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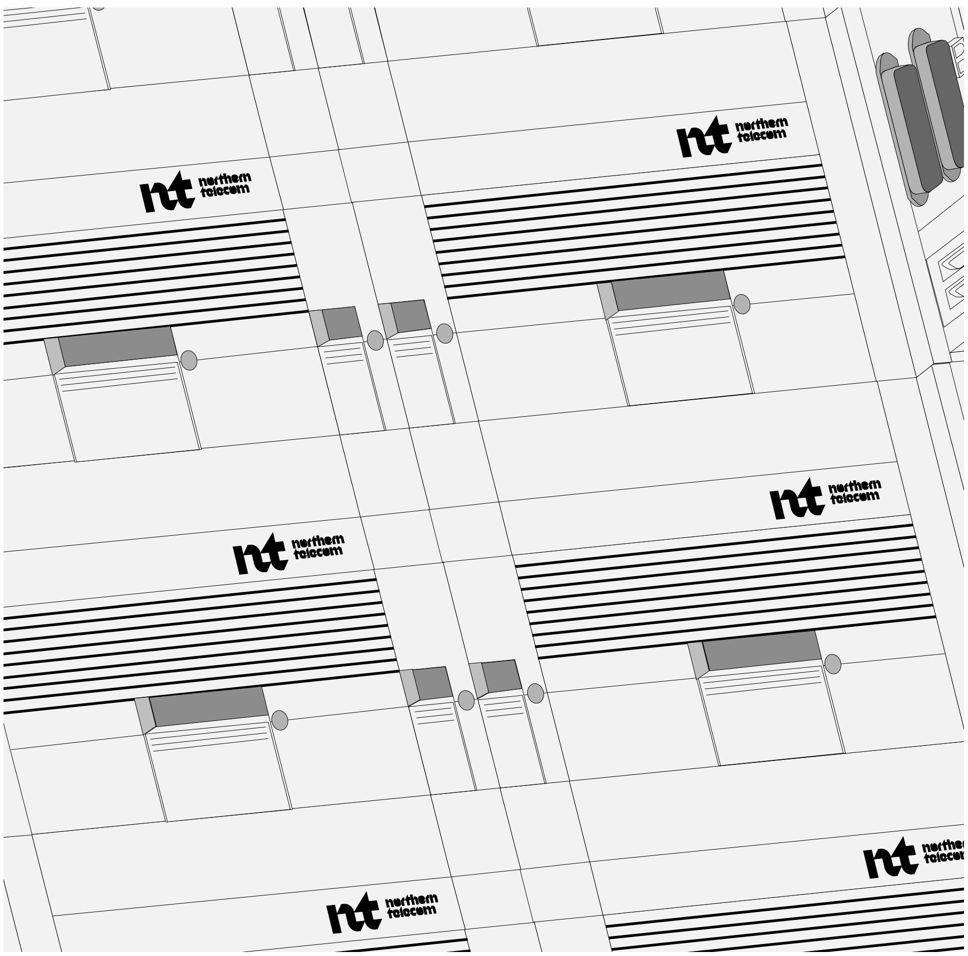
SONET Products

AccessNode

Line and Loop Testing Overview

Issue 3.0 October 1999



NORTEL NETWORKS™

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Line and Loop Testing Overview

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Issue 3.0 for AN17.20 standard release. Changes include:

- new information about provisioning the ILC in Chapter 2
- replaced references to MVICFGCI and TR8CFGCI tools with LLTCFGCI tool in Chapters 4 and 7

June 1999

Issue 2.0 for AN17 standard release. Added shelf interface card for Universal Edge 9000 shelves to Chapters 2, 3, 4, 6, 7, 8, and 9.

February 1999

AN16 standard release of the document, Issue 1.0. Updated Chapters 2, 6, and 7 to include single test head IRTU information.

June 1998

AN15 Standard 01.01 release of the document. Changes include:

- new information about DMS Direct Connect in chapters 7 and 11
- new information about SARTS and DARTS in chapter 6

September 1997

AN14 Standard 01.01 release of the document. Changes include adding GR-303 MVI information as a new chapter.

July 1996

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May 1995

Update to AN10 Standard release of the document for compact disc. Changes include improved figure references in Chapter 7, and additional clarification in Appendix C.

April 1995

Standard AN10 release of the document. Additions include additional testing information about the integrated remote test unit (IRTU) and testing of TR08 systems. Figures showing integrated applications have been modified so that they apply to point-to-point, DS1-fed, and single-ended systems.

December 1994

Standard AN08 release of the document, including new testing capabilities involving the integrated remote test unit (IRTU), testing of TR08 systems, and other new functionality.

November 1994

Reissue of standard AN07 release of the document with improvements to most chapters.

April 1994

Standard AN07 release of the document.

May 1993

Standard FWP06 release of the document.

Contents

About this document

This document overviews the line and loop testing features available in the current release of AccessNode.

This document does not contain instructions on how to conduct line and loop testing. Refer to the following documents for that information:

- *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B, explains how to install and diagnose line cards, how to line up the customer loop of special service circuits, and how to perform end-to-end testing of lines.
- *Commissioning and Testing*, Volume 3, explains how to verify connections established in the AccessNode, to permit line testing systems to function.
- *Circuit Testing from the OPC User Interface*, 323-3001-548, in *Maintenance*, Volume 5C, explains how to conduct line and loop testing using the OPC Test Manager.

For information on conducting metallic testing on Universal Edge 9000 (UE9000) systems, see the *UE9000 Voice OAM&P User Guide*.

Audience

The intended audience for this document includes the following groups:

- strategic and current planners
- provisioners
- transmission engineers
- network administrators

References in this document

This document refers to the following documents:

Description, Volume 2A

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

Description, Volume 2B

- *System Specifications*, 323-3001-180

Operations, Administration, and Provisioning, Volume 4A

- *System Administration Procedures*, 323-3001-302

Operations, Administration, and Provisioning, Volume 4B

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

Operations, Administration, and Provisioning, Volume 4C

- *System Expansion Procedure*s, 323-3001-324

Maintenance, Volume 5A

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

Maintenance, Volume 5C

- *Circuit Testing from the OPC User Interface,* 323-3001-548

Separately bound documents

- *Bay in Central Office Installation Manual—ABM*, 323-3001-201
- *TL1 Interface Description,* 323-3001-190

DMS SuperNode family documentation

- BCS36 document *SMA Translations Guide*, 297-2741-350
- NA002 document *XPM Translations Reference Manual*, 297-8321-815

Basic concepts of line/loop testing

This chapter overviews the types of testing that you can use to test the AccessNode customer loops and lines.

Overview of AccessNode systems

This section overviews the different types of AccessNode systems.

Point-to-point fiber-fed

The AccessNode point-to-point fiber-fed system is composed of two terminals, or network elements, connected by an optical carrier. The fiber central office terminal (FCOT) interfaces to other equipment at voice frequency or at a DS1 rate. The remote fiber terminal (RFT) is located closer to customers. Subscriber loops (customer services) terminate on line cards in the copper-distribution shelves at the RFT.

The RFT delivers the customer services to the central office by way of optical carrier. The system supports the delivery of analog and digital, locally switched and non-switched, narrowband and wideband services (including universal services, GR-303 CSC and TR08 integrated services, DS1 tandem services, and DS1 and DS3 transport services). It also supports the line and loop testing systems described in this document.

DS1-fed

DS1-fed systems omit the FCOT. The RFT delivers customer services to the central office by way of DS1 facilities instead of optical carrier. It supports the delivery of GR-303 common signaling channel (CSC) and TR08 integrated services and DS1 tandem services, but not DS1 or DS3 transport services or universal services. It also supports line and loop testing systems described in this document.

Single-ended

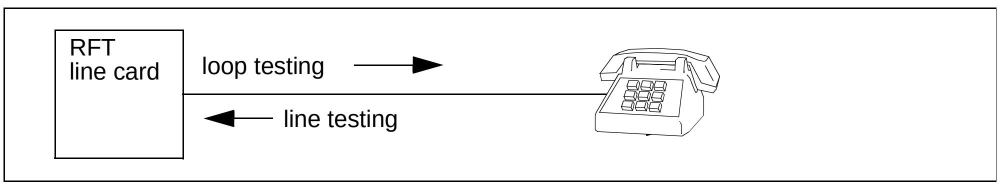
Single-ended systems also omit the FCOT. The RFT delivers customer services to the central office by way of a fiber multiplex system. Single-ended systems support the delivery of GR-303 CSC and TR08 integrated services, DS1 tandem services, and DS1 transport services, but not DS3 transport or universal services. It also supports line and loop testing systems described in this document.

Optical ring

Optical ring systems also omit the FCOT. The RFTs are configured in a ring configuration that provides route diversity for protection against loss-of services during transmission path disruptions. Ring systems support the delivery of GR-303 CSC and TR08 integrated services, DS1 tandem services, and DS1 transport services, DS3 transport and universal services. It also supports line and loop testing systems described in this document.

Line and loop testing

Line and loop testing refers to testing of the subscriber lines and loops that terminate at the line cards in the RFT. As illustrated in the following diagram, loop testing is performed towards the metallic facility or loop, and line testing is performed towards the line card.



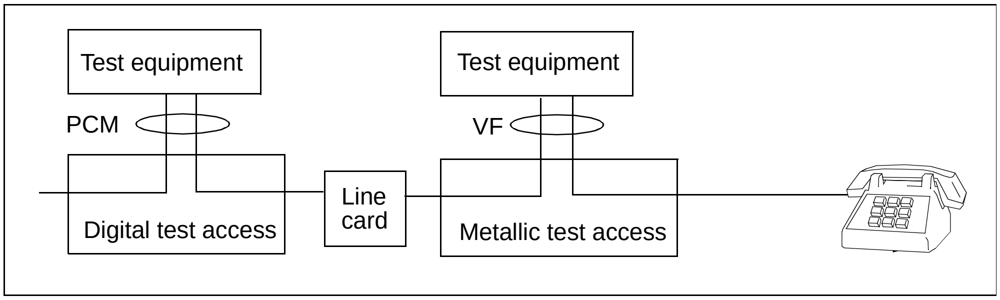
Line/loop testing is performed during circuit provisioning and installation to ensure that the circuit is working and that it meets tariff requirements. It is also performed as part of preventive maintenance, or in response to trouble reports. Loop testing includes voltage, resistance, and balance measurements. Line testing incudes signalling tests and transmission parameter measurements.

Metallic test access

Metallic test access is access to the metallic (loop or drop) side of a line card for testing purposes. Metallic test access is possible from several directions: using a test bypass pair from the central office, or using a remote test unit connected to a test access path, or using metallic jack access on the local craft access panel (LCAP).

Digital test access

Digital test access is access to the digital (line or PCM) side of a line card for testing purposes. Two types of digital access are possible at the LCAP: 0TLP jack access and DDS jack access. Metallic test access and digital test access are illustrated in the following diagram.



Methods of testing

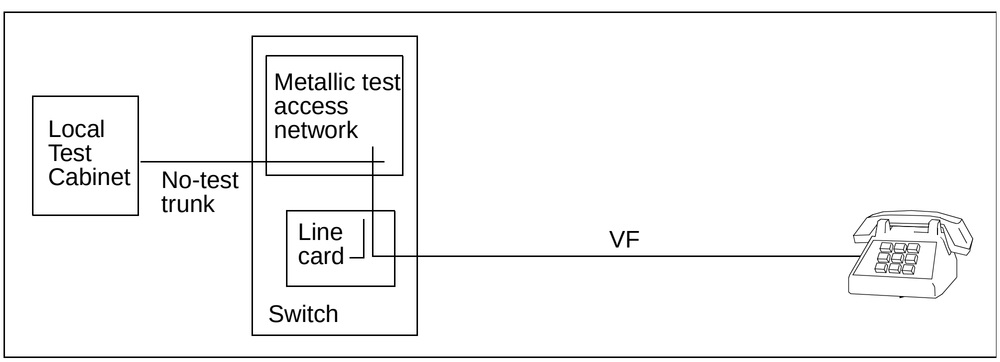
You may use either of several different testing systems to perform line/loop testing on AccessNode systems. The following paragraphs describe the most commonly used systems and test connections used.

Local testing system

A local testing system is dedicated to a switch or a carrier system, and provides a stand-alone testing capability. Testing can be manual or automatic. Some local testing systems can also be accessed by a test operations system, which can then direct the testing of lines. An example of a local testing system is the Nortel Networks 3703 Local Test Cabinet (LTC).

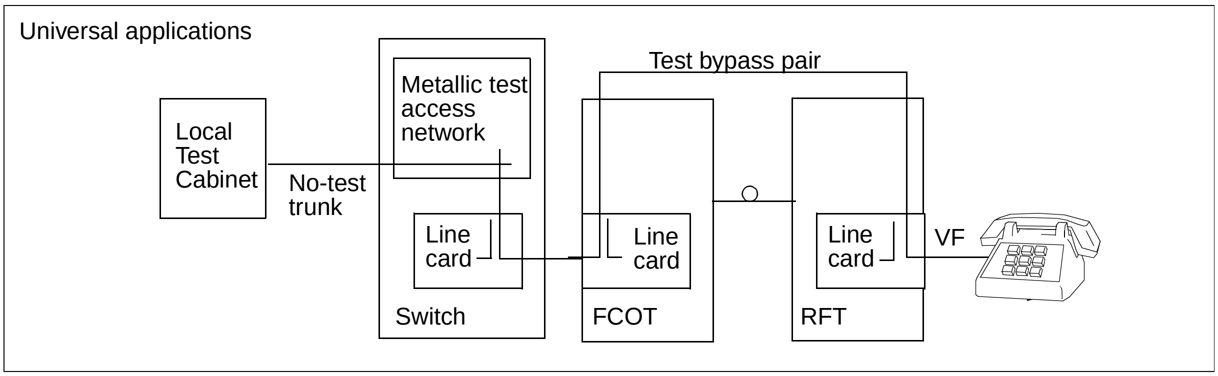
No-test trunk

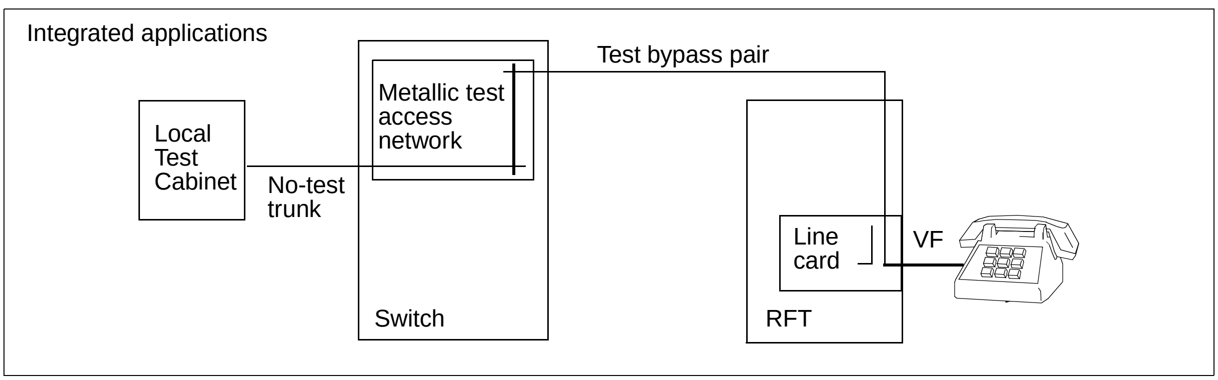
A no-test trunk (NTT), illustrated in the following diagram, is the means used by a local testing system to set up a metallic connection to a subscriber loop through the metallic test access network of a local switch. The no-test trunk protocol is described in Bellcore document TR536. The tip-ring pair of the NTT is connected metallically to the loop to be tested. The sleeve-ground pair of the NTT is used for control.



Carrier bypass (test bypass pair)

A test bypass pair is a pair of wires between a switch (or central office terminal) and a remote terminal, bypassing the carrier. At the remote terminal, the test bypass pair can be connected to the analog side of any line card, to perform loop tests. As illustrated in the following diagrams (universal and integrated applications), the test bypass pair is part of the metallic path used in NTT testing. It is also used in GR-303 DMS MAP LTP testing, described in the chapter “Locally-Switched Services (LSS) testing”. Test bypass pairs can be used in other applications such as DS1 fed and optical rings.

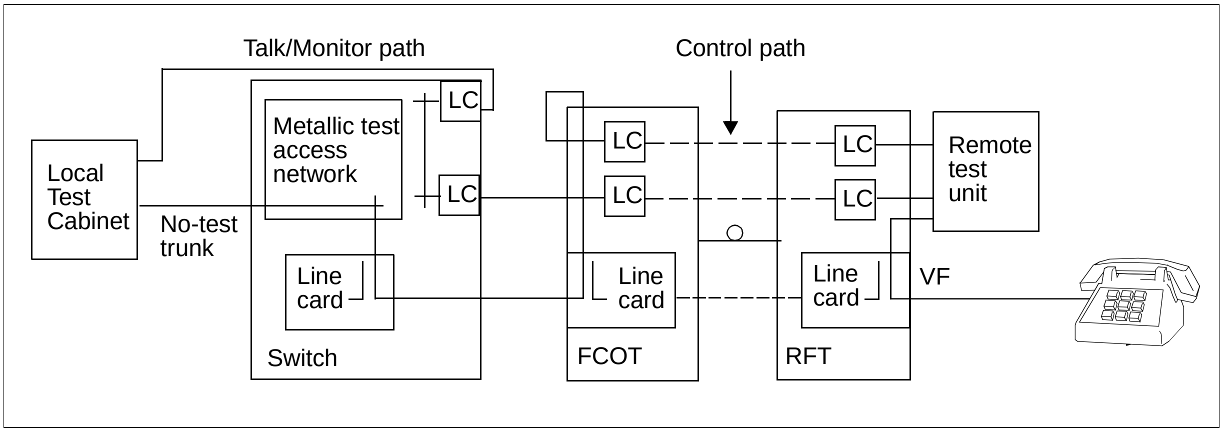


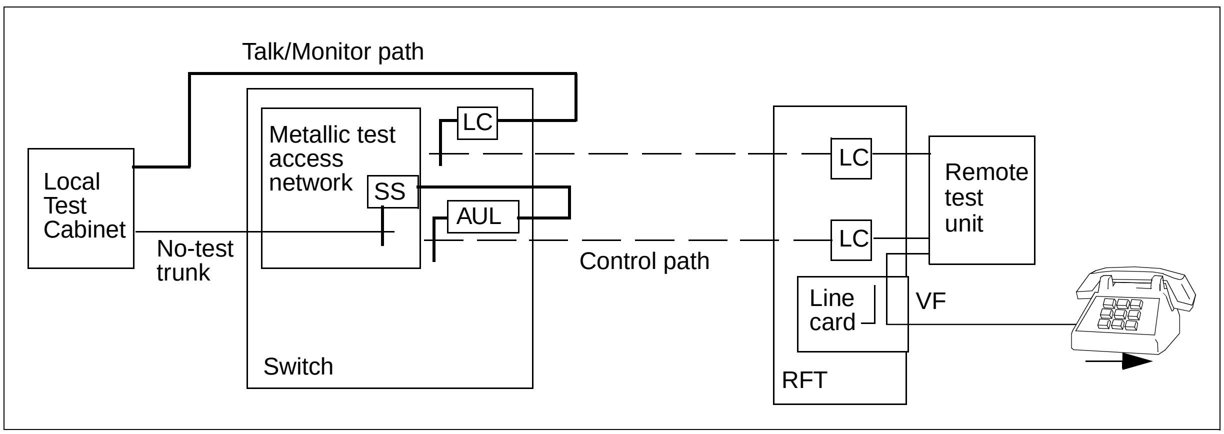


Remote test unit

A remote test unit (RTU) installed at the remote location is an alternative to the test bypass pair, which has distance limitations. As illustrated in the following figure (universal application), the local testing system connects the RTU to the line under test. Upon request, the RTU performs measurements and reports results.

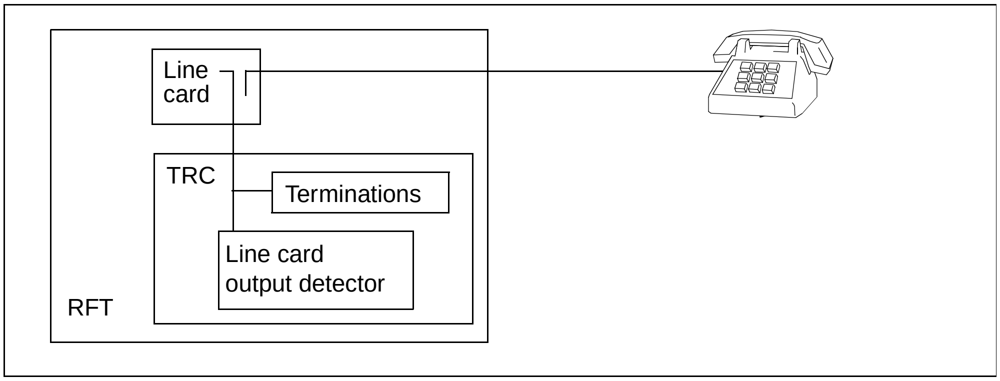
The RTU requires two lines back to the central office. A communication (control) path is established from the local testing system and carries the test requests and the test results. A voice (callback monitor) path, terminating on the switch, allows the tester to monitor the voice quality of the loop, or to communicate with the customer.





Test response circuit

A test response circuit (TRC) at the RFT can be connected to a line card as illustrated in the following figure. The connection is initiated by way of commands or signals from a line testing system, such as the pair gain test controller. It provides a set of controlled terminations to the line card, to stimulate operations. It detects the line card responses and reports them on request. In AccessNode, the TRC resides on the test access card (TAC), and is used to test locally switched services, such as POTS or COIN.



Line card diagnostics

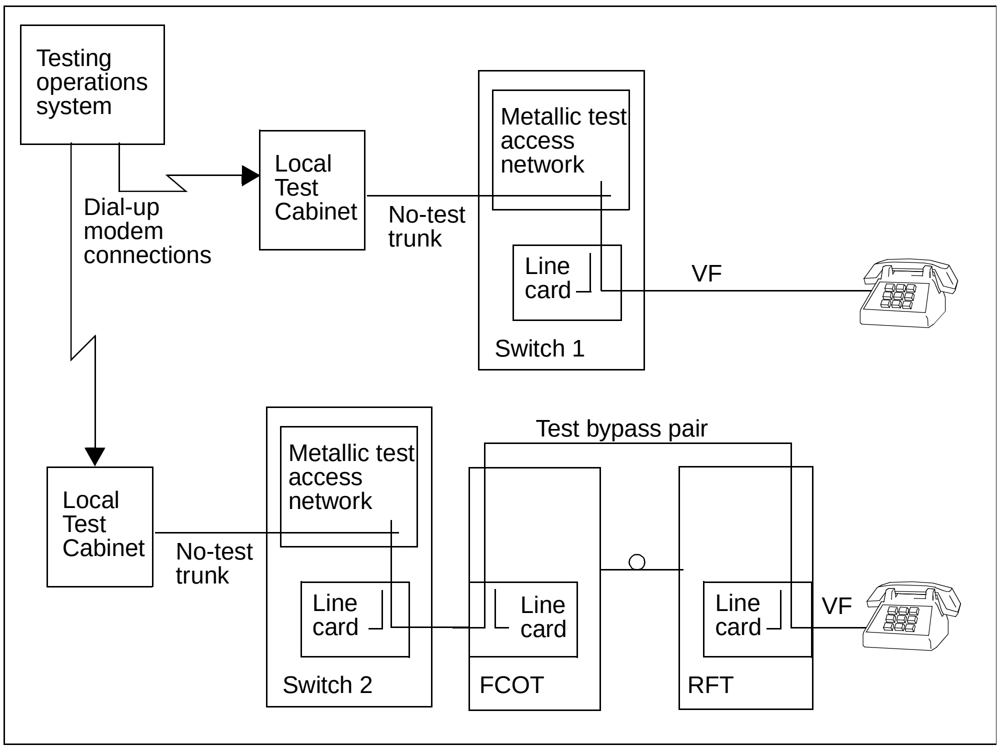
Line card diagnostics provide standalone testing of a line card. Diagnostics include an on-board self-test, which is performed automatically upon insertion of the line card. Diagnostics can be requested when the card is in the in-service state. The tester can also request more complete line card diagnostics by placing the card out-of-service first. These are full diagnostics, which use TAC circuitry to test the analog circuitry on the line card.

Operations system

An operations system (OS) is a centralized system used for controlling operations, administration, maintenance (testing), and provisioning of equipment in the telephone network.

The following figure shows a typical example of how a testing OS directs the testing of customer lines on more than one switch or carrier system from a central location. Testing may be automatic or manual. The testing OS connects to the local testing system dedicated to the line equipment. To initiate a connection, the testing OS usually dials the modem number of the local testing system.

Refer to *TL1 Interface Description*, 323-3001-190, for details on testing through TL1 tools.



Test system controller

Some OSs direct customer testing through a test system controller (TSC) instead of a local testing system. A TSC links an operations system to a local switch or carrier system and performs a translation of standard test commands and responses between the OS and the line equipment. To initiate a connection, the testing OS usually enters the network address of the test system controller.

AccessNode line/loop testing resources

The following line and loop test resources provided on the AccessNode are described in this chapter:

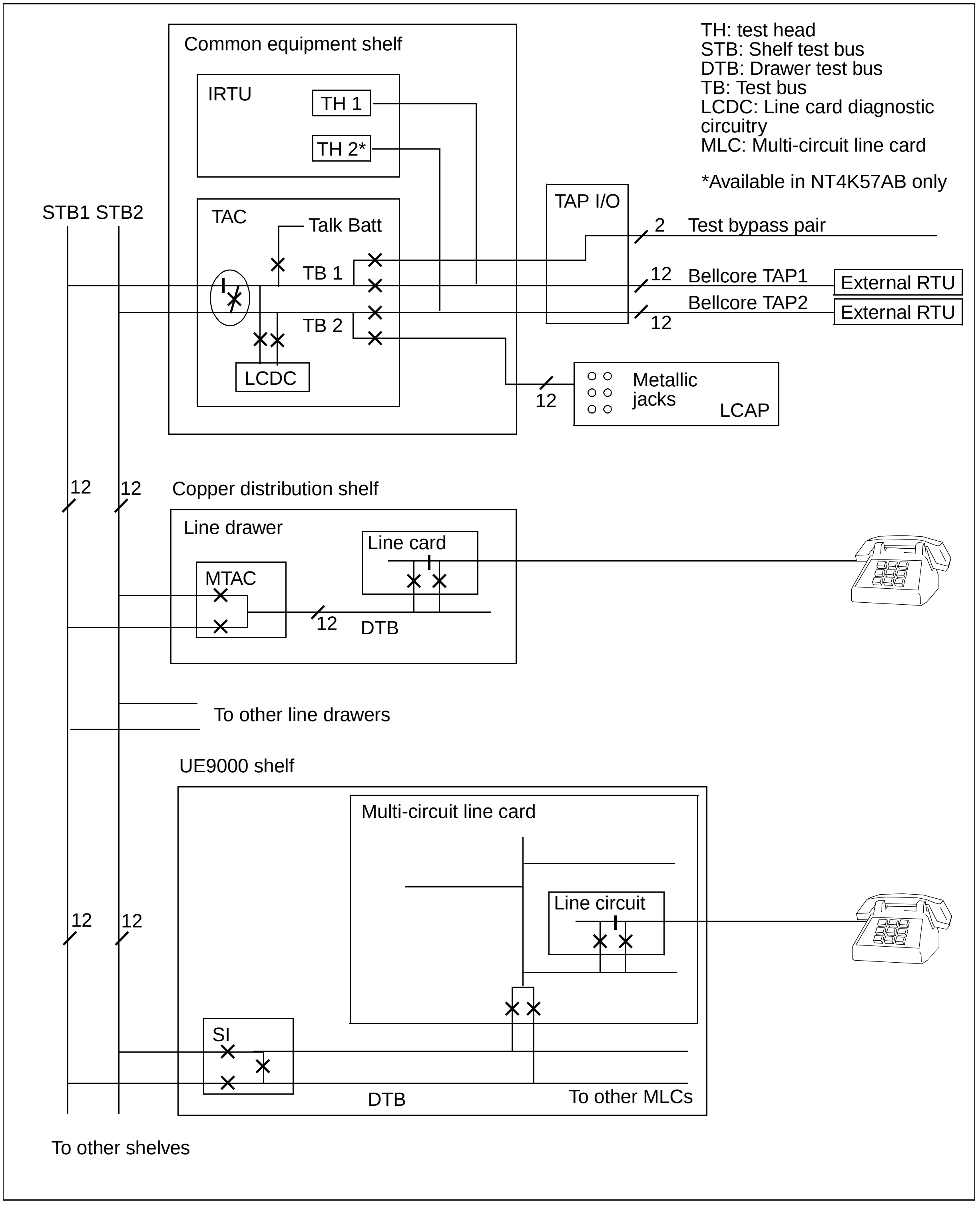
- test access card (TAC)
- single and dual test head integrated remote test units (IRTU)
- IRTU line card
- test response circuit
- input/output (I/O) cards (TBP, PGTC/MTA, and TAP)
- test buses
- metallic test access card (MTAC)
- LCAP jack access
- system interface (SI) card

Additional information about circuit packs is included in *Signal Flow and Circuit Pack Descriptions*, 323-3001-102, in *Description*, Volume 2A.

Metallic test access architecture

The AccessNode metallic test access architecture is illustrated in Figure 2-1 on page 2-2. It provides the context for many of the RFT test resources explained in this chapter.

Figure 2-1
AccessNode metallic test access architecture (RFT)



Test access card

The NT4K54 test access card (TAC) provides the basic narrowband subscriber testing capability for AccessNode, including:

- metallic test access (MTA)
  - — metallic jack access (2-wire, 4-wire, and 6/8-wire) at the local craft access panel (LCAP)
  - — test bypass pair (TBP)
  - — Bellcore TR95 metallic test access unit (MTAU) with two simultaneous, full-split test access paths (TAPs)
- digital test access (DTA)
  - — 0TLP jacks
  - — DDS jacks
- line card diagnostics
- carrier bypass operation for use in no-test-trunk (NTT) testing of locally switched services (LSS)
  - — pair gain test controller (PGTC)
  - — metallic test access (MTA)
- test response circuit (TRC) for GR-303 LSS testing and PGTC testing in a universal application

Metallic test access The TAC provides a relay switching matrix which connects external interfaces (metallic jack, TBP, TAP1, and TAP2) onto one of two internal test buses.

Digital test access The TAC provides a coder/decoder (CODEC) for 0TLP jack operation at voice frequency, and a clock and DSP processing to support DS0DP DDS testing.

Line card diagnostics The TAC provides passive resistive terminations along with voltage sources during diagnosis of Omega line cards. For diagnosis of Epsilon line cards, which do not have diagnostics software, the TAC DSP is used to perform channel loss and echo return loss measurements, in addition to verifying signaling and supervision.

Carrier bypass operation The TAC, in conjunction with the PGTC I/O card, provides the 28-lead interface at the FCOT for connection to a pair gain test controller. For metallic test access (MTA), the TAC provides ±130 volt reporting and teardown pulse detection and also 1600 Hz and signature resistances for reporting of line card diagnostic results.

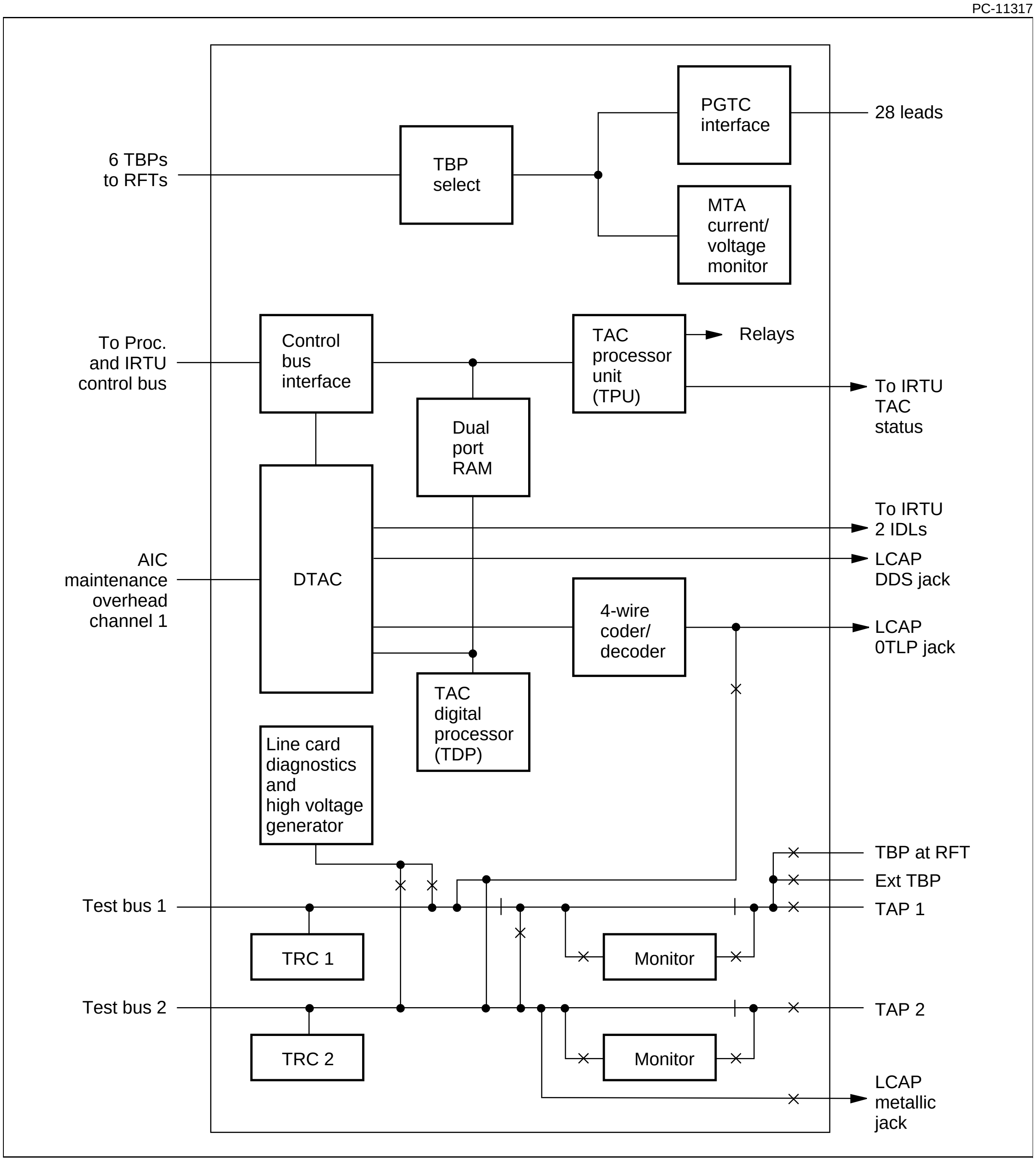
GR-303 test response circuit The TRC is used for locally-switched services testing. In particular, the TRC is used in conjunction with the DMS SuperNode MAP/LTP DIAG command for POTS, COIN, and EBS services, and also with DMS SuperNode NTT testing when the NTT is provisioned as a mechanized loop tester (MLT) trunk. In universal applications, the TRC provides the “RT Termination” state machine operation specified in TR-465, for testing the carrier channel. Measurement specifications for the TRC are listed in the document *System Specifications*, 323-3001-180, in *Description*, Volume 2B. Additional TRC information is provided on page 2-16.

