Requirement |
|---|---|
| NT7E01 BA/BB/BC/BD | –28.0 ≤ optical power ≤ –8.0 dBm |

*Nominal value optical power approximately equal to -20 dBm.*

**26** Repeat steps 1 to 25 for each OC-3 tributary.

**27** If the tributary is configured for unidirectional switching, perform the protection-switching tests at the OC-3 equipment providing the signal. For example, if the tributary is connected to an OC-3 TBM terminal, perform the switching tests for OC-3 G1 and G2 on the OC-3 terminal.

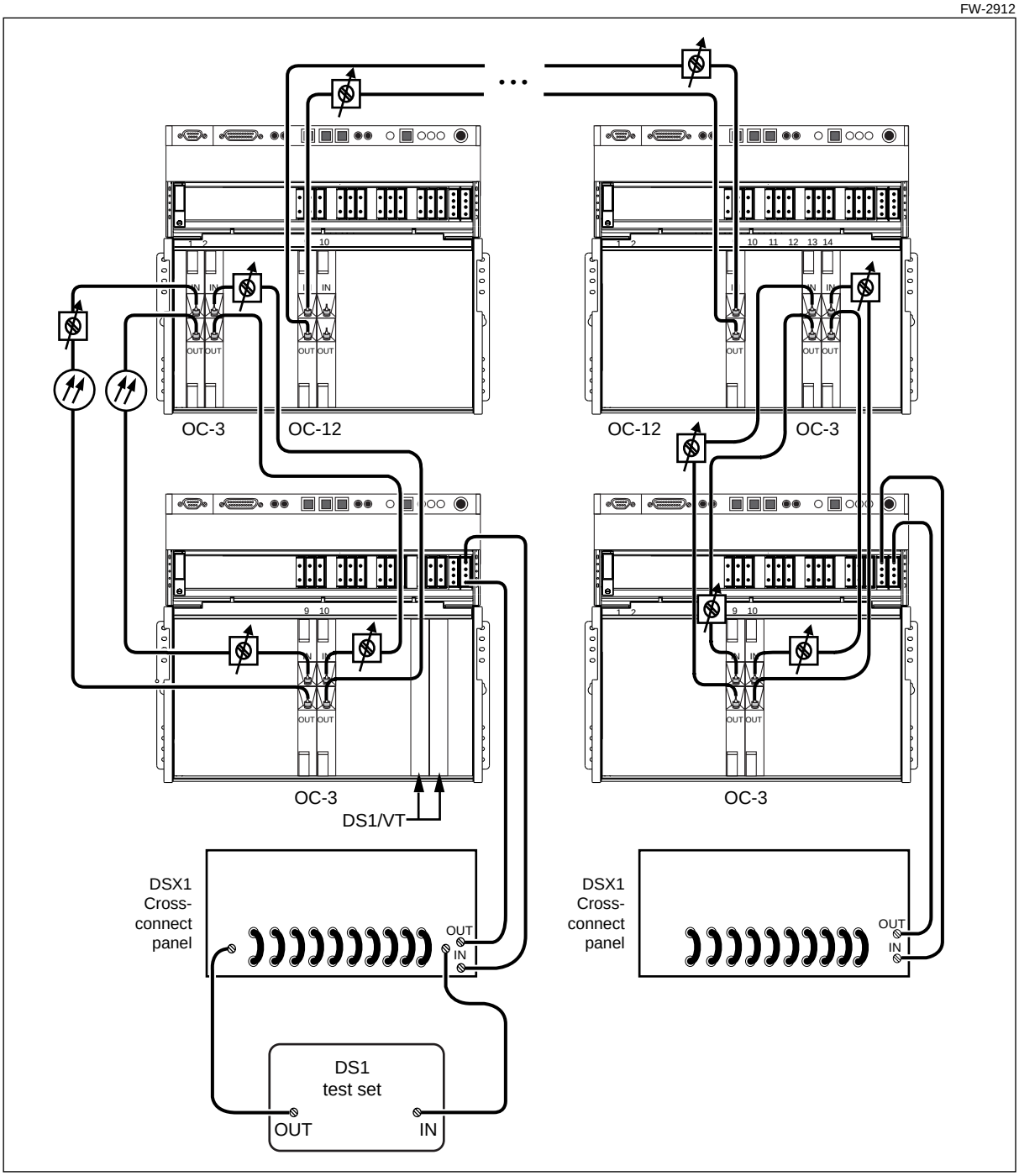
**28** Repeat steps 1 to 27 for each terminal and ADM in the subnetwork that is equipped with OC-3 tributaries.

**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

**Figure 4-3**
**OC-3 tributary protection switching test setup (using DS1s)**

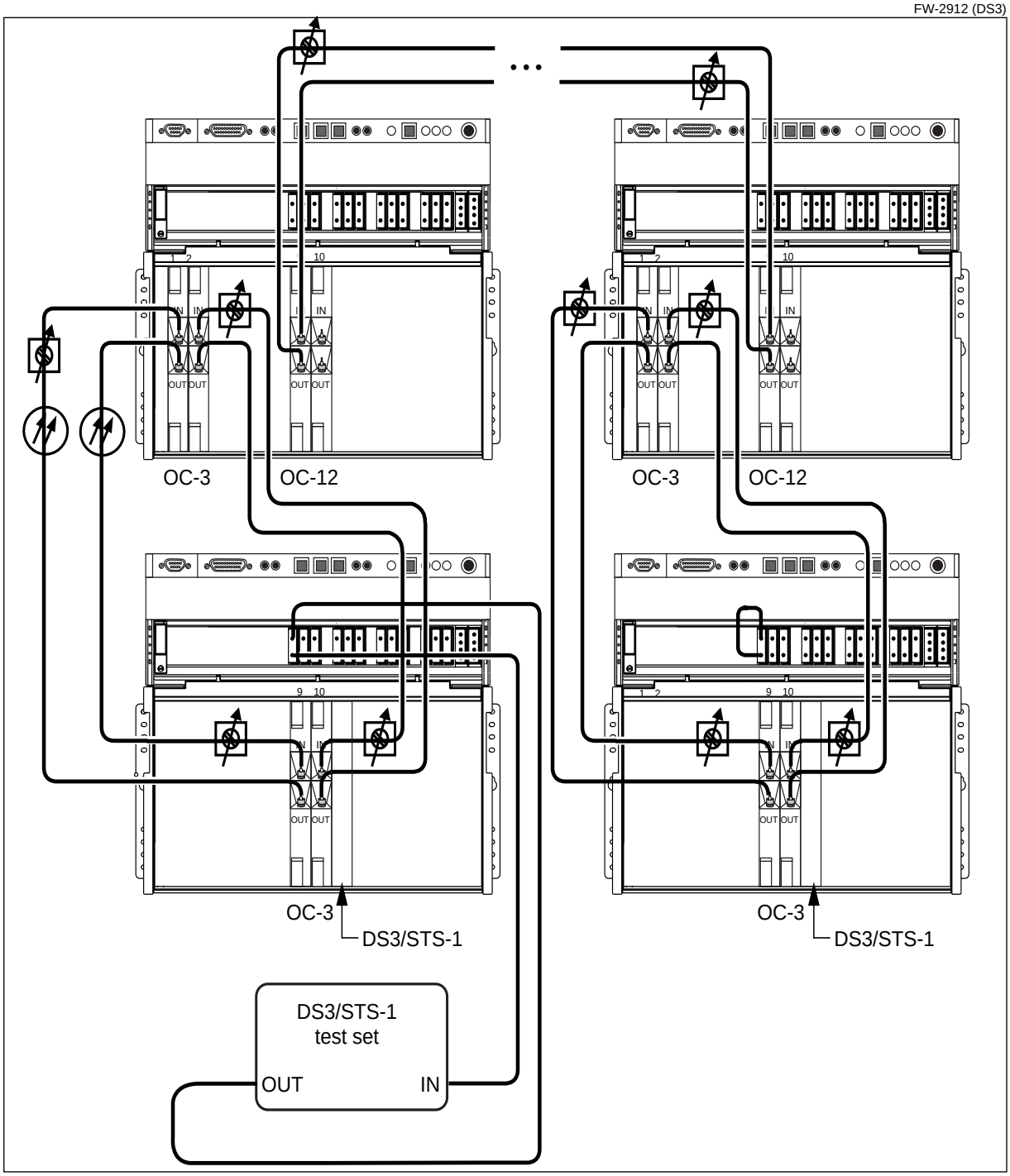
FW-2912




**—continued—**

Procedure 4-6 (continued)
**OC-3 tributary protection switching tests**

**Figure 4-4**
**OC-3 tributary protection switching test setup (using DS3s or STS-1s)**




**—end—**

# End-to-end tests for VTBM rings

This chapter has the procedures for performing end-to-end testing on a new VTBM ring. The VTBM ring is a bidirectional line-switched ring (BLSR) with virtual tributary management.

## How to use this chapter

Refer to the flow charts and task lists in Chapter 1 when using this chapter. These flow charts and task lists identify the procedures that must be performed in this chapter.

### Chapter topics

The table below shows the information contained in this chapter for end-to-end tests for VTBM rings.



When all the system tests are completed, the DS1, DS3, and STS-1 facilities not carrying traffic must be deactivated and deleted.

***Note:*** Loopback and daisy chain connections are used only during commissioning and testing of a new system, and must *never* be used once the VTBM ring is in service. Daisy chaining is only used for testing continuity and should never be used during protection switching tests.

# Procedure 5-1
# **Measuring the received optical power**

Use this procedure to verify that the optical signal transmitted at one network element (NE) is received at the proper level at a second NE. Repeat this procedure at each new with optical cards installed.

This procedure can be performed by one technician. However, it is more efficient to have two technicians and two sets of equipment, one at each end of the optical link.

## Requirements

The following requirements must be met before starting this procedure.

- transmit optical patch cords must be connected to the optical interface circuit packs (transmit connectors) at all NEs in the ring, so that optical signals are being sent from each NE. Receive optical patch cords need not be connected to their respective optical interface circuit packs.
- the NEs in this system must not be carrying customer traffic

The following equipment is required when two technicians perform this procedure:

- an optical power meter, Photodyne 17XTA or equivalent (one at each end of the optical link), is correctly calibrated using the manufacturer's instructions
- telephone link between the two NEs under test
- two (2) VT100-compatible terminals (one at each NE), connected to the NE
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 to record testing information

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

**—continued—**

Procedure 5-1 (continued)
**Measuring the received optical power**

## Action

| Step | Action |
|---|---|

**1** Log in to the network element user interface (NEUI).

Optical lockout prevents protection switching during testing. Set up a lockout as follows:

| If the NE is equipped with | Then go to |
|---|---|
| NT7E01 OC-3 optical interface | step 2 |
| NT7E02 OC-12 optical interface | step 2 |
| NT7E05 OC-12 VTBM optical interface | step 3 |

**2** Lockout the primary OC-3/OC-12 circuit pack to prevent optical protection switching during provisioning and testing, by entering:

**pr; dp <oc3** or **oc12>** ↵

*The detailed OC-3 /OC-12 protection screen is displayed.*

**lockout op** ↵

**y** ↵

*When a lockout is operated, the screen displays an asterisk (*) in the Lockout column. The banner line is also updated under the Lockout column, and a "Lockout request" alarm is raised.*

Skip to step 4.

**3** Lockout the OC-12 VTBM circuit pack to prevent optical protection switching during provisioning and testing, by entering:

**pr; dp oc12 g1** ↵

*The OC-12 Protection screen is displayed.*

**lockout op w g1** ↵

**y** ↵

**lockout op w g2** ↵

**y** ↵

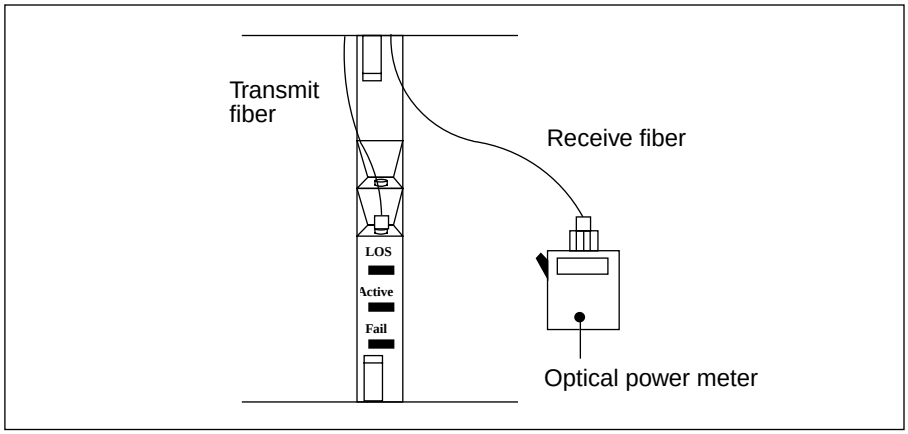
*Asterisks are displayed in the LcktW column for units G1 and G2.*

**—continued—**

Procedure 5-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|

**4** Disconnect the receive patch cord from the OC-3/OC-12 circuit pack under test and connect it to the optical power meter, as shown below.




**5** If the patch cord is equipped with a mini variable optical attenuator (mVOA), reduce the attenuation to maximize the received signal.

**6** Measure the received optical power.

*The measured value must be greater than or equal to the following:*

| PEC | Module | Minimum receiver power ($P_{R\ min}$) |
|---|---|---|
| NT7E01CA/CB/CC/CD | OC-3 LR | – 34.0 dBm |
| NT7E01DA/DB/DC/DD | OC-3 IR | – 28.0 dBm |
| NT7E02KA/KB/KC/KD | OC-12 LR | – 32.0 dBm |
| NT7E02LA/LB/LC/LD | OC-12 IR | – 24.5 dBm |
| NT7E05AB/AC/AD | OC-12 VTBM LR | – 29.5 dBm |
| NT7E05BB/BC/BD | OC-12 VTBM IR | – 28.0 dBm |
| ***Note***: The above values for the OC-12 VTBM optical interface circuit packs are for a Nortel-to-Nortel proprietary link. For a link meeting the Bellcore Midspan-meet specification, the following values apply. | | |
| NT7E05AB/AC/AD | OC-12 LR VTBM | – 28.0 dBm |
| NT7E05BB/BC/BD | OC-12 IR VTBM | – 28.0 dBm |

**—continued—**

Procedure 5-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|

**CAUTION**
**Risk of connector damage**
Make sure that the optical connections are clean and correctly connected. Follow the procedure for cleaning and assembling connectors in *Site Testing Procedures,* 323-3001-221, in *Commissioning and Testing*, Volume 3B.

**7** If the requirement is not met, carefully clean the fiber connectors.

If the requirement is still not met, verify the optical meter calibration, the fiber pigtail connections, mVOA setting, the fiber link, and the OC-3/OC-12 transmitter at the other end. Repeat from step 6.

**8** Record the received optical power level on the System Test Results Form.

**9** Reduce the received optical power to the level desired for system operation by adjusting the mVOA on the fiber pigtail (so that the receive signal is between –15 dBm and –28 dBm; –20 dBm is the suggested level).

**CAUTION**
**Risk of increased optical errors**
Received optical power should not exceed the overload levels for optical interfaces meeting Nortel-to-Nortel proprietary links:

| | |
|---|---|
| NT7E01 OC-3 LR: | – 10.0 dBm |
| NT7E01 OC-3 IR: | – 8.0 dBm |
| NT7E02 OC-12 LR: | – 7.0 dBm |
| NT7E02 OC-12 IR: | – 4.0 dBm |
| NT7E05 OC-12 VTBM LR: | 0.0 dBm |
| NT7E05 OC-12 VTBM IR: | 0.0 dBm |

These overload levels also apply to optical interfaces in a Bellcore TR-NWT-000253 Midspan-meet specification, with the following exceptions:

| | |
|---|---|
| NT7E05 OC-12 VTBM LR: | – 8.0 dBm |
| NT7E05 OC-12 VTBM IR: | – 8.0 dBm |

**—continued—**

Procedure 5-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|

**CAUTION**
**Risk of damage to the optical receiver**
For the NT7E02 OC-12 long-reach (LR) interface unit, received optical power must not exceed the following safe level: **– 6.0 dBm**. Refer to *Site Installation Planning and Engineering*, 323-3001-200, in the *Engineering, Configuration, and Ordering Guide*, Volume 1.