Other TAC functions The TAC, when used in conjunction with the IRTU for enhanced testing, also provides the processing for the emulation of a POTS line card and Bell 212A 1200/300 baud modem. This line card/modem emulation is referred to as the IRTU line card as described on page 2-9.

The TAC also provides the necessary terminations to support special services circuit lineup, which is controlled from the OPC Specials Lineup Manager tool. Additional details are provided in Chapter 3, “Basic testing capability”.

TAC hardware/software TAC functionality is illustrated in Figure 2-2 on page 2-5. The TAC is an intelligent circuit pack, having both a 32-bit microprocessor and a digital signal processor on board. The TAC has its own managed software load, downloaded from the OPC. The TAC is a mandatory card installed in slot 20 of the access bandwidth manager (ABM) shelf.

Figure 2-2
Test access card (TAC) functional block diagram



Integrated remote test unit

The NT4K57 integrated remote test unit (IRTU) provides an enhanced testing capability for AccessNode narrowband subscriber services. The IRTU provides the hardware for either one or two fully-featured test heads depending on the card type. The test heads are used to test locally-switched services, NLS/NS special services, and EBS/ISDN services.

IRTU Upgrades

When a single test head IRTU is removed and a dual test head IRTU is inserted after the IRTU initializes and completes the diagnosis process, the second test head is out of service. The craftperson must manually put the second test in service from the eq irtu screen.

Software Features

In this release, the following software features are provided:

- DRTU emulation
- MTU emulation
- Bellcore TR834 testing

DRTU emulation

An IRTU test head emulates an external Nortel Networks model 3704 digital remote test unit (DRTU). DRTU-type testing of locally-switched services is directed from the Nortel Networks Centralized Automated Loop Reporting System/Line Test Cabinet (CALRS/LTC).

MTU emulation

An IRTU test head emulates the DMS SuperNode multi-line test unit (MTU), remoting the function to the RFT. Testing of locally-switched services is directed from the DMS MAP interface.

Bellcore TR834 testing

TR834 testing is provided by way of the AccessNode operations controller (OPC). TR834 testing of non-switched and non-locally-switched services is directed from one of the following systems:

- AT&T’s Switched Access Remote Test System (SARTS)
- Bell Canada’s Digital Analog Remote Testing System (DARTS)
- OPC Test Manager tool

Additional information about these IRTU emulations is provided in Chapter 5, “Enhanced testing”.

Detailed measurement specifications for the IRTU are listed in *System Specifications*, 323-3001-180, in *Description*, Volume 2B.

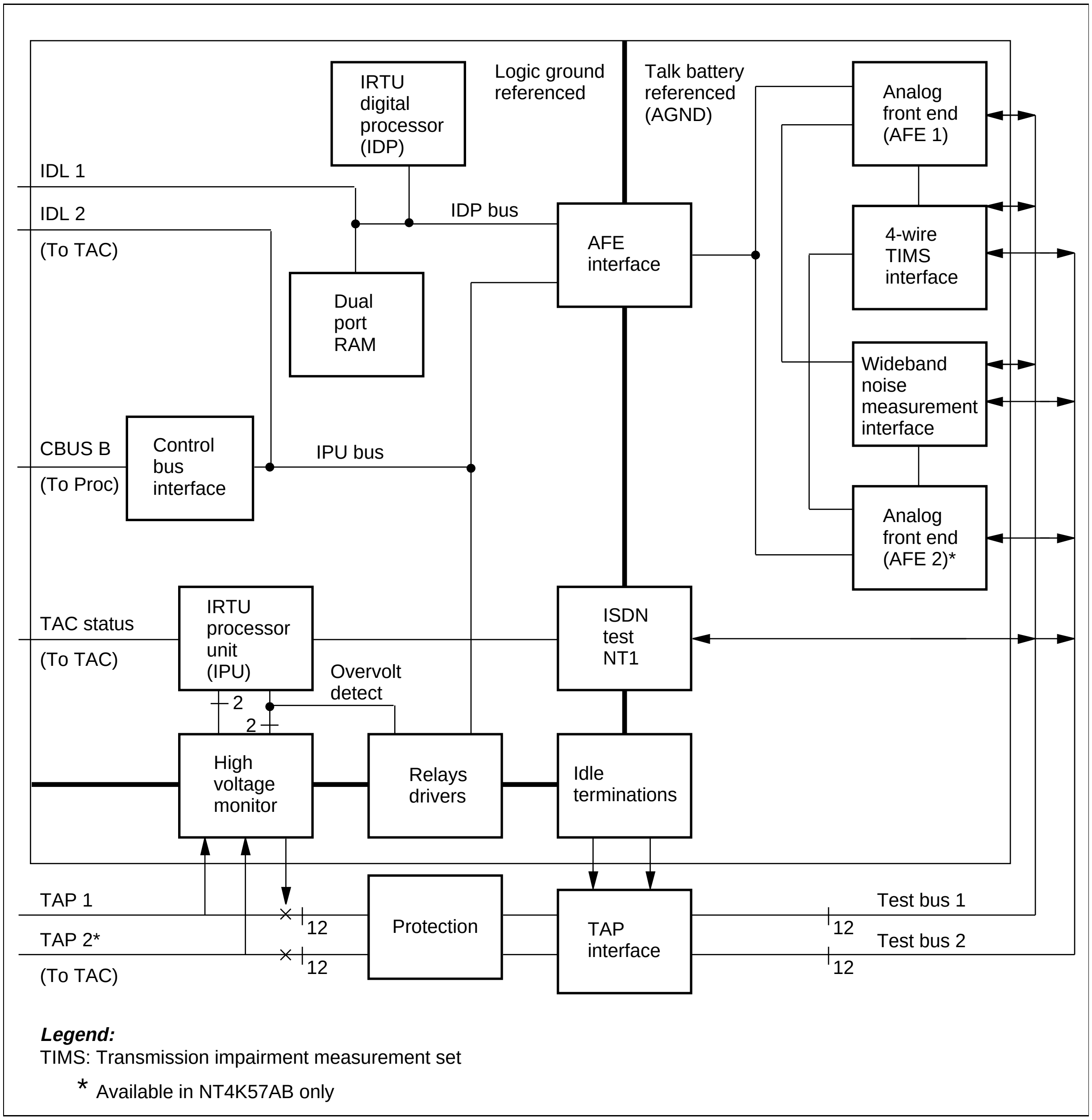
Functional Diagram

A functional block diagram of an IRTU test head is shown in Figure 2-3. This figure shows the following IRTU components:

- one or two independent analog front ends (AFEs) which includes 2-wire Transmission Impairment Measurement Set (TIMS) circuitry
- 4-wire TIMS section shared between test heads on a test session basis

Figure 2-3
IRTU functional block diagram

PC-11316



IRTU simultaneous test session capabilities

The IRTU permits dynamic use of test heads, that is, both test heads can be running a different emulation at the same time, and each test head is reusable in a different emulation in its next test session. Table 2-1 lists the simultaneous test session combinations that are possible.

Table 2-1
Possible test session combinations using two IRTU test heads

DRTU emulation	MTU emulation	2-wire TR834	4-wire TR834	Notes
✔✔ (note 2)				**Note 1:** One test session = ✔ **Note 2:** Multihosting application, with each switch using a different test head **Note 3:** Two 4-wire TR834 test sessions are not possible, due to the shared 4-wire TIMS
✔	✔			
✔		✔		
✔			✔	
	✔✔			
	✔	✔		
	✔		✔	
		✔✔		
		✔	✔	

The shared 4-wire TIMS section means that two simultaneous 4-wire TR834 test sessions are not possible. If one 4-wire TR834 test session is active, a request for a second 4-wire TR834 test session will be rejected. Also note that any jack access will limit IRTU use to one test head (TH1). Any carrier bypass connection through a metallic test pair will also limit IRTU use to one test head (TH2).

IRTU hardware/software

The IRTU, like the TAC, is an intelligent circuit pack, having both a 32-bit microprocessor and a digital signal processor on board. The IRTU has its own managed software load, which is downloaded from the OPC.

The IRTU is an optional dual-width circuit pack installed in slot 21 of the access bandwidth manager shelf at the remote fiber terminal. It provides two independent test heads, replacing external remote test units (RTUs). When the IRTU is equipped, then the test access card (TAC) must also be equipped and functional.

If the IRTU circuit pack is being installed in an NT4K10AA ABM shelf older than release 7, then the shelf must be modified to accommodate the IRTU. The procedure for modifying an in-service shelf is given in *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C.

The IRTU test head service states are visible from the IRTU circuit pack equipment screen. This same screen allows the test head to be manually placed out of service. When you attempt to put test head two in service or take it out of service on a single test head IRTU, the system displays this message: “The test head does not exist. Please select another test head.”

IRTU calibration

The IRTU is a self-calibrating test head. It does *not* require periodic factory calibration as do most pieces of test equipment. The IRTU continuously monitors calibration limits during idle periods. If a limit is exceeded, the IRTU will automatically recalibrate, also during idle periods.

Calibration of the IRTU is performed when the IRTU circuit pack is inserted or restarted. Subsequently, the IRTU monitors for drift in temperature-sensitive hardware and automatically recalibrates if needed. This feature ensures that the IRTU meets accuracy specs over the full operating temperature range, even when there are rapid temperature changes. There are two common scenarios where this might happen:

1. if the door to an environmentally controlled enclosure is opened during severe weather conditions, such as extreme cold or hot
2. during normal temperature variations experienced within a non-environmentally controlled enclosure from morning to evening

If the IRTU detects a need to calibrate, but the test head subsequently fails to calibrate, then the status of the test head is changed to FAILED. To account for temperature-related faults, the IRTU will attempt to recover a test head by trying to recalibrate periodically. This automatic recovery provides greater availability of the IRTU under some Partial Fail conditions (if the IRTU does not recalibrate under temperature extremes) until it can be replaced.

The IRTU will not allow measurements to be made or test signals to generate using uncalibrated test head circuitry. The automatic recalibration feature of the IRTU during idle periods ensures high availability of the test head with minimal blocking of test functions due to self-calibration.

IRTU line card

The IRTU line card (ILC) is a POTS line card and Bell 212A 1200/300 baud modem emulation that is used in conjunction with the IRTU enhanced testing. The line card/modem emulation is accomplished using microprocessor/DSP resources on the TAC and IRTU.

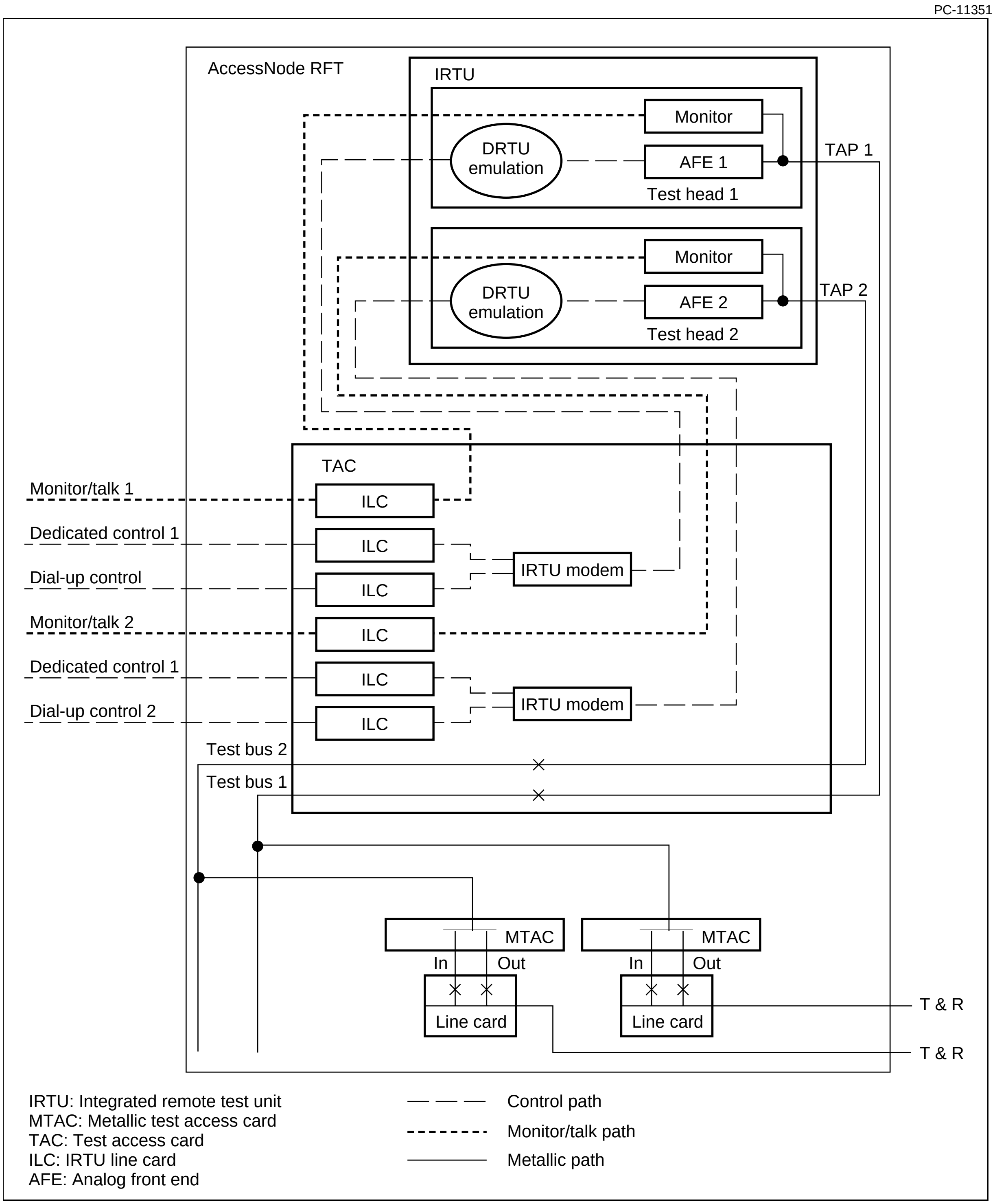
Implemented on the TAC at the RFT, an ILC circuit is carried on maintenance overhead (MOH) channels between the TAC and the access interface card (AIC), where it is multiplexed into its provisioned DS0 channel.

External remote test units (RTUs) normally require two POTS circuits, as shown in the RTU illustrations on page 1-5. One of the circuits is used as a control path, normally a dial-up modem path in which ASCII command strings are passed to control operation of the RTU. The other path is for a talk/monitor path. This path is also referred to as a callback path because a command sent over the control path is used to initiate the callback, in which the RTU goes off-hook and dials the callback number supplied over the control link. The talk/monitor path allows the tester at the test position to monitor VF on the line under test or to talk with the customer.

The ILCs eliminate the need for physical line cards and all of the installation wiring normally required for external RTUs. However, the ILCs do require the use of a physical line card slot (the slot must be left empty). Figure 2-4 on page 2-11 shows how the ILCs logically relate to the IRTU testing function.

> ***Note:*** The AccessNode does not support provisioning the ILC using a Universal Edge 9000 (UE9000) line card address. You must provision the ILC using a CDS line card address.

Figure 2-4
IRTU dual test head (NT4K47AB) and IRTU line card functionality



Equipping rules

An ILC does not need a physical line card at the RFT, although a physical line card slot must be reserved (left empty) for each ILC. If an ILC is provisioned in a slot, and a physical line card is installed in that slot, a mismatch will be reported in the Line Card Equipment screen in FWPUI. The mismatch is removed when the physical line card is removed.

> ***Note:*** The AccessNode does not support provisioning the ILC using a Universal Edge 9000 (UE9000) line card address. You must provision the ILC using a CDS line card address.

Provisioning

Each IRTU test head can support up to three kinds of ILCs: a dedicated control path, a dial-up control path, and a talk/monitor path. The actual number of ILCs required depends on which IRTU testing capabilities are being used:

- one talk/monitor ILC must be provisioned for each test head used for TR834, DRTU emulation, or MTU emulation, for a maximum of two
- a dial-up control path ILC must be provisioned for a test head used for DRTU emulation in an integrated application. If one test head is used for DRTU emulation, then provision only one dial-up control path ILC. If both test heads are used for DRTU emulation, then provision two dial-up control path ILCs.
- a dedicated control path ILC must be provisioned for a test head used for DRTU emulation in a universal application. Only one such connection is supported in an AccessNode system, so provision one dedicated control path ILC, if required.

ILCs in a universal or DS1 tandem application are provisioned using the OPC Provisioning Manager tool (refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B). In an integrated application, ILCs are provisioned at the DMS SuperNode MAP (refer to DMS family documentation: in BCS36 release, refer to *SMA Translations Guide*, 297-2741-350; in later releases, refer to *XPM Translations Reference Manual*, 297-8321-815).

ILC provisioning restrictions by FCOT shelf and software release

Table 2-2 lists the ILC circuit types permitted in IRTU testing arrangements, depending on combinations of DMS SuperNode release, AccessNode release, and FCOT shelf type.

Table 2-2
ILC provisioning options based on software release and FCOT shelf type

AccessNode FCOT shelf		
DMS SuperNode release	**ABM shelf**	**TBM shelf**
NA008 - NA010	Integrated ILC TR08 ILC Universal ILC	Integrated ILC TR08 ILC

Several figures follow which illustrate the application of ILC circuits in IRTU testing.

Figure 2-5 shows that two integrated ILCs can be used in a DMS SuperNode MAP – IRTU (MTU emulation) arrangement, one talk/monitor line to each of two test heads.

Figure 2-5
IRTU line cards in a DMS SuperNode MAP – IRTU test arrangement

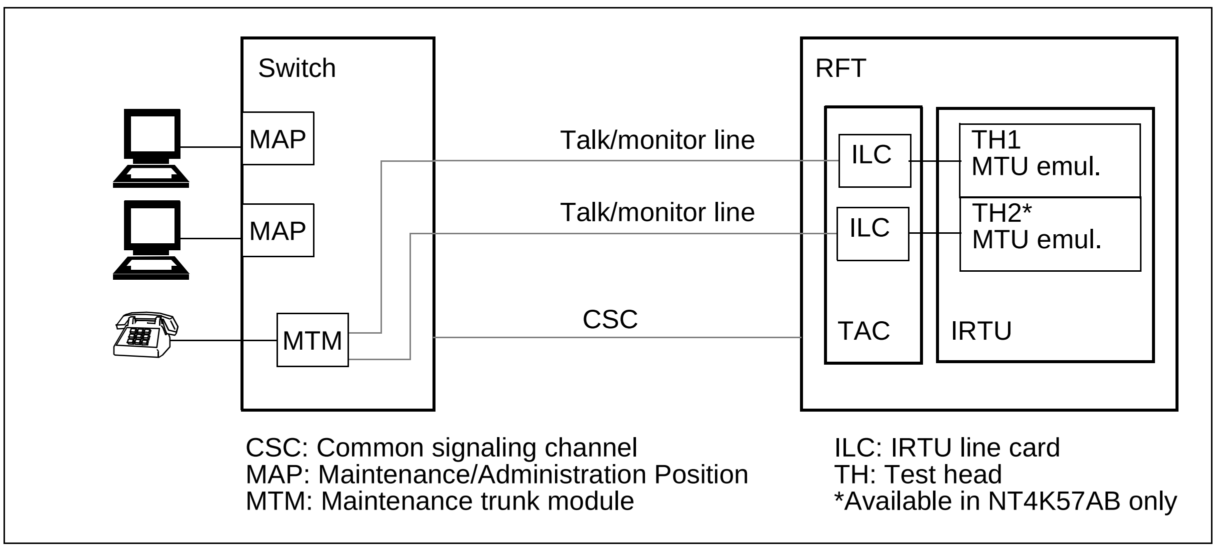


Figure 2-6 on page 2-14 shows that in an NTT-IRTU (DRTU emulation), universal application, two universal ILCs terminate on one test head, one ILC for a dedicated control path, and one for a talk/monitor path. The universal ILCs use line cards at the FCOT, and ILCs at the RFT.

Universal ILCs can also be used in a combined UDLC/GR-303 DMS application with BCS36 software at the DMS SuperNode.

Figure 2-6
IRTU line cards in a NTT-IRTU universal application

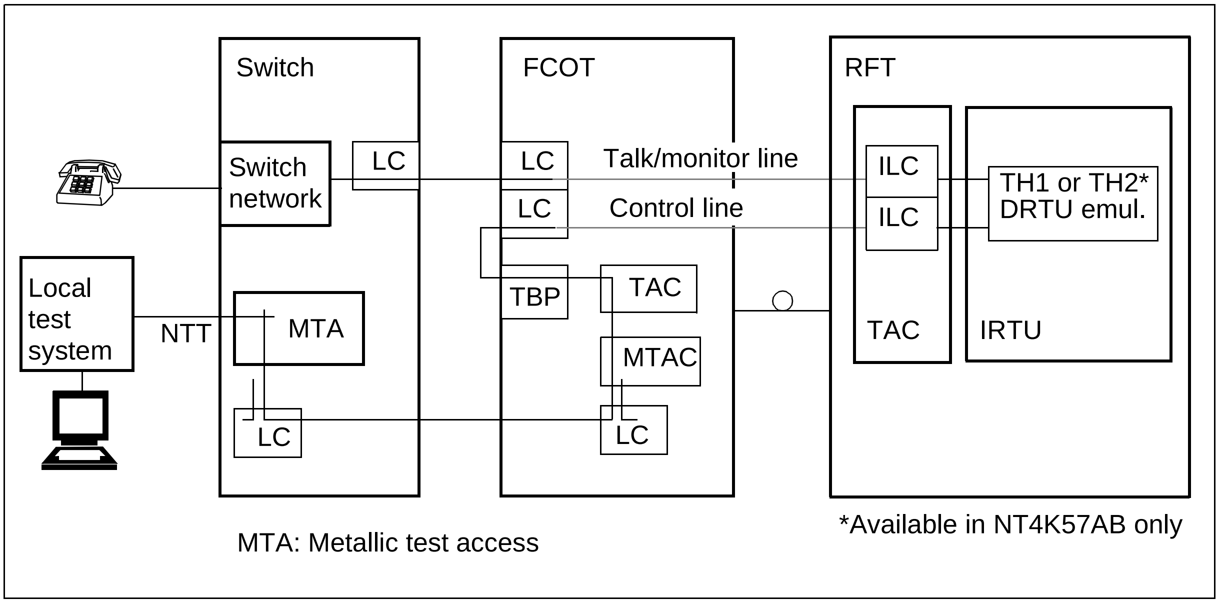
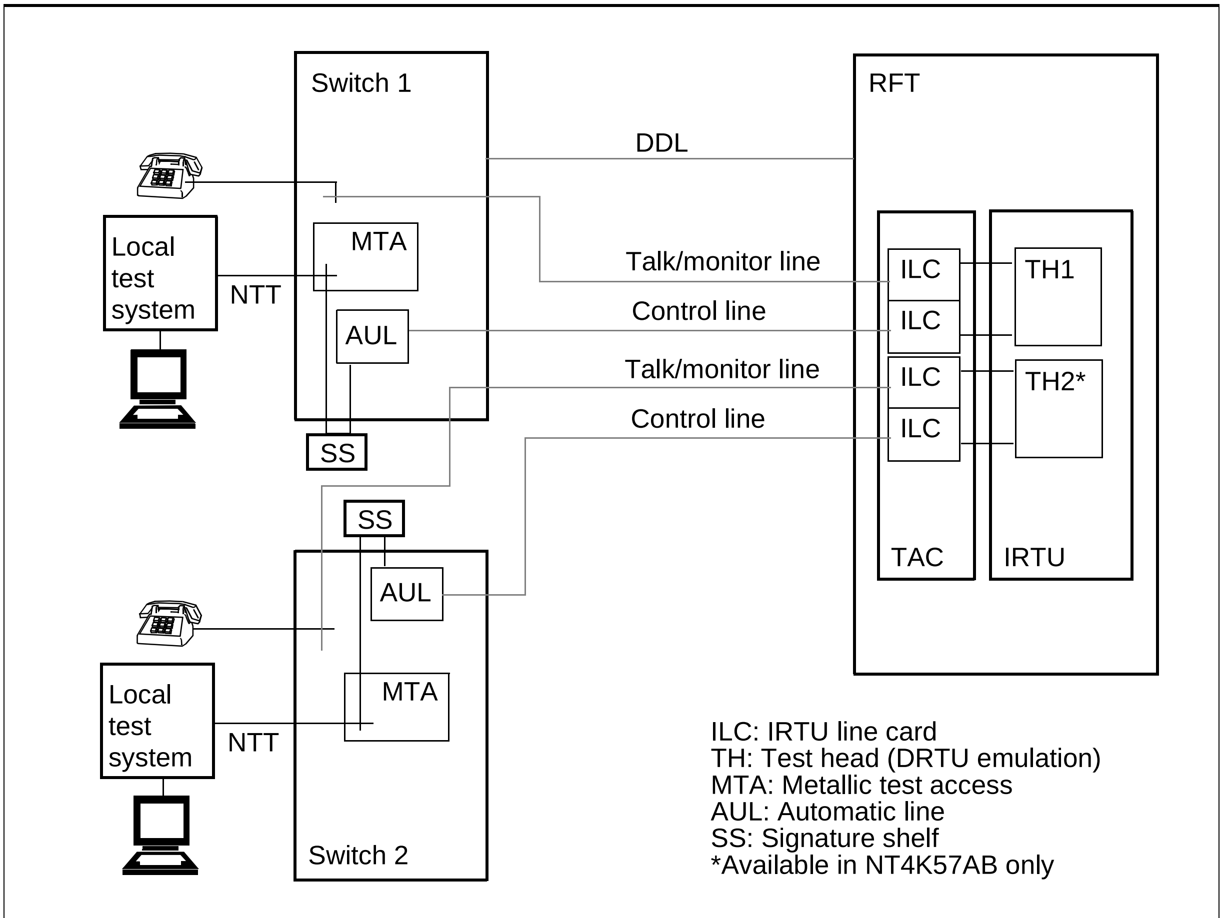


Figure 2-7 on page 2-15 illustrates the use of four TR08 ILCs in an NTT-IRTU (DRTU emulation), TR08 application, in which two TR08 ILCs terminate on each test head. One test head is used for testing from one switch, and the other test head is used by a second switch.

> ***Note:*** Although the second pair of ILCs are not used by the single test head IRTU, there is no interlock to prevent them from being provisioned at the DMS.

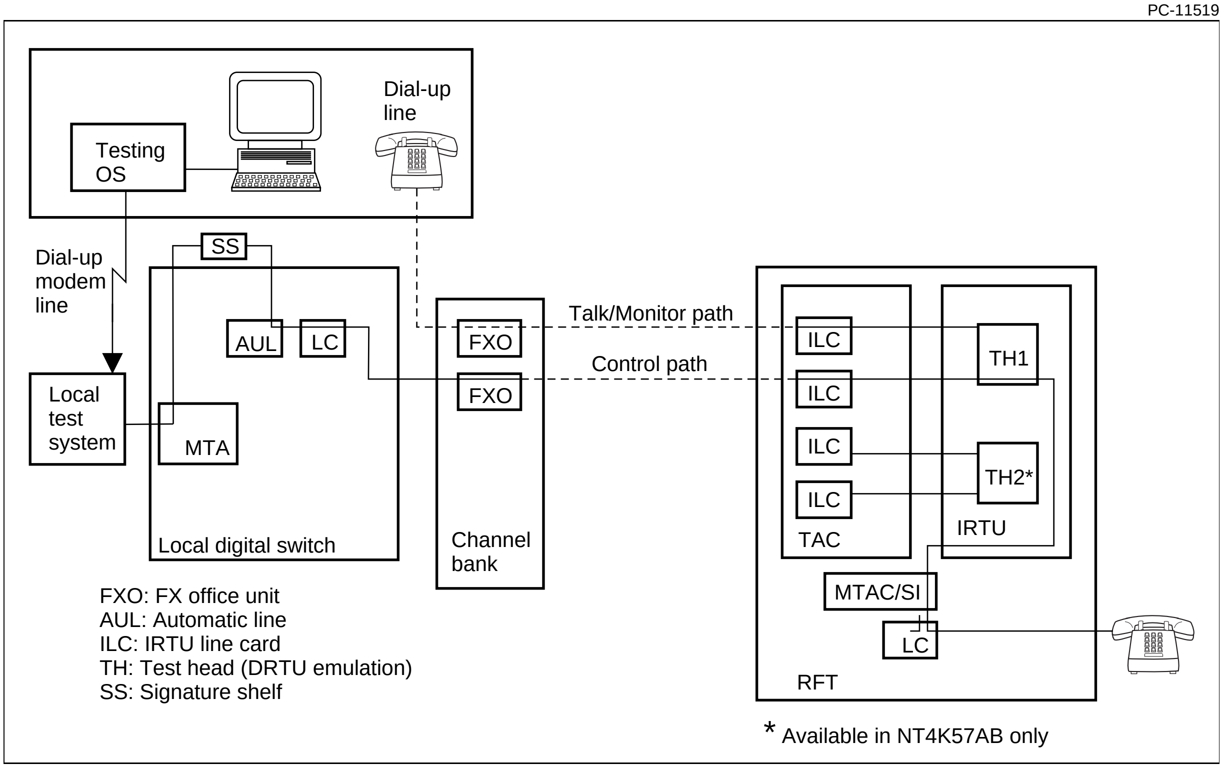
Figure 2-7
IRTU line cards in a NTT-IRTU TR08 application



In a combined application with multihosting (one analog and two digital switches), then an NTT-IRTU (DRTU emulation) test arrangement may use up to five ILCs: two talk/monitor lines, two dial-up control lines, and one dedicated control line. This configuration is not illustrated, but is a composite of Figure 2-6 on page 2-14 and Figure 2-7.

Several other arrangements are also possible. An alternative arrangement for integrated-only systems (GR-303 DMS) provides control and talk/monitor paths by way of DS1 tandem ILCs, as shown in Figure 2-8 on page 2-16. In this arrangement, a PCM channel bank is equipped with FXO channel units to terminate the ILC circuits at the central office. The ILCs are provisioned as DS1 tandem ILCPOTS services.

Figure 2-8
IRTU line cards terminated on a channel bank, integrated application



Test response circuit

Two independent test response circuits (TRCs) are provided by the TAC for use in GR-303 locally-switched services (LSS) testing, such as in DMS SuperNode MAP/LTP DIAG testing of AccessNode GR-303 DMS services. In addition, the TRC is used in conjunction with TR465 PGTC testing of AccessNode UDLC locally-switched services. The basic function of the test response circuit is to implement the GR-303 command OPERATE_TERM (INITIAL_TERM, LUOC, FINAL_TERM). The operation of the OPERATE_TERM command is to apply an initial termination, and upon detecting the requested LUOC, to apply the final termination.

As an example of an LSS test, the host GR-303 switch can command the RFT TRC to apply an initial open termination (on-hook condition) and then apply a loop closure absorptive termination (900 ohms tip-to-ring, corresponding to an off-hook condition) when the TRC detects ringing voltage on ring. The test is conducted by the host switch commanding the line card to generate ringing. If an off-hook message is generated by the line card, then the ringing test passes. If no off-hook message is generated, then the ringing test fails.

The function and operation of the TRC is detailed in GR-303 and TR465. In addition to supporting the TR465 version of the TRC, the TAC will also support the forward-looking TA-313 terminations. The TAC test response circuit provides the GR-303 terminations listed in Table 2-3.

Table 2-3
GR-303 terminations provided by the TAC test response circuit

Term. code	Termination explained	Termination applied
OPEN	all leads open circuit	
LCRF	loop closure reflective	short circuit tip-to-ring
LCAB	loop closure absorptive	900 ohms tip-to-ring
LCPG	loop closure absorptive, positive path to ground	900 ohms tip-to-ring with 1210-ohm positive path to ground
LCNG	loop closure reflective, negative path to ground	Short tip-to-ring with 1210-ohm negative path to ground
RNGG	ring ground, ground on ring lead	Tip open, 1663 ohms ring-to-ground
NTPG	negative tip ground: negative path to ground on tip, ring open	Ring open, 1663-ohm negative path to ground on tip
PTPG	positive tip ground: positive path to ground on tip, ring open	Ring open, 1663-ohm positive path to ground on tip

The TAC test response circuit will detect the line unit output conditions (LUOCs) listed in Table 2-4.

Table 2-4
Line unit output conditions detected by the TAC test response circuit

LUOC code	LUOC explained	LUOC condition
NSRR	negative superimposed ringing on ring	ac > 60 V rms, dc < −20 V on ring
PSRR	positive superimposed ringing on ring	ac > 60 V rms, dc > +20 V on ring
NSRT	negative superimposed ringing on tip	ac > 60 V rms, dc < −20 V on tip
PSRT	positive superimposed ringing on tip	ac > 60 V rms, dc > +20 V on tip
	—continued—	

Table 2-4 (continued)
Line unit output conditions detected by the TAC test response circuit

LUOC code	LUOC explained	LUOC condition
PCCV	positive coin control voltage	dc > 90 V on tip
NCCV	negative coin control voltage	dc < –90 V on tip
PCCH	positive coin check	42 < dc < 60 V dc on tip
NCCH	negative coin check	✍60 < dc < –42 V dc on tip
NLCF	normal loop current feed	tip-to-ring > 9 V dc, ring < –5 V dc
RLCF	reverse loop current feed	ring-to-tip > 9 V dc, tip < –5 V dc
PLCF	positive loop current feed	ring-to-tip > 9 V dc, ring > –5 V dc
NLPC	normal loop current	same as NLCF
RLPC	reverse loop current	satisfied by the requirements of either RLCF or PLCF
NLC	no loop current	tip-to-ring < 5 V dc
GSTI	ground start idle	tip-to-ring < 5 V dc
ANY	anything	
—end—		

All combinations of initial terminations and line unit output conditions are not compatible. Table 2-5 captures the supported initial termination/LUOC combinations.