There are no damage levels for NT7E01 IR and LR, NT7E02 IR, and NT7E05 IR and LR optical interfaces.

**10** Record the attenuated received optical power level on the System Test Results Form.

**11** Reconnect the fiber pigtail to the receive connector on the optical interface circuit pack.

**12** Repeat steps 4 through 11 for each optical receiver.

**13** Remove the optical lockout:

| If the NE is equipped with | Then go to |
|---|---|
| NT7E01 OC-3 or NT7E02 OC-12 optical interface | step 14 |
| NT7E05 OC-12 VTBM optical interface | step 15 |

**14** Release the lockout from the primary optical circuit pack:

**pr; dp <oc3** or **oc12>** ↵

*The detailed OC-3 /OC-12 protection screen is displayed.*

**lockout re** ↵

**y**↵

*When a lockout is released, the screen displays a period (.) in the Lockout column. The banner line is also updated under the lockout column, and the "Lockout request" alarm is cleared.*

You are finished with this procedure.

**—continued—**

Procedure 5-1 (continued)
**Measuring the received optical power**

| Step | Action |
|---|---|
| **15** | Release the lockout of the OC-12 VTBM circuit packs, by entering:<br>**pr; dp oc12 g1** ↵<br>*The OC-12 Protection screen is displayed.*<br>**lockout re w g1** ↵<br>**y**↵<br>**lockout re w g2** ↵<br>**y**↵<br>*Periods replace the asterisks in the LcktW column for units G1 and G2.*<br>**—end—** |

# Procedure 5-2
# Checking the control network (CNet) and data communications channel (DCC) error statistics

This procedure checks the control network (CNet) and data communications channel (DCC) error statistics after fiber connections are made but prior to putting the system in service. The tests check the receive fibers and must be performed for each network element (NE) in the system.

It is necessary to make sure the facilities carrying data communications operate correctly. Poor facilities can result in lower data throughput, longer delay, and, in severe cases, communications failure during operations, administration, maintenance, and provisioning (OAM&P).

Commands entered using the data communications user interface only affect the network element where the command is entered. That is, one end of the bi-directional data communications.

#### Control Network (CNet)

The CNet is a local-area network (LAN) used to interconnect system NEs at one site (by way of RS232-C cables) for OAM&P purposes. A SONET DCC bridge can be used to link SDCCs by way of control network connections. For engineering limits for control network connections, see *System Specifications*, 323-3001-180, in *Description*, Volume 2B.

For CNet ports, this test monitors the number of errors that occur in the CNet communications. The CNet should be checked whenever the CNet configuration is changed or new cables or terminators are installed.

#### SDCC

The system supports synchronous optical network (SONET) section data communications channels (SDCCs) over the fibers between NEs. By default, channels are assigned to the primary transport lines, but an SDCC can also be assigned to an OC-3 tributary.

For SDCC ports, this test monitors the number of errors that occur in the frames of the communications protocol used by the DCCs. This communications protocol is called LAPD (link access protocol for integrated services digital network D channel). The DCCs should be checked whenever a new shelf processor is installed and when the optics are aligned.

**—continued—**

Procedure 5-2 (continued)
**Checking the control network (CNet) and data communications channel (DCC) error statistics**

## Requirements

The following requirements must be met before starting this procedure.

- make sure all other system tests are performed for the system, including the bit-error rate (BER) tests
- be logged in the network element user interface (NEUI) at the main menu level. For an overview of the NEUI, see *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.

## Action

| Step | Action |
|---|---|
| **1** | At the command input (CI) area, enter the following commands<br>**quit all** ↵<br>**port** ↵<br>**cnet stats** ↵<br>**dcc stats** ↵ |
| **2** | Write down the values for the current statistics (stats). Allow the statistics to accumulate for a period of time. A minimum of 1 hour is recommended. In steps 3 and 4, you check the deltas between the start and finish values: |
| **3** | At the command input (CI) area, enter the following command:<br>**cnet stats** ↵<br>*The statistics accumulated are displayed. Any differences (deltas) in the statistics indicate accumulated errors/stats.*<br>Deltas other than zero for “TBL errors” or “Tokens failed” indicate that a CNet connection is introducing errors.<br>The most likely causes are a bad cable, a bad or missing terminator, or a CNet engineering limit that is exceeded. See *Bay in Central Office Installation Manual —ABM*, 323-3001-201, and *Bay in Central Office Installation Manual —TBM*, 323-3001-202, for installation of CNet cables and terminators. See *System Specifications*, 323-3001-180, in *Description*, Volume 2B for details on the engineering limits for control network cable connections. |

**—continued—**

Procedure 5-2 (continued)
**Checking the control network (CNet) and data communications channel (DCC) error statistics**

| Step | Action |
|---|---|
| **4** | At the command input (CI) area, enter the following commands:<br>**dcc stats** ↵<br>*The statistics accumulated are displayed. Any differences represent error/stat deltas.*<br>Deltas other than zero for “Frame Errors” on any parts, indicate a problem affecting the link access protocol - D channel, (LAPD) of the data communications channel (DCC).<br>The most likely cause is a problem on the optics corresponding to the DCC, that is, the optics circuit pack group, a fiber, or a fiber connection. Check the performance-monitoring statistics for the optics. See *Performance Monitoring Procedures*, 323-3001-520, in *Maintenance*, Volume 5C.<br>If the performance-monitoring statistics do not indicate a problem on the optics, replace the shelf processor. See *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C, for instructions.<br>**—end—** |

# Procedure 5-3
# Setting up for the progressive end-to-end tests

Use this procedure to set up the test sets and the equipment in order to perform the progressive end-to-end tests. These tests verify the timeslot assignment feature and bit-error rate (BER) for the links between ring nodes as nodes are progressively added to the ring. Refer to Figure 5-1 on page 5-13 for the test setup for a five-node ring.

During these tests, an automatic switch is active whenever the ring is not closed.

## Requirements

The following requirements must be met before starting this procedure.

- make sure that one technician is at each ring node for the link under test
- choose one node in the ring as the starting point of the tests. It is useful to choose the node housing the primary operations controller (OPC) as the starting node. From this point, the ring is built node by node, until the ring is closed. As each node is brought into the ring, the progressive end-to-end tests are performed between the starting node and the node brought into the ring (see Figure 5-1 on page 5-13).
- for BER testing, make sure one DS1, DS3, or STS-1 facility is looped back as shown in Figure 5-2 on page 5-16. If this ring is VT-managed, then it can be a DS1 loopback or STS-1 loopback.
- if you are unfamiliar with OPC tools, OPC procedures for opening and closing an OPC tool, and logging in and out of the OPC and network element user interfaces (NEUIs), then refer to the procedures in *Network Element User Interface Description*, 323-3001-300, and *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.
- have a copy of the OPC procedures. The OPC procedures describe how to use the Configuration Manager to configure a ring, and how to use the Connection Manager on the OPC to provision an STS or VT1.5 connection. Procedures are in *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.

**—continued—**

Procedure 5-3 (continued)
**Setting up for the progressive end-to-end tests**

### Tools and materials for DS3 tests

- one (1) DS3 digital transmission test set (Tx) (for example, Tau-Tron S5200D)
- one (1) DS3 digital transmission test set (Rx) (for example, Tau-Tron S5200E)
- two (2) DS3 coaxial test cords equipped with the type of connectors required to connect to the DS3 termination panel
- one (1) DS3 coaxial cable
- one (1) VT100-compatible terminal with user interface cable

### Tools and materials for STS-1 tests

- one (1) STS-1 digital transmission test set (Tx and Rx) (for example, HP 37704A SONET test set or equivalent)
- two (2) STS-1 coaxial test cords equipped with the type of connectors required to connect to the STS-1 termination panel
- STS-1 coaxial cables (BNC-to-BNC or WECO-to-WECO) as required
- one (1) VT100-compatible terminal with user interface cable

### Tools and materials for DS1 tests

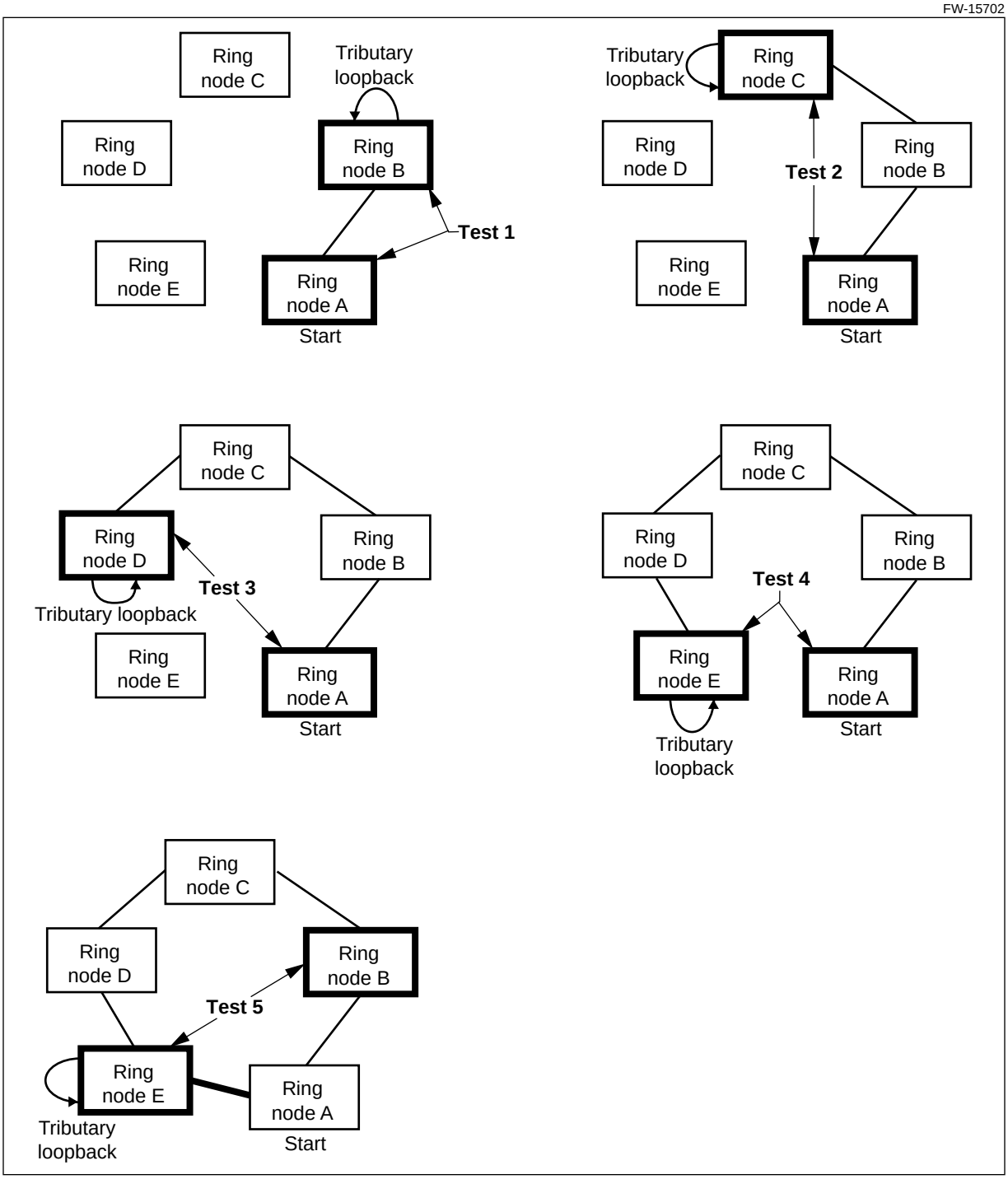
- one (1) DS1 Tx-Rx test set (for example, Tau-Tron S5104)
- two (2) DS1 electrical test cords
- one (1) VT100-compatible terminal

**—continued—**

Procedure 5-3 (continued)
**Setting up for the progressive end-to-end tests**

**Figure 5-1**
**Setup for progressive end-to-end tests for a five-node ring**

FW-15702




**—continued—**

Procedure 5-3 (continued)
**Setting up for the progressive end-to-end tests**

## Action

| Step | Action |
|---|---|
| **1** | Choose a starting node as node A. It is recommended that this be the node housing the primary OPC. Connect the optics interfaces of the starting node to a neighboring node (this is considered node B in this example) as shown in Figure 5-2 on page 5-16. That is, connect node A optics G1 circuit pack group to node B optics G2. Do not connect fibers between G2 of node A and G1 of node B. |
| **2** | Log into the primary OPC and open the Configuration Manager. |
| **3** | Using the Configuration Manager tool , add nodes A and B into the ring as a closed ring. Then provision the node maps as if node A G1 is connected to node B G2 and node A G2 is connected to node B G1.<br><br>***Note:*** An automatic protection switch is active because there is no fiber link between node A G2 and node B G1. Expect LOS alarms on unequipped OC-12s. |
| **4** | At the starting ring node (node A), set the DS1, DS3, or STS-1 transmission test sets as follows:<br>• transmitter DS1/DS3 framed, PRBS (pseudo-random binary sequence), error-free, DSX level.<br>• receiver DS1/DS3 framed, PRBS, untimed, DSX level, total bit errors. |

**—continued—**

Procedure 5-3 (continued)
**Setting up for the progressive end-to-end tests**

| Step | Action |
|---|---|
| **5** | Connect the transmitter of the DS1, DS3, or STS-1 test set to any available DS1, DS3, or STS-1 at node A. For a fully provisioned shelf, the first available DS3 is the DS3 on DS3 mapper or STS-1 interface card G1, port 1 (see Figure 5-2 on page 5-16). |
| **6** | At node A, connect the receiver of the DS1, DS3, or STS-1 test set to the output of the DS1, DS3, or STS-1 chosen in step 5 (for example, G1 port 1 OUT, if you are using G1 port 1 IN). |
| **7** | At the far-end node (node B in the example shown in Figure 5-2 on page 5-16), connect a loopback on any available DS1, DS3, or STS-1 (for example, from G1 port 1 OUT to G1 port 1 IN). This feeds the output of the back into its input. |
| **8** | At the node housing the primary OPC module (usually the starting node) and using the Connection Manager tool of the OPC, provision connections for testing: |