Table 2-5
Supported combinations of TRC initial terminations and LUOCs

LUOC	Termination							
	OPEN	LCAB	LCRF	LCPG	LCNG	RNGG	NTPG	PTPG
NLCF	*	*	1	*	1	*	*	*
RLCF	*	*	2	*	2	*	*	*
PLCF	*	*	NA	*	NA	*	*	*
GSTI	1	*	NA	*	NA	1	1	1
NCCH	& *	& *	&	& *	&	& *	& *	& *
PCCH	& *	& *	&	& *	&	& *	& *	& *
—continued—								

Table 2-5 (continued)
Supported combinations of TRC initial terminations and LUOCs

LUOC	Termination							
	OPEN	**LCAB**	**LCRF**	**LCPG**	**LCNG**	**RNGG**	**NTPG**	**PTPG**
NCCV	& *	&	&	&	&	& *	& *	& *
PCCV	& *	&	&	&	&	& *	& *	& *
NSRR	*	NA	NA	NA	NA	NA	*	*
NSRT	*	NA	NA	NA	NA	*	NA	NA
PSRR	*	NA	NA	NA	NA	NA	*	*
PSRT	*	NA	NA	NA	NA	*	NA	NA
NLPC	*	*	1	*	1	*	*	*
RLPC	*	*	NA	*	NA	*	*	*
NLC	*	*	*	*	*	*	*	1
ANY	*	*	*	*	*	*	*	*
Legend:	*: a valid combination assuming a path to ground from either the tip or ring lead and a valid combination assuming either the tip or ring lead is left open (unconnected) NA: an invalid combination: it is undetectable or does not make sense 1: LUOC cannot be uniquely identified under these conditions. Loop current LUOCs cannot be detected unless an absorptive termination is applied. 2: LUOC cannot be uniquely identified under these conditions. Loop current LUOCs cannot be detected unless an absorptive termination is applied. In many cases, the voltages measured on tip and ring will appear identical for NCCH and RLCF.							
—end—								

I/O cards for line and loop testing

Three input/output (I/O) cards are provided to facilitate line and loop testing:

- test bypass pair (TBP) card
- PGTC/MTA card
- test access path (TAP) card

These cards are illustrated in functional position in layout figures in later chapters. A description of each card follows.

Test bypass pair I/O card

The NT4K58CA test bypass pair (TBP) card is used at the FCOT in one of two ways: to terminate the test bypass pair, or to provide the control path connection to an FCOT line card, to facilitate dedicated access to a remote test unit at the RFT. It installs in I/O slot 51 of the FCOT ABM shelf.

PGTC/MTA I/O card

The NT4K58DA PGTC/MTA I/O card provides the connection point at the FCOT for one of two external test interfaces: either the pair gain test controller (PGTC) or metallic test access (MTA). It installs in I/O slot 52 of the FCOT ABM shelf.

Test access path I/O card

The NT4K58KA test access path (TAP) I/O card provides a connection point for a number of external test interfaces at the RFT:

- It terminates the test bypass pair.
- It is used to connect one or two external remote test units to the RFT.
- It is used to terminate a test bus termination unit, if testing with an R-TEC system.

The TAP card installs in I/O slot 53 of the RFT ABM shelf.

Test buses

In general, there are two test paths available for testing line cards in an AccessNode system. They are the shelf test bus (STB) and the drawer test bus (DTB).

In copper distribution shelves, the two STBs provide the test paths between the TAC in the common equipment shelf and the MTACs. In Universal Edge 9000 (UE9000) shelves, the two STBs provide the test paths between the TAC in the common equipment shelf and the shelf interface (SI) card.

In copper distribution shelves, the DTB, also called the midplane test bus, provides the test path between the MTAC in each line drawer and the line card to be tested. In UE9000 shelves, the DTB provides the test path between the SI card and the multi-circuit line card (MLC) to be tested. A logical representation of the STB and DTB is shown in Figure 2-1 on page 2-2.

Bus-sharing rules

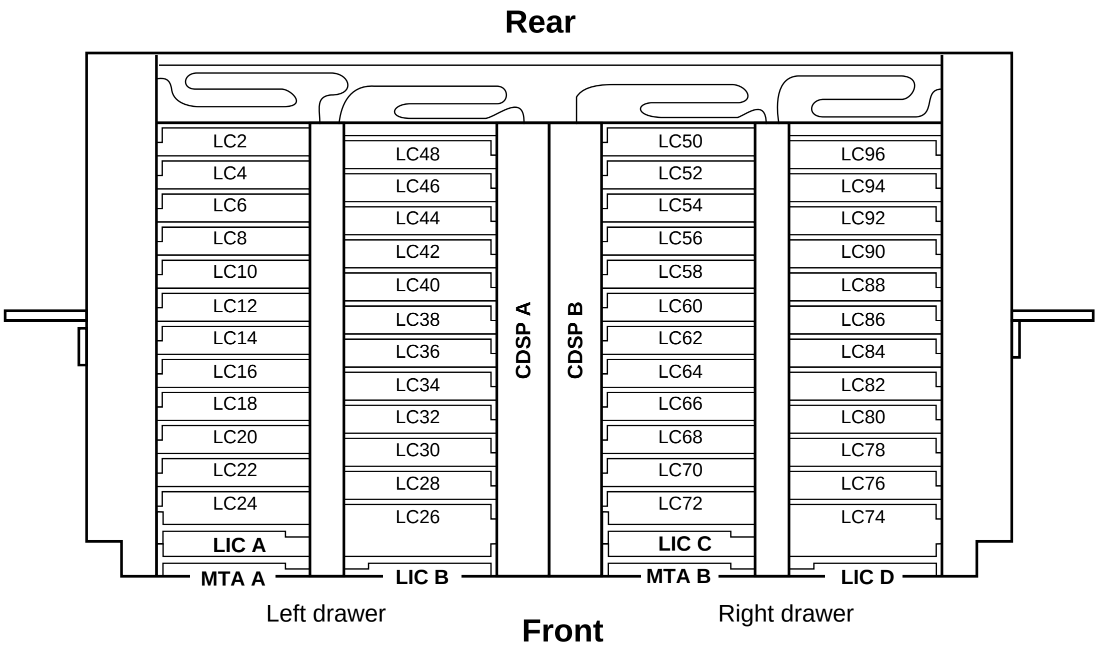
Every line card can connect to either shelf test bus, but each line drawer has only one drawer test bus. This permits, for example, simultaneous metallic test access to two line cards, as long as the two line cards are not in the same line card drawer.

Metallic test access card (NT4K73AB)

The NT4K73 metallic test access card (MTAC) provides a relay connection between each shelf test bus (STB) and the drawer test bus (DTB).

Two MTACs are installed in each copper distribution shelf: one in slot MTA A in the left drawer, and the other in slot MTA B in the right drawer. A fully-equipped system contains fourteen cards. The location of the MTACs in a shelf is shown in Figure 2-9 on page 2-22.

Figure 2-9
Location of cards in a copper distribution shelf



Note 1: The odd-numbered line card slots are not visible from the top, only from the side.

Note 2: The narrowband line-interface cards (LIC A-D) and metallic test access cards (MTA A and B) are full-height common cards.

Metallic test access card (NT4K73CA)

The metallic test access card (MTAC) is used to switch the CDS drawer test busses onto the shelf metallic test busses as required for metallic test access and sparing. Additional circuitry monitors for fault with any card in the CDS drawer and for Talk Battery loss at the drawer level. If a card fault is detected, the red fail LED remains constant. If loss of Talk Battery is detected, the red fail LED flashes. (The LED is located on the surface of the printed circuit board and shines through the front of the drawer.) A Talk Battery Loss alarm is also generated in the system software.

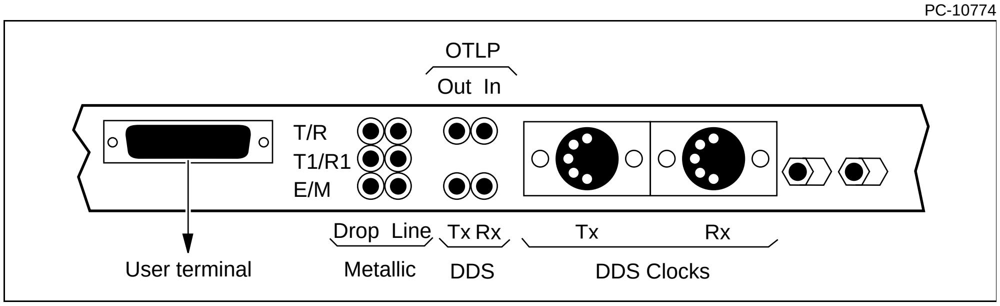
Shelf interface card (NTNP23AA)

The shelf interface (SI) card is used to switch the UE9000 drawer test busses onto the shelf metallic test busses as required for metallic test access and sparing. Additional circuitry monitors for fault with any card in the UE9000 shelf and for talk battery or signal battery loss. The SI also provides access to the UE9000 shelf ID PROM which is located on the Power I/O card.

LCAP jack access

The NT4K16 local craft access panel (LCAP) has test jacks which permit the connection of test equipment for testing all kinds of line card services. The LCAP jacks are illustrated in Figure 2-10. See Chapter 3, “Basic testing capability,” for additional details about the LCAP jack access feature. Procedures for using jack access are described in the document *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

Figure 2-10
NT4K16 LCAP jack access



When testing a line card in a CDS shelf, test resources used in local jack access include: the TAC, the MTAC, shelf test buses, drawer test buses, and the local craft access panel (LCAP). When testing a line card in a UE9000 shelf, test resources used in local jack access include: the TAC, SI card, shelf test buses, drawer test buses, and the LCAP.

Basic testing capability

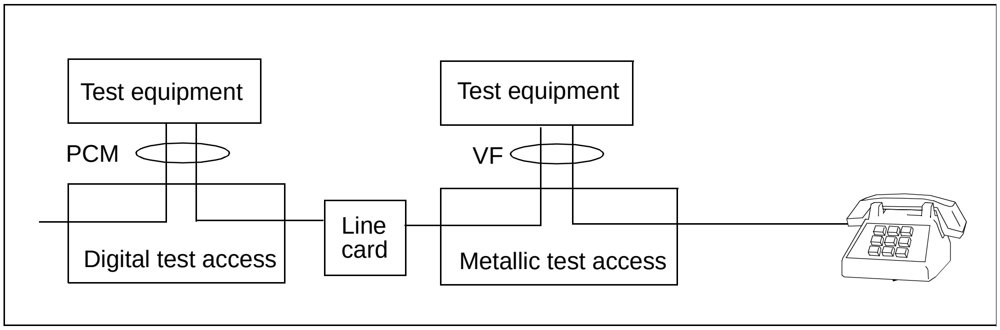
This chapter describes the basic testing capabilities of the AccessNode, which include:

- metallic test access
- digital test access
- line card diagnostics
- special services lineup

Metallic test access can be provided to several sources: a test bypass pair, one or two external remote test units, and test equipment connected to the metallic jacks on the local craft access panel.

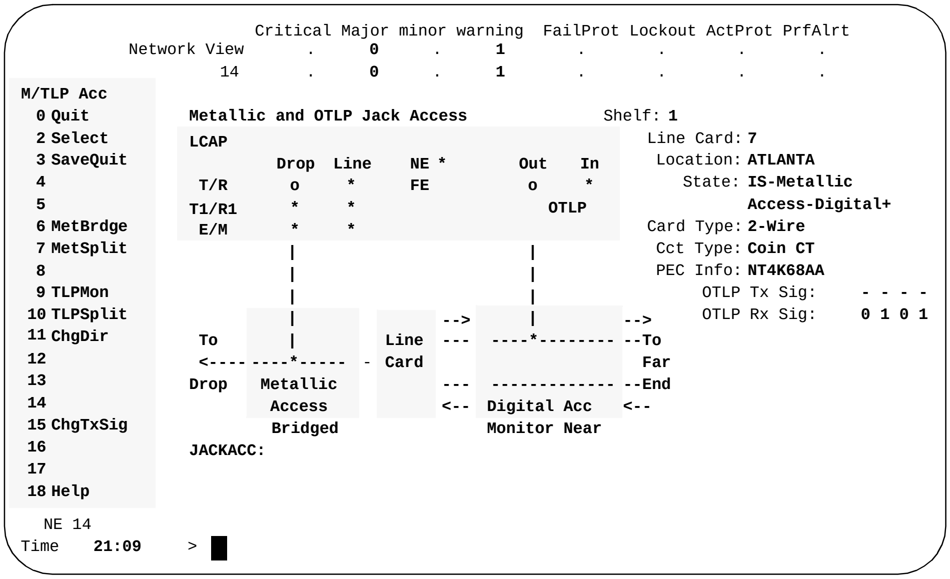
Digital test access provides two kinds of access to jacks on the local craft access panel: 0TLP jack access, and DDS jack access.

A high-level view of metallic and digital test access is illustrated following.



Note that this view of test access is reflected on the AccessNode FWPUI screen, JackAcc level. Figure 3-1 on page 3-2 shows an example of simultaneous metallic and 0TLP jack access.

Figure 3-1
Typical jack access screen in FWPUI



The test access card (TAC) plays a central role in the delivery of basic testing functions in the AccessNode. Among its key features are:

- test access relays for controlling metallic test access
- circuitry for controlling digital test access
- test circuitry for performing full line card diagnostics

These and other test functions are described in this chapter.

Metallic test access

Metallic test access is access to the metallic (loop or drop) side of a line card for testing purposes. Metallic test access is possible from several directions: using metallic jack access on the local craft access panel (LCAP), using a test bypass pair from the central office, or using a remote test unit connected to a test access path.

The metallic test architecture of the AccessNode is shown in Figure 2-1 on page 2-2.

Features of the metallic test access architecture include the following:

- TAP I/O card and metallic jacks provide the physical connection points.
- TAC connection and cross-over relays control the test access paths (cross-over relays permit Test Head 1 of the IRTU to access shelf test bus 2 when line card diagnostics are requested at the network element user interface).
- Two shelf test busses provide access to each shelf.
- Two MTACs per copper distribution shelf (CDS) (one per line drawer) connect the shelf test bus (STB) to the drawer test bus (DTB).
- One shelf interface (SI) card per Universal Edge 9000 (UE9000) shelf connects the STB to the DTB.
- Line card relays permit test in and test out directions.

Constraints on metallic (and digital) test access

As shown in Figure 2-1 on page 2-2, MTA architecture, metallic (and digital) test access constraints can be characterized as follows:

- A maximum of two MTA accesses can be active at any one time. This is constrained by the two internal STBs.
- A maximum of one MTA access can be active in any one CDS drawer at any one time. This is constrained by each drawer having only one drawer test bus (DTB).
- A maximum of two MTA accesses can be active in any one UE9000 shelf as long as two different multi-circuit line cards (MLC) are accessed. Each MLC can have only one MTA session active at any one time.
- IRTU test head 1 access, test bypass pair, and Bellcore TAP1 access are mutually exclusive, since these access points connect internally to test bus 1 (TB1).
- IRTU test head 2 access, metallic jack access, and Bellcore TAP2 access are mutually exclusive, since these access points connect internally to TB2.

- Silent switchperson operation (a DMS SuperNode subscriber premises testing feature) within a CDS shelf is also mutually exclusive with any other type of MTA access in a drawer, because the Silent Switchperson operation uses the DTB.
- Silent switchperson operation within a UE9000 shelf is mutually exclusive with any other type of MTA access on a MLC.
- Line card diagnostics can utilize either test bus, TB1 or TB2. If line card diagnostics are active, they may temporarily block other types of testing. Cross-over relays permit TB1 to access shelf test bus 2 when line card diagnostics are requested at the network element user interface. However, the reverse capability is not provided: TB2 cannot access Shelf Test Bus 1.
- Line card diagnostics make use of the TAC CODEC. Therefore, 0TLP jack access and line card diagnostics are mutually exclusive.
- EBS diagnostics, requested from the DMS SuperNode MAPCI, require talk battery to be connected to the loop in order to maintain EBS settings. The talk battery feed circuit for this purpose is connected to TB1 only. Therefore, EBS diagnostics will block any other activity on TB1. Conversely, EBS diagnostics can be performed only if TB1 is available.

Metallic jack access

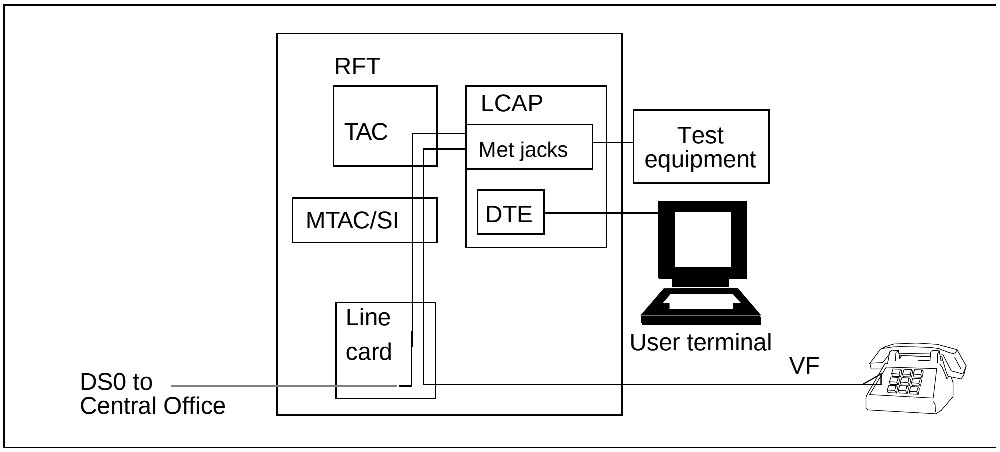
The metallic jack access feature provides a jack-access point to the metallic loops on the VF sides of the line cards. Jack access can be used to perform loop measurements and transmission tests during circuit setup or fault-location, on any supported customer service. It is supported at the RFT, and also at an FCOT equipped with copper distribution shelves.

In a CDS shelf, the connection between the test jacks and the line cards is by way of the TAC, the shelf test bus, the MTAC, and the drawer test bus. The TAC and MTAC relays allow switchable access to any line card. A CDS shelf supports simultaneous metallic jack access and 0TLP digital jack access to the same line card.

In a UE9000 shelf, the connection between the test jacks and the line cards is by way of the TAC, the shelf test bus, the SI card, and the drawer test bus. The TAC and SI relays allow switchable access to any line card. A UE9000 shelf supports only metallic jack access to a line card.

Jack access to a line card is established by using the manual jack access tool on the NE user interface or the Specials Lineup Manager tool on the OPC user interface. The user interface lets you select either bridged or split access. Jack access test procedures are included in the document *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

Test equipment is connected to the jacks on the NT4K16 local craft access panel (LCAP). Jacks are provided for 2-wire, 4-wire, and 6/8-wire circuits, as shown in Figure 2-10 on page 2-23. It also shows the DTE user interface port for connecting a VT100-type terminal. A typical metallic jack access test arrangement is illustrated below.

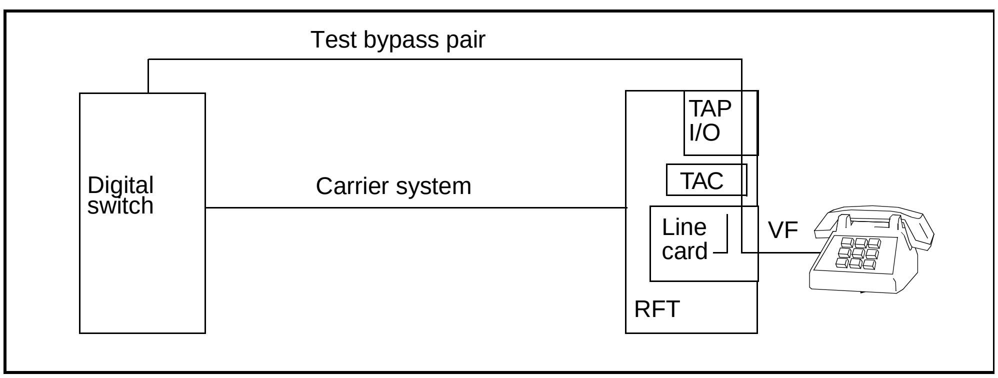


TBP access

A test bypass pair (TBP) is a pair of wires between a switch (or central office terminal) and a remote terminal, bypassing the carrier. It is used primarily for testing of locally-switched services. At the RFT, the test bypass pair terminates on the test access path (TAP) I/O card. When a loop test on a line card is requested, the test bypass pair is connected to the analog side of the line card, under the control of the TAC.

TBP in integrated application

In an integrated application, illustrated following, the test bypass pair connects to a digital switch at the central office.

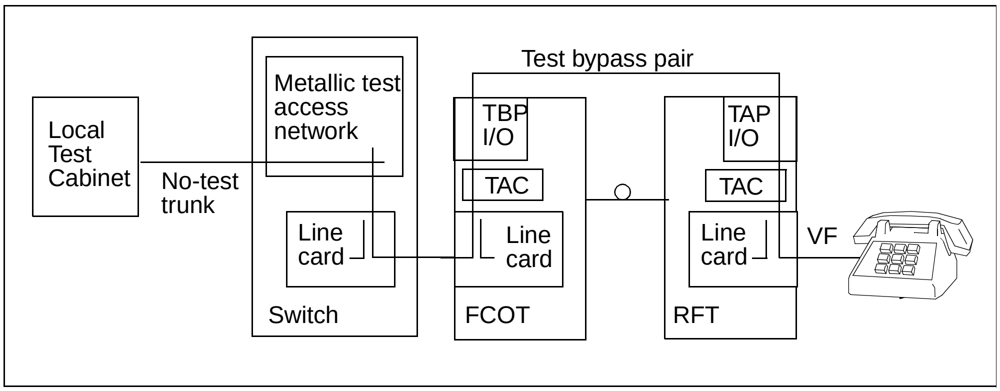


The central office test head gains metallic access to the subscriber loop by dialing the number of the subscriber line through the no-test trunk (NTT). The NTT access results in a carrier signature being presented to the central office (CO) test head. The CO test head, upon detecting this signature, generates a “test bypass initiate” to complete the metallic connection around the carrier system to the subscriber’s loop. The CO test head can then perform electrical measurements directly on the loop.

The test bypass pair is sometimes used in MAP LTP testing, which is described in Chapter 7, “Locally switched services (LSS) testing.”

TBP in universal application

The test bypass pair is part of the metallic path often used in NTT testing or MAP LTP testing, described in Chapter 7, “Locally switched services (LSS) testing.” The test bypass pair for a universal application is illustrated following. At the central office, the test bypass pair connects to the test bypass pair card (TBP) in the upper level of the access bandwidth manager shelf in the FCOT.



The central office test head gains metallic access to the subscriber loop in a way similar to that of the integrated application. The CO test head dials the number of the subscriber whose loop is to be tested. This completes a metallic connection through the analog switch to a VF pair, which terminates on an FCOT line card. To complete the access, the CO test head generates a “test bypass initiate” signal using coin control-type voltages. The TAC responds to the request by completing the connections from the FCOT line card to the subscriber loop side of the RFT line card through the TBP.

TAP access

As shown in Figure 2-1 on page 2-2, there are two test access paths reserved for external remote test units. These test access paths have two ports on the TAP I/O card, TAP1 and TAP2. Each TAP is a Bellcore-standard 12-lead interface, which permits the simultaneous split of 2-wire, 4-wire, or 6-wire circuits in both the IN and OUT directions.

Circuitry on the TAC controls the connection of each TAP to a line card. TAP1 uses shelf test bus 1 (STB1), and TAP2 uses STB2. Cross-over relays on the TAC permit TAP1 to access STB2, when line card diagnostics are requested at the network element user interface.

The IRTU also uses these TAPs but does not require the TAP I/O card, since these connections are internal, as shown in Figure 2-1 on page 2-2.

Provisioning the remote access point as TBP, TAP1, or TAP2

The remote access point (either TBP, TAP1, or TAP2) is activated by either a PGTC or an MTA carrier bypass operation at the start of a test access session. For UDLC applications, the remote access point is provisioned using the PGTC/MTA Provisioning Manager tool on the OPC. Procedures for using the tool are described in *Commissioning and Testing*, Volume 3.

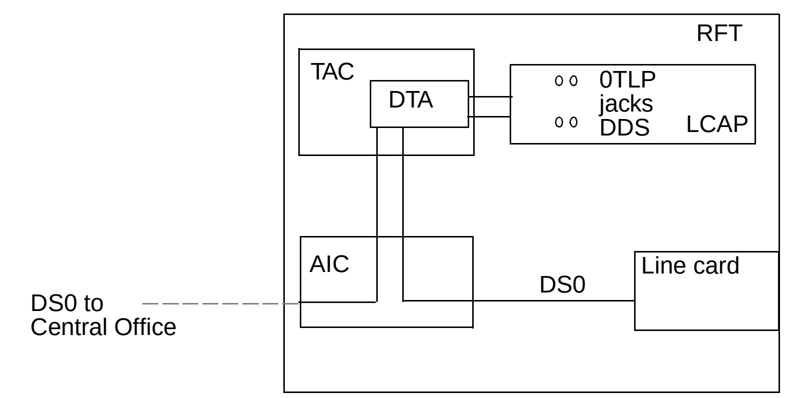
For GR-303 DMS applications, the remote access point is provisioned from the switch RDTINV table for NTT and MAP access. For additional information, refer to DMS SuperNode BCS36 document *Subscriber Carrier Module—100 Access Translations Guide*, 297-2741-350 or NA002 document *XPM Translations Reference Manual*, 297-8321-815.

At the RFT, the TAP1 and TAP2 ports on the TAP I/O card should be used for external remote test unit connections only. The TBP port on the TAP I/O card can be used to connect an external remote test unit or a test bypass pair.

Digital test access

Digital test access provides access to both directions of transmission on the digital (line or PCM) side of a line card for testing purposes. Two types of digital access are possible at the local craft access panel (LCAP): 0TLP jack access and DDS jack access.

The digital test access architecture in AccessNode is shown in the next figure. Although the architectures for 0TLP access and DDS access are similar, the 0TLP access uses a coder/decoder (CODEC) on the TAC to translate digital signals to voice frequency. These signals can be read by VF test equipment connected to the 0TLP jacks. DDS test access does not use the CODEC.



DTA: digital test access function

0TLP jack access

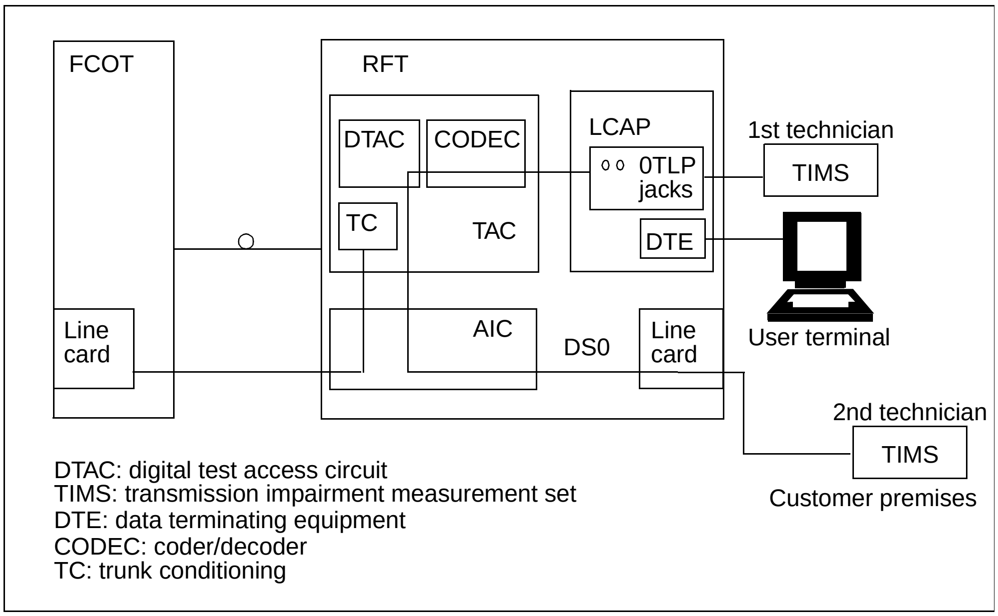
0TLP is the zero transmission level point, the reference point defined in a circuit design, such that the required signal level at all other points in the circuit can be calculated. 0TLP jack access is used for manual lineup of voice and special services. Special service lineup is the process of testing the transmission quality of a circuit and adjusting line card parameters to meet the circuit design.

0TLP jack access is supported for all analog special services on universal and DS1 tandem applications, and locally-switched services on universal applications. The 0TLP jacks on the NT4K16 LCAP provide access to the 0TLP signal point associated with the digital bit stream. The location of the 0TLP jacks on the NT4K16 LCAP is shown in Figure 2-10 on page 2-23.

Test access to a line card is established by using the manual jack access tool on the NE user interface or the Specials Lineup Manager tool on the OPC user interface. The user interface lets you select either bridged or split access to the near end or the far end. The IN and OUT jacks permit connection of test equipment for the sending and receiving of signals. 0TLP jack access procedures are described in *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

The 0TLP jack access screens in the network element user interface can be used to control and to monitor signaling to and from the line card. The AB bits sourced by the line card can be viewed in the 0TLP jack Rx field. The AB bits being sent to the line card can be controlled by the TxSignaling command and are displayed in the 0TLP jack Tx field.

Special service lineup is generally performed by dispatching craftspersons to the RFT and the customer premises. An example arrangement is shown following. During a near-end 0TLP jack access session, the DTAC provides trunk conditioning to the far end.



The craftsperson at the RFT typically uses the 0TLP jacks to send and receive signals through the line card and the loop to the craftsperson at the customer premises. Typical measurements are made at 404, 1004, and 2804 Hz. The craftsperson uses the OPC user interface to provision the line card parameters to meet transmission requirements.

> ***Note:*** You can have simultaneous 0TLP jack access and metallic jack access to the same line card.

DDS jack access

DDS jack access is used for digital testing of DDS services. The DDS test access jacks on the NT4K16 LCAP provide connection points for Digital Data Service (DDS) test sets. Both near-end and far-end DS0 signals are simultaneously accessible by DDS test sets connected to the DDS Tx and Rx bantam jacks. Figure 2-10 on page 2-23 shows the locations of the DDS jacks on the NT4K16 LCAP, and also shows the DTE connector for accessing the network-element user interface.

The craftsperson can use the network-element user interface to control DDS jack access. Full monitor and full split arrangements can be established using manual jack access commands. DDS jack access procedures are described in the document *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

D4 DS0 Dataport line cards use bipolar DSX-0 signals for test access, and D4 office channel unit (OCU) Dataport line cards use single-ended TTL. AccessNode provides the single-ended TTL access for both DS0 and OCU line card access. The clock and sync signals are also provided on the LCAP, to a five-pin DIN connector, as differential TTL.

DS0 test access on a conventional D4 OCU line card is shown in Figure 3-2 on page 3-11. Figure 3-3 on page 3-11 illustrates DDS DS0 test access functionality in AccessNode.

DDS jack access on the AccessNode provides monitor and split access capability. Monitor access presents the Tx and Rx DS0 data streams on the DDS Rx jack. Data from the far end will be error-corrected if error correction is provisioned on the circuit being accessed.

Split access emulates test access provided on conventional D4 OCU line cards. The DDS Rx jack terminates near-end and far-end data while the DDS Tx jack sources data to the near and far ends. Data to and from the far end will be zero-compressed and error-corrected if these features are provisioned on the circuit being accessed. Data to and from the near end is not zero-compressed or error-corrected.

Figure 3-2
Conventional D4 OCU line card - DS0 test access

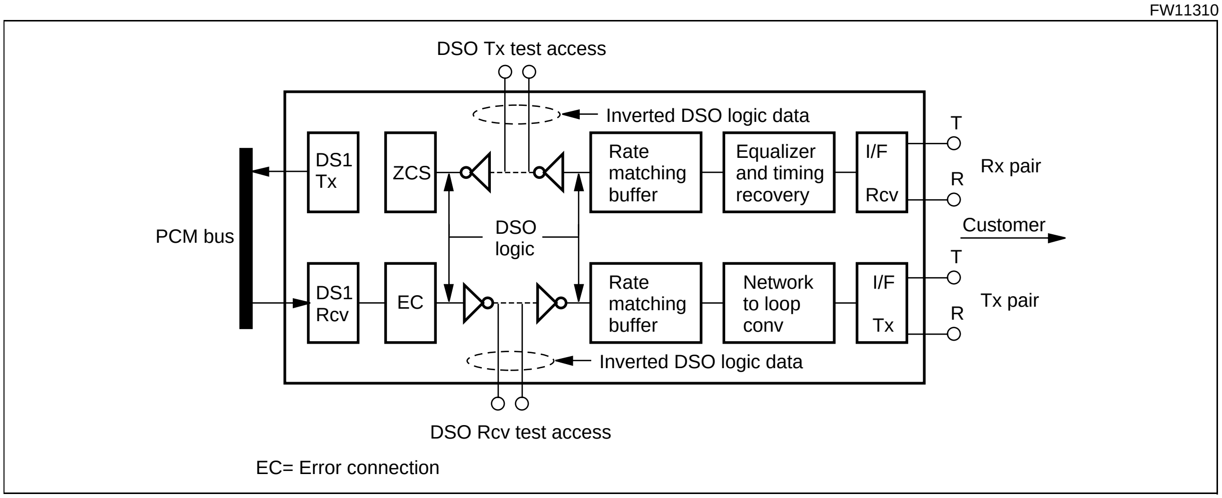
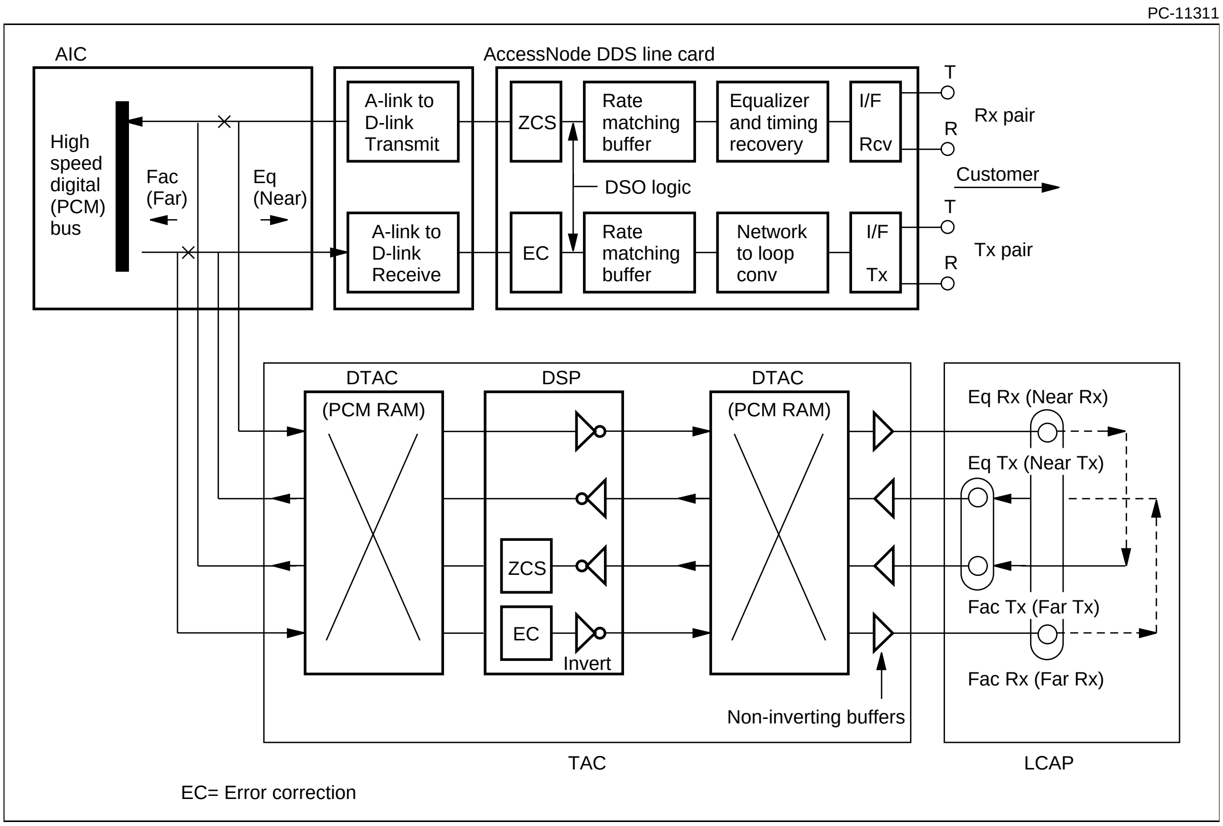


Figure 3-3
AccessNode DS0 test access



Line card diagnostics

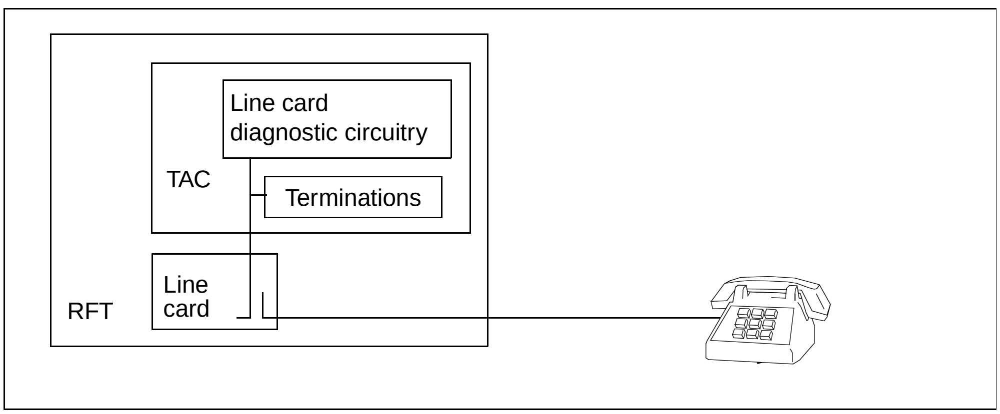
Line card diagnostics provide standalone testing of a line card. Diagnostics include an on-board self-test, which is performed automatically upon insertion of the line card. In addition, basic self-tests are performed before software is downloaded to a line card.

Line card diagnostics allow for the detection and isolation of line card faults. The diagnostics exercise the hardware of the line card. Omega line cards run two levels of diagnostics: short and full. The results of the diagnostics are sent to the event-reporting system and displayed as logs.

Short diagnostics, which are run on card insertion and shelf power up, test digital and analog sections of the line card which can be tested by line card diagnostic loads.

Full diagnostics include the short diagnostics, and also include more thorough testing of the analog circuitry using line card diagnostic circuitry (LCDC) on the TAC, as illustrated in the next figure.

For CDS shelves, the connection between the TAC and the line cards is by way of the shelf test bus, the MTAC, and the drawer test bus. For UE9000 shelves, the connection between the TAC and the line cards is by way of the shelf test bus, SI card, and the drawer test bus.



Line card diagnostics can utilize either test bus 1 or test bus 2 (TB1 or TB2). When line card diagnostics are requested from the network element user interface, cross-over relays in the TAC permit TB1 to access shelf test bus 2 (STB2). This capability is illustrated in Figure 2-1 on page 2-2. If line card diagnostics are active, they may temporarily block other types of testing. Both line card diagnostics and 0TLP jack access make use of the TAC CODEC. Therefore, line card diagnostics cannot be performed if a 0TLP jack access session is active.

Out-of-service diagnostic testing

Out-of-service diagnostic testing requires that dedicated diagnostic software be downloaded to the line card. Customer service is suspended until the diagnostic testing has been completed, and the service software has been downloaded once again to the line card.

Out-of-service diagnostic testing can be initiated in the following ways:

- It can be invoked automatically. Diagnostics are automatically executed whenever a line card is inserted into a slot in a copper-distribution drawer.
- It can be invoked by explicit command, entered in the network element user interface or in certain OPC user interface tools. Alternatively, for integrated AccessNodes, the command can be entered from the line test position (LTP) level of the DMS SuperNode MAPCI.
- It can be scheduled to run on a scheduled basis if the AccessNode is integrated with a DMS SuperNode switch. The command to schedule the diagnostics can be entered from the automatic line testing (ALT) level of the DMS SuperNode MAPCI.

From the Line Card Equipment screen in the network element user interface, diagnostics initiated on an in-service line card are rejected, but the ResetLC command permits full (long) diagnostics to execute. From the OPC Specials Lineup Manager tool or the OPC Test Manager tool, diagnostics initiated on an in-service line card cause the line card to go out of service, then full diagnostics are performed, and then the line card is placed back in service.

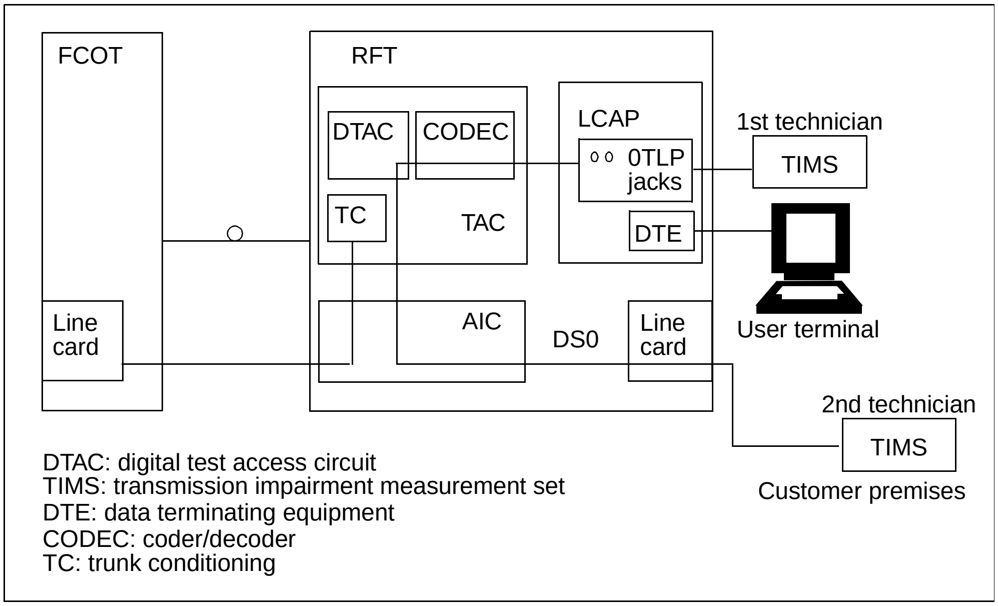
Special services lineup

The Specials Lineup Manager tool is used to line up certain analog special services so that they perform within design parameters.

This tool is used in conjunction with the OPC Provisioning Manager tool. The Specials Lineup Manager is used to provide 0TLP jack access to the circuit under test and to diagnose line cards. The Provisioning Manager tool is used to adjust the line card parameters. Test equipment (such as a transmission impairment measurement set) is connected to the jacks at the local craft access panel (LCAP) to perform measurements to verify the line card parameter adjustments. An example test layout is shown in the next figure.

Procedures for using the Specials Lineup Manager tool are provided in *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

Figure 3-4
Equipment layout for lining up a special service



Carrier bypass operation

AccessNode supports the following carrier bypass arrangements in conjunction with a test bypass pair, to gain metallic access to the desired line card:

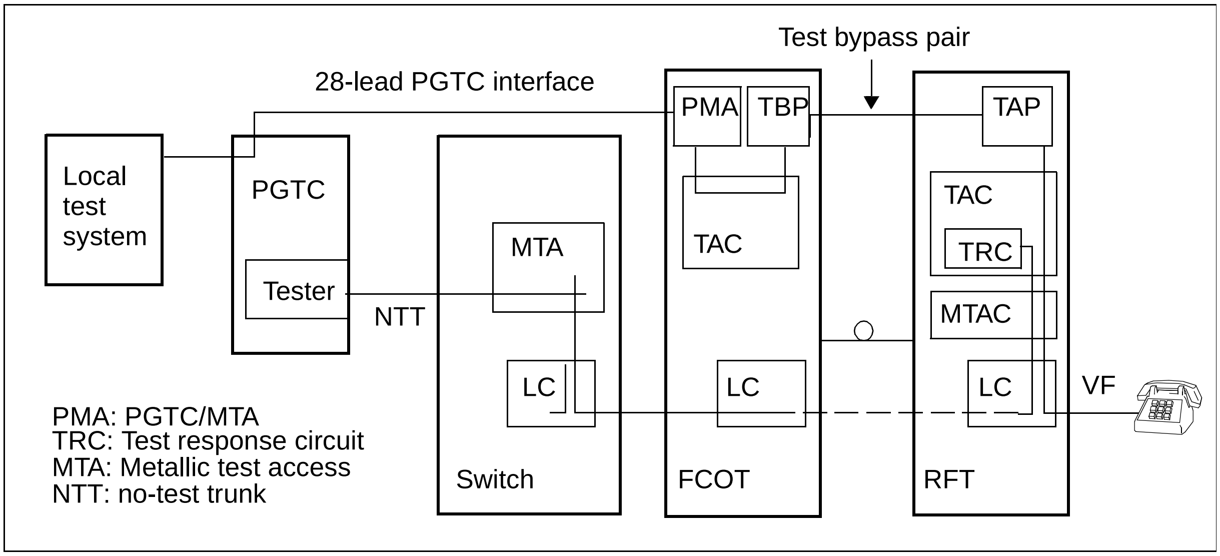
- pair gain test controller (PGTC)
- metallic test access (MTA), a pulse-type line access and control method
- test access to TR08 loops

Further explanation of these carrier bypass methods follows.

Pair gain test controller

A pair gain test controller (PGTC) is used to establish a test bypass pair connection to a subscriber loop for metallic testing, and also to test the carrier portion of the subscriber line. It is the Bellcore standard interface (TR465) used to test locally switched single-party, multiple-party, and coin telephone lines. A typical arrangement of PGTC in a universal application is illustrated in Figure 4-1.

Figure 4-1
Testing AccessNode lines using PGTC, universal application



The pair gain test controller connects to the switch line under test using no-test trunk access. This connection is used to test the carrier channel assigned to the line under test. A second PGTC connection, through the 28-lead PGTC interface, is to the test bypass pair. With this connection, the PGTC provides metallic access to the loop, enabling the local testing system to perform loop tests.

Method of operation

The following sequence of activities describes pair gain test controller operation in a universal application:

1. The local test system (LTS) performs a no-test-trunk (NTT) access using the local switch.
2. At the end of the NTT, the LTS is metallically connected to the loop side of the switch line card (looking in to the FCOT line card).
3. The LTS makes a loop measurement and measures the signature of the FCOT line card.
4. The LTS analyzes the results of the test and determines that the line is served by a carrier system.

5 The LTS then initiates carrier bypass by applying +116 V to the tip with the ring open (the ring is grounded on a coin line).

6 The FCOT line card detects this test initiate signal and returns a 333 Hz tone to indicate to the PGTC that a carrier system has been accessed. The PGTC tone detector detects the 333 Hz and starts the following handshaking sequence:

a. The carrier asserts SEIZE towards the PGTC within 725 ms of starting the 333 Hz tone.

If ANY major alarm is present on the carrier system, TMAJ is asserted by the carrier instead and the carrier bypass is denied. The PGTC will return a one-kilohm leakage to ground on the tip at 60 impulses per minute (ipm) towards the LTS to indicate the carrier is in a major alarm condition.

Note: This Bellcore requirement to return TMAJ for any major alarm is interpreted literally. No attempt is made to determine if a particular major alarm truly impacts the PGTC access.

If the test bypass pair is already in use, as indicated by a grounded INHIBIT lead, then the carrier will return SEZBY. This will also deny the carrier bypass. The PGTC will return a one-kilohm leakage to ground at 120 ipm towards the LTS, to indicate that the carrier bypass cannot be made.

b. The PGTC asserts PROCEED towards the carrier within 725 ms of receiving SEIZE.

c. The carrier asserts SLEEVE towards the PGTC within 1.5 seconds after receiving PROCEED. The SLEEVE activation indicates that the carrier has established the metallic test bypass and connected the TRC to the line card under test. The RFT line card loop is connected to the test access point that was specified with the OPC PGTC/MTA Provisioning Manager tool. This test access point is provisionable to be either of the following:

—test bypass pair

—test access path 1 (TAP1)

—test access path 2 (TAP2)

If metallic resources are unavailable, then the carrier system does not assert SLEEVE. In this case, the PGTC will time-out and will return a 120-ipm 1-kilohm leak to ground on the tip, towards the LTS. This signal indicates to the LTS that the carrier bypass cannot be completed.

   d. The PGTC asserts LOCK towards the carrier within 1.5 seconds of receiving SLEEVE.

   e. The PGTC removes the test initiate signal from the FCOT line card tip. The carrier responds by removing the 333 Hz tone.

7. At this point, the carrier bypass sequence is complete. The LTS performs loop measurements over the test bypass pair while the PGTC performs an automatic series of signaling/supervision and transmission tests on the carrier system channel, using the test response circuit on the RFT TAC to provide the desired terminations.

8. The LTC requests the results of PGTC testing. At the end of testing, the PGTC removes LOCK and the carrier system tears down all connections.

Equipment required for PGTC in a universal application

In universal applications, the pair gain test controller bus connects to the PGTC/MTA I/O card in the upper level of the access bandwidth manager shelf in the FCOT. At the FCOT, the test bypass pair connects to the test bypass pair (TBP) I/O card in the access bandwidth manager shelf. At the RFT, the test bypass pair connects to the test access path (TAP) I/O card in the access bandwidth manager shelf. The test access card (TAC) in the RFT connects the test bypass pair to the line card tip and ring.

Equipment required for PGTC in an integrated application

In an integrated application, a separate PGTC is not required because the DMS SuperNode emulates the PGTC. The test bypass pair connects between the CO digital switch and the test access path (TAP) I/O card in the RFT.

Provisioning for PGTC

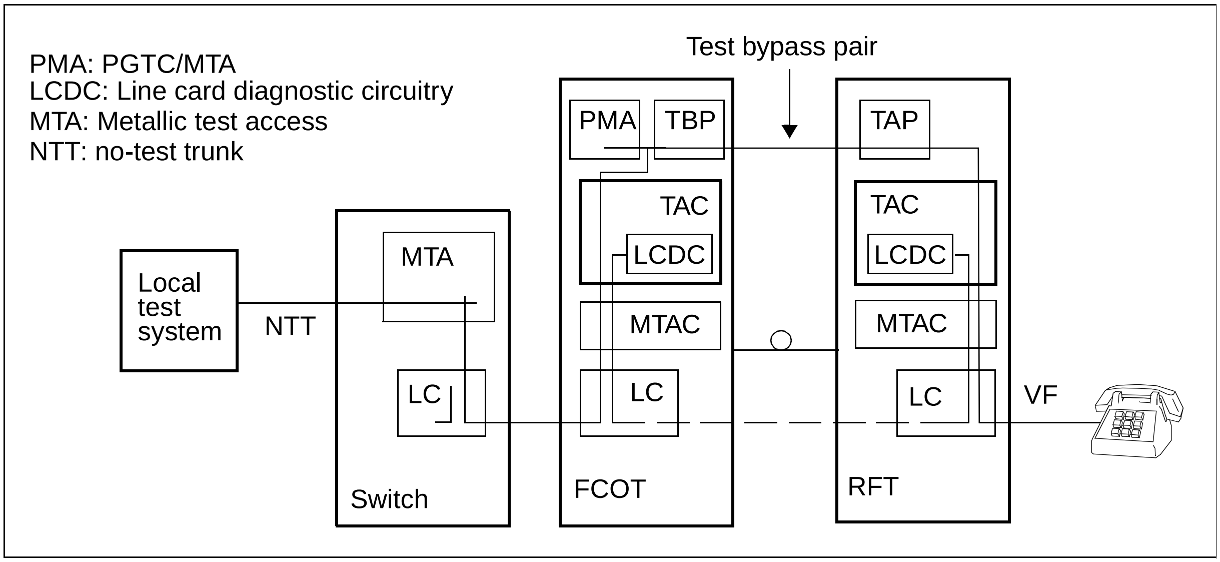
The PGTC/MTA Provisioning Manager tool on the OPC is used to select PGTC carrier bypass operation. It is also used to select the remote access point (TBP, TAP1, or TAP2) that is to be activated upon a PGTC access. Procedures using the PGTC/MTA Provisioning Manager are described in *Commissioning and Testing*, Volume 3.

For integrated configurations with an IRTU, using DS1 tandem lines for communication links, provision AccessNode control and talk/monitor links as ILCPOTS. Refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B.

Metallic test access (MTA)

Metallic test access (MTA) is a pulse-type method of line test access, similar to the method used with the Nortel Networks DMS-1 Urban subscriber carrier product. Figure 4-2 illustrates MTA in a universal application.

Figure 4-2
Testing AccessNode lines using MTA, universal application



The local test system connects to the switch with a no-test trunk (NTT). Metallic access between the switch and the RFT uses a test bypass pair. The local test system sends coin control pulses to the test access card (TAC) in the FCOT, telling it to establish test access, perform tests, report test results, and disconnect test access.

The MTA carrier bypass configuration utilizes the test access card (TAC) to perform diagnostics on the FCOT and RFT line cards. The FCOT/RFT carrier channel is not tested. The TAC sends the results of the line card tests by way of tones and resistances.

Method of operation

The following sequence describes the operation of metallic test access in a universal configuration:

1. The local test system (LTS) performs a no-test trunk (NTT) access using the local switch.
2. At the end of the NTT sequence, the LTS is metallically connected to the loop side of the switch line card (looking into the FCOT line card).
3. The LTS makes a loop measurement and measures the signature of the FCOT line card.

4 The LTS analyzes the results of the test and determines that the line is served by a carrier system.

5 The LTS then initiates carrier bypass by applying a one-second +130-volt pulse on the tip (five seconds for a coin line).

6 The FCOT line card detects the +130 V pulse on the tip and attempts to set up carrier bypass.

- If the bypass cannot be completed because test resources are busy, then a busy tone is returned by the carrier system. Note that the tone is generated on-hook by the FCOT line card and is approximately –6 dBm.
- If the bypass cannot be completed because test resources are failed or out-of-service, then a reorder tone is returned by the carrier system. Note that the tone is generated on-hook by the FCOT line card and is approximately –6 dBm.
- If all resources are available, then the FCOT line card tip/ring is connected through the TAC to the test bypass pair, port 1 of the TBP I/O card. The RFT line card loop is connected to the test access point that was specified with the OPC PGTC/MTA Provisioning Manager tool. This test access point is provisionable to be either of the following:

—test bypass pair

—test access path 1 (TAP1)

—test access path 2 (TAP2)

7 If the carrier bypass was successful, then the LTS can start performing loop measurements over the test bypass pair. If the line card diagnostics option was enabled with the OPC PGTC/MTA Provisioning Manager tool, then the carrier immediately starts full line card diagnostics. These diagnostics may take up to 40 seconds to complete.

8 When the LTS has completed making loop measurements, it can query the carrier for line card diagnostic results by applying a second coin control pulse (± 130 V). The polarity of this pulse and the takedown pulse is specified with the OPC PGTC/MTA Provisioning Manager tool. Upon receipt of the second pulse, the carrier system reports results by supplying a 1600 Hz tone according to the following codes:

- both FCOT and RFT line cards OK: continuous tone, 300 kΩ termination
- RFT line card failed: 120 ipm, 30 kΩ termination
- FCOT line card failed: 60 ipm, 100 kΩ termination
- result unavailable: 15 ipm, > 5 MΩ termination

Note: If line card diagnostics have not been enabled, then the second pulse is interpreted as a bypass takedown request. If diagnostics have been enabled with the PGTC/MTA Provisioning Manager tool, and diagnostics have not completed at the time that the second pulse is received, then the second pulse and subsequent pulses are interpreted as a “Results request” until valid diagnostic results can be reported. The pulse which follows a valid diagnostic results report is interpreted as a takedown pulse.

9 The LTS then requests bypass takedown by issuing a third coin control pulse (± 130 V on tip). The polarity of this coin control pulse and the diagnostics results request pulse is specified with the PGTC/MTA Provisioning Manager tool. Note that if line card diagnostics has not been enabled, then the takedown request pulse is the second pulse, rather than the third.

10 If the carrier system has not received a takedown pulse within five minutes, then the carrier times out and tears down all connections.

11 The LTS completes the teardown sequence by releasing the NTT access.

Equipment required for MTA in universal application

In a universal application, the test access cards (TACs) in the FCOT and the RFT provide single-ended line card testing at both ends, and the fiber channel is not tested. The test bypass pair connects to the TBP I/O card in the FCOT, and to the TAP I/O card in the RFT. The PGTC/MTA I/O card is required at the FCOT.

Provisioning for MTA

The PGTC/MTA Provisioning Manager tool on the OPC is used to select MTA carrier bypass operation. It is also used to select the remote access point (TBP, TAP1, or TAP2) that is to be activated upon an MTA access. The tool is also used to enable line card diagnostics, if desired.

Procedures using the PGTC/MTA Provisioning Manager are described in *Commissioning and Testing*, Volume 3.

TR08 carrier bypass

Testing of TR08 lines can be performed from either the DMS SuperNode MAP, or from an external loop test system (such as the Mechanized Loop Testing system connected by way of a no-test trunk connection) over a test bypass pair to the RFT.

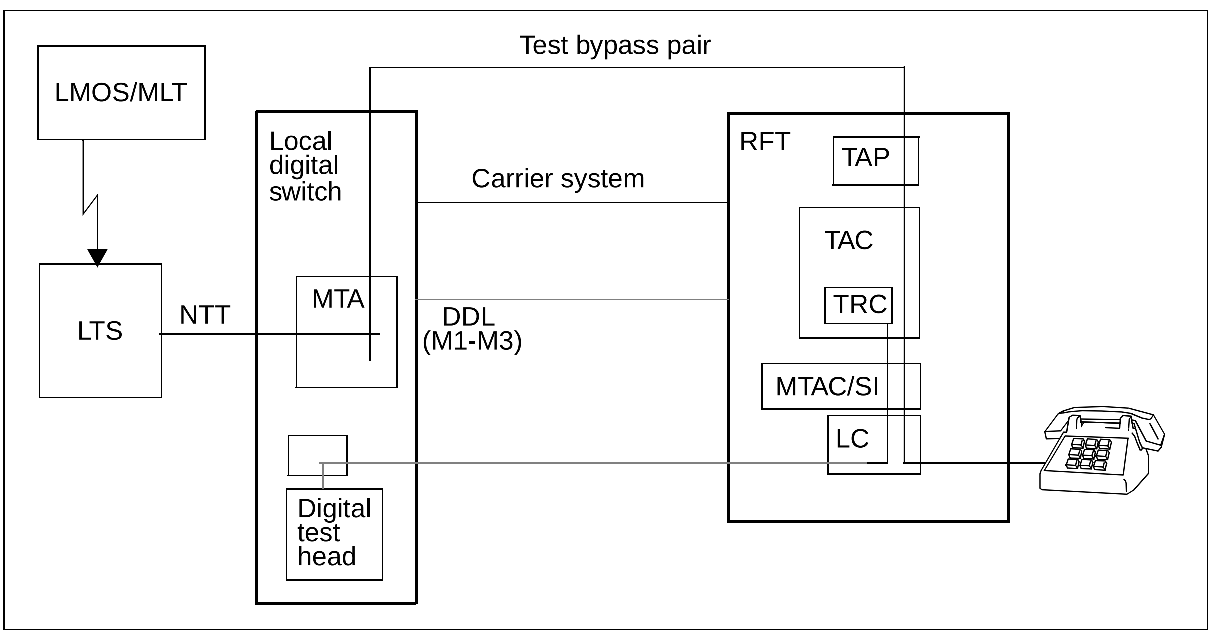
The TR08 interface supports testing of both the customer loop and the DS0 channel equipment dedicated to the customer. The interface supports a test bypass pair from the central office to the RFT for testing the loop. Prior to performing a test, the MLT system can test the integrity of the test bypass pair to the RFT.

DS0 channel (line) testing, from the line card back to the local digital switch (LDS) is performed by the LDS, using an internal digital test head. The channel tests performed are usually patterned after those specified in TR465 and include signaling/supervision tests, channel loss, echo return loss, and idle channel noise measurements.

AccessNode TR08 systems can use the following line card services: Epsilon POTSRT, Omega POTSRT, Omega UVGRT, Omega COINRT, and ILC (IRTU line card).

The typical test layout is shown in Figure 4-3.

Figure 4-3
TR08 line testing configuration in AccessNode



Method of operation

The following sequence explains how TR08 carrier bypass works for line testing:

1. The local digital switch initiates the metallic test access sequence by sending the “channel test” AB bit pattern to the line card which is to be tested.
2. The line card recognizes the “channel test” bit pattern and initiates the metallic test access sequence at the RFT.
3. The RFT acknowledges the “channel test” request by sending the SeizeRC M-bit message over the DDL link.
4. The LDS then sends the ProceedCR DDL message to the RFT.
5. Once the metallic connections have been established at the RFT (connection to TBP or TAP and connection of the TRC), the RFT sends the ProceedRC message to LDS.
6. At this point, the LDS ceases sending the “channel test” AB bits and proceeds to perform channel tests while the external LTS performs loop measurements over the test bypass pair.
7. When testing is finished, the LDS stops applying the ProceedCR M-bit message, and the RFT tears down the test connections.
8. After the test connection teardown is complete, the RFT removes the ProceedRC and SeizeRC M-bit signals.
9. If any major alarms exist on the RFT at the time a “channel test” is requested by the LDS, the channel test is denied by RFT by sending a TestAlmRC message to the LDS.
10. If a metallic test access has been previously established, the LDS can indicate an abnormal teardown by sending the TestAlmCR M-bit signal to the RFT. Upon receipt of this DDL message, the RFT stops sending the ProceedRC and SeizeRC M-bit signals, and initiates teardown of the RFT test connections.

Equipment required for TR08 carrier bypass

The following equipment is required at the RFT to implement TR08 line testing:

- test access card (TAC), NT4K54, in slot 20
- test access path (TAP) I/O card (NT4K58KA) in slot 53
- TAP cable, NT4K85EA/EB/EC/ED, to connect the test bypass pair to the TAP I/O card
- two metallic test access cards (MTACs), NT4K73, in each copper-distribution shelf
- one shelf interface (SI) card in each Universal Edge 9000 (UE9000) shelf

Provisioning for TR08 carrier bypass

The CI tool LLTCFGCI tool is used to provision the RFT test access connection point (TBP, TAP1, or TAP2). TBP is the default connection point. Refer to *Commissioning and Testing*, Volume 3, for the necessary procedure.

Metallic test access resources at the local digital switch must also be provisioned to provide a connection path for the test bypass pair to the RFT.

Enhanced testing

The NT4K57 integrated remote test unit (IRTU), in conjunction with the NT4K54 test access card (TAC), provides an enhanced testing capability for AccessNode narrowband subscriber services. A description of these circuit packs is given in Chapter 2, “AccessNode line/loop testing resources”.

Overview of enhanced testing

The IRTU is a reconfigurable digital signal processor (DSP) measurement test head, which, when combined with specific software loads, is capable of emulating or implementing a variety of line and loop testing systems. In particular, the IRTU is designed to interface with and perform measurements compatible with the following embedded and future test systems:

- DMS SuperNode MAP line testing menus
- Loop Maintenance Operations System (LMOS)
- Centralized Automatic Loop Reporting System (CALRS)
- Switched-Access Remote Test System (SARTS)
- Digital Analog Remote Test System (DARTS)
- Integrated Test System (ITS), a future test system

The IRTU can test non-locally switched (NLS) and nonswitched (NS) analog VF special services using the following test interfaces:

- SARTS interface (TR834 command subset)
- DARTS interface (TR834 command subset plus additional commands)
- OPC Test Manager tool (TR834 subset command equivalents)

The IRTU can test locally switched services (LSS), including TR08 services, using the following test interfaces:

- DMS SuperNode MAP (MTU emulation)
- CALRS/ELTU (DRTU emulation)
- CALRS/LTC (DRTU emulation)
- 3703 Local Test Cabinet (DRTU emulation)

Test emulation features

TR834 test head The IRTU can emulate a TR834-compatible remote test unit. Driven by a remote test operations system (SARTS or DARTS), the IRTU responds to test commands delivered by way of the OPC TL1 interface. In this arrangement, the OPC functions as a test system controller. In an independent TR834 testing arrangement, the TR834 commands originate from the OPC user interface, under the control of the Test Manager tool.

DRTU emulation The IRTU can emulate a Nortel Networks model 3704 Digital Remote Test Unit (DRTU), and perform locally switched service testing (POTS, COIN) from CALRS/ELTU, CALRS/LTC, or directly from a 3703 Local Test Cabinet (LTC).

MTU emulation The IRTU can emulate the multi-line test unit (MTU) normally resident in the DMS SuperNode switch. This provides improved measurement range and quality of results over a test arrangement requiring a long test bypass pair from the MTU in the central office to the customer loop. Testing is driven from the Maintenance and Administration Position (MAP) command interface of the DMS SuperNode.

Each of these emulations is described in this chapter.

TR834 test head

When the IRTU test heads are running TR834 emulation software, the AccessNode supports testing of nonswitched and non-locally switched services as directed from one of the following systems:

- — AT&T’s Switched-Access Remote Test System (SARTS)
- — Bell Canada’s Digital Analog Remote Test System (DARTS)
- — OPC Test Manager tool

TR834 commands are transmitted from an OS via an X.25 connection to the operations controller (OPC) in the fiber central office terminal (FCOT). The OPC communicates with the IRTU in the RFT.

Analog voice frequency special services testing includes, noise, impulse noise, phase jitter, and other tests listed in Bellcore standards TR476 and TR834.

Detailed measurement specifications for the IRTU are listed in the document *System Specifications*, 323-3001-180, in *Description*, Volume 2B.

The IRTU supports the following simultaneous test session capability:

- two 2-wire test sessions
- one 2-wire test session and one 4-wire TR834 test session

TR834 commands supported

Table 5-1 lists the TR834 command set and additional proprietary commands supported by the IRTU in this release.

Table 5-1
TR834 test functions supported by the IRTU

Test function	TR834 TL1 command	Basis
Change Monitor Filter	CHG-MONFLT	TR834
Change Monitor Level	CHG-MONLEV	TR834
Change Port Parameters	CHG-PRTPAR	TR834
Change Port Restore	CHG-PTRST	TR834
Change Split and Supervision	CHG-SPLTSUPV	TR834
Connect Battery	CONN-BATT	Proprietary
Connect Ground	CONN-GND	Proprietary
Connect IMD Signal	CONN-IMDSIG	TR834
Connect 4-Wire Loopback	CONN-LPBK	Proprietary
Connect Monitor Bridged	CONN-MONBRDGD	TR834
Connect Monitor Establish	CONN-MONEST	TR834
Connect Monitor Listen	CONN-MONLIST	TR834
Connect Peak To Average Ratio Test Signal	CONN-PARSIG	TR834
Connect Short	CONN-SHORT	Proprietary
Connect Test Access	CONN-TACC	TR834
Connect Talk Split	CONN-TLKSPLT	TR834
Connect Tone	CONN-TN	TR834
Disconnect Loopback	DISC-LPBK	Proprietary
Disconnect Measurement	DISC-MEAS	TR834
Disconnect Monitor	DISC-MON	TR834
Disconnect Term	DISC-TERM	Proprietary
Disconnect Test Access	DISC-TACC	TR834
Disconnect Test Signal	DISC-TSTSIG	TR834
Measure Capacitance	MEAS-CAPNC	TR834

—continued—

Table 5-1 (continued)
TR834 test functions supported by the IRTU

Test function	TR834 TL1 command	Basis
Measure Current	MEAS-CUR	TR834
Measure IMD	MEAS-IMD	TR834
Measure Impulse Noise	MEAS-IMPNSE	TR834
Measure Noise	MEAS-NSE	TR834
Measure Outpulsing	MEAS-OUTPLSE	TR834
Measure Peak To Average Ratio	MEAS-PAR	TR834
Measure Phase Jitter	MEAS-PHJTR	TR834
Measure Resistance	MEAS-RES	TR834
Measure Resistance Simplex	MEAS-RESSX	TR834
Measure Return Loss	MEAS-RLOSS	TR834
Measure Signaling Resistance	MEAS-SIGRES	TR834
Measure Signaling Voltage	MEAS-SIGVG	TR834
Measure Tone	MEAS-TN	TR834
Measure Transients	MEAS-TRSNTS	TR834
Measure Voltage	MEAS-VG	TR834
Measure Voltage Simplex	MEAS-VGSX	TR834
Report Initialization	REPT–INITZN	TR834
Report Initialization Automatic	REPT INITZN	TR834
Report Result	REPT-RSLT	TR834
Report Supervision Status	REPT-SUPVSTAT	TR834
Test Outpulsing	TST-OUTPLSE	TR834
Test Ringing Signal	TST-RINGSGNL	TR834

—end—

DRTU emulation

DRTU emulation software allows the IRTU to emulate an external Nortel Networks model 3704 digital remote test unit (DRTU). DRTU-type testing of locally switched services is directed from Nortel Networks Centralized Automated Loop Reporting System/Enhanced Local Test Unit (CALRS/ELTU), or CALRS/3703 Local Test Cabinet (CALRS/LTC). The DRTU supports the testing of POTS and COIN services, and limited testing of other services.