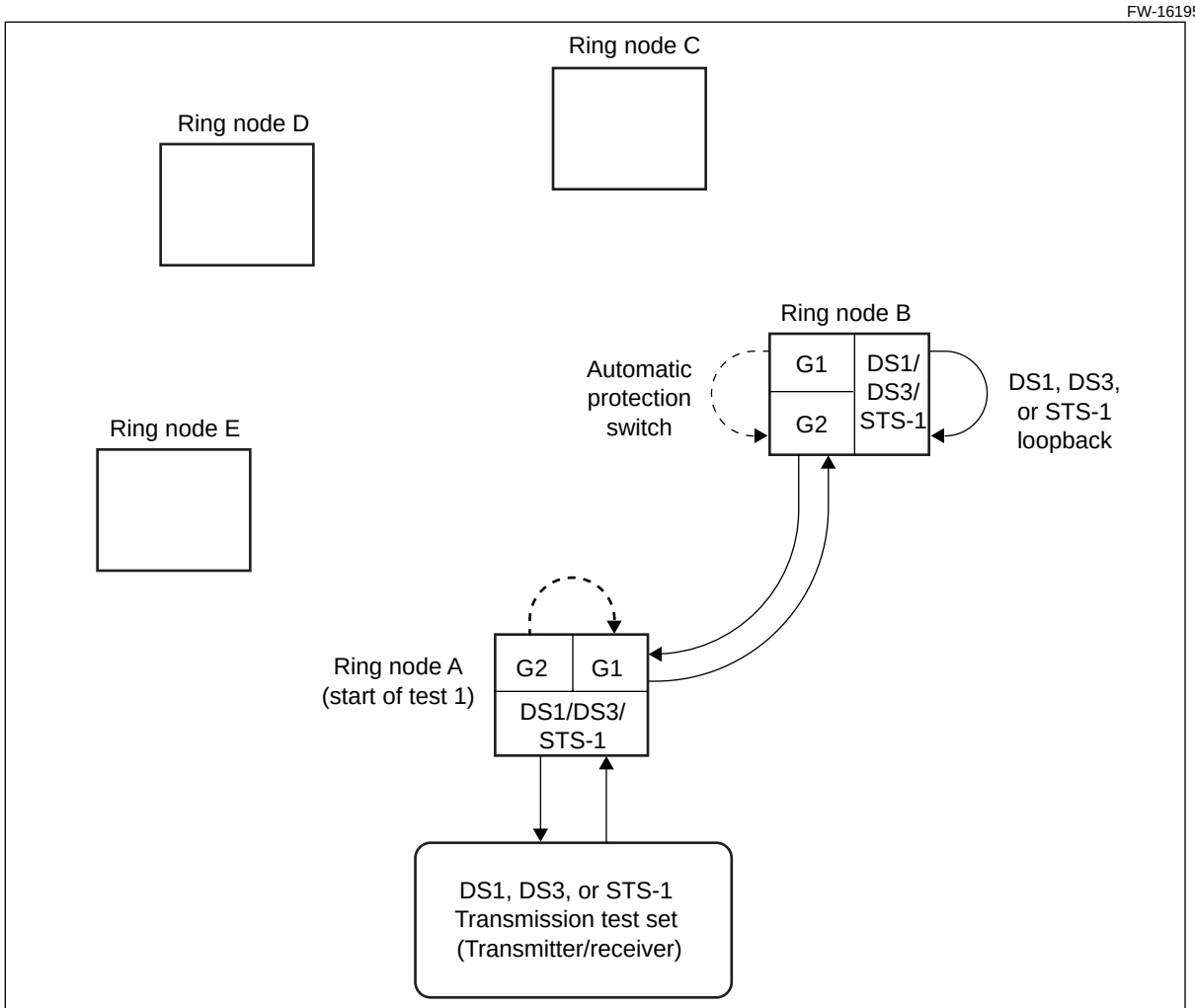
| If this ring is a | Then go to |
|---|---|
| VT-managed VTBM ring | step 9 |
| STS-managed VTBM ring | step 1 |

| | |
|---|---|
| **9** | Provision a VT1.5 connection (such as VT #1 in VT group #1) between the DS1 or STS-1s chosen at nodes A and B. Use STS-1 channel 1 and the short route.<br><br>Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B for detailed instructions on using the Connection Manager tool.<br><br>***Note:*** In order to open the STS Connection Manager tool, the Configuration Manager tool must be closed.<br><br>Go to step 2. |

**—continued—**

Procedure 5-3 (continued)
**Setting up for the progressive end-to-end tests**

**Figure 5-2**
**Progressive end-to-end test between nodes A and B in a five-node ring**




***Note 1:*** The Configuration Manager is provisioned as if the ring contained only ring ADM nodes A and B, with optical connections of:
- node A G1 connected to node B G2
- node A G2 connected to node B G1

***Note 2:*** An automatic protection switch is active because there is no fiber link between node A G2 and node B G1.

***Note 3:*** One DS1, DS3, or STS-1 facility is looped back between node A and node B.

***Note 4:*** One STS-1 (for DS1, DS3, or STS-1 testing) or VT1.5 (DS1 or STS-1) connection is provisioned between node A and node B.

**—continued—**

Procedure 5-3 (continued)
**Setting up for the progressive end-to-end tests**

| Step | Action |
|---|---|
| **1** | Provision an STS-1 connection between the DS3s chosen at nodes A and B. Use STS channel 1 and the short route.<br><br>In the example, you would provision G1 port 1 at node A to G1 port 1 at node B. Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B, for detailed instructions on how to add an STS-1 connection.<br><br>***Note:*** In order to open the Connection Manager tool, the Configuration Manager tool must be closed. |
| **2** | At node A, reset the DS1, DS3, STS-1 receiver test set and send a valid DS1, DS3, or STS-1 signal.<br><br>*The test set shows "in process" and displays 0 error. This shows that traffic continuity is established. It tests both directions of the STS-1 (VT1.5) connection.* |
| **3** | Make sure no minor, major, or critical alarms are present on the system, other than those expected as the result of the protection switch. The expected alarms are:<br><br>• "Section Rx loss of signal" on node A G2 optics and node B G1 optics<br>• "STS Rx unequipped" on any DS3 facilities that are in service (IS) but have no STS-1 connections<br>• "SONET DCC port link fail", depending on which optical circuit pack group is not connected to a fiber<br><br>If any other alarms are present, clear them according to *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.<br><br>**—end—** |

# Procedure 5-4
# Testing STS timeslot assignment and passthrough capabilities

Use this procedure to test the STS timeslot assignment and passthrough capabilities of the ring nodes under test. Continuity tests are performed on a small subset of the potential timeslot assignments for the nodes under test.

## Requirements

- Before starting this procedure, you must set up the two ring nodes being tested as described in Procedure 5-3 on page 5-11.
- Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B, for detailed instructions on how to edit or delete an STS connection.

## Action

| Step | Action |
|---|---|
| **1** | Log into the primary operations controller (OPC) and open the Connection Manager tool. If you do not know how to do this, refer to the *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning,* Volume 4A. |
| **2** | Delete the STS connection shown in the listing (as provisioned in Procedure 5-3 on page 5-11). The list should show STS channel 1 as the connection. |
| **3** | Add a new STS connection, incrementing the channel number by one (that is, if the STS-1 channel number was 1, add the new STS connection as channel 2). Use the same DS1, DS3, or STS-1 port and route you used previously. Press OK. |
| **4** | After the new connection is provisioned, reset the DS1, DS3, or STS-1 test set.<br>*It should show 0 error (traffic continuity).*<br>If not, troubleshoot according to the OC-12 Facility alarm clearing procedures in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. |
| **5** | Repeat steps 2 through 4 until you have tested channels 1 through 6. |
| **6** | Change the STS-1 channel to channel 1, then change the route to long. |
| **7** | Repeat steps 2 through 4 until you have tested channels 1 through 6 on the long route. |
| **8** | Delete the STS-1 connection using the Connection Manager. |

**—end—**

# Procedure 5-5
# Testing VT1.5 timeslot assignment and passthrough capabilities

Use this procedure to test the VT1.5 timeslot assignment between two nodes in a new VTBM ring. At the same time, this procedure also verifies the passthrough capabilities of any intervening nodes.

Continuity tests are performed on a small subset of the potential timeslot assignments for the nodes under test. A VT1.5 connection is provisioned between mapper or TIC ports at two nodes and continuity is checked. The VT1.5 connection is then reassigned to a new pair of equipment ports at each site, and continuity is checked. This test is repeated until all VT1.5 connections to each DS1/VT mapper (and the TIC circuit pack) are checked.

## Requirements

The following requirements must be met before starting this procedure.

- set up the two ring nodes being tested as described in Procedure 5-3
- provision all DS1 equipment and facilities for testing, including line buildout, frame format, and line coding parameters. To provision DS1 facilities, refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.
- be familiar with using operations controller (OPC) tools, as follows:
  - — using the Connection Manager to provision a VT1.5 connection. Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.
  - — logging in and out of the OPC and opening/closing an OPC tool. Procedures are in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.
- make available equipment and materials required to perform an end-to-end test using line cards, for testing a VT1.5 connection to a TIC port. Procedures using the OPC Provisioning Manager tool to provision a line card are in *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B. Testing procedures are in *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

**—continued—**

Procedure 5-5 (continued)
**Testing VT1.5 timeslot assignment and passthrough capabilities**

# Action

| Step | Action |
|---|---|

**1** Log into the primary OPC and open the Connection Manager tool.

Proceed according to the type of equipment terminating the VT1.5 channel:

| If you are testing between | Then go to |
|---|---|
| two DS1/VT mappers | step 2 |
| a DS1/VT mapper and a TIC port | step 10 |

**Testing a VT1.5 assignment between DS1/VT mappers**

**2** Provision a VT1.5 channel (such as VT#1, VT group #1, STS-1 channel #1) between DS1 ports at the two nodes under test.

**3** Connect the DS1 test sets as described in Procedure 5-3 on page 5-11.

**4** Reset the DS1 test set at each node.

*Each DS1 test set should show zero errors (traffic continuity).*

If necessary, troubleshoot according to the OC-12 Facility alarm clearing procedures in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

**5** At both sites, connect the DS1 test set to a DS1 port on another DS1/VT mapper.

**6** On the Edit dialog of the Connection Manager tool, reprovision the STS-1 and VT1.5 channel to the DS1 port on the DS1/VT mappers connected to DS1 test sets in step 5. Press OK.

*A warning dialog is displayed for editing in-service connections. Press Yes to continue.*

**7** After the connection is reprovisioned, reset the DS1 test set.

*The DS1 test set should show zero errors (traffic continuity).*

If necessary, troubleshoot according to the OC-12 Facility alarm clearing procedures in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

**8** Repeat steps 6 and 7 until you have tested this STS-1 channel and VT1.5 assignment for one DS1 tributary on each DS1/VT mapper.

**9** Proceed to step 18.

**—continued—**

Procedure 5-5 (continued)
**Testing VT1.5 timeslot assignment and passthrough capabilities**

| Step | Action |
|---|---|
| | **Testing a VT1.5 assignment to a TIC port** |
| **10** | Use the Connection Manager to add a VT1.5 connection between a TIC port/subport at the RFT under test and a DS1 facility at the FCOT. |
| **11** | Use the Connection Manager to assign the DS1 facility for DS1 tandem circuits.<br><br>Refer to the procedure for provisioning DS1 facility assignments in *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B. |
| **12** | Provision a POTS service from a line card slot in the RFT to a DS1 tandem circuit on the DS1 facility.<br><br>Refer to the procedure for adding a DS1 tandem VT circuit in *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B. |
| **13** | Install a line card at the RFT in the provisioned slot. |
| **14** | Set up a DS1 digital data test set at the DS1 cross-connect panel in the central office. Adjust the Digital data test set to monitor the DS0 channel assigned to the RFT line card.<br><br>Refer to the procedure for testing a DS1 tandem circuit in *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B. |
| **15** | Connect VF test equipment at a customer access or at the RFT LCAP. |
| **16** | Verify continuity between the RFT and the FCOT.<br><br>Refer to the procedure for testing a DS1 tandem circuit in Chapter 5 of *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B. |
| **17** | If necessary, troubleshoot according to the OC-12 Facility alarm clearing procedures in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. |
| **18** | Delete the VT1.5 connection using the Connection Manager. |
| **19** | If you want to perform another VT1.5 connection test, go to step 1. Otherwise, you have finished this procedure. |

**—end—**

# Procedure 5-6
# Short-term bit-error rate (BER) tests

Use this procedure to verify that the DS1, DS3, or STS-1 bit-error rate (BER) over a path between two nodes in a bidirectional line-switched ring (BLSR) ring is within operational specifications.

## Requirements

The following requirements must be met before starting this procedure.

- make sure the two ring nodes being tested are set up as described in Procedure 5-3 on page 5-11
- make sure the tests in Procedure 5-4 on page 5-18 or Procedure 5-5 on page 5-19 are performed

  ***Note:*** The Connection Manager on the operations controller (OPC) is used to provision connections. For procedures using the Connection Manager, see *Provisioning and Operations Procedures*, 323-3001-310, in the *Operations, Administration and Provisioning*, Volume 4B.

## Action

| Step | Action |
|---|---|
| **1** | Log into the primary OPC and open the Connection Manager tool. Refer to *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A, if you do not know how to do this. |
| **2** | Provision an STS-1 (for DS3 or STS-1 test) or VT1.5 (for DS1 or STS-1 test) connection (using STS-1 channel 1) between the DS1, DS3 or STS-1 facilities chosen at nodes A and B. If you are testing OC-3 tributaries, provision three STS-1 connections.<br><br>Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B for detailed instructions. |
| **3** | The DS1, DS3, or STS-1 test set should show 0 error (traffic continuity) after the connection is provisioned. If not, troubleshoot according to *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. |
| **4** | If OC-3 tributaries are equipped, the DS1, DS3, or STS-1 or OC-3 test set (depending on the test setup) monitoring the tributary should show 0 error (traffic continuity). If not, troubleshoot according to *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. Press the DS3/STS-1 receiver test set Reset push-button. |

**—continued—**

Procedure 5-6 (continued)
**Short-term bit-error rate (BER) tests**

| Step | Action |
|---|---|

**5** Inject 3 single bit errors into the ring at node A.

*Three total bit errors are displayed on the DS1, DS3, or STS-1 receiver test set at node B.*

*If OC-3 tributaries are equipped, the DS1, DS3, or STS-1 test set (depending on the test setup) monitoring the OC-3 tributary should continue to show zero errors (traffic continuity).*

**6** Reset the DS1, DS3, o r STS-1 receiver test set and monitor for one hour.

| Total number of sites in the path | Number of errored bits for 95% or better confidence level (DS3 or STS-1) | Number of errored bits for 95% or better confidence level (DS1) |
|---|---|---|
| 2 | 23 | - |
| 3 | 51 | - |
| 4 | 80 | 0 |
| 5 | 109 | 0 |
| 6 | 139 | 1 |
| 7 | 170 | 2 |
| 8 | 200 | 3 |
| 9 | 231 | 3 |
| 10 | 261 | 4 |
| 11 | 292 | 5 |
| 12 | 322 | 6 |
| 13 | 353 | 7 |
| 14 | 383 | 8 |
| 15 | 415 | 8 |
| 16 | 446 | 9 |

***Note:*** Fewer than 2 errored bits corresponds to a BER better than 10-11. Fewer than 5 errored bits corresponds to a BER better than 3.1 x 10-11.

**—continued—**

Procedure 5-6 (continued)
**Short-term bit-error rate (BER) tests**

| Step | Action |
|---|---|

| If these values | Then |
|---|---|
| are met | record the actual reading on a separate sheet of paper |
| are not met | troubleshoot according to *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A |

**7** Clear the trouble and repeat steps 5 and 6 for each direction. If further resolution is required, monitor the BER at each node to obtain transmission performance statistics for each direction separately.

**8** Delete the STS-1 or VT1.5 connection using the Connection Manager.

Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B for detailed instructions on using the Connection Manager tool.

**—end—**

# Procedure 5-7
# Setting up for end-to-end tests for the whole ring

Use this procedure to set up the test sets and the OC-12 equipment to perform the end-to-end tests for an entire bi-directional line-switched ring (BLSR) ring. The end-to-end tests include high-speed protection switching tests and a long-term bit-error rate (BER) test.

## Requirements

The following requirements must be met before starting this procedure.

- all nodes are added to the ring making the ring optically closed
- Procedure 5-4 on page 5-18 (or Procedure 5-5 on page 5-19) and Procedure 5-6 on page 5-22 are performed
- choose one node in the ring where you will perform the tests; the node housing the primary operations controller (OPC) is recommended

  ***Note:*** A single STS-1 connection is established. This STS-1 connection starts on one node and travels to all the other nodes in the ring, then terminates on the originating node (see Figure 5-3 on page 5-11). For procedures using the Connection Manager, see *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.

- choose two DS1, DS3, or STS-1 facilities to use in the test setup

  ***Note:*** Two bidirectional facilities are needed because you connect one input port and one output port to the test sets; then you loopback a second output port to a second input port as shown in Figure 5-3 on page 5-28.

**CAUTION**
**When handling the equipment, the following precautions should always be observed.**

**Cross-connect signal** Check twice before inserting a test signal in a cross-connect.
**Live traffic path** Do not attempt to complete any switch on a live traffic path.
**Static discharge** Wear an antistatic strap. Refer to the safety guidelines in Chapter 1.

**—continued—**

Procedure 5-7 (continued)
**Setting up for end-to-end tests for the whole ring**

### Tools and materials for DS3 tests

- one (1) DS3 digital transmission test set (Tx) (for example, Tau-Tron S5200D)
- one (1) DS3 digital transmission test set (Rx) (for example, Tau-Tron S5200E)
- three (3) DS3 coaxial test cords with connectors suitable for the DS3 termination panel and test sets
- one (1) VT100-compatible terminal with user interface cable

### Tools and materials for STS-1 tests

- one (1) STS-1 digital transmission test set (Tx and Rx) (for example, HP 37704A SONET test set or equivalent)
- two (2) STS-1 coaxial test cords equipped with the type of connectors required to connect to the STS-1 termination panel
- STS-1 coaxial cables (BNC-to-BNC or WECO-to-WECO) as required
- one (1) VT100-compatible terminal with user interface cable

### Tools and materials for DS1 tests

- one (1) DS1 Tx-Rx test set (for example, Tau-Tron S5104)
- three (3) DS1 electrical test cords
- one (1) VT100-compatible terminal

## Action

| Step | Action |
|---|---|
| **1** | Add and provision two DS1, DS3, or STS-1 facilities. In this procedure, the example used is DS1 G1 port 1 and DS1 G4 port 1 (both from node A connecting to node B).<br><br>Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B, for detailed instructions on how to add and provision facilities. |

**—continued—**

Procedure 5-7 (continued)
**Setting up for end-to-end tests for the whole ring**

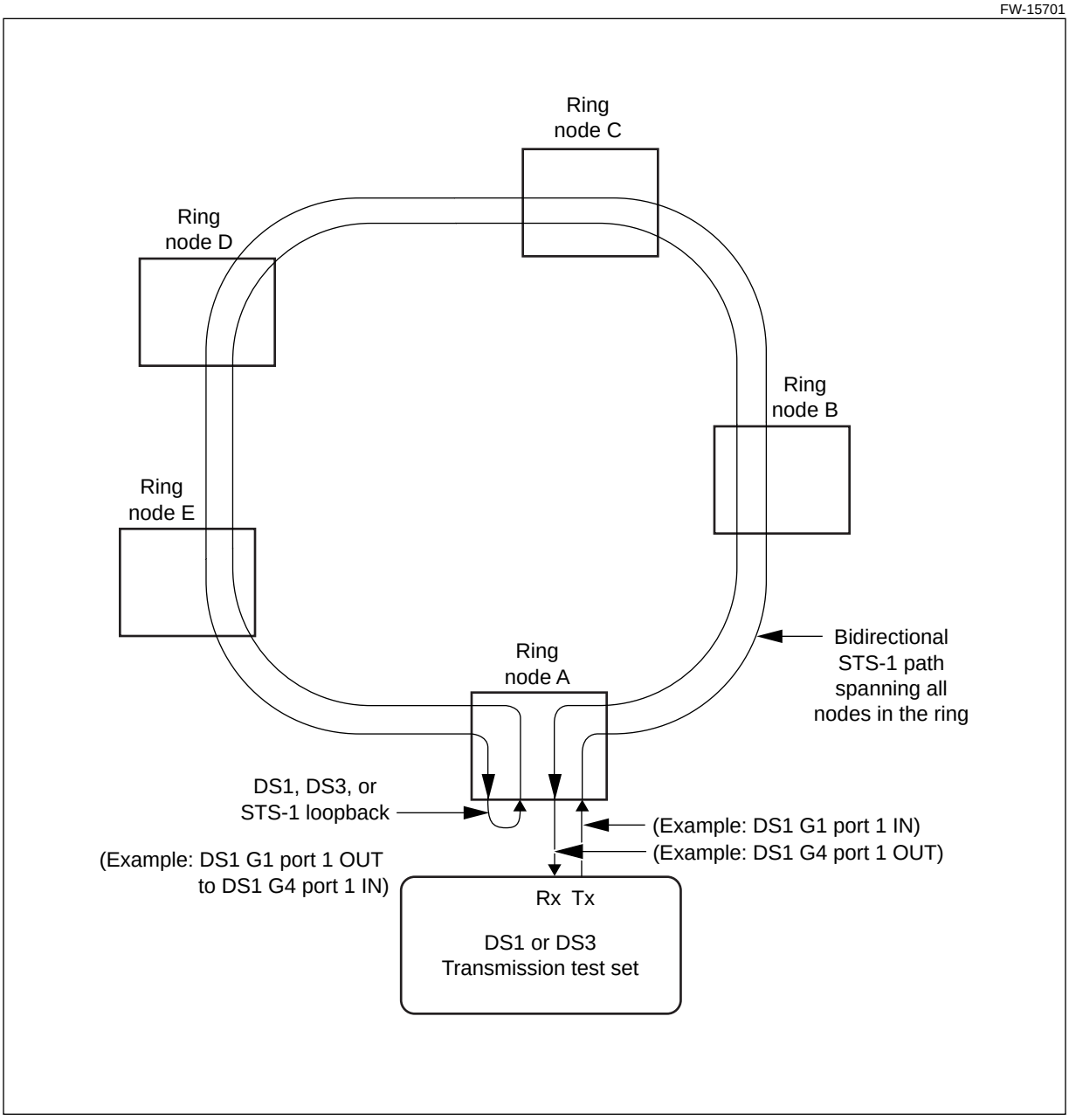
| Step | Action |
|---|---|
| **2** | Use a test cord to connect the transmitter output of the DS1, DS3, or STS-1 test set to the input connector (on the DS1, DS3, or STS-1 interconnect panel) of DS1, DS3, or STS-1 group 1 port 1 (DS1 example is shown in Figure 5-3 on page 5-28). |
| **3** | Loop back a DS1, DS3, or STS-1 test cord from the G1 output port to the input port. |
| **4** | Use a test cord to connect the DS1, DS3, or STS-1 output port (on the DS1, DS3, or STS-1 interconnect panel) to the receiver input of the DS1/DS3 (error detector) test set. |
| **5** | Using the Connection Manager tool of the OPC, provision an STS-1 connection (for example, STS-1 channel 1) that originates and terminates at the DS1, DS3, or STS-1 channels added in step 2. |

**—continued—**

Procedure 5-7 (continued)
**Setting up for end-to-end tests for the whole ring**

**Figure 5-3**
**STS-1 connection and DS1, DS3, or STS-1 setup for end-to-end tests for a five-node ring**

FW-15701




**—end—**

# Procedure 5-8
# Performing optical protection-switching tests

Use this procedure to verify protection switching between VTBM ring nodes. Perform this procedure at each node in the ring.

## Requirements

The following requirements must be met before starting this procedure.

- make sure the node is set up as described in Procedure 5-7 on page 5-25 and shown in Figure 5-3 on page 5-28
- be logged into the network element user interface (NEUI) of the originating and terminating node and be at the main level. You can use the protection-switching capabilities of the operation controller (OPC) Network Summary tool instead of the high-speed switching capabilities of the NEUI. The Network Summary tool is described in *Network Surveillance Procedures,* 323-3001-510, in *Maintenance*, Volume 5C.

**CAUTION**
**Risk of service interruption**
Do not attempt to complete any switch on a live traffic path.

## Action

| Step | Action |
|---|---|

**1** Check that the shelf is provisioned for the in-service DS1, DS3, or STS-1 channel (IS), which was connected in Procedure 5-7 on page 5-25. Access the facility screen from the main menu of the NEUI and display the active DS1, DS3, or STS-1 channels by entering the following command:

**facility <type> <circuit pack group> <port number>** ↵

**where**

| | |
|---|---|
| <type> | **ds1**, **ds3**, or **sts1** |
| <circuit pack group> | is the mapper under test |
| <port number> | is **1** to **3** for DS3 or STS-1 and **1** to **14** for DS1 |

You must enter the above command twice, once for each circuit pack group of the pair you have chosen to use.

*A facility screen is displayed.*

**—continued—**

Procedure 5-8 (continued)
**Performing optical protection-switching tests**

| Step | Action |
|---|---|
| | **Optical switching tests** |
| **2** | Make sure the system is configured as a 2-fiber bidirectional line-switched ring (BLSR) by accessing the OC-12 protection screen. Both G1 and G2 should be active. Enter the following command on the NEUI:<br>**protectn** ↵<br>**dtlprot oc12** ↵<br>*The protection screen appears. The Protection Scheme field shows 2-Fiber BLSR.* |
| **3** | )Make sure the OC-12 protection screen does not have a fail (F), request (R), waiting to restore (W), or active switch (*) indication on any of the Forced, AutoSw, or Manual fields. |
| **4** | Reset the error detector on the DS1, DS3, or STS-1 receiver test set. Make sure the receiver test set monitors an error-free signal. |
| | **Manual switch (G1)** |
| **5** | Operate an OC-12 manual switch from G1 (working timeslots) to G2 (protection timeslots) by entering the following command on the NE user interface:<br>**manual op g1** ↵<br>*The traffic transfers from the working STS-1 timeslots of G1 to the protection timeslots of G2.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*If OC-3 tributaries are equipped, the OC-3 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The user interface protection screen has an asterisk (*) under the Manual switch field (active) for G1.* |
| **6** | Release the manual switch by entering the following command on the NE user interface:<br>**manual re g1** ↵<br>*The traffic transfers from the protection STS-1 timeslots of G2 to the working timeslots of G1.*<br>*The asterisk (*) is replaced by a dot (.) in the Manual switch field for G1.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The green active LEDs on the circuit packs of both G1 and G2 are lit.* |

**—continued—**

Procedure 5-8 (continued)
**Performing optical protection-switching tests**

| Step | Action |
|---|---|
| | **Manual switch (G2)** |
| **7** | Operate an OC-12 manual switch from G2 (working timeslots) to G1 (protection timeslots) by entering the following command on the NEUI:<br>**manual op g2** ↵<br>*The traffic transfers from the working STS-1 timeslots of G2 to the protection timeslots of G1.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch). The user interface protection screen has an asterisk (*) under the Manual switch field (active) for G2.* |
| **8** | Release the manual switch by entering the following command on the NEUI:<br>**manual re g2** ↵<br>*The traffic transfers from the protection STS-1 timeslots of G1 to the working timeslots of G2.*<br>*The asterisk (*) is replaced by a dot (.) in the Manual switch field for G2.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*Due to the manual switch, the active LEDs on the OC-12 cards are turned off.* |
| | **Forced switch (G1)** |
| **9** | Operate an OC-12 forced switch from G1 (working timeslots) to G2 (protection timeslots) by entering the following command on the NEUI:<br>**forced op g1** ↵<br>**yes** ↵<br>*The traffic transfers from the working STS-1 timeslots of G1 to the protection timeslots of G2.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The user interface protection screen has an asterisk (*) under the Forced switch field (active) for G1.* |

**—continued—**

Procedure 5-8 (continued)
**Performing optical protection-switching tests**

| Step | Action |
|---|---|
| | **Forced switch (G1)** |
| **10** | Operate an OC-12 forced switch from G1 (working timeslots) to G2 (protection timeslots) by entering the following command on the NEUI:<br>**forced op g1** ↵<br>**yes** ↵<br>*The traffic transfers from the working STS-1 timeslots of G1 to the protection timeslots of G2.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The user interface protection screen has an asterisk (*) under the Forced switch field (active) for G1.* |
| **11** | Release the forced switch by entering the following command on the NEUI:<br>**forced re g1**↵<br>**yes** ↵<br>*The traffic transfers from the protection STS-1 timeslots of G2 to the working timeslots of G1.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The asterisk (*) is replaced by a dot (.) under the Forced switch field for G1.*<br>*The green active LEDs on the circuit packs of both G1 and G2 are lit.* |
| | **Forced switch (G2)** |
| **12** | Operate an OC-12 forced switch from G2 (working timeslots) to G1 (protection timeslots) by entering the following command on the NEUI:<br>**forced op g2** ↵<br>**yes** ↵<br>*The traffic transfers from the working STS-1 timeslots of G2 to the protection timeslots of G1.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The user interface protection screen has an asterisk (*) under the Forced switch field (active) for G2.* |

**—continued—**

Procedure 5-8 (continued)
**Performing optical protection-switching tests**

| Step | Action |
|---|---|
| **13** | Release the forced switch by entering the following command on the NEUI:<br>**forced re g2** ↵<br>**yes** ↵<br>*The traffic transfers from the protection STS-1 timeslots of G1 to the working timeslots of G2.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The asterisk (*) is replaced by a dot (.) under the Forced switch field for G2.*<br>*The green active LEDs on the circuit packs of both G1 and G2 are lit.* |
| **Automatic switch (signal fail)** | |
| **14** | Make sure that both optical circuit pack groups G1 and G2 are alarm free. Check that the DS1, DS3, and STS-1 error detectors monitor error-free signals. |
| **15** | Remove the fiber from the OC-12 Receive Interface for G1. Verify that the working traffic of G1 switches to protection timeslots of G2.<br>*The OC-12 traffic continuity is restored.*<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).*<br>*The loss of signal (LOS) LED on the loopback G1 is lit.*<br>*The user interface protection screens show the alarm conditions and switching status.* |
| **16** | Reconnect the optical fiber. |
| **17** | Check that all alarms clear (except for the performance-monitoring alarms and the automatic protection switch alarm indication that may have been raised due to surpassed threshold values). |
| **18** | Check that traffic reverts to the G1 working timeslots after 5 minutes of wait-to-restore.<br>*The DS1, DS3, or STS-1 traffic is error-free (except for hits taken because of the high-speed switch).* |
| **19** | Check that the error detector of the receiver test set is monitoring an error-free signal. |
| **20** | Repeat steps 13 through 19 to test the protection switch from G2, removing the fiber from the OC-12 Receive Interface for G2. |

**—continued—**

Procedure 5-8 (continued)
**Performing optical protection-switching tests**

| Step | Action |
|---|---|
| | **Automatic switch (signal degrade)** |
| **21** | Make sure that G1 is alarm-free. Check that the DS1, DS3, or STS-1 error detector is monitoring an error-free signal. |
| **22** | Check the signal degrade threshold value (default is 10-6) by entering:<br>**facility oc12 g1** ↵<br>*A facility screen is displayed.* |
| **23** | While monitoring the BER reading on the DS1, DS3, or STS-1 error detector, slowly increase the attenuation by adjusting the mVOA (turn screw clockwise) of the G1 receive patchcord until a high-speed switch occurs. Be careful not to apply too much pressure to the attenuator screw, as damage can result. Slowly, gradually turn the attenuator screw. Do not overturn it.<br>*The BER reading on the DS3 or STS-1 error detector should read approximately the same value (default is $10^{-6)}$, just before the switch occurred.*<br>*Check that the traffic is now error free on G2.*<br>*Check that the user interface screen indicates the signal-degrade condition and the automatic switch is reported.*<br>*A minor alarm (non-service affecting) should be active for the signal-degrade condition.* |
| **24** | Readjust the mVOA by turning screw counterclockwise (decreasing attenuation) by two full turns.<br>*The signal-degrade alarm condition should clear after a few seconds.*<br>*The high-speed switch should automatically revert after 5 minutes.* |
| **25** | Measure the receive level for G1 and adjust to its nominal value (it should be -20 dBm nominal). |
| **26** | Restore the equipment to its original setup and repeat steps 21 to 25 to test the protection switch from G2. |

**—end—**

# Procedure 5-9
# Performing long-term bit-error rate (BER) tests

Use this procedure to check that the DS1, DS3, or STS-1 bit-error rate (BER) for an STS-1 path spanning all the nodes of a bidirectional line-switched ring (BLSR) ring is within specifications.