Detailed measurement specifications for the IRTU are listed in the document *System Specifications*, 323-3001-180, in *Description*, Volume 2B.

The IRTU supports two simultaneous 2-wire DRTU emulation test sessions, one from each of two digital switches, in an integrated multihosting application.

Each IRTU test head running DRTU emulation requires two IRTU line cards (ILCs): one dial-up control path and one dial-up monitor/talk path.

DRTU commands

Table 5-2 on page 5-6 lists the DRTU command set supported by the IRTU in this release. For additional details, refer to “Appendix A: DRTU commands” in this document. It lists commands alphabetically, and includes a description, the command syntax, and the response syntax for each command.

Table 5-2
DRTU commands supported by the IRTU

CMD	Description
ACT	Activity time-out: Change the time-out interval between successive commands
CAN	Cancel: Cancel continuous commands, such as Sounder
CLB	Callback: Establish a dialup connection from the DRTU towards a craftsperson
CLS	Callback w/acknowledgement: Same as CLB except craftsperson must press DTMF # key
COI	Coin collect/return: Apply rampng voltage to line to test paystation collect/return relay
DIR	Testing direction: Change testing direction to IN (to LC), OUT (to subscriber) or BRIDGED
DSL	Dial on subscriber line: Dial DP or DTMF digits into the subscriber’s line card
EPX	Echoplex: DRTU echos each character received and enables simple editing functions
KHZ	KiloHertz tone: Apply a 1004 Hz tone to the subscriber appearance under test
LAS	Send last response: Instruct DRTU to retransmit its last response.
LCD	Loop condition: Apply a selected ground and battery condition to the test tip and ring
LOG	Login: Turn off the 90-second login timer in the dialup port
MCX	Modem carrier detect time-out: Modify the loss of modem carrier time-out
PDT	Plunge for dialtone: Apply a loop or groundstart seizure to the subscriber pair
REC	DP/DTMF receive: Invoke DP or DTMF receiver within the DRTU
REM	Remote device activation: Apply 130 dc voltage to the test tip to operate equipment
REV	Reverse tip and ring: Reverse tip and ring within the DRTU
RNG	Ring subscriber: Ring subscriber; on answer provide talk batt. and voice conn. to CB pair
SND	Sounder: Apply sounder tone to the subscriber’s loop
SLF	Self-test: Perform a self-diagnostic
TER	Terminate line: Terminate the test appearance with a nominal 900-ohm termination
TLK	Talk: Establish a voice connection between callback tip-ring pair and the test pair
TST	Test verify measurements: Invoke a measurement sequence for TR, TG, and RG pairs
VFY	Test verify measurement: Same as TST, but response is easier to read
WHO	Who are you: Identify the DRTU (unit name and software version)

Table 5-3 lists DRTU commands not supported by the IRTU.

Table 5-3
DRTU commands not supported by the IRTU

CMD	Description
MTA	Metallic test access activate: Toggle the MTAU lead between applying CO gnd and open

IRTU (DRTU emulation) measurements compared with external DRTU

In some cases, measurements taken by the IRTU running DRTU emulation will differ from those of an external DRTU. The only notable difference is for resistance measurements with ac foreign voltage.

Resistance measurements with ac foreign voltage

If the frequency is a multiple of 20 Hz, the IRTU can reject the foreign voltage. This is viewed as acceptable because the line voltage is a multiple of 20 Hz, and is therefore rejected.

IRTU differences do not result in erroneous fault classifications by the Local Test Cabinet (LTC).

MTU emulation

The IRTU can emulate the multi-line test unit (MTU) normally resident in the DMS SuperNode switch. This provides improved measurement range and quality of results over a test arrangement requiring a long test bypass pair from the MTU in the central office to the customer loop.

Testing is driven from the Maintenance and Administration Position (MAP) command interface of the DMS SuperNode. Testing can be performed manually using the line test position (LTP) menu, or testing of a range of lines may be performed automatically as scheduled in the automatic line test (ALT) menus.

MTU testing supports the testing of POTS and COIN services, and limited testing of other services.

The IRTU supports two simultaneous, independent 2-wire MTU emulation test sessions (as long as the IRTU test heads are testing in different line card drawers). The test sessions can originate from one DMS SuperNode switch, or from several switches in an integrated multihosting application. Each DMS SuperNode can be provisioned to access both test heads for LTP testing. However, only one test head can perform ALT testing.

Each IRTU test head running MTU emulation requires one IRTU line card (ILC): one dial-up monitor/talk path.

Commands supported with MTU emulation

MTU emulation supports the command functionality listed in Table 5-4. Test functionality includes some DRTU commands and other special commands, to make better use of IRTU features. A description of each command is given in "Appendix B: IRTU (MTU emulation commands)."

Table 5-4
IRTU (MTU emulation) commands

Command	Function
Emulate MTU commands	
ACRING	A.C. Ring Generator Test
BATT	Apply Battery to Loop
CAPT	Capacitance Test
CON900	Continuous 900 Ohm Termination
EBS	Measure Loop Parameters with Battery
FACEP	Foreign AC EMF
FDCEP	Foreign DC EMF
FEMF	Foreign AC and DC EMF Test
GRDST	Ground Start Test
ISDN	Measure Loop Parameters of ISDN Loop
LIT	LTU Type Line Insulation Test
OUTPULSING	Outpulsing
RCAPT	LTU Type Repeated Capacitance Test
REBS	Repeated Measure Loop Parameters with Battery
RESET	Warm Reset
REST	Resistance Test
RFACEP	Repeated AC Voltage
RFDCEP	Repeated DC Voltage Test
RISDN	Repeated Measure Loop Parameters of ISDN Loop
RREST	LTU Type Repeated Resistance Test
STOP TEST	Stop Test Command

—continued—

Table 5-4 (continued)
IRTU (MTU emulation) commands

Command	Function
Generate Tone command	
GENTONE	Generate Tone
Establish Monitor command	
ANSWER	Answer Monitor/Talk Path
HANGUP	Hangup Monitor/Talk Path
Short Circuit commands	
INSCKT	Insert Short
REMSCKT	Remove Short
Emulate DRTU commands	
TALK	Apply Talk Connection
DIR	Change Direction
Test Access commands	
CONN-TACC	Connect Test Access
DISC-TACC	Disconnect Test Access

—end—

Special services testing

This chapter describes the testing systems used for testing special services on AccessNode. First, the Bellcore TR834 standard testing architecture is outlined, followed by a description of several versions of the testing architecture that are implemented on AccessNode in this release of the product.

The following versions of the test architecture are supported:

- Digital Analog Remote Test System (DARTS)
- Switched-Access Remote Test System (SARTS)
- Test Manager tool on the OPC

Other special services testing features on AccessNode are described in Chapter 3, "Basic testing capability," including:

- 0TLP and DDS jack access
- Specials lineup manager

Special services generic testing architecture

Bellcore standard TR834 defines a generic testing architecture, illustrated in Figure 6-1 on page 6-2 with a point-to-point AccessNode system, universal application. The main components consist of: a testing operations system called an Integrated Test System (ITS), a test system controller (TSC), a remote test unit (RTU), a test access path (TAP), and a metallic test access unit (MTAU). These components are connected by well-defined command and signal interfaces.

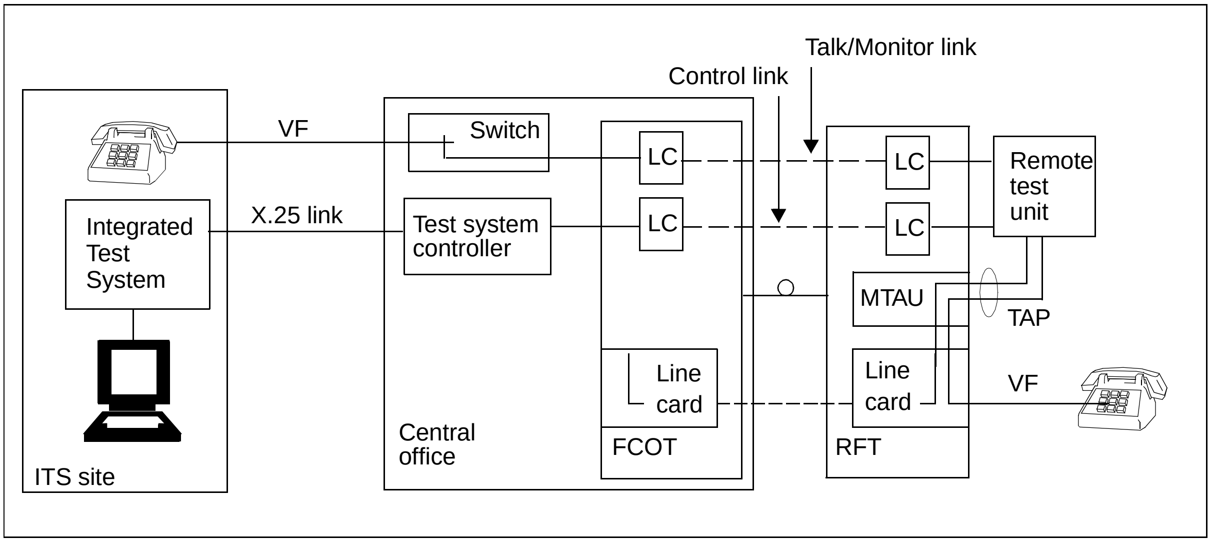
In the generic architecture, the ITS sends and receives TL1 commands and responses over an X.25 virtual circuit to the TSC. This interface is described in the document *TL1 Interface Description*, 323-3001-190.

The TSC communicates over a control link to the remote test unit.

A talk/monitor path can also be provisioned. It is used to confirm voice quality or to communicate with the customer.

The interface between the RTU and the loop side of the line card is also part of the TR834 standard. The MTAU and TAP support a 12-lead interface for simultaneous split access of a 6-wire circuit in both the IN and OUT test directions.

Figure 6-1
Bellcore generic test architecture in a universal application



AccessNode implementation of the generic architecture

In AccessNode, the operations controller (OPC) performs the function of the TSC. The integrated remote test unit (IRTU) provides one or two TR834 test heads (RTUs), depending on the card type. NT4K57AB provides two. NT4K57BA provides one. The MTAU function is supported on the test access card (TAC), the metallic test access card (MTAC) for CDS shelves, the shelf interface (SI) card for Universal Edge 9000 (UE9000) shelves, and the line card. The IRTU line cards (ILCs) are on the TAC.

Two AccessNode implementations of the test architecture are shown in Figure 6-2 and Figure 6-3 on page 6-3. Figure 6-2 shows the ILC terminating directly on the digital switch, while Figure 6-3 shows the ILC terminating on a PCM channel bank with a VF connection to the switch. Point-to-point systems, DS1-fed systems, and single-ended systems all function similarly.

Figure 6-2
AccessNode special services test architecture

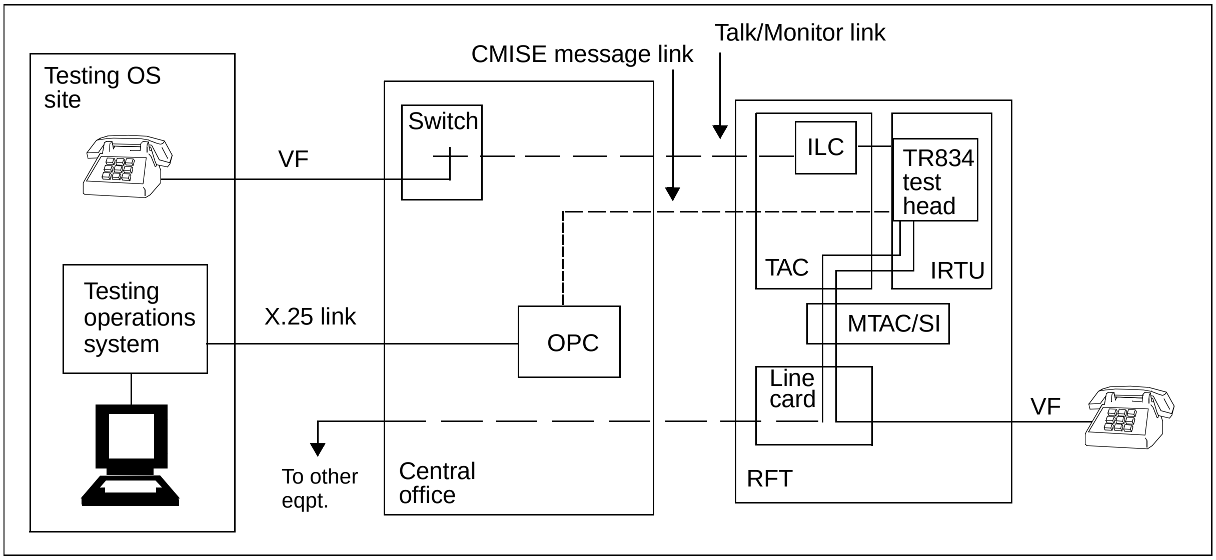
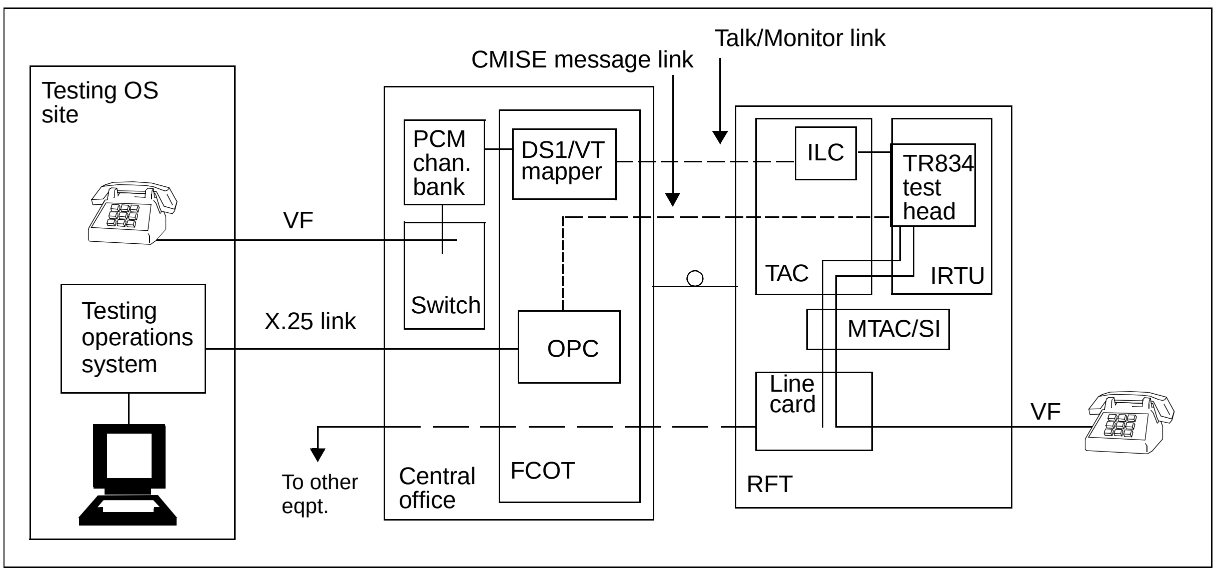


Figure 6-3
AccessNode special services test architecture



Method of operation

The OS (operations system) can test a special service by connecting to two points on the circuit; one connection point can be the RFT line card, and the second point can be at a distant central office. To determine the condition of the circuit, the OS directs that the test head at one connection point sends signals, which are measured by the test head at the other connection point. Results are sent to the OS over the control link.

Loop testing can also be performed, in which the OS establishes a connection to the RFT line card.

To start a loop test, the OS dials up a virtual circuit connection to the OPC X.25 port. The testing operations system (OS) sends the TR834 test connect request to the TL1 interface at the OPC. The OPC translates the TL1 command into a proprietary protocol (ASN.1) which is transmitted over the CMISE message link to the TR834 test head. The TR834 test head is then connected to the line card. The OS directs testing on the circuit. The IRTU sends the test responses back to the OS.

Provisioning requirements

Using the OS Connection Manager tool on the OPC, a target identifier (TID) is provisioned for each testing OS, so that an association can be established between the OS and any network element in the OPC span of control. This provisioning is optional for some OSs, which pick up the network element name automatically.

One of the OPC ports (ports 1, 2, or 3 in an ABM shelf, or port 1 or 2 in a TBM shelf) must be provisioned for X.25 operation. TID mapping and X.25 port provisioning are described in the document *System Administration Procedures*, 323-3001-302, in *Operations, Administration, and Provisioning*, Volume 4A.

The talk/monitor path is required in some cases, which requires an ILCPOTS circuit to be provisioned from the OPC Provisioning Manager tool. Circuit provisioning procedures are described in *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B.

Equipment requirements

The RFT must be equipped with TAC and IRTU circuit packs. If the monitor path is equipped, then a DS1 tandem circuit is required, including a channel on a DS1/VT mapper and a channel on a PCM channel bank at the FCOT.

Commissioning checklist

The following activities are required to set up this testing architecture in AccessNode:

- Install, terminate, and cross-connect DS1 equipment, if the monitor path is required.
- Install, terminate, and cross-connect OPC communications cables.
- Provision the OPC X.25 port.
- Provision the ILCPOTS circuit, if the monitor path is required.
- Provision the TID, if required.
- Verify the continuity of connections by performing a line and loop test.

Special services testing systems supported by AccessNode

The following testing systems are versions of the generic architecture implemented on AccessNode to test nonswitched services and non-locally switched services:

- SARTS (Switched-Access Remote Test System)
- DARTS (Digital Analog Remote Test System)
- OPC Test Manager tool

Following is a description of each test system indicating any notable differences from the general implementation already described.

SARTS

SARTS is AT&T’s Switched-Access Remote Test System, used for the testing of special services.

A target identifier (TID), sent by an OS in a TL1 message, identifies the network element to which the message is directed. Most OSs, except SARTS, use the network element name as the TID. SARTS usually uses a user-specified TID (ten characters or less) instead.

The SARTS test functions (commands) defined in TR834 and implemented in AccessNode are listed in Table 6-1. These commands are explained further in *TL1 Interface Description*, 323-3001-190.

> ***Note:*** SARTS is not supported by the host digital terminal or AccessNode Express.

Table 6-1
SARTS test functions supported by AccessNode

Test function	TR834 TL1 command
Change Port Parameters	CHG-PRTPAR
Change Port Restore	CHG-PTRST
Change Split and Supervision	CHG-SPLTSUPV
Connect Monitor Bridged	CONN-MONBRDGD
Connect Monitor Establish	CONN-MONEST
Connect Monitor Listen	CONN-MONLIST
Connect Peak To Average Ratio Test Signal	CONN-PARSIG
Connect Test Access	CONN-TACC

—continued—

Table 6-1 (continued)
SARTS test functions supported by AccessNode

Test function	TR834 TL1 command
Connect Talk Split	CONN-TLKSPLT
Connect Tone	CONN-TN
Disconnect Measurement	DISC-MEAS
Disconnect Test Access	DISC-TACC
Disconnect Test Signal	DISC-TSTSIG
Measure Capacitance	MEAS-CAPNC
Measure Current	MEAS-CUR
Measure Impulse Noise	MEAS-IMPNSE
Measure Noise	MEAS-NSE
Measure Peak To Average Ratio	MEAS-PAR
Measure Phase Jitter	MEAS-PHJTR
Measure Resistance	MEAS-RES
Measure Tone	MEAS-TN
Measure Voltage	MEAS-VG
Report Initialization	REPT-INITZN
Report Initialization Automatic	REPT INITZN
Report Result	REPT-RSLT
Report Status	REPT-STAT
Test Outpulsing	TST-OUTPLSE
Test Ringing Signal	TST-RINGSGNL
—end—	

DARTS

DARTS is Bell Canada's Digital Analog Remote Test System, used for the testing of special services. DARTS communication to AccessNode is similar to SARTS, except that extra commands provide additional functionality beyond the TR834 standard set.

As with SARTS testing, a user-specified target identifier (TID) is available for DARTS testing, if the telephone operating company requires this capability. Generally, DARTS uses the network element name as the TID.

The DARTS test functions (commands) implemented in this release are listed in Table 6-2. These commands are explained further in *TL1 Interface Description*, 323-3001-190.

> ***Note:*** DARTs is not supported by the host digital terminal or AccessNode Express.

Table 6-2
DARTS test functions supported in AccessNode

Test function	TR834 TL1 command	Basis
Change Monitor Filter	CHG-MONFLT	TR834
Change Monitor Level	CHG-MONLEV	TR834
Change Port Parameters	CHG-PRTPAR	TR834
Change Port Restore	CHG-PTRST	TR834
Change Split and Supervision	CHG-SPLTSUPV	TR834
Connect Battery	CONN-BATT	Proprietary
Connect Ground	CONN-GND	Proprietary
Connect IMD Signal	CONN-IMDSIG	TR834
Connect 4-Wire Loopback	CONN-LPBK	Proprietary
Connect Monitor Bridged	CONN-MONBRDGD	TR834
Connect Monitor Establish	CONN-MONEST	TR834
Connect Monitor Listen	CONN-MONLIST	TR834
Connect Peak To Average Ratio Test Signal	CONN-PARSIG	TR834
Connect Short	CONN-SHORT	Proprietary
Connect Test Access	CONN-TACC	TR834
Connect Talk Split	CONN-TLKSPLT	TR834
Connect Tone	CONN-TN	TR834
Disconnect Loopback	DISC-LPBK	Proprietary
Disconnect Measurement	DISC-MEAS	TR834
Disconnect Monitor	DISC-MON	TR834
Disconnect Term	DISC-TERM	Proprietary
Disconnect Test Access	DISC-TACC	TR834

—continued—

Table 6-2 (continued)
DARTS test functions supported in AccessNode

Test function	TR834 TL1 command	Basis
Disconnect Test Signal	DISC-TSTSIG	TR834
Measure Capacitance	MEAS-CAPNC	TR834
Measure Current	MEAS-CUR	TR834
Measure IMD	MEAS-IMD	TR834
Measure Impulse Noise	MEAS-IMPNSE	TR834
Measure Noise	MEAS-NSE	TR834
Measure Outpulsing	MEAS-OUTPLSE	TR834
Measure Peak To Average Ratio	MEAS-PAR	TR834
Measure Phase Jitter	MEAS-PHJTR	TR834
Measure Resistance	MEAS-RES	TR834
Measure Resistance Simplex	MEAS-RESSX	TR834
Measure Return Loss	MEAS-RLOSS	TR834
Measure Signaling Resistance	MEAS-SIGRES	TR834
Measure Signaling Voltage	MEAS-SIGVG	TR834
Measure Tone	MEAS-TN	TR834
Measure Transients	MEAS-TRSNTS	TR834
Measure Voltage	MEAS-VG	TR834
Measure Voltage Simplex	MEAS-VGSX	TR834
Report Initialization	REPT-INITZN	TR834
Report Initialization Automatic	REPT INITZN	TR834
Report Result	REPT-RSLT	TR834
Report Supervision Status	REPT-SUPVSTAT	TR834
Test Outpulsing	TST-OUTPLSE	TR834
Test Ringing Signal	TST-RINGSGNL	TR834

—end—

OPC Test Manager tool

The OPC Test Manager tool provides an OPC user interface to perform line and loop testing, equivalent to the functionality offered at the SARTS and DARTS TL1 interfaces.

The OPC Test Manager tool permits routine testing and troubleshooting of AccessNode portions of non-locally switched and nonswitched special service circuits using the TR834 command set and additional test functions. The OPC Test Manager tool also performs line card diagnostics on request. Details of operation are available in the document *Circuit Testing from the OPC User Interface*, 323-3001-548, in *Maintenance*, Volume 5C.

The test arrangement for testing a line from the OPC Test Manager is illustrated in Figure 6-4 and Figure 6-5 on page 6-10. Figure 6-4 shows the arrangement using IRTU line cards. Figure 6-5 shows an arrangement using PCM channels. The latter arrangement will be phased out in a future release.

Figure 6-4
TR834 testing with the OPC Test Manager tool (GR-303 CSC application using an IRTU line card)

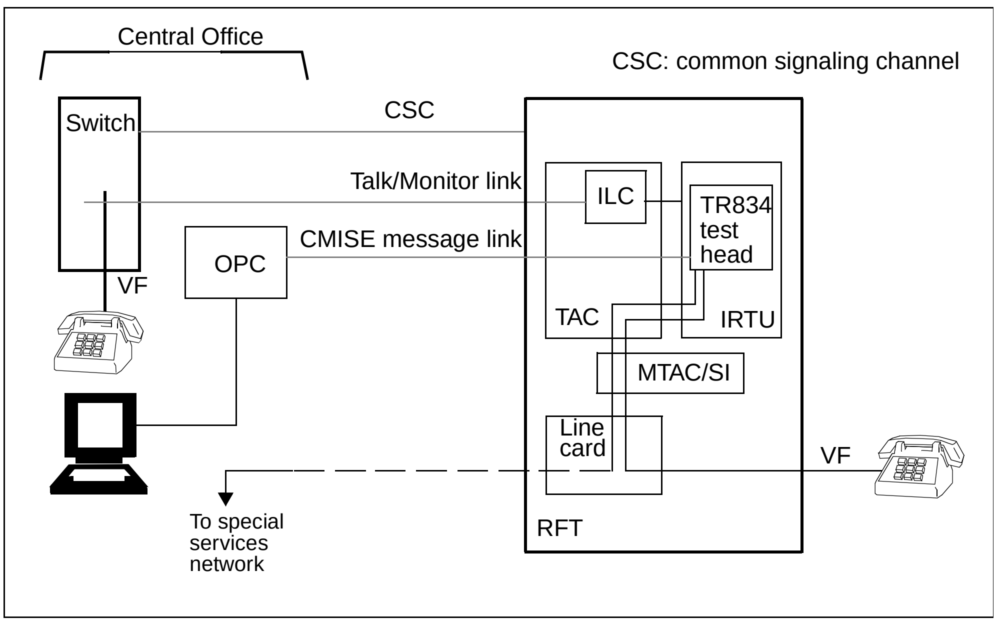
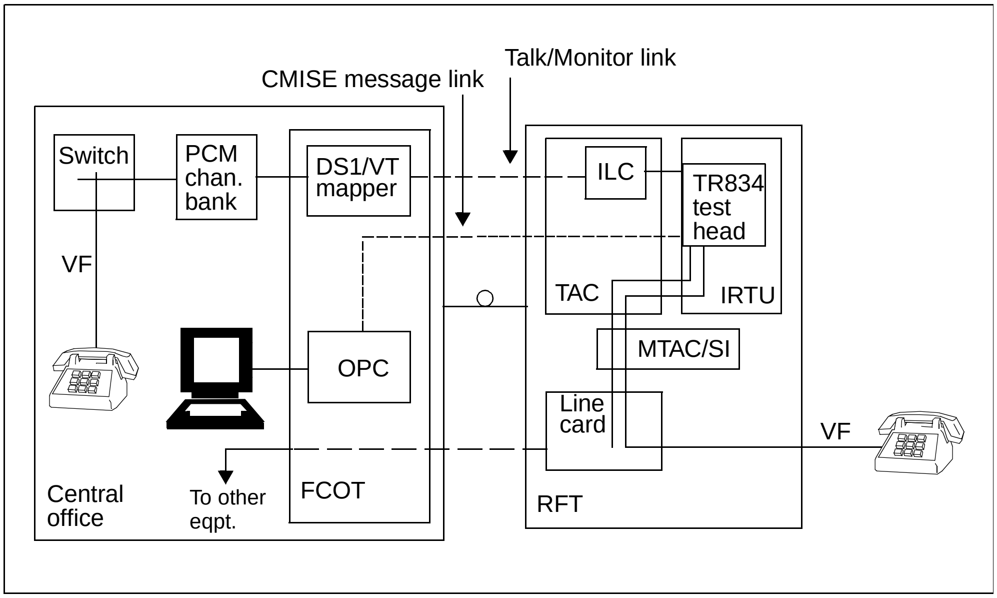


Figure 6-5
TR834 testing with the OPC Test Manager tool (using a PCM channel)



A test session is started with a connect test access command. The Test Manager tool uses the test heads located on the integrated remote test unit (IRTU) at the RFT to perform tests. The test session is terminated by a disconnect test access command.

The test functions supported by the OPC Test Manager tool in this release are listed in Table 6-3. Commands are listed alphabetically by TR834 command name, in the categories to which they apply.

Table 6-3
Test functions supported on the OPC Test Manager

TR834 TL1 command	Test function	User interface button
Metallic test access		
CHG-PTRST	Change Port Restore	Reset
CONN-TACC	Connect Test Access	Connect
DISC-TACC	Disconnect Test Access	Disconnect
Multimeter		
CHG-PTRST	Change Port Restore	Set Bridge & Restore
CHG-SPLTSUPV	Change Split and Supervision	Set Splt & Supervsn
—continued—		

Table 6-3 (continued)
Test functions supported on the OPC Test Manager

TR834 TL1 command	Test function	User interface button
DISC-MEAS	Disconnect Measurement	Stop Measurement
MEAS-CAPNC	Measure Capacitance	Measure Capacitance
MEAS-CUR	Measure Current	Measure Current
MEAS-RES	Measure Resistance	Measure Resistance
MEAS-RESSX	Measure Resistance Simplex	Measure Resistance Simplex
MEAS-SIGRES	Measure Signaling Resistance	Measure Signaling Resistance
MEAS-SIGVG	Measure Signaling Voltage	Measure Signaling Voltage
MEAS-VG	Measure Voltage	Measure Voltage
MEAS-VGSX	Measure Voltage Simplex	Measure Voltage Simplex
Talk & Listen		
CHG-MONFLT	Change Monitor Filter	Set Monitor Filter
CHG-MONLEV	Change Monitor Level	Set Monitor Level
CHG-SPLTSUPV	Change Split and Supervision	Set Splt & Supervsn
CONN-MONBRDGD	Connect Monitor Bridged	Set Mon. Bridged
CONN-MONEST	Connect Monitor Establish	Set Mon. Establish
CONN-MONLIST	Connect Monitor Listen	Set Mon. Listen
CONN-TLKSPLT	Connect Talk Split	Set Talk
DISC-MON	Disconnect Monitor	Disconnect Monitor
Sig. & Supv.		
CHG-PTRST	Change Port Restore	Set Bridge & Restore
CHG-SPLTSUPV	Change Split and Supervision	Set Splt & Supervsn
DISC-MEAS	Disconnect Measurement	Stop Measurement
DISC-TSTSIG	Disconnect Test Signal	Stop Test Signal
MEAS-OUTPLSE	Measure Outpulsing	Measure Outpulsing
REPT-SUPVSTAT	Report Supervision Status	Measure Supv Status
TST-OUTPLSE	Test Outpulsing	Test Outpulsing
TST-RINGSGNL	Test Ringing Signal	Test Ringing Signal

—continued—

Table 6-3 (continued)
Test functions supported on the OPC Test Manager

TR834 TL1 command	Test function	User interface button
Special Terminations		
CHG-SPLTSUPV	Change Split and Supervision	Set Splt & Supervsn
CONN-BATT	Connect Battery	Connect Battery
CONN-GND	Connect Ground	Connect Ground
CONN-SHORT	Connect Short	Connect Short
DISC-TERM	Disconnect Term	Disc. Termination
Transmission		
CHG-PTRST	Change Port Restore	Set Bridge & Restore
CHG-SPLTSUPV	Change Split and Supervision	Set Splt & Supervsn
CONN-IMDSIG	Connect IMD signal	Send Intermodulation Signal
CONN-LPBK	Connect 4-Wire Loopback	Connect Loopback
CONN-PARSIG	Connect Peak To Average Ratio Test Signal	Send PAR Signal
CONN-TN	Connect Tone	Send Tone Signal
DISC-LPBK	Disconnect Loopback	Disconnect Loopback
DISC-MEAS	Disconnect Measurement	Stop Measurement
DISC-TSTSIG	Disconnect Test Signal	Stop Test Signal
MEAS-IMD	Measure IMD	Measure IMD
MEAS-IMPNSE	Measure Impulse Noise	Measure Impulse Nse
MEAS-NSE	Measure Noise	Measure Noise
MEAS-PAR	Measure Peak To Average Ratio	Measure PAR
MEAS-PHJTR	Measure Phase Jitter	Measure Phase Jttr
MEAS-RLOSS	Measure Return Loss	Measure Return Loss
MEAS-TN	Measure Tone	Measure Tone
MEAS-TRSNTS	Measure Transients	Measure Transients
REPT-RSLT	Report Result	Get Continuous Result

—end—

Locally switched services (LSS) testing

This chapter describes the following no-test trunk (NTT) and digital switch line and loop testing architectures.

Process overview for line card commissioning

Table 7-1 describes how to set up line/loop testing configurations for testing lines on various AccessNode applications. Not all details apply to any one architecture. To find out detailed requirements for your arrangement, refer to the applicable heading in Chapter 6 or Chapter 7.

Table 7-1
Line card commissioning process

Commissioning task	See
Install, terminate, and cross-connect cables, if any are required.	*Bay in Central Office Installation Manual—ABM*, 323-3001-201 or other installation document
Modify the ABM shelf to add the IRTU, if the shelf is earlier than release (Rls) 07 and is not yet modified.	*System Expansion Procedures*, 323-3001-324, in Volume 4C
Install and test circuit packs (such as DS1/VT mappers, IRTU, and TAC).	*Commissioning and Testing*, Volume 3
Install and test line cards, if required.	*Line Card Testing Procedures*, 323-3001-316, in Volume 4B
Provision the following with the OPC Provisioning Manager tool, if required in your configuration: • For universal applications with an external RTU, provision line card service, for a control link and a talk/monitor link, as POTS. • For integrated applications with an IRTU using DS1 tandem lines for communication links, provision AccessNode control and talk/monitor links as ILCPOTS.	*Line Card Provisioning Procedures*, 323-3001-315, in Volume 4B

—continued—

Table 7-1 (continued)
Line card commissioning process

Commissioning task	See
Provision the following at the DMS SuperNode MAP, if required in your configuration: • For integrated applications with a test bypass pair (TBP), datafill the RDTINV table for the remote access point, TBP. • For integrated applications with an external remote test unit (ERTU), perform the following steps: - Datafill the RDTINV table for the remote access point, ERTU. - Provision control and talk/monitor lines as RDTLSG. • For integrated applications with an integrated remote test unit (IRTU), perform the following tasks: - Datafill the RDTINV table for the remote access point, IRTU. - Select IRTU test head 1 or test head 2 (you may select test head 2 on NT4K57AB card type only). - Provision AccessNode control and talk/monitor links as ILCLSR, as applicable. ***Note:*** For AccessNode Express, IRTU can not be used in the RDTINV provisioning.	*BCS36 SMA Translations Guide*, 297-2741-350 or *NA002 XPM Translations Reference Manual*, 297-8321-815
Provision the DMS-10NA MAP, if required in your configuration.	DMS-10 Family, 400 Series Generic, *Index to the Nortel Networks Publications*, 297-3401-000
Provision the following, if required in your configuration: • For universal applications, provision the test access method and remote access point using the PGTC/MTA Provisioning tool. • For TR08 integrated applications, provision the RFT test access connection point. • For R-TEC testing with T-9X RTU, enable the R-TEC signature. • For Teradyne testing, disable the R-TEC signature.	*Commissioning and Testing*, Volume 3
For special services, perform SARTS or DARTS line and loop testing: • Provision the RFT-to-OS host association using the OS Connection Manager tool on the OPC. • Configure the X.25 port on the OPC.	*System Administration Procedures*, 323-3001-302, in Volume 4A
Verify the continuity of the connections by performing a line and loop test.	*Commissioning and Testing*, Volume 3
For universal applications, troubleshoot the metallic test access connections if necessary.	*Alarm and Trouble Clearing Procedures*, 323-3001-543, in Volume 5A
—end—	

General equipment requirements

The following equipment is required in all line/loop test configurations:

- RFT: one TAC, NT4K54, slot 20 in the ABM shelf
- FCOT: one TAC, NT4K54, slot 20, if equipped with an ABM shelf
- two MTACs, NT4K73, CDS slots MTA A and MTA B, in each equipped CDS, for a maximum of 14 MTACs per network element
- one shelf interface (SI) card for each Universal Edge 9000 (UE9000) shelf

Equipment requirements (I/O card, IRTU, etc.) are described within each application section.