***Note:*** 24-hour DS3 tests are not required to demonstrate a BER of $10^{-10}$. The one-hour test result shown in Procedure 5-6 on page 5-22 must be met.

## Requirements

Before starting this procedure the following requirements must be met.

- set up the node according to Procedure 5-7 on page 5-25
- log into the network element user interface (NEUI) of the originating and terminating node and be at the main level

## Action

| Step | Action |
|---|---|
| **1** | With test setup of Procedure 5-7, make sure the STS-1 channel 1 connection is set to the long path (this is the default). |
| **2** | Check that the DS1, DS3, or STS-1 test set shows zero errors (traffic continuity). If not, troubleshoot according to *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. |
| **3** | Press the DS1, DS3, or STS-1 receiver test set Reset push-button.<br>*The display indicates 0 error.* |
| **4** | Inject 3 single bit errors.<br>*Three total bit errors are displayed on the DS1, DS3, or STS-1 receiver test set.* |

**—continued—**

Procedure 5-9 (continued)
**Performing long-term bit-error rate (BER) tests**

| Step | Action |
|---|---|

**5** Reset the DS1, DS3, or STS-1 receiver test set and monitor for the period given in the following table. Make sure the errors do not exceed the count given. Specifications are provided to reflect a 95% confidence of a BER equal to or better than $10^{-10}$, assuming one looped-back DS1, DS3, or STS-1 connection.

| Total number of ring nodes | Number of errored bits for BER <$10^{-10}$ (95% confidence) | | |
|---|---|---|---|
| | 1-hour DS3 or STS-1 test | 24-hour DS1 test | 48-hour DS1 test |
| 2 | 23 | 17 | 41 |
| 3 | 51 | 41 | 89 |
| 4 | 80 | 65 | 139 |
| 5 | 109 | 89 | 188 |
| 6 | 139 | 114 | 239 |
| 7 | 170 | 139 | 290 |
| 8 | 200 | 164 | 340 |
| 9 | 231 | 189 | 392 |
| 10 | 261 | 214 | 443 |
| 11 | 292 | 239 | 495 |
| 12 | 322 | 265 | 564 |
| 13 | 353 | 290 | 598 |
| 14 | 383 | 315 | 649 |
| 15 | 415 | 340 | - |
| 16 | 446 | 367 | - |

***Note:*** Fewer than 2 errored bits corresponds to a BER better than $10^{-11}$. Fewer than 5 errored bits corresponds to a BER better than $3.1 \times 10^{-11}$. 24-hour DS3 tests are not required to demonstrate BER at $10^{-10}$. A 1-hour test is sufficient.

**—continued—**

Procedure 5-9 (continued)
**Performing long-term bit-error rate (BER) tests**

**Step** **Action**

| If the requirement | Then |
|---|---|
| is met | record the actual reading on the System Testing form at the end of this document |
| is not met | troubleshoot according to *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A |

**—end—**

# Setting up and testing the data communications services

This chapter describes how to do the following:

- query the operational status of the data communication services between a network element (NE) and its associated operations controller (OPC)
- query the status of the control network (CNet) and SONET section data communications channels (SDCCs)
- place the SDCCs in or out of service
- check the SDCC and control network error statistics to verify proper operation
- check the performance-monitoring statistics (error statistics) collected on a periodic basis

OC-3/OC-12 NEs support SONET section data communications channels (SDCCs) over the fibers between system NEs. By default, channels are assigned to the OC-3/OC-12 transport lines, but an SDCC can also be assigned to an OC-3 tributary.

The CNet is a local-area network (LAN) used to interconnect system network elements at one site (by way of RS232-C cables) for operations, administration, maintenance, and provisioning (OAM&P) purposes. A SONET DCC bridge can be used to link SDCCs by way of control network connections. For engineering limits for control network connections, see *System Specifications*, 323-3001-180, in *Description*, Volume 2B.

Commands entered using the data communications user interface only affect the network element where the command is entered. That is, one end of the bi-directional data communications.

## How to use this chapter

Refer to the flow charts and task lists in Chapter 1 when using this chapter. These flow charts and task lists identify the procedures that must be performed in this chapter.

### Chapter topics

The table below shows the information contained in this chapter for end-to-end tests for setting up and testing the data communications services.

# Procedure 6-1
# Querying the data communications ports

Use this procedure to check the data communication ports operation status for a given NE. There are two ports:

- the control network (CNet) ports
- the LAPD ports (link access protocol for integrated services digital network D channel) for SONET data communications channels (DCCs)

## Requirements

The following requirements must be met before starting this procedure:

- perform this procedure using the local command input (CI) area at the network element (NE)
- you must be logged in to the network element user interface (NEUI) at the main menu level

You can log into the NEUI either directly from a VT100-compatible terminal or through the operations controller (OPC). Connection instructions for the VT100-compatible terminal, OPC setup instructions, and information on the NEUI are provided in *Network Element User Interface Description*, 323-3001-300, and in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.

## Action

| Step | Action |
|---|---|
| **1** | Access the command input (CI) area by entering the following command:<br>**quit all** ↵ |
| **2** | Enter the following commands:<br>**port** ↵<br>**dcc info** ↵<br>**cnet info** ↵ |

**—continued—**

Procedure 6-1 (continued)
**Querying the data communications ports**

| Step | Action |
|---|---|

For DCC LAPD, the system returns a state of UP or DOWN.

***Note:*** DCCs are numbered from 0 to 9 in this tool and from 1 to 10 in the Comm Fac Port screen.

For control network, the system returns one of the following states:

| | |
|---|---|
| IS | In Service |
| TB | Trouble |
| MT | Maintenance |
| OOS-FL | Out of service fault |
| NPV | not provisioned |
| PV | provisioned |
| LP | link pending-this indicates that the NE is the only node on a LAN |

**3** Exit the CI area by entering:

**mapci** ↵

**4** Log out of the NEUI by entering:

**logout** ↵

**—end—**

# Procedure 6-2
# Displaying the status of all data communications ports or channels

Use this procedure to display the operational status of all the data communications ports or channels for a network element (NE).

> ***Note:*** The **selectne** command is not available for the data communications user interface screens. The data communications commands affect only the local NE.

## Requirements

The following requirement must be met before starting this procedure:

- before starting this procedure, you must be logged in to the network element user interface (NEUI) and at the main menu level. You can log into the NEUI either directly from a VT100-compatible terminal or through the OPC.

Connection instructions for the VT100-compatible terminal, OPC setup instructions, and information on the NEUI are provided in *Network Element User Interface Description*, 323-3001-300, and in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.

## Action

| Step | Action |
|---|---|
| **1** | Display the COMM Fac Port screen by entering the following command:<br>**facility comm; ports sdcc**↵<br>*The COMM Fac Port screen is displayed.*<br>***Note:*** DCCs are numbered from 1 to 10 in this tool and from 0 to 9 in CNET. |

**—continued—**

Procedure 6-2 (continued)
**Displaying the status of all data communications ports or channels**

**Step** **Action**

**Fields on the COMM Facility Ports screen**

| Field | Field Description | |
|---|---|---|
| Type | Displays the type of data communications service. The type is always SDCC (for SONET data communications channel connections). There are ten SDCCs per shelf (one per optic card). | |
| Port Num | A fixed number (1 to 10) is associated with each potential assignment of the SDCCs. The numbers map to a slot for an optics card. All logical port numbers are shown on the COMM Facility screen. See Table 6-1 on page 6-8 for a mapping of SDCC numbers to the provisioned services and system configuration. | |
| Prov | The provisioned state of the SDCC. For the COMM Facility Screen, each port shows a Y for provisioned or an N for not provisioned. | |
| Status | Operational status of the SDCC, where UP means the channel is in service and functioning normally and DOWN means it is intended to be in service, but is not operational. If the status is DOWN, check the Alarm field for an indication of the problem. | |
| Alarm | The alarm information associated with the SDCC as follows. Alarms should be cleared according to *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A. | |
| | dash | indicates no alarms are affecting the channel. |
| | link fail | indicates a failure on the communications link with the neighboring node. This can be a facility failure or the circuit pack serving the port is missing or failed. |
| | link degrade | indicates a performance degradation affecting the communications link with the neighboring node. |
| Connected To | The circuit pack supporting the SDCC port. | |

**—end—**

# Procedure 6-3
# Placing SONET data communications ports in or out of service

This procedure places SONET data communications ports for a network element (NE) in service (IS) or out of service (OOS) and applies to both transport and tributary optics on all node types. This procedure is performed using the Facility Communications user interface on the NE.

## The control network (CNet) port

The physical data communications ports at the NE are provided by the shelf processor and include one control network (CNet) port and two SONET DCC ports.

If the NE is connected to the local-area network (LAN) by way of CNet, the CNet port is automatically enabled. If the circuit packs required to support data communications for SONET DCC are not present in the shelf, you must either manually deprovision the CNet port to be out of service or disable the "CNet link fail" alarm so this alarm is not raised. For instructions on how to deprovision the "CNet link fail" alarm, see *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.

## The SONET data communications channels

The transport optics SDCCs are autoprovisioned to default values used by most system configurations. As a result, this procedure is usually not required.

An SDCC port is provisioned automatically or manually.

Automatically provisioned (transport optics only) when the OC-3 or OC-12 equipment is provisioned. If the optics protection group is not diversely routed (this is the default) then one SDCC port is provisioned for the working/protection pair in the optics protection group. The data for that SDCC port is carried over the active line (working or protection).

Route diversity means the transport fibers use different routes with each route having its own regenerators.

Non-route diversity means that both fibers use the same route and, therefore, pass through the same regenerator.

Table 6-1 on page 6-8 shows the default assignments of the SDCCs according to the system configuration.

**—continued—**

Procedure 6-3 (continued)
**Placing SONET data communications ports in or out of service**

**Table 6-1**
**Default SDCC assignments**

| **Optics connected to** | | **SDCC port number** | | |
|---|---|---|---|---|
| **Circuit pack** | **Slot** | **Protected (A stream card)** | **Protected (B stream card)** | **Diversely routed** |
| OC3 G3 | 1 | 1 | not provisioned | n/a |
| OC3 G4 | 3 | not provisioned | 2 | n/a |
| OCn G1S | 5 | 3 | not provisioned | 3 |
| OCn G2S | 7 | not provisioned | 4 | 4 |
| OCn G1 | 9 | 5 | not provisioned | 5 |
| OCn G2 | 10 | not provisioned | 6 | 6 |
| OC3 G5 | 11 | 7 | not provisioned | n/a |
| OC3 G6 | 13 | not provisioned | 8 | n/a |
| OC3 G7 | 15 | 9 | not provisioned | n/a |
| OC3 G8 | 17 | not provisioned | 10 | n/a |

***Note:*** The shading separates the optics cards into pairs (working and protection card). On each pair of optics cards there are three possible configurations for the SONET data communications channels. The SDCC may be either protected or diversely routed. A protected SDCC may be provisioned on either card of the pair (A or B card).

## Provisioning rules

The OC-12 transport optics can be configured for route diverse or non-route diverse operation.

For OC-3 tributaries, SONET DCC is only supported in non-route diverse (protected) mode.

**—continued—**

Procedure 6-3 (continued)
**Placing SONET data communications ports in or out of service**

## Requirements

The following requirement must be met before starting this procedure:

- before starting this procedure, you must be logged in to the network element user interface (NEUI) and at the main menu level

You can log into the NEUI either directly from a VT100-compatible terminal or through the operations controller (OPC).

Connection instructions for the VT100-compatible terminal, OPC setup instructions, and information on the NEUI are provided in *Network Element User Interface Description*, 323-3001-300, and in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.

## Action

| Step | Action |
|---|---|
| **1** | Display the COMM Fac Port screen by entering the following command:<br>**facility comm; ports sdcc**↵<br>*The COMM Fac Port screen is displayed. Refer to Procedure 6-2, "Displaying the status of all data communications ports or channels" on page 6-5.*<br>Look for the SDCC that corresponds to the desired optics whose LAPD link is to be deleted/added. |
| **2** | Select add to add the SDCC. Select delete to delete the SDCC.<br>**<action>**<br>where<br><action> is **add** or **del**<br>*If you are deleting a port, the system returns a warning that the command may affect service and then asks for confirmation.*<br>*If you are adding a port, the system returns the following message:*<br>`WARNING: Please ensure that the SDCC of the connected optics is also provisioned on the far end. Otherwise it will not come in service.` |

**—continued—**

Procedure 6-3 (continued)
**Placing SONET data communications ports in or out of service**

| Step | Action |
|---|---|
| **3** | To proceed, enter:<br>**y** ↵<br>*The system returns a message indicating the command is completed.*<br>To cancel the command, enter:<br>**n** ↵ |
| **4** | Exit the CI area by entering:<br>**mapci** ↵ |
| **5** | Log out of the NEUI by entering:<br>**logout** ↵ |

**—end—**

# Procedure 6-4
# Checking the control network (CNet) and data communications channel (DCC) error statistics

Use this procedure to check the control network (CNet) and data communications channel (DCC) error statistics after fiber connections are made but prior to putting the OC-12 system in service and to check the receive fibers. This procedure must be completed for each network element (NE) in the system.

For CNet ports, this test monitors the number of errors that occur in the control network communications. The CNet should be checked whenever the CNet configuration is changed or new cables or terminators are installed.

For SONET DCC ports, this test monitors the number of errors that occur in the frames of the communications protocol used by the DCCs. This communications protocol is called LAPD (link access protocol for integrated services digital network D channel). The DCCs should be checked whenever a new shelf processor is installed and when the optics are aligned.

It is necessary to make sure the facilities carrying data communications operate correctly. Poor facilities can result in lower data throughput, longer delay, and, in severe cases, communications failure during operations, administration, maintenance, and provisioning (OAM&P).

## Requirements

The following requirements must be met before starting this procedure:

- make sure all other system tests have been performed for the system, including the bit-error-rate (BER) tests
- be logged in the network element user interface (NEUI) at the main menu level. Connection instructions for the VT100-compatible terminal, OPC setup instructions, and information on the NEUI are provided in *Network Element User Interface Description*, 323-3001-300, and in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.

**—continued—**

Procedure 6-4 (continued)
**Checking the control network (CNet) and data communications channel (DCC) error statistics**

## Action

| Step | Action |
|---|---|
| **1** | At the command input (CI) area, enter the following commands, write down the values for the current statistics, then wait for a period of time for statistics to accumulate (at least 1 hour is recommended). Later, you will check the deltas between the start and finish values:<br>**quit all** ↵<br>**port** ↵<br>**cnet stats** ↵<br>**dcc stats** ↵ |
| **2** | Allow the statistics to accumulate for a period of time. A minimum of 1 hour is recommended. |
| **3** | At the command input (CI) area, enter the following command:<br>**cnet stats** ↵<br>*The statistics accumulated are displayed. Any differences (deltas) in the statistics indicate accumulated errors/stats.*<br>Deltas other than zero for “TBL errors” or “Tokens failed” indicate that a control network connection is introducing errors.<br>The most likely causes are a bad cable, a bad or missing terminator, or a CNet engineering limit has been exceeded. See *Bay in Central Office Installation Manual —ABM*, 323-3001-201, and *Bay in Central Office Installation Manual —TBM*, 323-3001-202, for installation of CNet cables and terminators. See *System Specifications*, 323-3001-180, in *Description*, Volume 2B for details on the engineering limits for CNet connections. |
| **4** | At the command input (CI) area, enter the following commands:<br>**dcc stats** ↵<br>*The statistics accumulated are displayed. Any differences represent error/stat deltas.*<br>Deltas other than zero for “Frame Errors” on any parts, indicate a problem affecting the LAPD protocol of the DCC communications.<br>The most likely cause is a problem on the optics corresponding to the DCC channel, that is, the optics circuit pack group, a fiber, or a fiber connection. Check the performance-monitoring statistics for the optics. See *Performance Monitoring Procedures*, 323-3001-520, in *Maintenance*, Volume 5C.<br>If the performance-monitoring statistics do not indicate a problem on the optics, replace the shelf processor. See *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C, for instructions.<br>**—end—** |

# System integrity tests

Use this chapter to test certain system equipment at the networking level; that is, after two or more network elements (NEs) are connected together. Unless otherwise noted, the tests can be performed by one technician.

## How to use this chapter

Refer to the flow charts and task lists in Chapter 1 when using this chapter. These flow charts and task lists identify the procedures that must be performed in this chapter.

### Chapter topics

The table below shows the information contained in this chapter for system integrity tests.



If you cannot successfully complete these procedures, contact your next level of support.

# Procedure 7-1
# Testing backup and restoration of NE data

Use this test to verify the back up capability of the network element (NE) database to the operations controller (OPC). It makes a new (current) copy of the database, but makes sure that the existing database copy is retained as backup 1.

The test can be conducted at the operations controller user interface (OPC UI) or at the network element user interface (NEUI). In this procedure, the OPC version is described because it also tests the functions of remote login to the NE and communications over the SONET channel of the optical feeder.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service

The character-mode terminal (VT100-compatible) is connected to the OPC. If necessary, obtain the userID and password for the admin security level from your system administrator.

- read the command conventions for the interface you are using (CMT or graphical) in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.
- a copy of the System Test Results Form, located in “Appendix A: System Test Results Form” on page 8-1 to record testing information

## Action

| Step | Action |
|---|---|
| | **Set the number of database copies retained to two** |
| **1** | Log in to the OPC at the admin security level and open the Software Management toolset.<br>***Note:*** For instructions on how to log in to an OPC and open an OPC tool, refer to *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A. |
| **2** | Open the Backup/Restore Manager tool.<br>*The Backup/Restore Manager main window is displayed.* |
| **3** | Display the Utilities menu by pressing Ctrl_L T (or Keypad ,).<br>*The Utilities menu is displayed.* |
| **4** | Using the arrow keys move to the Set number of backups entry and select it by pressing the Space bar (or Keypad 0).<br>*The number of backups dialog is displayed.* |

**—continued—**

Procedure 7-1 (continued)
**Testing backup and restoration of NE data**

| Step | Action |
|---|---|
| **5** | If 2 is not already selected as follows: (♦) 2, tab to the Number of backups per release buttons, move to the box ( ) 2 and select the button by pressing Ctrl_A (or Keypad 0).<br>*A diamond is displayed in the selected button.* |
| **6** | Tab to the OK button and select it by pressing Ctrl_A (or Keypad 0).<br>*The dialog disappears.* |
| **Perform the backup from the fiber central office terminal (FCOT)** | |
| **7** | Log in to the remote NE. Refer to *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A. |
| **8** | Display the equipment shelf screen by entering:<br>**eq sh** ↵<br>*The shelf equipment screen is displayed.* |
| **9** | Backup the shelf database to OPC disk storage by entering:<br>**backupdb** ↵<br>*Confirmation is requested. After you enter "yes", the NE generates a backup request to the OPC. Backup begins. Results are listed as a log message.* |
| **10** | Change some provisioned data; a change that can be undone later by restoring the database backed up in step 9. For example, take the OC-12 facility out of service (OOS):<br>**quit** ↵<br>**fa oc12 g2** ↵<br>**chgstate oos** ↵<br>**y** ↵<br>*The OC-12 G2 facility is out of service.* |
| **Review the backup list at the OPC** | |
| **11** | To view the database backup list in the Backup/Restore tool, bring the tool forward by pressing Ctrl_T + several times until it appears.<br>***Note:*** The keyboard combination is Ctrl_T followed by the plus sign (+).<br>*The Backup/Restore main window is displayed.* |
| **12** | Using the arrow keys move to the remote NE and select it by pressing Ctrl_A (or Keypad 0).<br>*The NE list item is highlighted in reverse video.* |
| **13** | Display the List item menu by pressing Ctrl_L (or Keypad Enter).<br>*The List item menu is displayed.* |

**—continued—**

Procedure 7-1 (continued)
**Testing backup and restoration of NE data**

| Step | Action |
|---|---|
| **14** | Select Manage Backups by pressing Space (or Keypad 0).<br>*The Manage Backups dialog is displayed, showing all backups currently stored on the OPC for the NE. The new database copy and its creation time is displayed in the list.* |
| **15** | Verify that the latest backup is displayed in the list. The new database copy can be verified by its creation time. |
| **16** | To close the dialog, tab to the Done button and select it by pressing Ctrl_A (or Keypad 0).<br>*The dialog disappears.* |
| **Restore the database for the NE** | |
| **17** | Bring the NEUI screen forward for the remote NE, by pressing Ctrl_T + (several times if necessary).<br>*The NEUI screen is displayed.* |
| **18** | Restore the database for the NE, by entering:<br>**quit** ↵<br>**eq sh** ↵<br>**restore backup1** ↵<br>*A message stating that this command causes a reboot/reload of the shelf processor is displayed, and asks you to confirm your action.*<br>Enter:<br>**y** ↵<br>*The OPC downloads the database to the remote NE. When restoration is complete, a message in the log utility verifies completion.* |
| **19** | Verify that the change made in step 10 is removed—that both OC-12 facilities are in service again.<br>**quit** ↵<br>**fa oc12 g2** ↵<br>*The OC-12 facility screen for G2 is displayed and shows the facility as in service (IS). This verifies that the backup and restoration of the NE database is successful.* |
| **20** | Log out of the NEUI:<br>**logout** ↵ |
| **21** | Close the Backup/Restore Manager and log out of the OPC. If necessary, refer to *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A. |
| **22** | Note the completion of this procedure on the System Test Results Form. Continue using the form with the results from the procedures in the previous chapter. |

**—end—**

# Procedure 7-2
# Verifying communication between primary and backup OPCs

Use this procedure to verify the following:

- the primary operations controller (OPC) can be shut down and rebooted
- the primary and backup OPCs can communicate

If this system has no backup OPC, there is no need to perform this procedure.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service

Equipment must be set up at the site of the primary OPC as specified in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.

- you must be logged in to the OPC at the admin security level
- read the command conventions for the interface you are using (CMT or graphical) in *OPC User Interface Description*, 323-3001-301, in *Operations, Administration, and Provisioning*, Volume 4A.
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 to record testing information

## Action

| Step | Action |
|---|---|
| **1** | Log in to the primary OPC and shut it down. Refer to *Data Administration Procedures*, 323-3001-304, in *Operations, Administration, and Provisioning*, Volume 4A. You do not remove the OPC; but allow the OPC to reboot. |
| **2** | Log back in to the OPC at the admin security level.<br>*The User Session Manager is displayed.* |
| **3** | Select the Event Browser tool from the Available tools list.<br>*The Event Browser main window is displayed.* |
| **4** | Check the list of logs for the following, which records the restoration of communications between the primary and backup OPCs:<br>`STBY509 Communication between this OPC and the other OPC in this network is established.` |
| **5** | Close the Event Browser, and log out of the OPC. |
| **6** | Note the completion of this procedure on the System Test Results Form. |

**—end—**

# Procedure 7-3
# **Testing the orderwire operation**

Use this procedure to test the operation of the system orderwire. This procedure:

- can be performed on a new system being tested prior to placing it in service, or it can be performed on an existing system, already in service
- requires two technicians and two sets of test equipment, so that tests can be conducted from each end of the circuit

**DANGER**
**Risk of injury or damage**
Read the warnings and precautions in Chapter 1 to minimize any risk to personnel and equipment.

## Requirements

The following requirements must be met before starting this procedure.

- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 to record testing information
- two (2) Digitone handsets, NT2E36AA

***Note 1:*** As an alternative to using the Digitone handset, you can use four-wire headsets such as Western Electric Company (WECO) dual tip and sleeve. However, if you use four-wire headsets, you cannot carry out some of the tests, as noted in the procedure. The handset and headset are shown in Figure 7-1 on page 7-7.

***Note 2:*** In the access bandwidth manager (ABM) shelf, you can connect butt-ins (two-wire handsets with alligator clips) to the two-wire handset binding posts as an alternative to using the Digitone handset. However, you cannot use a butt-in at a central-office (CO) site where the orderwire system is connected to a line in the public switched telephone network. This type of connection is optional.

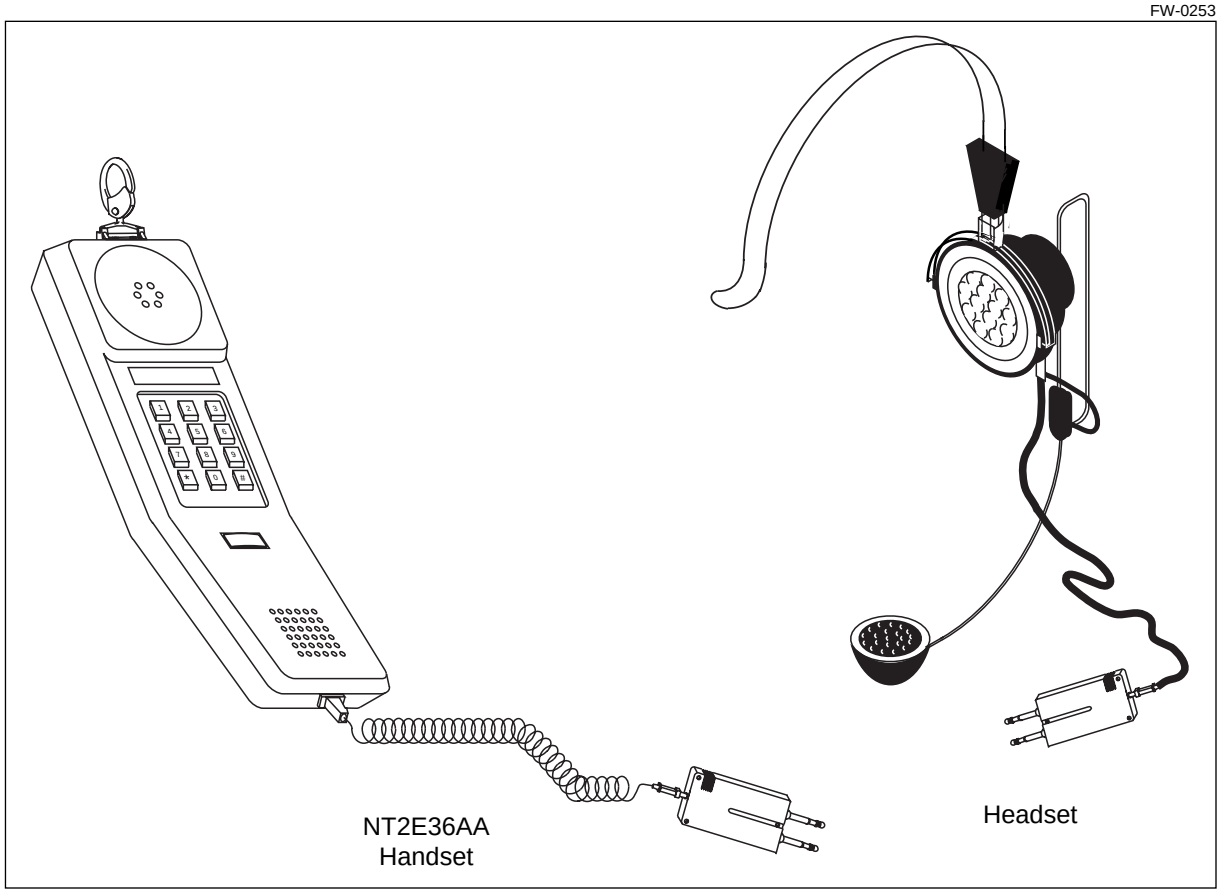
***Note 3:*** On the local craft access panel (LCAP) of the transport bandwidth manager (TBM) shelf there is no butt-in connection.

**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

**Figure 7-1**
**Digitone handset and four-wire headset**

FW-0253




## Action

| Step | Action |
|---|---|
| | **Testing broadcast calling for local and express** |
| **1** | At the calling site, plug the Digitone handset or the four-wire headset into the appropriate jack on the local craft access panel (LCAP), as shown in Figure 7-2 on page 7-8 (ABM shelf) or Figure 7-3 on page 7-9 (TBM shelf).<br>*The Call incoming indicator and the Local call indicator light up.* |

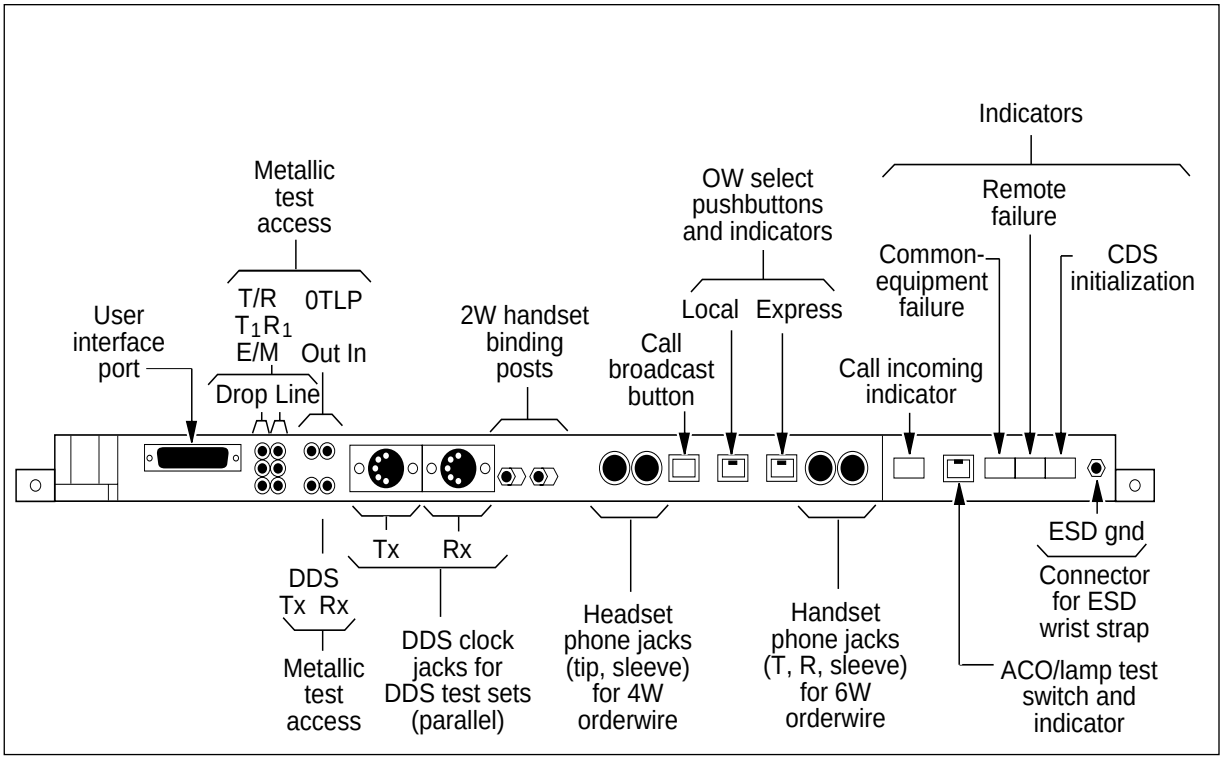
**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

| Step | Action |
|---|---|
| **2** | Press the Call broadcast button to originate the call.<br>*After a delay of about three seconds, the following occurs at the called site: the Call incoming indicator and the Local call indicator flash on and off, and the ringer in the LCAP rings. At the called site, ringing continues for up to 45 seconds, or until a handset or headset is connected to the LCAP. If a handset or headset is already connected, ringing continues for up to five seconds.* |