Architectures

Table 7-2 lists the no-test trunk and digital switch line and loop testing architectures (and any variations) you can use for testing locally-switched services.The remaining pages of this chapter contain descriptions for each architecture and variation.

Table 7-2
Supported variations of line and loop testing architectures

If you have this architecture	With this variation	Then refer to
NTT-IRTU (DRTU emulation)	MTA, universal application	page 7-4
	PGTC emulation, GR-303 CSC integrated application	page 7-8
	PGTC emulation, TR08 integrated application	page 7-16
	Integrated application with DS1 tandem	page 7-18
NTT-external remote test unit	MTA, universal application	page 7-23
	MTA, integrated application	page 7-26
	PGTC, universal application	page 7-29
	PGTC emulation, GR-303 CSC integrated application	page 7-32
	PGTC emulation, TR08 integrated application	page 7-37

—continued—

Table 7-2 (continued)
Supported variations of line and loop testing architectures

If you have this architecture	With this variation	Then refer to
NTT- test bypass pair	MTA, universal application	page 7-40
	MTA, integrated application (DMS SuperNode)	page 7-43
	MTA, integrated application (DMS-10NA)	page 7-45
	PGTC, universal application	page 7-47
	PGTC emulation, GR-303 CSC integrated application	page 7-49
	PGTC emulation, TR08 integrated application	page 7-50
DMS MAP testing	DMS SuperNode MAP testing with IRTU (MTU emulation)	page 7-53
	DMS-10NA MAP testing, with IRTU (LTU emulation)	page 7-57
Switch-directed testing with test bypass pair	DMS SuperNode MAP testing with test bypass pair	page 7-58
—end—		

NTT-IRTU (DRTU emulation)

The following variations of no-test trunk/internal remote test unit (DRTU emulation) architectures are described:

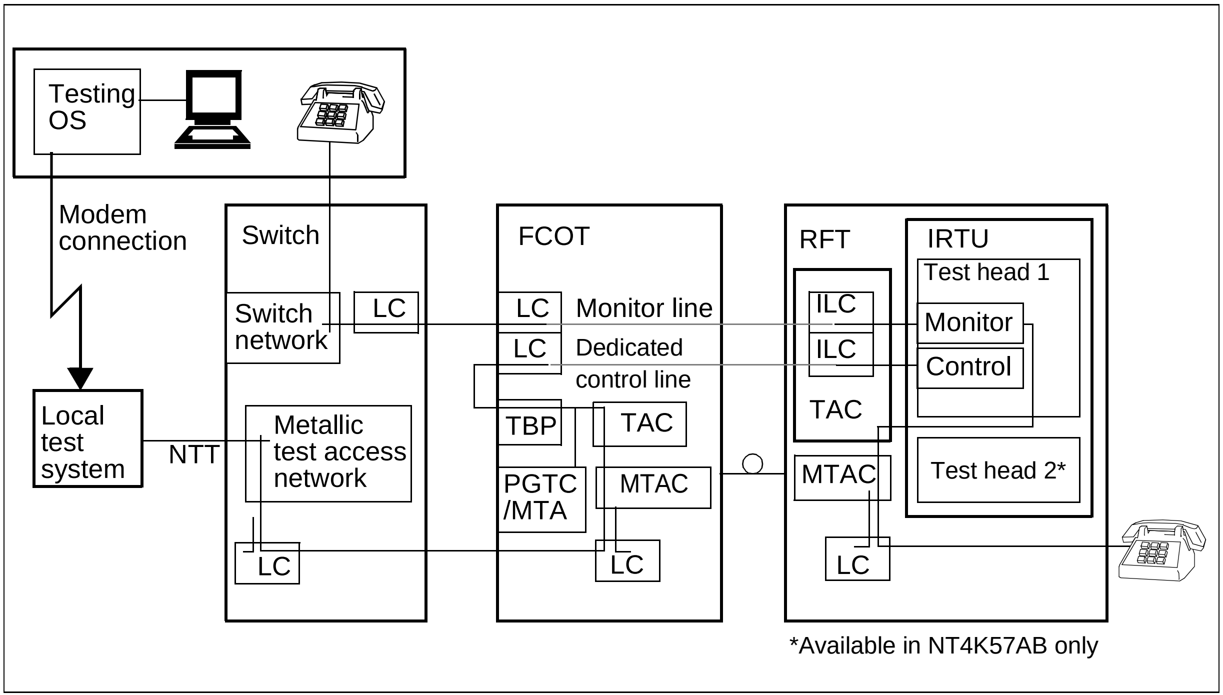
- MTA, in a universal application
- PGTC emulation, in a GR-303 integrated application
- PGTC emulation, in a TR08 integrated application
- integrated application with DS1 tandem

NTT-IRTU (DRTU emulation): MTA, in a universal application

As illustrated in Figure 7-1 on page 7-5, this architecture uses a dialup modem connection from the testing operations system (OS) to the local test system of the switch connected to the AccessNode. The local test controller uses a no-test trunk (NTT) connection to the local switch. A dedicated control line is provisioned from the FCOT to the IRTU in the RFT. A second line from the IRTU through the FCOT to the switch is provisioned to monitor the customer line under test. It is accessible from the public switched telephone network.

The OS/local test system combinations using this architecture in the universal application of AccessNode include the Nortel Networks Centralized Automated Loop Reporting System (CALRS) with Local Test Cabinet (LTC) NT 3703.

Figure 7-1
NTT-IRTU (DRTU emulation): MTA, in a universal application



Method of operation

The following sequence is used to perform a customer line test using an NTT-IRTU (DRTU emulation): MTA testing configuration in universal applications:

1. The tester at the operations system (OS) test position initiates testing of the subscriber loop.
2. The OS establishes a dialup modem link to the local test system (such as LTC) of the host switch. The OS controls tests by sending ASCII commands to the LTC.
3. The LTC performs a no-test-trunk sequence to get metallic access to the FCOT line card.
4. The LTC initiates carrier bypass using the MTA method. At the end of this sequence, LTC has established the control path to the IRTU, by way of an IRTU line card (ILC) at the RFT.
5. The LTC sends ASCII commands to the IRTU running DRTU emulation.

6 The IRTU makes the requested measurements on the loop and reports results to the LTC, which reports results to the OS.

7 The tester at the OS can establish a talk/monitor path to the line under test by specifying the OS telephone number in a command string to the IRTU. The IRTU dials the number and establishes the path over the ILC monitor line.

Equipment requirements

The list of AccessNode equipment required to implement this configuration is given in Table 7-3.

Table 7-3
Equipment requirements

Equipment	FCOT	RFT
IRTU, NT4K57, slot 21	-	1
TAC, NT4K54, slot 20	1	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS	two per CDS
Line cards (one control line and one monitor line)	2 Omega NT4K68	2 line card slots must remain empty
I/O cards		
TBP, NT4K58CA, slot 51	1	-
PGTC/MTA, NT4K58DA, slot 52	1	-
Cables		
TBP cable, (same as TAP cable, NT4K85 EA/EB/EC/ED))	1	-

Refer to the respective product documentation for detailed switch equipment requirements.

Provisioning requirements

Using the OPC PGTC/MTA Provisioning tool, provision the MTA test access method (refer to *Commissioning and Testing,* Volume 3).

Using the OPC Provisioning Manager tool, provision two universal circuits, one for a control path and one for a talk/monitor path (refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning,* Volume 4B):

- Provision one dedicated control path circuit: set the FCOT service code to POTSCT, and the RFT service code to ILCPOTS; set the ILCPOTS type to “control path.”

- Provision one talk/monitor circuit: set the FCOT service code to POTSCT, and the RFT service code to ILCPOTS; set the ILCPOTS type to “monitor.”

Provision switch equipment according to the switch product documentation. For DMS SuperNode, refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815.

Other commissioning requirements

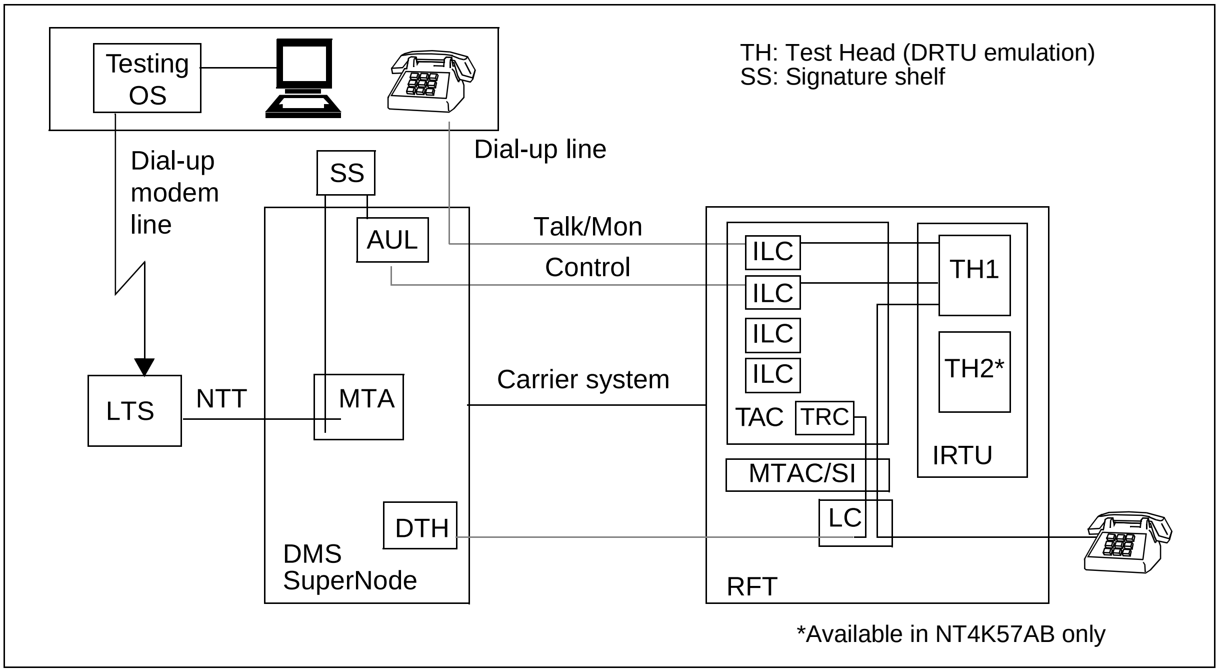
The following list provides additional details about setting up an NTT-IRTU (DRTU emulation): MTA testing configuration, in a universal application:

- Install, terminate, and cross-connect cables. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 and related documents.
- Modify the ABM shelf to add the IRTU, if the shelf is earlier than release (Rls) 07 and has not yet been modified. Refer to *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C.
- Install and test circuit packs and line cards. Refer to *Commissioning and Testin*g, Volume 3, for IRTU and TAC. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B, for line cards.
- Verify the continuity of connections by performing a line and loop test.
- If necessary, troubleshoot the MTA connection. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC integrated application

Figure 7-2 below and Figure 7-3 on page 7-9 illustrate single host and multihost applications, respectively.

Figure 7-2
NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC integrated single host application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position initiates testing of the subscriber loop.

2 The OS establishes a dialup modem link to the local test system (LTS) of the host switch. The OS controls tests by sending ASCII commands to the LTS.

3 The LTS performs a no-test-trunk sequence to establish a test connection to the desired RFT and IRTU test head.

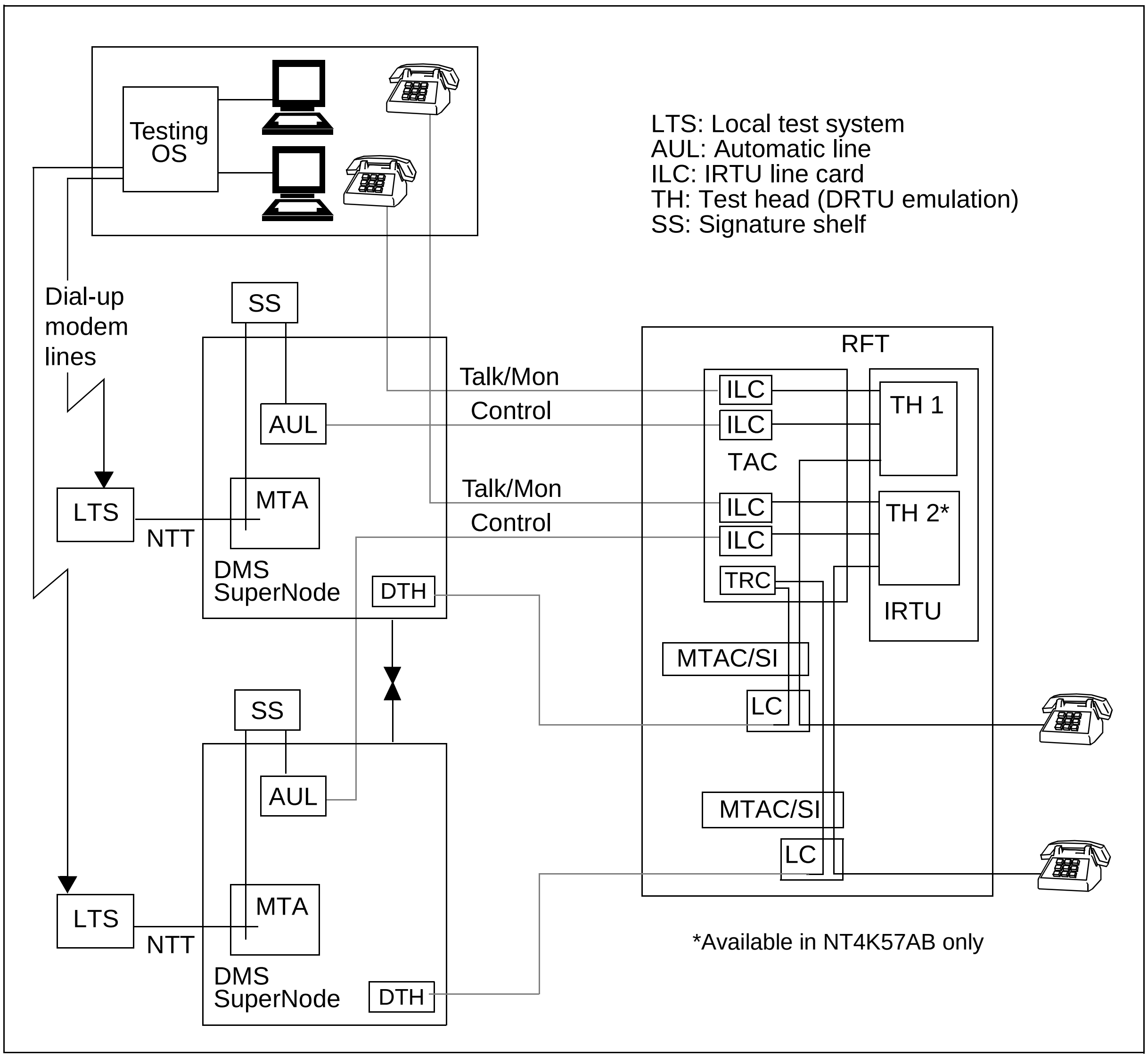
4 The LTS establishes a test session to the desired line card.

5 The LTS sends ASCII commands to the IRTU running DRTU emulation.

6 The IRTU makes the requested measurements on the loop and reports results to the LTS, which reports results to the OS.

7 The tester at the OS establishes a talk/monitor path to the line under test by specifying the OS telephone number in a command string to the IRTU. The IRTU dials the number and establishes the path over the ILC talk/monitor line.

Figure 7-3
NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC integrated multihosting application



Equipment requirements

The following table lists AccessNode equipment required to implement NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC integrated application.

Equipment	RFT
IRTU, NT4K57, slot 21	1
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Two line cards per test head: one control line and one talk/monitor line	ILC line card slots must remain empty

Refer to the respective product documentation for detailed switch equipment requirements.

Provisioning requirements

At the DMS SuperNode MAP, provision the following (refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815, as appropriate):

- Datafill the LNINV table for the RFT ILC services that are to provide talk/monitor and control path functions for the IRTU. Provision services as card code RDTILC and cardinfo as ILC1C, ILC1T, ILC2C, or ILC2T, as appropriate (for example, ILC1C is the control path to test head 1, and ILC2T is the talk/monitor path to test head 2). A SERVORD must also be done to provision ILCLSRs (ILCs with loop start res LSR parameters). DGT must be specified as an option.
- Datafill the TRKGRP table: provision the NTT as basic.
- Datafill the MTAVERT table to assign a vertical to the RFT network element. Provision the Vertsel parameter to S, the Selector to L, and the Linemod to NExx 1 0, where xx is the NE ID of the RFT.

- Datafill the RDTINV table: specify the NTT access as IRTU, and specify IRTU test head 1 or 2.

  Note 1: Software releases BCS36 and NA002 use different fields for provisioning these details.

  Note 2: In a multihosting application, the MAP table RDTINV at each switch can be provisioned to use one of two IRTU test heads. For example, if there are three switches hosting lines on this RFT, you can provision one digital switch to access IRTU test head 1, and provision two other digital switches to access IRTU test head 2.

  Note 3: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

- Datafill the LNINV table for an automatic line, used to ring down the IRTU control path ILC to establish an NTT access.

Other commissioning requirements

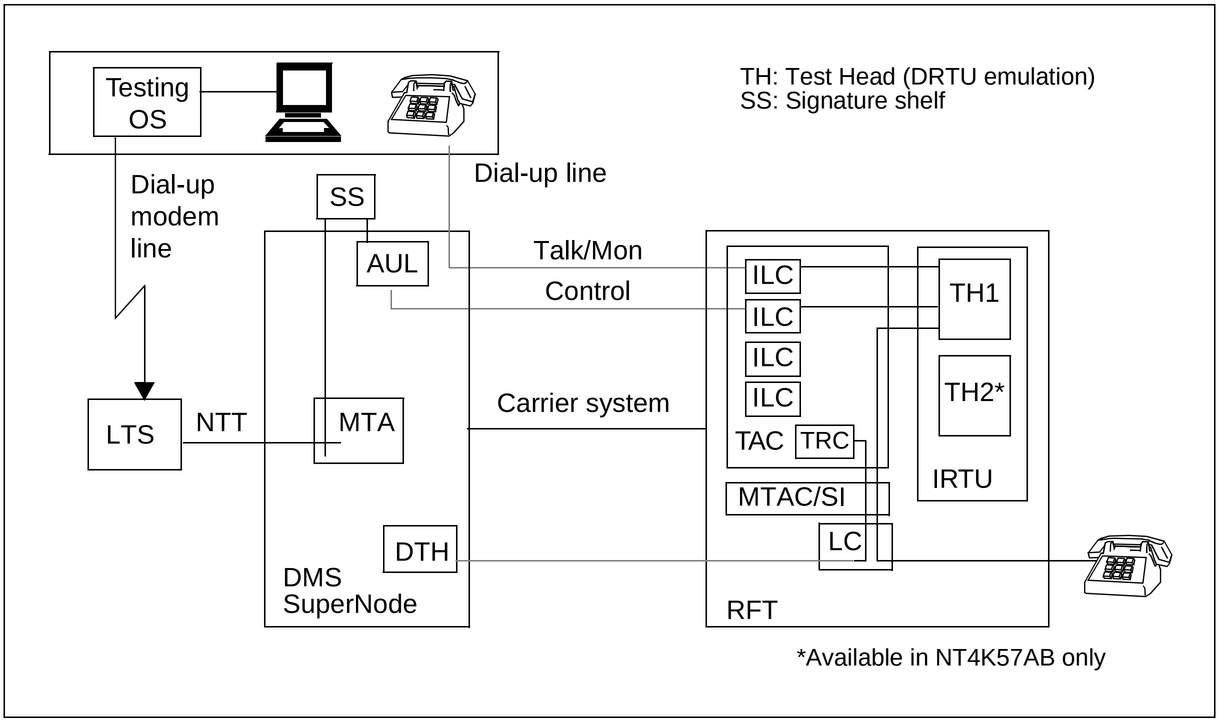
The following list provides additional details required to set up NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC integrated application:

- At the RFT, install and test the IRTU circuit pack. Refer to *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C.
- At the central office, set up the off-hook routing card connections to the automatic line.
- Verify the continuity of connections by performing a line and loop test.

NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC/MVI integrated application

Figure 7-4 below and Figure 7-5 on page 7-13 illustrate single host and multihost applications, respectively.

Figure 7-4
NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC/MVI integrated single host application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position initiates testing of the subscriber loop.

2 The OS establishes a dialup modem link to the local test system (LTS) of the host switch. The OS controls tests by sending ASCII commands to the LTS.

3 The LTS performs a no-test-trunk sequence to establish a test connection to the desired RFT and IRTU test head.

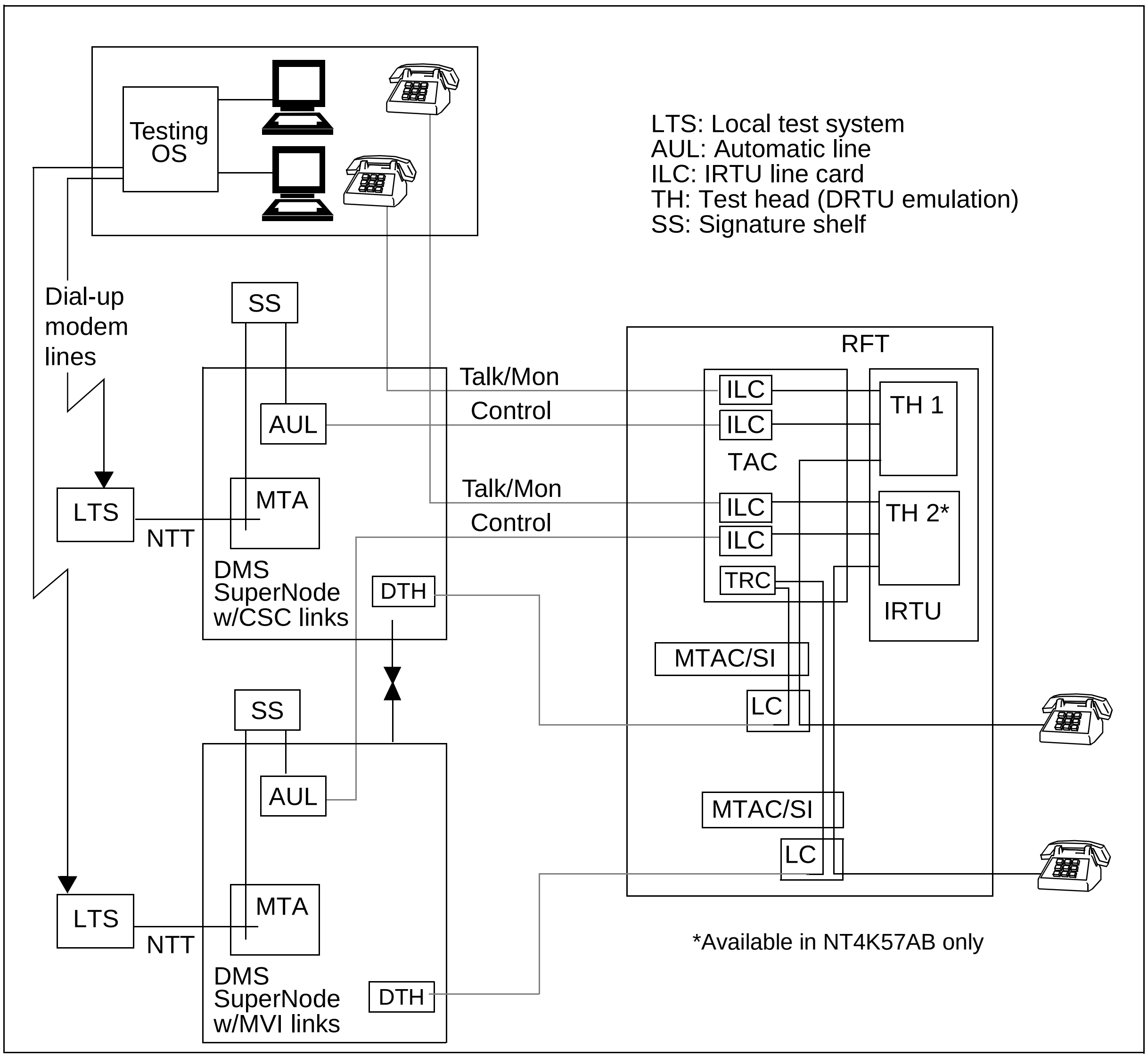
4 The LTS establishes a test session to the desired line card.

5 The LTS sends ASCII commands to the IRTU running DRTU emulation.

6 The IRTU makes the requested measurements on the loop and reports results to the LTS, which reports results to the OS.

7 The tester at the OS establishes a talk/monitor path to the line under test by specifying the OS telephone number in a command string to the IRTU. The IRTU dials the number and establishes the path over the ILC talk/monitor line.

Figure 7-5
NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC/MVI integrated multihosting application



Note: You cannot provision an ILC from an MVI switch. Instead, provision the ILC from the CSC switch. Then route the MVI switch through the CSC switch to test MVI lines with an ILC.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC/MVI integrated application.

Equipment	RFT
IRTU, NT4K57, slot 21	1
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Two line cards per test head: one control line and one talk/monitor line	ILC line card slots must remain empty

Refer to the respective product documentation for detailed switch equipment requirements.

Provisioning requirements

At the DMS SuperNode MAP, provision the following (refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815, as appropriate):

- Datafill the LNINV table for the RFT ILC services that are to provide talk/monitor and control path functions for the IRTU. Provision services as card code RDTILC and cardinfo as ILC1C, ILC1T, ILC2C, or ILC2T, as appropriate (for example, ILC1C is the control path to test head 1, and ILC2T is the talk/monitor path to test head 2). A SERVORD must also be done to provision ILCLSRs (ILCs with loop start res LSR parameters). DGT must be specified as an option.

  Note: If using a Single Test Head IRTU (NT4K57BA) do not provision ILC2C or ILC2T, since test head two does not exist. In this situation, ILC1C and ILC1T must be shared by the switches.

- Datafill the TRKGRP table: provision the NTT as basic.
- Datafill the MTAVERT table to assign a vertical to the RFT network element. Provision the Vertsel parameter to S, the Selector to L, and the Linemod to NExx 1 0, where xx is the NE ID of the RFT.
- Datafill the RDTINV table: specify the NTT access as IRTU, and specify IRTU test head 1 or 2.

  Note 1: Software releases BCS36 and NA002 use different fields for provisioning these details.

Note 2: In a multihosting application, the MAP table RDTINV at each switch can be provisioned to use one of two IRTU test heads. For example, if there are three switches hosting lines on this RFT, you can provision one digital switch to access IRTU test head 1, and provision two other digital switches to access IRTU test head 2.

Note 3: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

- Datafill the LNINV table for an automatic line, used to ring down the IRTU control path ILC to establish an NTT access.

Other commissioning requirements

The following list provides additional details required to set up NTT-IRTU (DRTU emulation): PGTC emulation, in a GR-303 CSC/MVI integrated application:

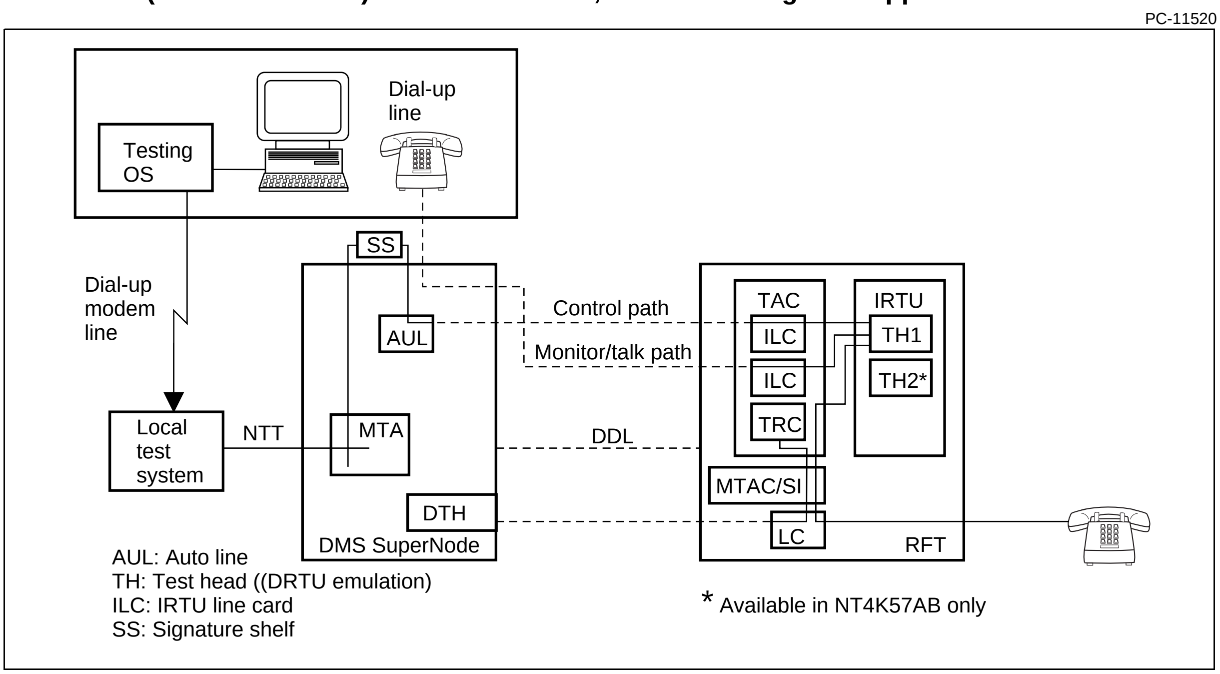
- At the RFT, install and test the IRTU circuit pack. Refer to *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C.
- At the central office, set up the off-hook routing card connections to the automatic line.

Verify the continuity of connections by performing a line and loop test.

NTT-IRTU (DRTU emulation): PGTC emulation, in a TR08 integrated application

The testing combination which uses this architecture and is supported by AccessNode is the Nortel Networks model 3703 Local Test Cabinet (LTC). The layout is illustrated in Figure 7-6.

Figure 7-6
NTT - IRTU (DRTU emulation): PGTC emulation, in a TR08 integrated application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the local test cabinet (LTC) initiates testing of the subscriber loop.

2 The LTC performs a no-test-trunk sequence to establish a test connection to the desired RFT and IRTU test head.

3 The LTC establishes a modem session to the DRTU emulation running on the IRTU.

4 The LTC sends ASCII commands to the IRTU running DRTU emulation.

5 The IRTU makes the requested measurements on the loop and reports results to the LTC.

6 The tester can establish a talk/monitor path to the line under test by specifying the telephone number in a command string to the IRTU. The IRTU dials the number and establishes the path over the ILC talk/monitor line.

Equipment requirements

The following table lists the AccessNode equipment required to implement NTT-IRTU (DRTU emulation): PGTC emulation, in a TR08 integrated application.

Equipment	RFT
IRTU, NT4K57, slot 21	1
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Two line cards per test head: one control line and one talk/monitor line	ILC line card slots must remain empty

Refer to the respective product documentation for detailed switch equipment requirements.

Provisioning requirements

Using the OPC Provisioning Manager tool, provision two TR08 services with an ILCPOTS service code. For each service, specify the termination point (IRTU test head 1 or 2) and type (one control path and one talk/monitor path). (Refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning,* Volume 4B.)

At the RFT user interface, use the LLTCFGCI tool to provision the RFT metallic test access point (TAP 1 or TAP 2) that is to be activated upon a TR08 channel test request. Note that IRTU test head-TAP connections are permanently wired on the common equipment shelf backplane. See *Commissioning and Testing*, Volume 3, for details.

At the DMS SuperNode MAP, provision the following (refer to NA002 document *XPM Translations Reference Manual*, 297-8321-815 and *Commissioning and Testing*, Volume 3, for details):

- Datafill the LNINV table for two TR08 POTS services (to provide one control path and one talk/monitor path from the IRTU) on the remote carrier SLC (RCS) peripheral to which the AccessNode is connected. A SERVORD must also be done to provision ILCs as POTS, and to specify DGT as an option.
- Datafill the TRKGRP table: provision the NTT as MLT, with the DGTTST parameter set for INTRCVR.
- Datafill the MTAVERT table to assign a vertical to the desired RCS. Provision the Vertsel parameter to S, the Selector to L, and the Linemod to RCSW 0 0, where W is the RCS number.
- Datafill the LNINV table for an automatic line, used to ring down the IRTU control path ILC to establish an NTT access.

Other commissioning requirements

The following list provides additional details required to set up NTT-IRTU (DRTU emulation): PGTC emulation, in a TR08 integrated application:

- At the RFT, install and test the IRTU circuit pack. Refer to *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C.
- At the central office, set up the off-hook routing card connections to the automatic line.
- Ensure that no major alarms exist on the RCS, that the RCS state is InSv, and that the TR08 links have a MsgCond of OPN.
- Verify the continuity of connections by performing a line and loop test.

NTT-IRTU (DRTU emulation): integrated application with DS1 tandem

This arrangement is used in an integrated application in which the AccessNode is running AN07 software and the DMS SuperNode is running BCS36 software. For additional information about DS1 tandem ILC provisioning, refer to page 2-12.

The testing operations system/local test system combinations which use this architecture and are supported by AccessNode include:

- The Nortel Networks Centralized Automated Loop Reporting System/Enhanced Line Test Unit (CALRS/ELTU)
- The Nortel Networks model 3703 Local Test Cabinet (LTC)

About CALRS

The Centralized Automated Loop Reporting System (CALRS) is an operations system (OS) that uses one of several central-office test heads, such as the model 3703 Local Test Cabinet (LTC), or an Enhanced Line Test Unit (ELTU).

Figure 7-7 illustrates the test layout for IRTU (DRTU emulation) in an integrated application, utilizing one IRTU test head. Figure 7-8 on page 7-20 illustrates the test layout for IRTU (DRTU emulation) in a multi-hosting integrated application, in which each digital switch utilizes one IRTU test head.

Figure 7-7
NTT–IRTU (DRTU emulation): in a single-host integrated application with DS1 tandem

PC-11519

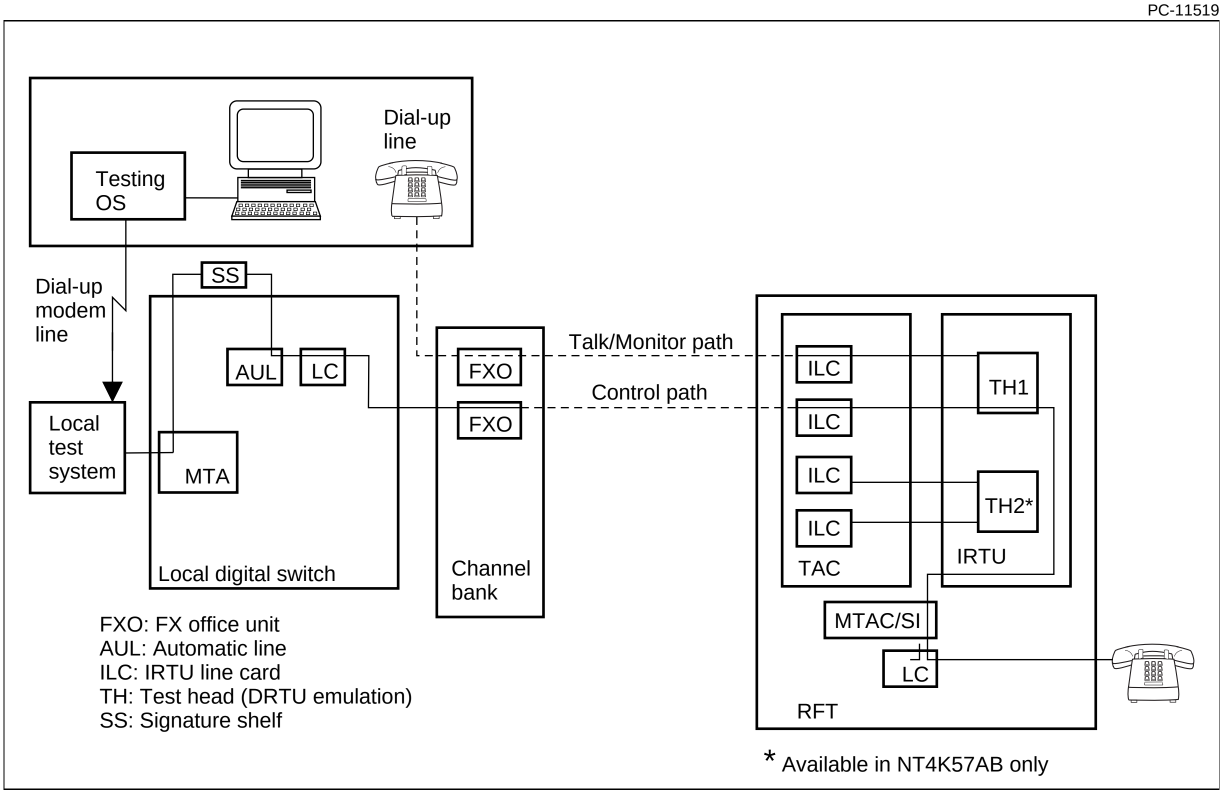
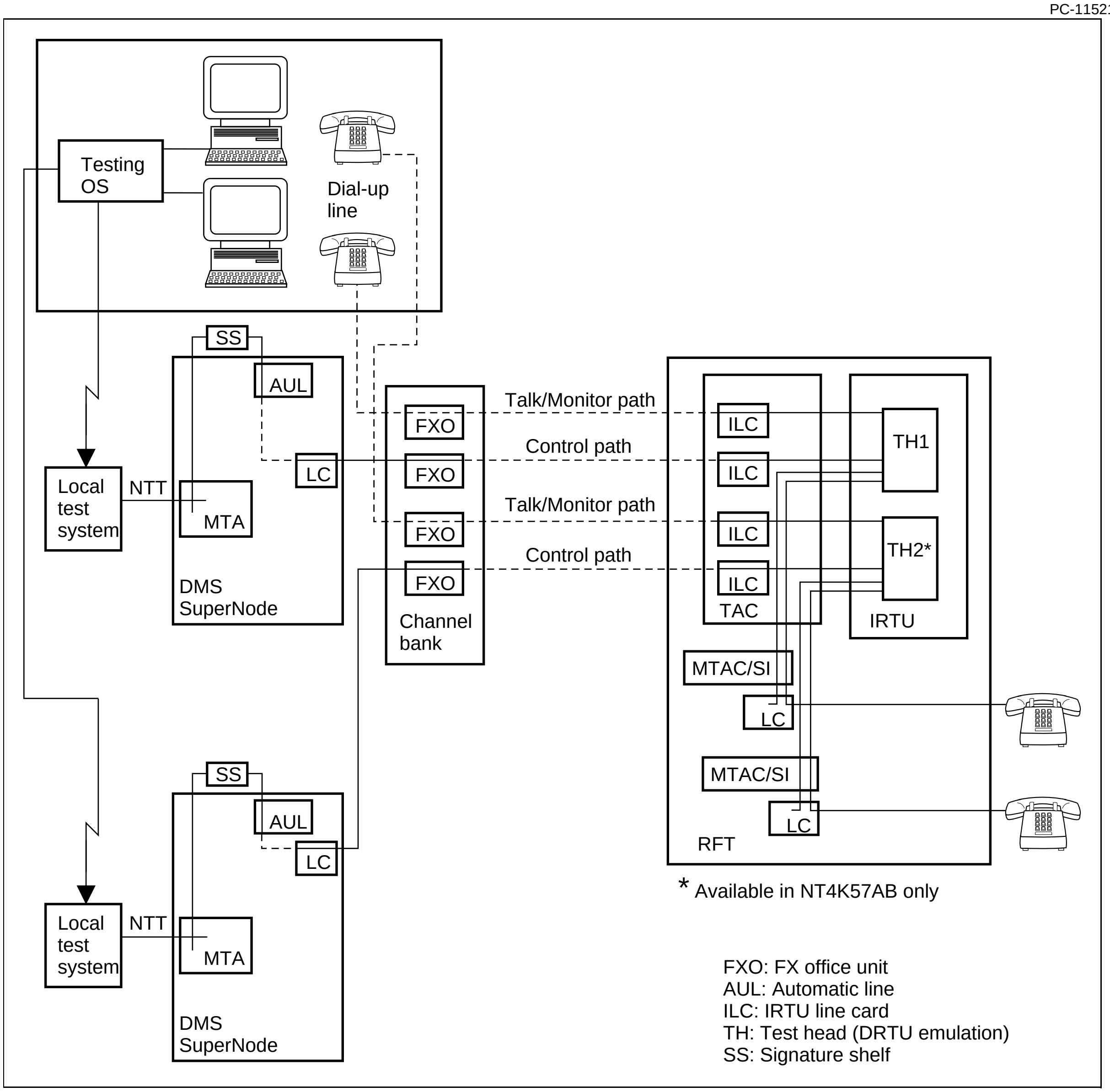


Figure 7-8
NTT-IRTU (DRTU emulation): in an integrated multi-hosting application with DS1 tandem



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The appropriate local test system connects to a switch automatic line via the no test trunk and switch MTA, and establishes a control path to the IRTU test head.

3 The IRTU establishes a metallic connection to the subscriber line.

4 Upon request, the IRTU establishes the callback connection to the OS test position. (The IRTU does not autonomously establish the callback.)

5 The OS performs tests on the line, and requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists the AccessNode equipment required to implement NTT-IRTU (DRTU emulation): in an integrated application with DS1 tandem.

Equipment	RFT
IRTU, NT4K57, slot 21	1
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf

The equipment required at the central office to implement this configuration on a single digital switch includes the following:

- spare DS0s on a DS1 facility at the FCOT, for DS1 tandem circuits
- a PCM channel bank, equipped with two foreign exchange office (FXO) channel units
- a digital switch equipped with sufficient MTA capacity, one automatic line, and two POTS line cards (refer to the switch product documentation for equipment details)

In a multihosting application, provide the following equipment at the central office:

- spare DS0s on a DS1 facility at the FCOT, for DS1 tandem circuits
- a PCM channel bank with four FXO channel units, two per digital switch
- two digital switches, each having sufficient MTA capacity, one automatic line, and two POTS line cards

Provisioning requirements

To test services on an integrated AccessNode system using DS1 tandem lines to the IRTU, provision the following:

- Using the DS1 Facility Assignment Manager tool on the OPC, assign one DS1 for DS1 tandem circuits. Refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B.

- Using the OPC Provisioning Manager, provision two ILCPOTS services on DS1 tandem circuits (one dial-up control path, and one talk/monitor path). Refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B.
- Provision at the DMS SuperNode MAP. Refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815:
  - — Provision two LpSt Res (POTS) line cards.
  - — Datafill the RDTINV table for the metallic test access point (IRTU).

  Note: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

  - — Datafill for NTT test access to a particular IRTU test head.

In a multi-hosting application, provision the following:

- Use the OPC Provisioning Manager tool to provision four ILCPOTS services on DS1 tandem circuits.
- Provision two POTS line cards and NTT access from one digital switch to IRTU Test Head 1, and provision two POTS line cards and NTT access from a second digital switch to IRTU Test Head 2.

Other commissioning requirements

The following list provides additional details about setting up NTT-IRTU (DRTU emulation): in an integrated application with DS1 tandem:

- Install, terminate, and cross-connect DS1 cables. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 and related documents.
- Modify the ABM shelf to add the IRTU, if the shelf is earlier than release (Rls) 07 and has not yet been modified. Refer to *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C.
- Install and test circuit packs. Refer to *Commissioning and Testing*, Volume 3, for DS1/VT mappers, IRTU, and TAC. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B, for line cards.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.

NTT-external remote test unit

The following variations of “no-test trunk with external remote test unit” architectures are described:

- MTA, in a universal application
- MTA, in an integrated application

- PGTC, in a universal application
- PGTC emulation, in a GR-303 CSC integrated application
- PGTC emulation, in a TR08 integrated application

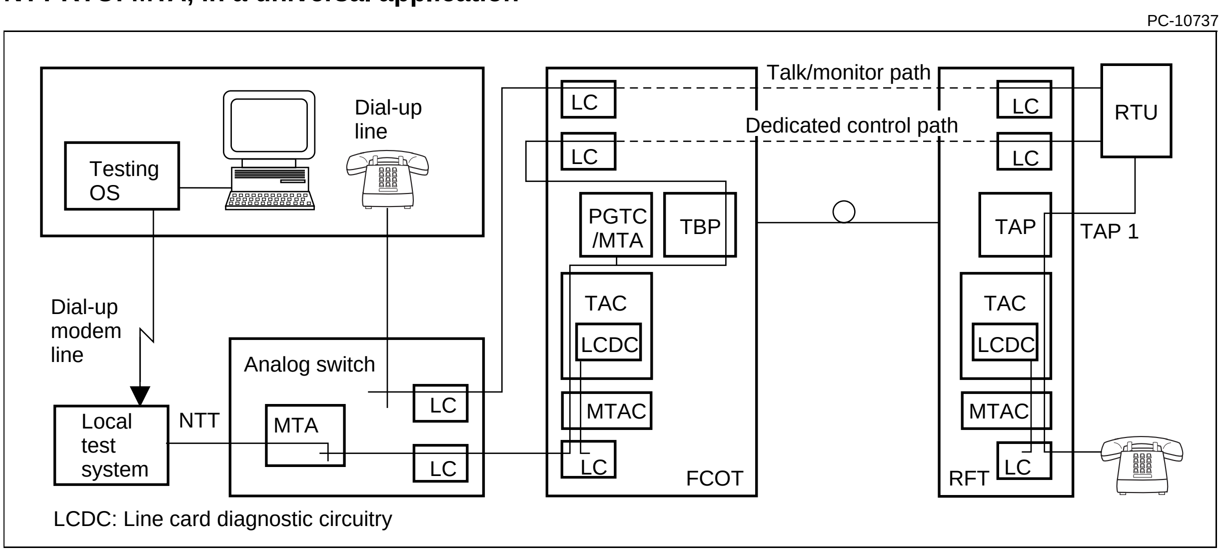
NTT-RTU: MTA, in a universal application

The testing operations system/local test system combinations which use this architecture and are supported by AccessNode include:

- Nortel Networks Centralized Automated Loop Reporting System/Enhanced Line Test Unit with model 3704 DRTU (CALRS/ELTUDRTU))
- The Nortel Networks model 3703 Local Test Cabinet with model 3704 DRTU (LTC/DRTU)
- AT&T LMOS/Reliance TSD RTEC T-9/SX Mechanized Loop Tester (refer to page 7-62 for additional information about the RTEC arrangement)
- Teradyne 4TEL CO RMU with RMU 220/225 (refer to page 7-63 for additional information about the 4TEL arrangement)

Figure 7-9 illustrates the test layout.

Figure 7-9
NTT-RTU: MTA, in a universal application



Method of operation

The following sequence is used to perform a customer line test using NTT-RTU: MTA in a universal application:

1. The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.
2. The OS establishes a dial-up modem link to the local test system (such as LTC or 4TEL CO RMU) of the host switch. The OS controls tests by sending ASCII commands to the LTC.
3. The LTC connects to the switch line card via the no-test trunk and the switch MTA.
4. Using a coin control pulse, the LTC initiates carrier bypass (MTA method), and establishes a control path to the external RTU.
5. The TAC establishes a metallic connection from the RTU to the subscriber loop.
6. Upon the request of the LTC, the RTU establishes the callback connection to the OS test position.
7. The LTC controls tests on the loop using ASCII commands, and the RTU makes the requested measurements.
8. The coin control detection circuitry on the TAC is connected to the line card, to detect the LTC control pulses sent from the test system to request measurements.
9. If line card diagnostics are enabled using the OPC PGTC/MTA provisioning tool, then the second coin control pulse is interpreted as a line card diagnostic test results request. (If line card diagnostics are disabled, this step is omitted.) The TAC reports test results, in the form of continuous or interrupted 1600 Hz tones, back to the craftsperson; the 1600 Hz codes are:

UDLC system OK	1600 Hz, continuous
control terminal (CT) failure	1600 Hz, 60 interruptions per minutes (IPM)
remote terminal (RT) failure	1600 Hz, 120 IPM
test results not yet ready	1600 Hz, 15 IPM
stop reporting test results	no tone

10. Using a final coin control pulse, the LTC requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists the AccessNode equipment required to implement NTT-RTU: MTA, in a universal application.

Equipment, PEC	**FCOT**	**RFT**
TAC, NT4K54, slot 20	1	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS	two per CDS
Two line cards (one for a dedicated control link, and one for a talk/monitor link)	Omega NT4K68	Omega NT4K67 or Epsilon NT4K65
I/O cards:		
TBP, NT4K58CA, slot 51	1	-
PGTC/MTA, NT4K58DA, slot 52	1	-
TAP, NT4K58KA, slot 53	-	1
Cables:		
TBP cable, (use TAP cable)	1	-
TAP cable, NT4K85EA/EB/EC/ED	-	1

The RTU can be connected to either the TBP port or one of the TAP ports on the TAP I/O card.

Provisioning requirements

Using the OPC Provisioning Manager tool, provision two POTS lines, a dedicated control link and a talk/monitor link (refer to *Line Card Provisioning Procedures*, 323-3001-315 in *Operations, Administration, and Provisioning,* Volume 4B). Only one test head can be assigned for testing universal circuits.

Using the OPC PGTC/MTA Provisioning tool, provision the MTA carrier bypass method and the planned remote access point (TBP, TAP1, or TAP2), (refer to *Commissioning and Testing,* Volume 3).

Other commissioning requirements

The following list provides additional details about setting up NTT-RTU: MTA, in a universal application:

- Install the PGTC/MTA I/O and the TBP I/O cards at the FCOT and the TAP I/O card at the RFT; terminate and cross-connect the associated cables. Refer to *Bay in Central Office Installation Manual—ABM,* 323-3001-201 and related documents.

- Install and test line cards. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.
- If necessary, troubleshoot the MTA connection. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

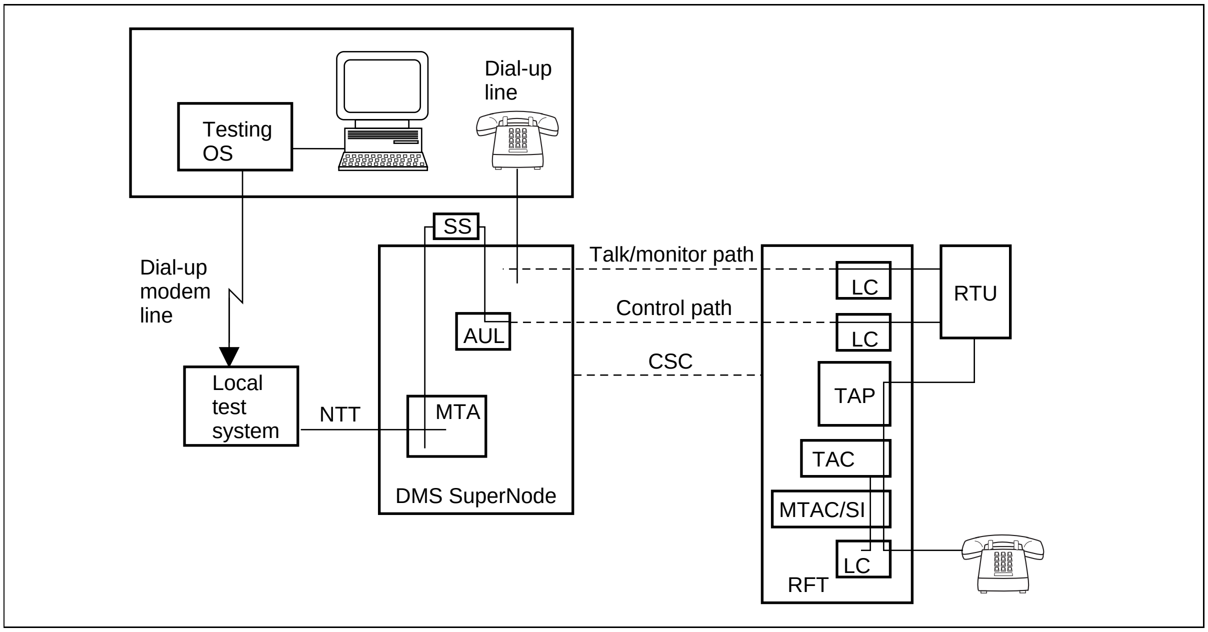
NTT-RTU: MTA, in a GR-303 integrated application

The testing operations system/local test system combinations which use this architecture and are supported by AccessNode include:

- The Nortel Networks Centralized Automated Loop Reporting System/Enhanced Line Test Unit (CALRS/ELTU) with model 3704 DRTU
- The Nortel Networks model 3703 Local Test Cabinet (LTC) with model 3704 DRTU
- AT&T LMOS/Reliance TSD RTEC T-9/SX Mechanized Loop Tester (refer to page 7-62 for additional information about the RTEC arrangement)
- Teradyne 4TEL CO RMU with 220/225 RMU (refer to page 7-66 for additional information about the 4TEL arrangement)

Figure 7-10 on page 7-27 illustrates the test layout.

Figure 7-10
NTT-RTU: MTA, in an integrated application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The OS establishes a dial-up modem link to the local test system (such as LTC) of the host switch. The OS controls tests by sending ASCII commands to the LTC.

3 The LTC performs the NTT sequence and initiates carrier bypass.

4 The switch MTA connects the NTT to an automatic line, which rings down to the RFT and establishes a control path to the external RTU.

5 The switch establishes a metallic connection to the subscriber line by sending messages over the CSC channel.

6 Upon the request of the LTC, the RTU establishes the callback connection to the OS test position.

7 The LTC controls tests using ASCII commands, and the RTU makes the requested measurements on the loop.

8 The LTC requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-RTU: MTA in an integrated application.

Equipment, PEC	**RFT**
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Line cards per test head (one for control link, and one for talk/monitor link)	two Epsilon NT4K65 or Omega NT4K67 (see note)
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1
Note: In a point-to-point system, provide two DS0 channels on a GR-303 DMS facility on a DS1/VT mapper at the FCOT. In a DS1-fed system, provide two DS0 channels on a GR-303 DMS facility on a DS1/VT mapper at the RFT. In a single-ended system, no additional DS1 equipment is required on the AccessNode.	

The RTU can be connected to the TBP or a TAP port on the TAP I/O card.

Provisioning requirements

At the DMS SuperNode, provision the following:

- Datafill the table LNINV for one control line and one talk/monitor line; specify cardcode RDTPOTS.
- Datafill the table RDTINV for the metallic test access point (ERTU).

  Note: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

Refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815 for details.

Other commissioning requirements

The following list provides additional details about setting up NTT-RTU: MTA, in an integrated application:

- At the RFT, install, terminate, and cross-connect the TAP I/O card and cable. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201, and related documents.

- Install and test line cards. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.

NTT-RTU: PGTC, in a universal application

The testing operations system/local test system combinations which use this architecture and are supported by AccessNode include:

- AT&T LMOS/MLT
- the Nortel Networks 3703 Local Test Cabinet with model 3704 DRTU (LTC/DRTU)

Figure 7-11 illustrates the test layout for an LMOS/MLT combination. Figure 7-12 on page 7-30 illustrates the test layout for an LTC/DRTU combination.

Figure 7-11
NTT-RTU: PGTC, in a universal application (LMOS/MLT)

PC-11345

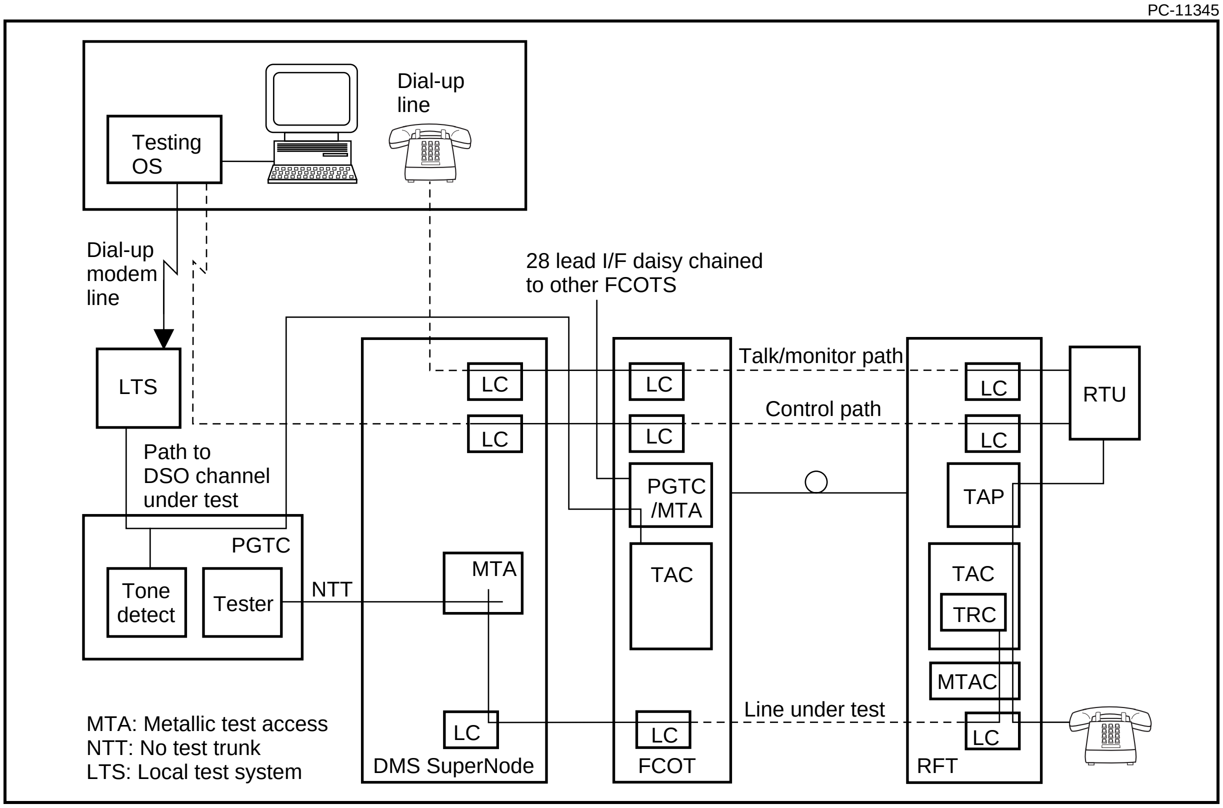
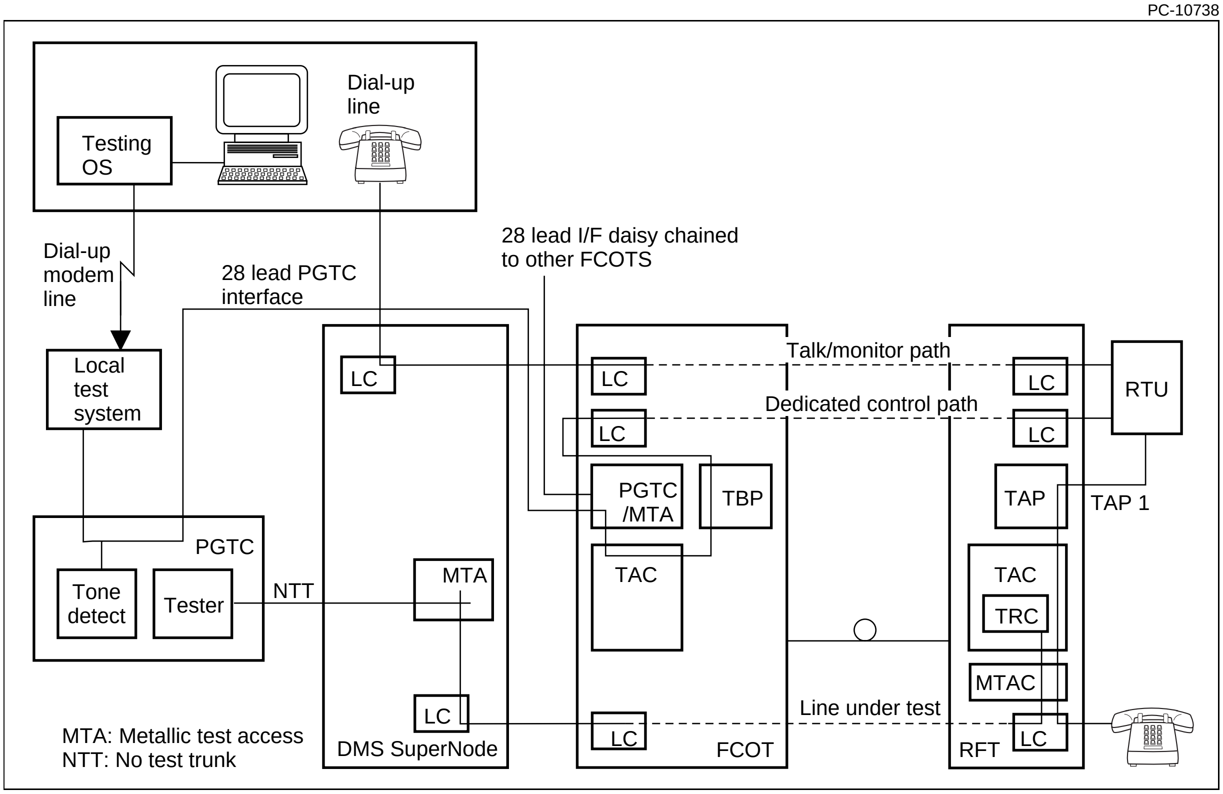


Figure 7-12
NTT-RTU: PGTC, in a universal application (LTC/DRTU)



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The OS establishes a dial-up modem link to the local test system (LTS) of the host switch. The OS controls tests by sending ASCII commands to the LTS.

3 The LTS initiates an NTT access through the local switch. This connects the LTS through the MTA circuitry of the switch to the FCOT line card of the digital loop carrier (DLC). Upon detection of the DLC signature, the LTS initiates a PGTC carrier bypass operation (+116 V applied to the tip lead; details for PGTC are in Chapter 4). At the end of the PGTC handshaking sequence, the PGTC is connected through the switch to the FCOT line card and the RTU is connected to the subscriber drop.

4 While the PGTC performs channel tests, the RTU can perform loop measurements. The control path setup to the RTU is different for LMOS/MLT than the setup for LTC/DRTU.

a. for LMOS/MLT, MLT dials up the RTU under a separate control path connection, as shown in Figure 7-11 on page 7-29

b. for LTC/DRTU, the control path uses the metallic path that would normally connect the TBP I/O card to a test bypass pair to connect instead to a dedicated FCOT-to-RFT circuit for the DRTU modem connection (see Figure 7-12 on page 7-30)

5 Upon the request of the MLT or LTC, the RTU establishes the callback connection to the OS test position.

6 The MLT or LTC controls tests using ASCII commands, and the RTU makes the requested measurements on the loop.

7 The LTS requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-RTU: PGTC, in a universal application.

Equipment, PEC	**FCOT**	**RFT**
TAC, NT4K54, slot 20	1	1
MTAC, NT4K73, CDS slots MTA A and MTA B	2 per CDS	two per CDS
Two line cards (one for control link, and one for talk/monitor link)	two Omega NT4K68	two Epsilon NT4K65 or Omega NT4K67
I/O cards:		
TBP, NT4K58CA, slot 51	1	-
PGTC/MTA, NT4K58DA, slot 52	1	-
TAP, NT4K58KA, slot 53	-	1
Cables:		
TBP cable, (use TAP cable)	1	-
PGTC/MTA cable, NT4K85BA	1	-
TAP cable, NT4K85EA/EB/EC/ED	-	1

The RTU can be connected to the TBP or a TAP port on the TAP I/O card.

Provisioning requirements

Using the OPC Provisioning Manager tool, provision two POTS lines, a dedicated control link for the LTC/DRTU configuration or a dial-up control link for the LMOS/MLT configuration, and a talk/monitor link (refer to *Line*

Card Provisioning Procedures, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B). Only one test head can be assigned for testing universal circuits.

Using the OPC PGTC/MTA Provisioning tool, provision the PGTC test access method and the remote access point (refer to *Commissioning and Testing*, Volume 3).

Other commissioning requirements

The following list provides additional details about setting up NTT-RTU: PGTC, in a universal application:

- Install and cross-connect TBP, PGTC, and TAP I/O cards and cables. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 and related documents.
- Install and test line cards. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.
- If necessary, troubleshoot the PGTC connection. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

NTT-RTU: PGTC emulation, in a GR-303 CSC integrated application

The testing operations system/local test system combination which uses this architecture and is supported by AccessNode is:

- AT&T LMOS/MLT
- The Nortel Networks 3703 Local Test Cabinet with model 3704 DRTU (LTC/DRTU)

Figure 7-13 on page 7-33 illustrates the test layout used by LMOS/MLT. Figure 7-14 on page 7-33 illustrates the test layout used LTC/DRTU.