**Figure 7-2**
**LCAP for the ABM shelf**

FW-10208




| | |
|---|---|
| **3** | To respond to the call at the called site, plug the handset or headset into the appropriate jack on the LCAP. If a handset or headset is already connected to the LCAP, respond to the call by pressing the Local button.<br>*The Call incoming indicator and the Local call indicator light up, and ringing stops.* |

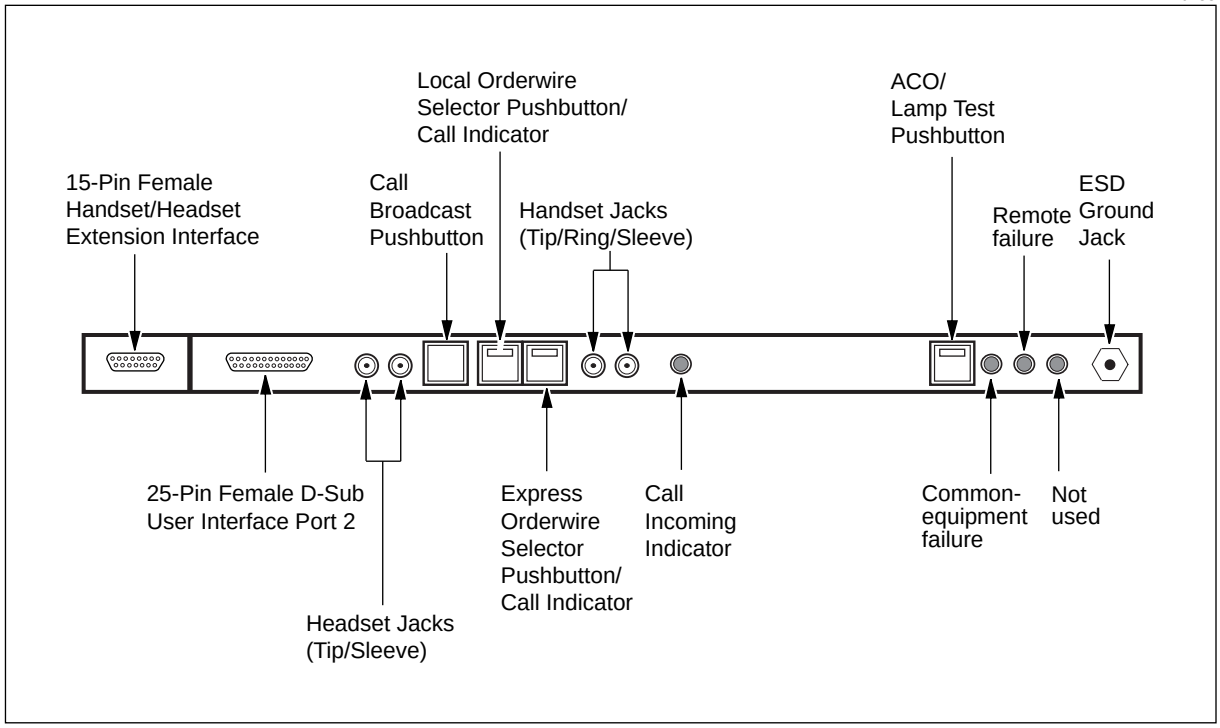
**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

| Step | Action |
|---|---|

**Figure 7-3**
**LCAP for the TBM shelf**

FW-10253




**4** Both parties should talk to verify a bidirectional voice path and record this test result on the System Test Results Form.

***Note:*** If you have not gotten to step 42 in this procedure, disregard this note. If you have progressed as far as step 42 in this procedure and are now repeating step 4 as part of the testing of the orderwire extension, you can test the external orderwire circuit by using a handset to verify the voice path.

**5** If the local orderwire fails to work, try the following in the order shown:

**a.** check the cable connections from the side interconnect left to the LCAP

**b.** verify your handset or headset connection: it is verified when the Local call indicator and the Call broadcast indicator are lit. The handset and headset connectors are polarized. Make sure the notched side of the connector points towards the left.

**c.** replace the handset or headset if both indicators are not lit

If the above checks fail, replace the maintenance interface card (MIC). Refer to *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C.

**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

| Step | Action |
|---|---|
| **6** | When you finish this test, unplug the handset or headset from the LCAP. |
| **Testing broadcast calling on express orderwire** | |
| **7** | At the calling site, again plug the Digitone handset or the four-wire headset into the appropriate jack on the LCAP.<br>*The Call incoming indicator and the Local call indicator light up.* |
| **8** | Press the Express button on the LCAP.<br>*The Express call indicator lights up and the Local call indicator turns off.* |
| **9** | Press the Call broadcast button to originate the call.<br>*After a delay of about three seconds, the following occurs at the called site: the Call incoming indicator and the Express call indicator flash on and off, and the ringer in the LCAP rings. At the called site, ringing continues for up to 45 seconds, or until a handset or headset is connected to the LCAP. If a handset or headset is already connected, ringing continues for up to five seconds.* |
| **10** | To respond to the call at the called site, plug the handset or headset into the appropriate jack on the LCAP. If a handset or headset is already connected to the LCAP, respond to the call by pressing the Express button.<br>*The Call incoming indicator and the Express call indicator light up, and ringing stops.* |
| **11** | Both parties should talk to verify a bidirectional voice path and record this test result on the System Test Results Form.<br>***Note:*** If you have not progressed to step 42 in this procedure, disregard this note. If you have progressed as far as step 42 in this procedure, and are now repeating step 11 as part of the testing of the orderwire extension, you can test the external orderwire circuit by using a handset to verify the voice path. If you have not previously progressed as far as step 42 in this procedure, disregard this note. |
| **12** | If the express orderwire fails to work, try the following in the order shown:<br>• check the cable connections from the side interconnect left to the LCAP<br>• verify your handset or headset connection: it is verified when the Local call indicator and the Call broadcast indicator are lit (on)<br>***Note:*** The handset and headset connectors are polarized. Make sure the notched side of the connector points towards the left.<br>• replace the handset or headset if both indicators are not lit<br>If the above checks fail, replace the MIC. Refer to *Module Replacement Procedures,* 323-3001-547, in *Maintenance*, Volume 5C. |
| **13** | When this test is completed, unplug the handset or headset from the LCAP. |

**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

| Step | Action |
|---|---|
| **14** | Repeat steps 1 through 13, but this time reverse the roles of the calling and called sites |
| | **Testing dial handset operation for local and express** |
| **15** | At the calling site, plug the Digitone handset into the handset phone jacks for 6W orderwire on the LCAP.<br>*The Call incoming indicator and the Local call indicator light up.* |
| **16** | Dial the 3-digit code of the other site. In the MIC, the three-digit default site identifier is 111. Find out from your system administrator if this identifier is changed.<br>*After a delay of about three seconds, the following occurs at the called site: the Call incoming indicator and the Local call indicator flash on and off, and the ringer in the LCAP rings. The same LEDs at the calling site flash on and off for about five seconds. At the called site, ringing continues for up to 45 seconds, or until a handset or headset is connected to the LCAP. If a handset or headset is already connected, ringing continues for up to five seconds.*<br>***Note:*** The following response is now expected at step 16:<br>*After a delay of about three seconds, the following occurs at both the calling site and the called site: the Call incoming indicator and the Local call indicator flash on and off, and the ringer in the LCAP rings.*<br>*Ringing continues for up to 45 seconds, or until a handset or headset is connected to the LCAP. If a handset or headset is already connected, ringing continues for up to five seconds.* |
| **17** | To respond to the call at the called site, plug the handset or headset into the appropriate jack on the LCAP. If a handset or headset is already connected to the LCAP, respond to the call by pressing the Local button.<br>*The Call incoming indicator and the Local call indicator light up and ringing stops.* |
| **18** | Both parties should talk to verify a bidirectional voice path and record this test result on the System Test Results Form. |
| **19** | If the local orderwire fails to work, try the following in the order shown:<br>• check the cable connections from the side interconnect left to the LCAP<br>• verify your handset or headset connection: it is verified when the Local call indicator and the Call broadcast indicator are lit. The handset and headset connectors are polarized. Make sure the notched side of the connector points towards the left.<br>• replace the handset or headset if both indicators are not lit<br>If the above checks fail, replace the MIC. Refer to *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C. |

**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

| Step | Action |
|---|---|
| **20** | When this test is completed, unplug the handset or headset from the LCAP. |
| **21** | Repeat steps 15 through 20 with the Digitone handset, but this time reverse the roles of the calling and called sites, and dial 000 to call all sites. |
| **Testing dial handset operation on express orderwire** | |
| **22** | At the calling site, again plug the Digitone handset into the handset phone jacks on the LCAP.<br>*The Call incoming indicator and the Local call indicator light up.* |
| **23** | Press the Express button.<br>*The Express call indicator lights up, and the Local call indicator turns off.* |
| **24** | Dial the three-digit code of the other site. In the MIC, the three-digit default site identifier is 111. Find out from your system administrator if this identifier has been modified.<br>*After a delay of about three seconds, the following things occur at the called site: the Call incoming indicator and Express call indicator flash on and off, and the ringer in the LCAP rings. The same LEDs at the calling site flash for about five seconds. (At the called site, ringing continues for up to 45 seconds, or until a handset or headset is connected to the LCAP. If a handset or headset is already connected, ringing continues for up to five seconds.)* |
| **25** | To respond to the call at the called site, plug the handset or headset into the appropriate jack on the LCAP. If a handset or headset is already connected to the LCAP, respond to the call by pressing the Express button.<br>*The Call indicator and the Express call indicator light up and ringing stops.* |
| **26** | Both parties should talk to verify a bidirectional voice path and record this test result on the System Test Results Form. |
| **27** | If the express orderwire fails to work, try the following in the order shown:<br>**a.** check the cable connections from the side interconnect left to the LCAP<br>**b.** verify your handset or headset connection: it is verified when the Local call indicator and the Call broadcast indicator are lit (on)<br>***Note:*** The handset and headset connectors are polarized. Make sure the notched side of the connector points towards the left.<br>**c.** replace the handset or headset if both indicators are not lit<br>If the above checks fail, replace the MIC. Refer to *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C. |
| **28** | When this test is completed, unplug the handset or headset from the LCAP. |
| **29** | Repeat steps 15 through 28, but this time reverse the roles of the calling and called sites. |

**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

| Step | Action |
|---|---|
| | **Calling a public network number from the local orderwire** |
| | ***Note:*** Perform steps 30 to 41 only if the orderwire system at an NE is connected to a line in the public switched telephone network (PSTN). This PSTN port connection is optional.<br>• on the ABM shelf, the connection is made by way of pins 25 (tip) and 26 (ring) on the wirewrap pin field on the BIP<br>• on the TBM shelf, the connection is made by way of pins 35 (tip) and 36 (ring) on the Access BIP connector (J14) on the side interconnect left circuit pack |
| **30** | At the calling site, plug the Digitone handset into the handset phone jacks on the LCAP.<br>*The Call incoming indicator and the Local call indicator light up.* |
| **31** | Dial the three-digit code of the site with the PSTN port (111 is the default site identifier), followed by the digit 9, followed by the number of a phone that a colleague can answer (for example, 111-9-555-1234).<br>*The telephone whose number you dialed rings and is answered by the called party.* |
| **32** | Both parties should talk to verify a bidirectional voice path and record this test result on the System Test Results Form. |
| **33** | If the connection to the public network fails to work, try the following, as necessary:<br>• verify the connections to the wirewrap pins on the breaker interface panel (BIP) at the site where the connection to the public network is made<br>• check the cable connections from the side interconnect left to the LCAP<br>• verify your handset or headset connection: it is verified when the Local call indicator and the Call broadcast indicator are lit. The handset and headset connectors are polarized. Make sure the notched side of the connector points towards the left.<br>• replace the handset or headset if both indicators are not lit<br>If the above checks fail, replace the MIC. Refer to *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C. |
| **34** | When this test is completed, unplug the handset (or headset) from the LCAP. |
| | **Calling a public network number from the express orderwire** |
| **35** | At the calling site, again plug the Digitone handset into the handset six-wire phone jackson the LCAP.<br>*The Call incoming indicator and the Local call indicator light up.* |
| **36** | Press the Express button.<br>*The call indicator on the Express button lights up, and the call indicator on the Local button turns off.* |

**—continued—**

Procedure 7-3 (continued)
**Testing the orderwire operation**

| Step | Action |
|---|---|
| **37** | Dial the 3-digit code of the side with the PSTN port (111 is the default site identifier), followed by the digit 9, followed by the number of a phone that a colleague can answer (for example, 111-9-555-1234).<br><br>*The telephone whose number you dialed rings and is answered by the called party.* |
| **38** | Both parties should talk to verify a bidirectional voice path and record this test result on the System Test Results Form. |
| **39** | If the connection to the public network fails to work properly, try the following, in the order shown:<br><br>**a.** verify the connections to the wirewrap pins on the breaker interface panel (BIP) at the site where the connection to the public network is made.<br><br>**b.** check the cable connections from the side interconnect left to the LCAP<br><br>**c.** verify your handset or headset connection: it is verified when the Local call indicator and the Call broadcast indicator are lit (on)<br><br>***Note:*** The handset and headset connectors are polarized. Make sure the notched side of the connector points towards the left.<br><br>**d.** replace the handset or headset if both indicators are not lit<br><br>**e.** if the above checks fail, replace the MIC. Refer to *Module Replacement Procedures*, 323-3001-547, in *Maintenance*, Volume 5C. |
| **40** | When this test is completed, unplug the handset or headset from the LCAP. |
| **41** | Repeat steps 30 through 40, but this time make the calls from the other site.<br><br>***Note:*** If permanent lockout occurs between the switch and NE after testing with the PSTN, plug the handset or headset back into the LCAP and initiate a forward disconnect by entering "##". |

**Testing the orderwire extension**

**42** The way to test the orderwire extension depends on whether the office end of the orderwire extension cable is connected to a local orderwire panel or an external orderwire circuit (that is a circuit in an orderwire network).

For pinout details of the orderwire extension cable connector on the side interconnect left, refer to the procedure "Installing an orderwire extension cable" in the document *Bay in Central Office Installation Manual—ABM*, 323-3001-201, or *Bay in Central Office Installation Manual—TBM*, 323-3001-202.

***Note:*** This is only a subset of the complete orderwire connections (the public switched telephone network port is not available by way of the extension port).

| If the OW extension is connected to | Then perform |
|---|---|
| a local orderwire panel | steps 1 through 41 |
| an external orderwire circuit | steps 1 through 14 |

**—end—**

# Procedure 7-4
# Testing remote network telemetry

Use this procedure to test the remote network telemetry feature.

## Requirements

The following requirements must be met before starting this procedure.

- the system must not be in service
- a VT100-compatible terminal is connected to the operations controller (OPC). If necessary, refer to *Network Element User Interface Description*, 323-3001-300, in *Operations, Administration, and Provisioning*, Volume 4A.
- telemetry byte-oriented serial (TBOS) (E2A) test set KS-22828 L1 and connecting cable is required
- a copy of the System Test Results Form, located in "Appendix A: System Test Results Form" on page 8-1 to record testing information

## Action

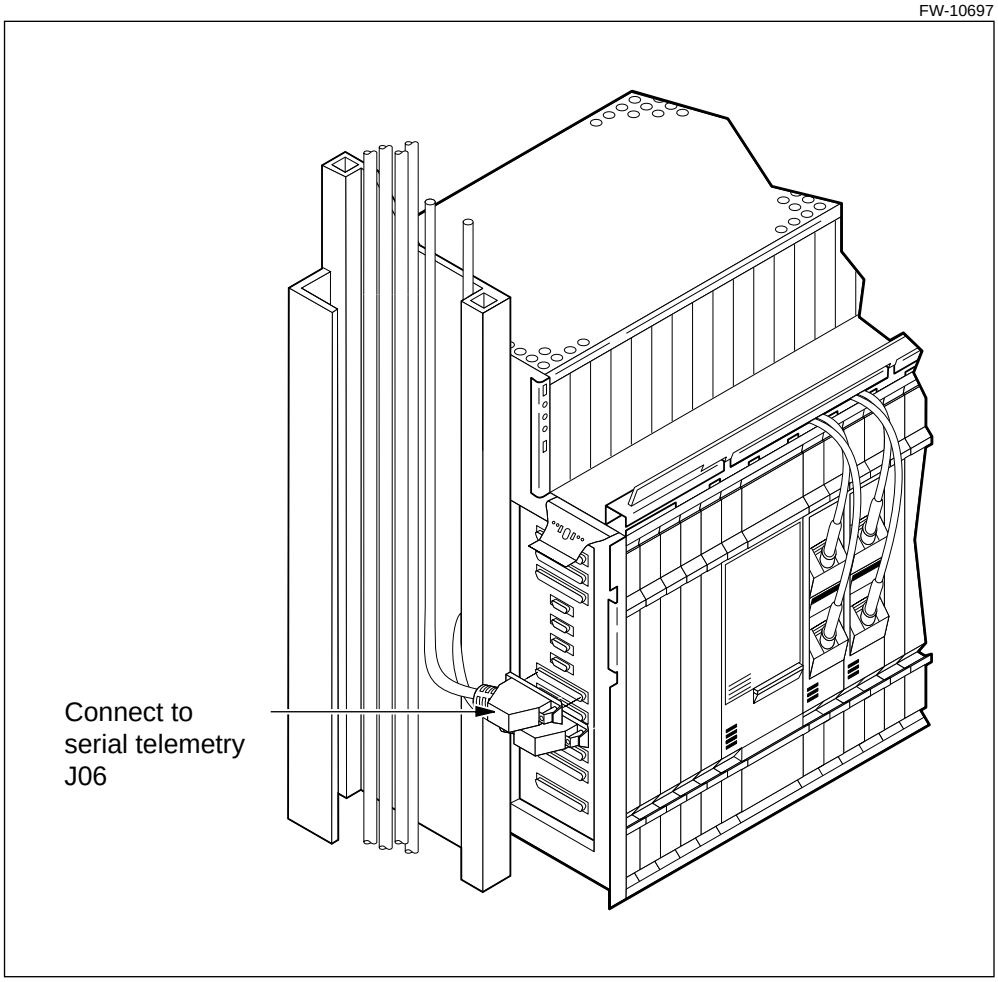
| Step | Action |
|---|---|
| **1** | Use the TBOS test cable to connect the TBOS test set to the serial telemetry connector on the side interconnect left circuit pack of the common-equipment shelf. Use jack J06 on the access bandwidth manager (ABM) shelf, as shown in Figure 7-4 on page 7-16 and use jack J08 on the transport bandwidth manager (TBM) shelf, as shown in Figure 7-5 on page 7-17. |
| **2** | Log in to the OPC under the "admin" userID.<br>*The User Session Manager screen is displayed.* |
| **3** | Select the Network Telemetry tool and choose the local network element (NE) as the one that is to receive the remote network telemetry display. Enter display number 7, on serial port 1. |
| **4** | Log in to the network element user interface (NEUI) of the local NE.<br>*The Network Element Status screen is displayed.* |

**—continued—**

Procedure 7-4 (continued)
**Testing remote network telemetry**

**Figure 7-4**
**Connection of the serial telemetry cable to the ABM shelf**

FW-10697

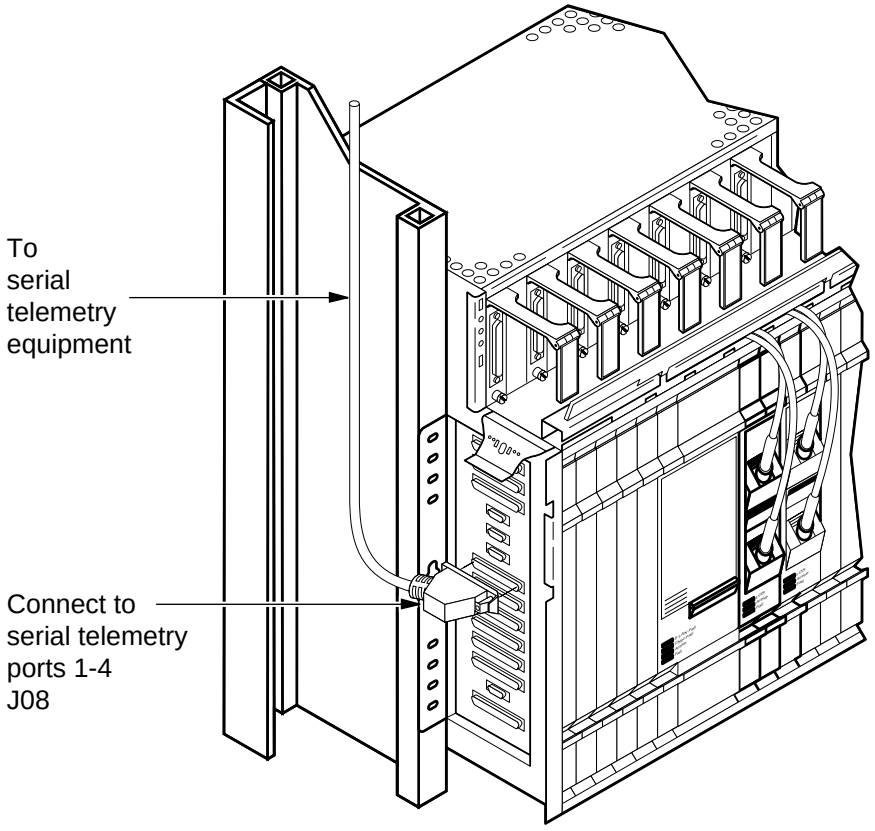



**—continued—**

Procedure 7-4 (continued)
**Testing remote network telemetry**

**Figure 7-5**
**Connection of the serial telemetry cable to the TBM shelf**

FW-10605




***Note:*** Connection for shelf position 2 shown. Shelf positions 1 and 3 are similar.

**—continued—**

Procedure 7-4 (continued)
**Testing remote network telemetry**

| Step | Action |
|---|---|
| **5** | Verify that the serial telemetry display field is updated:<br>**admin ip** ↵<br>**dtlport 3** ↵<br>*The TBOS Port screen is displayed, as shown below. Display 7 shows remote display 1.* |

FW-10587

```
                Critical Major minor warning  FailProt Lockout ActProt PrfAlrt
     Network View    .      .     .      .        .       .       .       .
      1 St.John's    .      .     .      .        .       .       .       .
Edit TBOS
 0 Quit       TBOS Port                              Shelf: CE
 2 Select                                             Unit: Port 3 TBOS
 3 Query                                   Connector Loc: Serial Telem Port 1:
 4                      Port State:  IS
 5 Status
 6 Display          Display      Shelf  Status        Display      Shelf  Status
 7             1 <Monitor     1>   1      On     5 <Monitor     5>   1      On
 8             2 <Monitor     2>   1      On     6 <Monitor     6>   1      On
 9             3 <Monitor     3>   1      On     7 <Remote      1>   1      On
10             4 <Monitor     4>   1      On     8 <Control     1>   1      On
11
12
13
14 DelDisp
15
16
17
18 Help
  NE 1
Time  17:35  >
```

| | |
|---|---|
| **6** | At the fiber central office terminal (FCOT), remove a DS1/VT synchronous mapper circuit pack. |
| **7** | At the local NE, review the TBOS port screen.<br>*The following alarm is raised on display 7 of the E2A TBOS port 1:*<br>`Network Element  Remote Display  Byte 1, Bit 3` |
| **8** | Replace the circuit pack and wait for the wait-to-restore (200 or 300 seconds) period to complete.<br>*The minor alarm clears on the TBOS test set.* |
| **9** | Remove a DS1 input or output card at the FCOT. |
| **10** | At the local NE, review the TBOS port screen.<br>*The following alarm is raised on display 7 of the E2A TBOS port 1:*<br>`Network Major  Remote Display  Byte 1, Bit 2`<br>*For the datacomm loss of signal alarm at the local NE.* |

**—continued—**

Procedure 7-4 (continued)
**Testing remote network telemetry**

| Step | Action |
|---|---|
| **11** | Reinsert the removed card.<br>*The alarm clears on the TBOS test set.* |
| **12** | At the FCOT, remove the processor card (Proc). |
| **13** | At the local NE, review the TBOS port screen.<br>*The following alarm is raised on the remote display 1 of the E2A TBOS port 1.*<br>`Network Minor  Remote Display  Byte 1, Bit 3`<br>*For the datacomm loss of signal alarm at the local network element.*<br>`Counts Inaccurate  Remote Display  Byte 1, Bit 5`<br>*Since the alarm information can not be retrieved from the FCOT.* |
| **14** | Reinsert the processor card.<br>*The processor card reboots.* |
| **15** | Make sure downloading is completed successfully by logging into the FCOT from the OPC.<br>*The Network Element Status screen of the FCOT is displayed.* |
| **16** | Logout of the NE.<br>**logout** ↵ |
| **17** | Logout of the OPC session: display the User Session Manager screen by pressing Ctrl_T + several times. Then tab to the Logout button and select it by pressing Ctrl_A or Keypad 0. Confirm the logout.<br>*The OPC login screen is displayed* |
| **18** | Note the completion of this procedure on the System Test Results Form. |
| **19** | Install the common-equipment shelf cover as described in *Routine Maintenance Procedures,* 323-3001-546, in *Maintenance,* Volume 5C. |

**—end—**

# Appendix A: System Test Results Form

A blank copy of the System Test Results Form is in this appendix. Before you begin system testing, make sufficient copies of the form. For point-to-point and single-ended systems, make one copy of pages 1 to 4. For VTBM ring systems, make one copy of page 1 and make sufficient copies of the remaining pages to perform all of the test cycles recommended in Chapter 5. (For example, for a five-node ring, make six copies of pages 2 to 4 of the System Test Results Form.)

Record your test results on the System Test Results Form. On each page, fill in the NEIDs of the network elements between which tests were performed. If you have completed a test and it is working as required, insert a check mark in the "pass_____" field. Or, insert your measured value, if this is indicated in the form.

If a test could not be successfully completed, record any pertinent details.

SONET Products

## System Test Results Form

Page 1 of 4

Customer: _____

Project: _____

COEO/Customer #: _____

OPC span of control system: _____

Central Office locations (NEIDs): _____

_____

_____

Remote locations (NEIDs): _____

Tested by: _____

Date: _____

| **System Test Results Form** (continued) | | | Page 2 of 4 |
|---|---|---|---|
| **Procedure** | **Procedure and items tested** | **FCOT** | **RFT** |
| 2-1 | Measuring the received optical power<br><br>Result must be greater than or equal to:<br>long-reach OC-3 unit: -34.0 dBm<br>Intermediate reach OC-3 unit: -28.0 dBm<br>long-reach OC-12 unit: -32.0 dBm<br>Intermediate reach OC-12 unit: -24.5 dBm<br><br>OC-3/OC-12 unit A<br>OC-3/OC-12 unit B | receive level (dBm)<br><br>_____<br>_____ | receive level (dBm)<br><br>_____<br>_____ |
| 2-2 | Setting up ESI end-to-end<br><br>Clock source: (ESI or LOOPTIMED) | pass _____<br><br>_____ | pass _____<br><br>_____ |
| 2-3 | Verifying the DS1 transmission test set | pass _____ | pass ____ |
| 3-3 | Verifying the DS3/STS-1 test set | pass _____ | pass ____ |
| 3-4 | Verifying STS-1 tributary SONET test set performance | pass _____ | pass _____ |
| 2-4 | Verifying DS1 continuity and bit error rate (BER): (Requirement: error-free operation for the indicated test period)<br>pass _____<br>pass _____<br>pass _____<br>pass _____<br>pass _____ | DS1 mapper slot number<br>_____<br>_____<br>_____<br>_____<br>_____ | DS1 mapper slot number<br>_____<br>_____<br>_____<br>_____<br>_____ |
| 3-5 | Verifying DS3 or STS-1 continuity and bit error rate (BER): (Requirement: error-free operation for the indicated test period)<br>pass _____<br>pass _____<br>pass _____ | DS3 or STS-1 circuit pack slot number<br>_____<br>_____<br>_____ | DS3 or STS-1 circuit pack slot number<br>_____<br>_____<br>_____ |

**—continued—**

| **Systems Test Results Form** (continued) | | | Page 3 of 4 |
|---|---|---|---|
| **Procedure** | **Procedure and items tested** | **FCOT** | **RFT** |
| 2-5 or 3-6 | Measuring optical receiver sensitivity<br>minimum level for LR OC-12: –32.0 dBm<br>minimum level for IR OC-12: –24.5 dBm<br>minimum level for IR OC-3: –28.0 dBm<br>maximum level for LR OC-12: –7.0 dBm<br>maximum level for IR OC-12: –4.0 dBm<br>maximum level for IR OC-3: –8.0 dBm<br>(Requirement: error-free operation for the indicated test period) | | |
| | OC-3/OC-12 unit A at minimum input level | pass _____ | pass _____ |
| | OC-3/OC-12 unit A at maximum input level | pass _____ | pass _____ |
| | OC-3/OC-12 unit B at minimum input level | pass _____ | pass _____ |
| | OC-3/OC-12 unit B at maximum input level | pass _____ | pass _____ |
| 2-6 or 3-7 | Testing OC-3/OC-12 protection switching<br>Normal receive level<br>Requirement:<br>LROC-3: –34.0 ≤normal ≤ –15.0 dBm<br>IROC-3: –28.0 ≤normal ≤ –15.0 dBm<br>LR OC-12: –32.0 ≤normal ≤ –15.0 dBm<br>IR OC-12: –24.5 ≤normal ≤ –15.0 dBm<br>(LR: long-reach) (IR: intermediate-reach) | | |
| | OC-3/OC-12 unit A | - _____ dBm | - _____ dBm |
| | OC-3/OC-12 unit B | - _____ dBm | - _____ dBm |
| 3-7 | Testing optical protection switching | | |
| | manual switching | pass _____ | |
| | forced switching | pass _____ | |
| | lockout from switching | pass _____ | |
| | automatic switching (signal failed) | pass _____ | |
| | automatic switching (signal degraded) | pass _____ | |

**—continued—**

| **System Test Results Form** (continued) | | | Page 4 of 4 |
|---|---|---|---|
| **Procedure** | **Procedure and items tested** | **FCOT** | **RFT** |
| 2-7 | Testing DS1 protection switching | | |
| | manual switching | pass _____ | |
| | forced switching | pass _____ | |
| | lockout from switching | pass _____ | |
| | automatic switching (signal failed) | pass _____ | |
| | priority switching | pass _____ | |
| 3-8 | Testing DS3 or STS-1 protection switching | | |
| | manual switching | pass _____ | |
| | forced switching | pass _____ | |
| | lockout from switching | pass _____ | |
| | automatic switching (signal failed) | pass _____ | |
| | priority switching | pass _____ | |
| 2-10 or 3-11 | Using the protection exerciser | pass _____ | pass _____ |
| 7-1 | Testing backup and restoration of NE data | | pass _____ |
| 7-2 | Verifying communication between primary and backup OPCs | | pass _____ |
| 7-3 | Testing the orderwire operation | | |
| | broadcast local orderwire | pass _____ | pass _____ |
| | dial handset operation | pass _____ | pass _____ |
| | express orderwire | pass _____ | pass _____ |
| | dialing a number in the public network | pass _____ | pass _____ |
| | testing external orderwire | pass _____ | pass _____ |
| 7-4 | Testing remote telemetry | pass _____ | |
| | **—end—** | | |

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## W

SONET Products

# AccessNode

## System Testing Procedures


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