Figure 7-13
NTT-RTU: PGTC emulation, in a GR-303 CSC integrated application (LMOS/MLT)

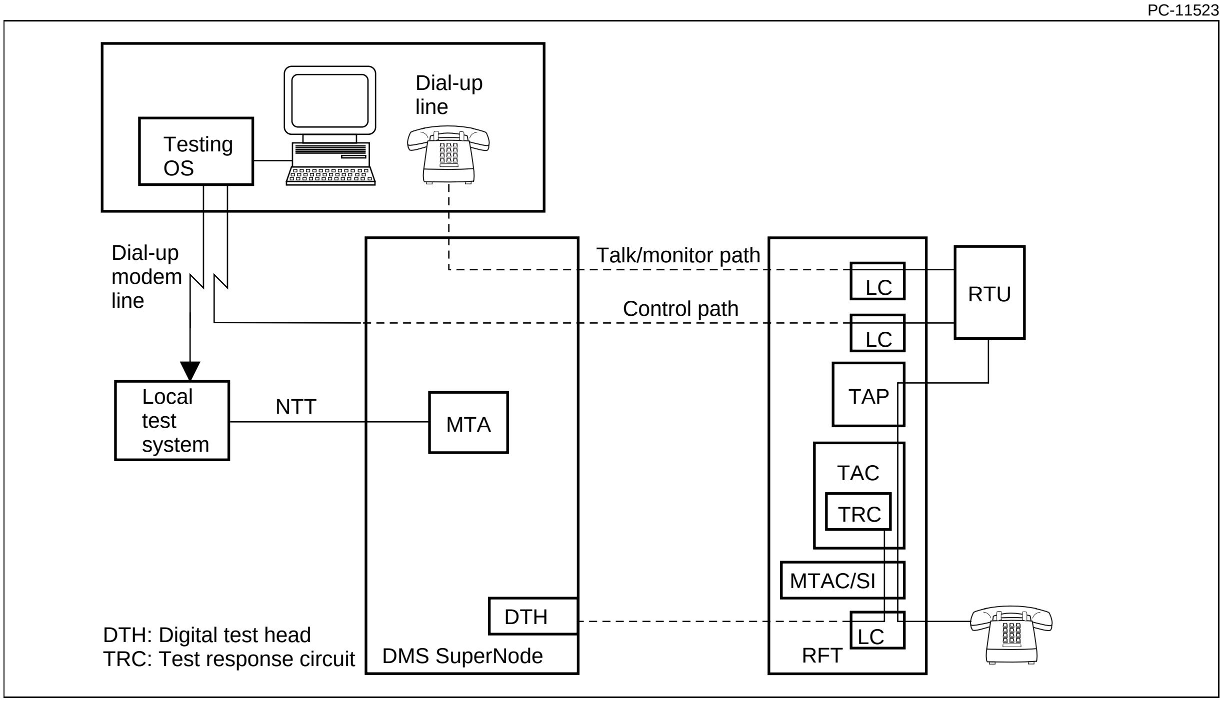
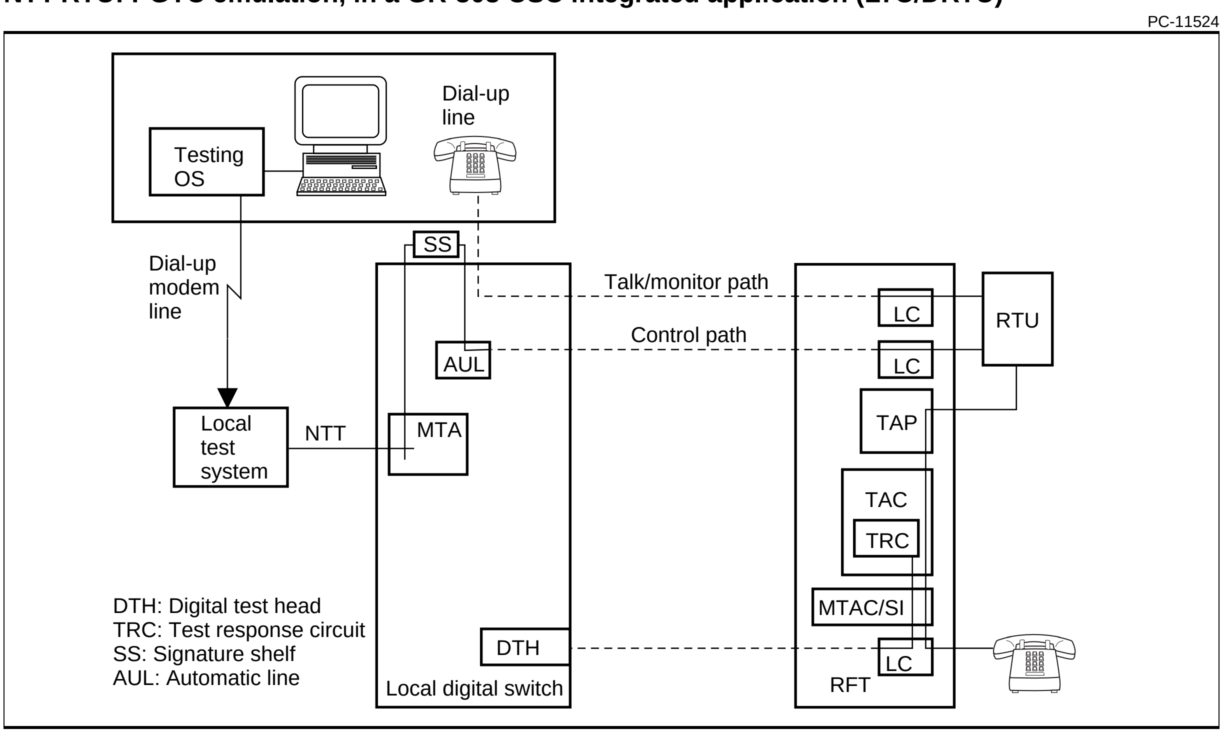


Figure 7-14
NTT-RTU: PGTC emulation, in a GR-303 CSC integrated application (LTC/DRTU)



Method of operation

The following sequence is used to perform a customer line test:

1. The operations system (OS) establishes a dial-up modem link to the loop testing system (such as LTS) of the host switch.
2. The LTS performs an NTT access sequence. The switch connects the no-test trunk to a digital loop carrier (DLC) signature circuit because the line being accessed resides on a DLC. Upon detection of this DLC signature, the LTS initiates carrier bypass (by applying +116 V on the tip). The carrier bypass operation results in the external RTU being connected to the subscriber drop at the RFT and TRC being connected to the line card under test.
3. While the switch digital test head performs channel tests, the RTU can perform loop measurements. The control path setup to the RTU for LMOS/MLT is different than for LTC/DRTU:
   a. for LMOS/MLT, MLT simply dials up the RTU under a separate control path connection, as shown in Figure 7-13 on page 7-33
   b. for LTC/DRTU, the control path uses the metallic path that would normally connect the MTA vertical to a test bypass pair to connect instead to an automatic line which rings down the DRTU modem (see Figure 7-14 on page 7-33)
4. MLT or LTC sends test commands, and the RTU makes the requested measurements on the loop. The RTU returns test results to the MLT or LTC.
5. The LTS requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-RTU: PGTC emulation, in a GR-303 CSC integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Line cards per test head (one control and one talk/monitor path)	two, Epsilon NT4K65 or Omega NT4K67
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Provisioning requirements

At the DMS SuperNode, provision the following (refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815, as appropriate):

- datafill the LNINV table for the RFT line cards for talk/monitor and control paths to the RTU. Provision cardcode as RDTPOTS. A SERVORD must also be done to provision lines with loop start res (LSR) parameters. DGT must be specified as an option.
- datafill the TRKGRP table: provision the NTT as MLT.
- datafill the MTAVERT table to assign a vertical to the RFT network element. Provision the Vertsel parameter to S, the Selector to L, and the Linemod to NExx 1 0, where xx is the NE ID of the RFT.
- datafill the RDTINV table: specify the NTT access as ERTU, and specify the remote access point (TBP, TAP 1, or TAP 2). Software releases BCS36 and NA002 use different fields for provisioning these details.

  Note: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

- datafill the LNINV table for an automatic line, used to ring down the RTU control path to establish an NTT access.

Other commissioning requirements

The following list provides additional details about setting up NTT-RTU: PGTC emulation, in a GR-303 CSC integrated application:

- Install and terminate the TAP I/O card and cable. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 or equivalent installation documents.
- Cross-connect the RTU to the chosen port on the TAP I/O card: TBP, TAP 1, or TAP 2. Refer to the TAP I/O cable pinout table in *Commissioning and Testing*, Volume 3.
- Install and test the RFT line card for the control link to the RTU test head and the switch line card. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B and switch documentation.
- At the central office, for an LTC/DRTU arrangement, set up the off-hook routing card connections to the automatic line.
- Verify the continuity of connections by performing a line and loop test.

NTT-RTU: PGTC emulation, in a TR08 integrated application

The testing operations system/local test system combinations of this type which are supported by AccessNode include:

- AT&T LMOS/MLT
- Nortel Networks LTC/DRTU

Figure 7-15 illustrates the LMOS/MLT test layout. Figure 7-16 on page 7-38 illustrates the LTC/DRTU test layout.

Figure 7-15
NTT-RTU: PGTC emulation, in a TR08 integrated application (LMOS/MLT)

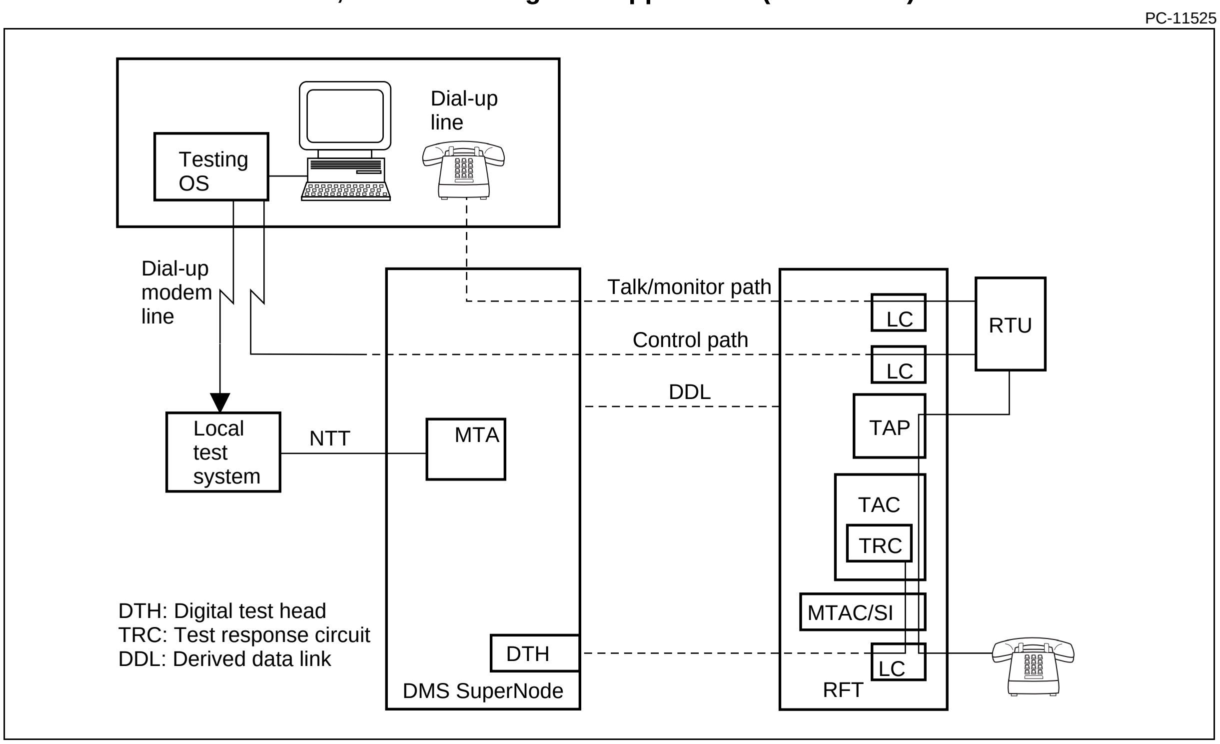
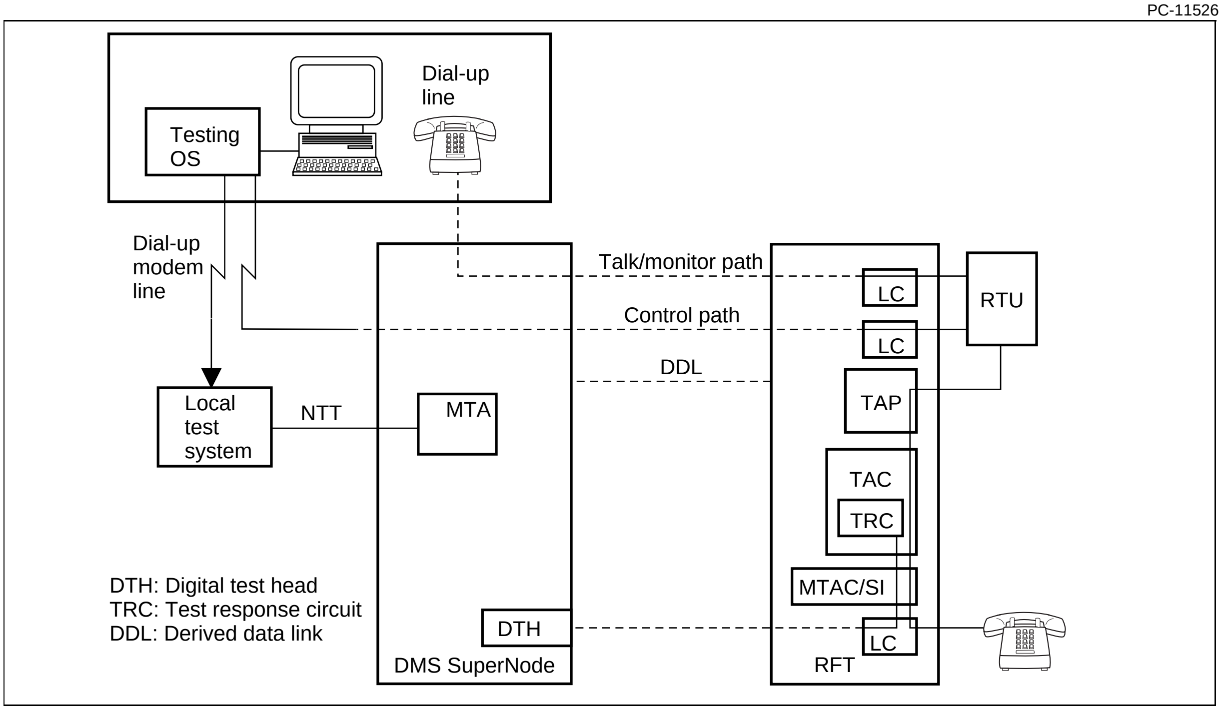


Figure 7-16
NTT-RTU: PGTC emulation, in a TR08 integrated application (LTC/DRTU)



Method of operation

The following sequence is used to perform a customer line test:

1 The operations system (OS) establishes a dial-up modem link to the local test system (LTS) of the host switch.

2 The LTS performs an NTT access sequence. The switch connects the no-test trunk to a digital loop carrier (DLC) signature circuit because the line being accessed resides on a DLC. Upon detection of this DLC signature, the LTS initiates carrier bypass (by applying +116 V on the tip). (See TR08 carrier bypass in Chapter 4 for more details.) The carrier bypass operation results in the external RTU being connected to the subscriber drop at the RFT and TRC being connected to the line card under test.

3 While the switch digital test head performs channel tests, the RTU can perform loop measurements. The control path setup to the RTU for LMOS/MLT is different than for LTC/DRTU:

   a. for LMOS/MLT, MLT simply dials up the RTU under a separate control path connection, as shown in Figure 7-15 on page 7-37.

   b. for LTC/DRTU, the control path uses the metallic path that would normally connect the MTA vertical to a test bypass pair to connect instead to an automatic line which rings down the DRTU modem (see Figure 7-16).

4 MLT or LTC sends test commands, and the RTU makes the requested measurements on the loop. The RTU returns test results to the MLT or LTC.

5 MLT or LTC requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-RTU: PGTC emulation, in a TR08 integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Line cards per test head (one talk/monitor and one control path)	two, Epsilon NT4K65 or Omega NT4K67
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Provisioning requirements

Using the Provisioning Manager, provision two TR08 line cards with a POTSRT service code. Refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning,* Volume 4B.

At the RFT user interface, use the LLTCFGCI tool to provision the RFT test access connection point (TBP, TAP 1, or TAP 2) that is to be activated upon a TR08 channel test request; TBP is the default connection point. (Refer to *Commissioning and Testing,* Volume 3.)

At the DMS SuperNode, provision the following (refer to NA002 document *XPM Translations Reference Manual*, 297-8321-815):

- Datafill the LNINV table for two RFT line cards to provide one talk/monitor path and one control path to the RTU. These are provisioned as TR08 POTS services from the switch perspective and are given a card code of SCD203. A SERVORD must also be done to provision line cards as POTS, and to specify DGT as an option.
- Datafill the TRKGRP table: provision the NTT as MLT, with the DGTTST parameter set for INTRCVR.

- Datafill the MTAVERT table to assign a vertical to the desired RCS. Provision the Vertsel parameter to S, the Selector to L, and the Linemod to RCSW 0 0, where W is the RCS number.
- For LTC/DRTU, datafill the LNINV table for an automatic line, used to ring down to the RTU control path line card, to establish an NTT access.

Other commissioning requirements

The following list provides additional details about setting up NTT-RTU: PGTC emulation, in a TR08 integrated application:

- At the central office, for an LTC/DRTU arrangement, set up the off-hook routing card connections to the automatic line.
- At the RFT, install and terminate the TAP I/O card and cable. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 or equivalent installation documents.
- At the RFT, cross-connect the RTU to the chosen port on the TAP I/O card: TBP, TAP 1, or TAP 2. Refer to *Commissioning and Testing*, Volume 3.
- At the RFT, install and test line cards. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B, for line cards.
- Verify the continuity of connections by performing a line and loop test.

NTT-test bypass pair

The following variations of no-test trunk/test bypass pair architectures are described:

- MTA, in a universal application
- MTA, in an integrated application
- PGTC, in a universal application
- PGTC emulation, in a GR-303 CSC integrated application
- PGTC emulation, in a TR08 integrated application

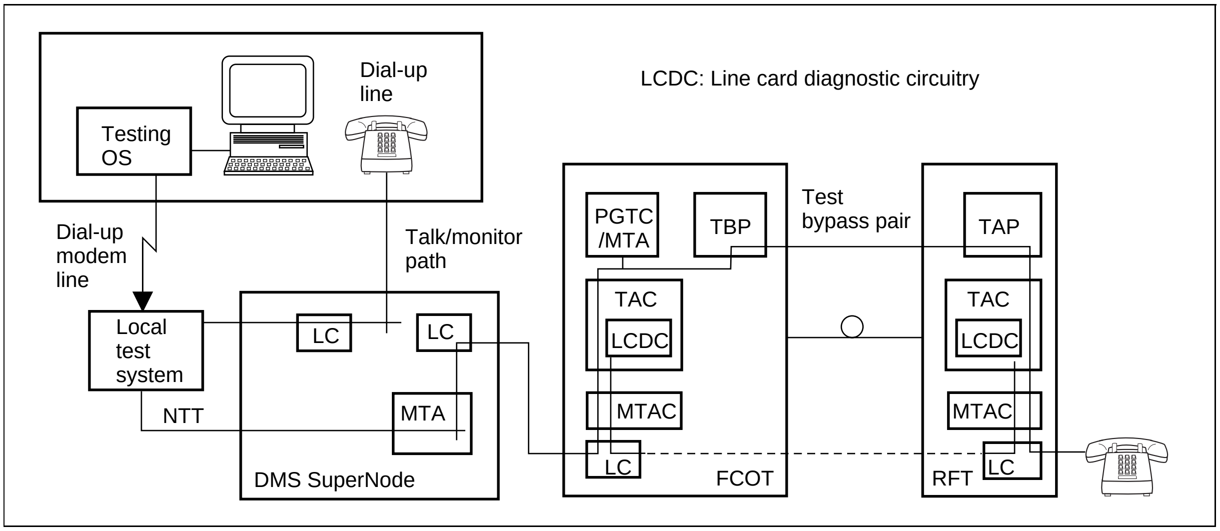
NTT-TBP: MTA, in a universal application

The testing operations system/local test system combinations which use this architecture and are supported by AccessNode include:

- The Nortel Networks Centralized Automated Loop Reporting System/Enhanced Line Test Unit (CALRS/ELTU)
- The Nortel Networks model 3703 Local Test Cabinet (LTC)
- Reliance TSD RTEC T-9/SX (refer to page 7-62 for additional information about the RTEC arrangement)
- Teradyne 4TEL

Figure 7-17 on page 7-41 illustrates the test layout.

Figure 7-17
NTT-TBP: MTA, in a universal application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The OS establishes a dial-up modem link to the local test system (such as LTC) of the host switch. The OS controls tests by sending ASCII commands to the LTC.

3 The LTC performs the no-test trunk sequence to get metallic access to the FCOT line card (the no-test trunk connects through the switch MTA to the switch line card, which is wired to the FCOT line card).

4 The LTC initiates carrier bypass (MTA method), and establishes a metallic path to the subscriber loop.

5 The LTC makes the requested measurements on the loop.

6 The LTC requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-TBP: MTA, in a universal application.

Equipment, PEC	FCOT	RFT
TAC, NT4K54, slot 20	1	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS	two per CDS
I/O cards:		
TBP, NT4K58CA, slot 51	1	-
PGTC/MTA, NT4K58DA, slot 52	1	-
TAP, NT4K58KA, slot 53	-	1
Cables:		
TBP cable, (use TAP cable)	1	-
TAP cable, NT4K85EA/EB/EC/ED	-	1

Provisioning requirements

Provision the following settings, as required. Refer to *Commissioning and Testing*, Volume 3.

- Use the OPC PGTC/MTA Provisioning tool to select the MTA test access method and the TBP remote access point at the RFT.
- Using the RFT user interface tool TBPCFG, provision the RTEC signature as enabled or disabled, if applicable to your test arrangement.

Other commissioning requirements

The following list provides additional details about setting up NTT-TBP: MTA, in a universal application:

- Install, terminate, and cross-connect TBP and TAP I/O cards and cables. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 and related documents.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.
- If necessary, troubleshoot the MTA connection. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

NTT-TBP: MTA, in an integrated application (DMS SuperNode)

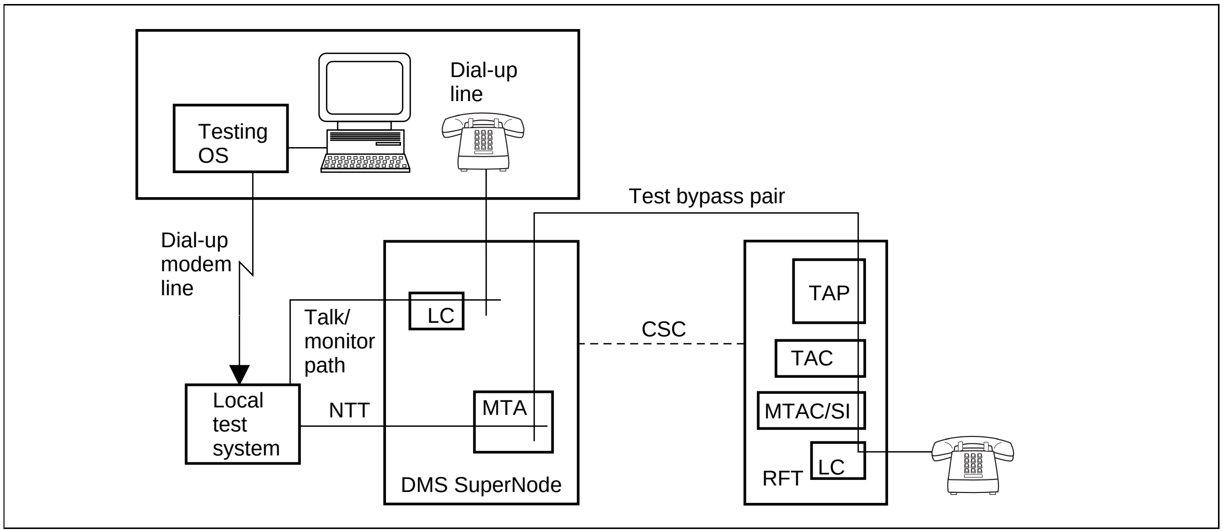
The testing operations system/local test system combinations which use this architecture and are supported by AccessNode include:

- The Nortel Networks Centralized Automated Loop Reporting System/Enhanced Line Test Unit (CALRS/ELTU)
- The Nortel Networks model 3703 Local Test Cabinet (LTC)
- Reliance TSD RTEC T-9/SX (refer to page 7-62 for additional information about the RTEC arrangement)
- Teradyne 4TEL

Figure 7-18 illustrates the test layout.

Figure 7-18
NTT-TBP: MTA, in an integrated application (DMS SuperNode)

PC-11527



Method of operation

The following sequence is used to perform a customer line test:

1. The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.
2. The OS establishes a dial-up modem link to the local test system (such as LTC) of the host switch. The OS controls tests by sending ASCII commands to the LTC.
3. The LTC performs the NTT sequence and initiates carrier bypass.
4. The switch MTA connects the NTT to the RFT's test bypass pair.
5. The switch establishes a metallic connection to the RFT subscriber line by sending messages over the CSC channel.

6 The LTC makes the requested measurements on the loop over the test bypass pair.

7 The LTC requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-TBP: MTA, in an integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Provisioning requirements

At the DMS SuperNode, datafill the RDTINV table for the metallic test access point, TBP. Refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815.

> ***Note:*** For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

Using the RFT user interface tool TBPCFG, provision the RTEC signature as enabled, if applicable to your test arrangement. Refer to *Commissioning and Testing*, Volume 3.

Other commissioning requirements

The following list provides additional details about setting up NTT-TBP: MTA, in an integrated application:

- Install, terminate, and cross-connect the TAP I/O card and cable. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 and related documents.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.

NTT-TBP: MTA, in an integrated application (DMS-10NA)

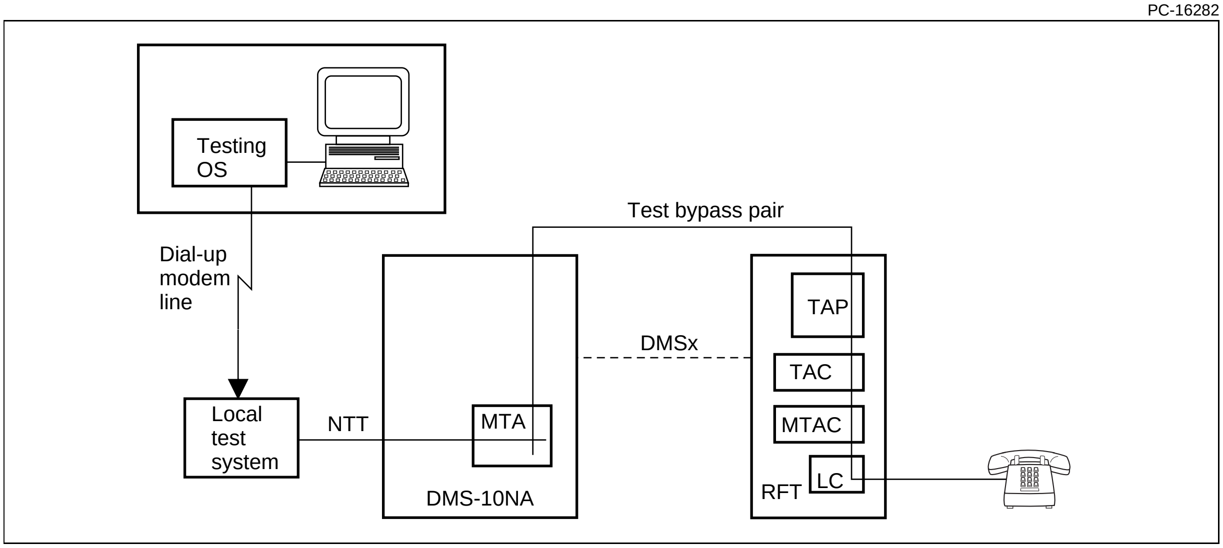
In a DMS-10NA arrangement, the AccessNode emulates a remote line concentrating module (RLCM) with a remote maintenance module (RMM), thus becoming a virtual line concentrating module (VLCM). External line/loop testing involves an external test system controller requesting a metallic connection to a specific line. The DMS-10NA signals the VLCM to connect the line to the test bypass pair at the RMM. The test system controller then performs tests and measurements using the metallic access to the line.

When the DMS-10NA requests a metallic connection to a line, the AccessNode sets up a metallic connection from the line card through the test access card (TAC) to the test bypass pair. This allows the external test system controller to have metallic access to the line/loop for testing.

Figure 7-19 shows the line/loop testing architecture on a copper-distribution shelf in an AccessNode.

Figure 7-19
NTT-TBP: MTA, in an integrated application (DMS-10NA)

PC-16282



Method of operation

The following sequence is used to perform a customer line test:

1. The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.
2. The OS establishes a dial-up modem link to the local test system (such as LTC) of the host switch. The OS controls tests by sending ASCII commands to the LTC.
3. The LTC performs the NTT sequence and initiates carrier bypass.
4. The switch MTA connects the NTT to the RFT’s test bypass pair.

5 The switch establishes a metallic connection to the RFT subscriber line by sending messages over the DMSx channel.

6 The LTC makes the requested measurements on the loop over the test bypass pair.

7 The LTC requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-TBP: MTA, in an integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

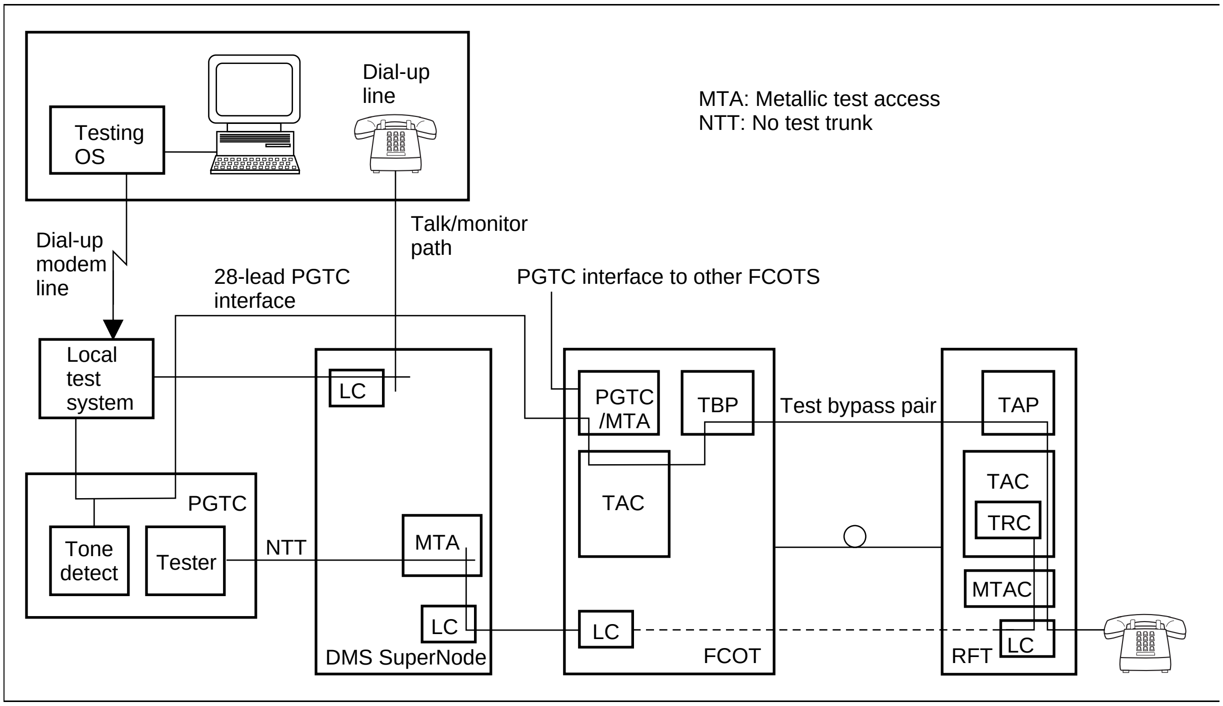
DMS-10NA requirements

For more information about the DMS Access feature on the DMS-10NA, see DMS-10 Family, 400 Series Generic, *Index to the Nortel Networks Publications*, 297-3401-000.

NTT-TBP: PGTC, in a universal application

The testing operations system/local test system combination which uses this architecture and is supported by AccessNode includes the AT&T Loop Maintenance Operations System/Mechanized Loop Testing (LMOS /MLT) system. Figure 7-20 illustrates the test layout.

Figure 7-20
NTT-TBP: PGTC, in a universal application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The MLT controls tests by sending commands to the loop test system (LTS) over an AT&T data communications network.

3 The LTS performs an NTT sequence, and initiates carrier bypass.

4 The FCOT line card recognizes the carrier bypass voltage.

5 The FCOT then goes through the PGTC 28-lead protocol sequence to set up the test bypass pair connections at the FCOT and the RFT.

6 The LTS makes the requested measurements on the loop over the test bypass pair.

7 The PGTC performs signaling and transmission tests on the line (carrier channel) using the PGTC tester and the TAC test response circuit.

8 The LTS requests teardown of connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-TBP: PGTC in a universal application.

Equipment, PEC	FCOT	RFT
TAC, NT4K54, slot 20	1	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS	two per CDS
I/O cards:		
TBP, NT4K58CA, slot 51	1	-
PGTC/MTA, NT4K58DA, slot 52	1	-
TAP, NT4K58KA, slot 53	-	1
Cables:		
TBP cable, (use TAP cable)	1	-
PGTC/MTA cable, NT4K85BA	1	-
TAP cable, NT4K85EA/EB/EC/ED	-	1

Provisioning requirements

Provision the PGTC test access method and the TBP remote access point, using the PGTC/MTA Provisioning tool. Refer to *Commissioning and Testing*, Volume 3.

Other commissioning requirements

The following list provides additional details about setting up NTT-TBP: PGTC, in a universal application:

- Install, terminate, and cross-connect the TBP, PGTC/MTA, and TAP I/O cards and cables. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201, and related documents.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.
- If necessary, troubleshoot the MTA connection. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

NTT-TBP: PGTC emulation, in a GR-303 CSC integrated application

The testing operations system/local test system combination of this type which is supported by AccessNode is the AT&T LMOS/MLT (Mechanized Loop Testing system). Figure 7-21 illustrates the test layout.

Figure 7-21
NTT-TBP: PGTC emulation, in a GR-303 CSC integrated application

PC-10528

```
                   Critical Major minor warning  FailProt Lockout ActProt PrfAlrt
        Network View  2      4      5      2        *        .       .       *
        1 St. John's  2      3      1      1        *        .       .       .
 DS1  Fac
  0  Quit       DS1 Facility                          Shelf:CE
  2  Select                                            Unit:DS1  G1  Port 6
  3  Query                      State: IS-Parent Eqpt Fail
  4
  5  ListAlms             Facility ID: <DS1FACILITY...HALIFAX...ST.JOHN'S....>
  6  AlmRpt               Line Coding: B8ZS
  7  Loopback          Line Build-Out: Short
  8  ChgState                Loopback: None
  9                    Framing Format: Superframe
 10  DtlProt           Alarm Encoding: Ones
 11  Edit             Synchronization: Byte Synchronous
 12              STS1 Path Term State: IS
 13  Add
 14  Delete     Query                            NE  ID: 1 St. Johns's
 15  Equipmnt                                     Shelf: 1
 16             Unit Port  State LCode LBO  LpBack FrameFmt AlmEnc STS1
 17  AlmProv    G1   1     Trbl  B8ZS  Shrt None   None     Ones   Trbl
 18  Help       G1   2     IS    B8ZS  Shrt None   None     Ones   Trbl
    NE 1        G1   3     IS    B8ZS  Shrt None   None     Ones   Trbl
 Time  17:35  >  MORE...
```

Method of operation

The following sequence is used to perform a customer line test:

1. The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.
2. The MLT controls tests by sending commands to the loop test system (LTS) over an AT&T data communications network.
3. The LTS performs an NTT sequence, and initiates carrier bypass.
4. The switch MTA connects the no-test trunk to the RFT’s test bypass pair.
5. The switch sets up metallic test access at the RFT by sending messages over the CSC channel.
6. The switch connects the test tone unit (TTU) to the carrier channel of the line under test.
7. The LTS makes the requested measurements on the loop over the test bypass pair.
8. The switch performs signaling and transmission tests on the line (carrier channel) using the TTU and the TAC test response circuit.
9. The LTS requests teardown of connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-TBP: PGTC emulation in a GR-303 CSC integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slot MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Provisioning requirements

Datafill the RDTINV table for the metallic test access point (TBP) at the DMS SuperNode MAP. Refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815.

> ***Note:*** For AccessNode Express, IRTU cannot be used in the RDTINV provisioning.

Other commissioning requirements

The following list provides additional details about setting up NTT-TBP: PGTC emulation in a GR-303 CSC integrated application:

- Install, terminate, and cross-connect the TAP I/O card and cable. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 and related documents.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to *Commissioning and Testing*, Volume 3.
- If necessary, troubleshoot the PGTC connections. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

NTT-TBP: PGTC emulation, in a TR08 integrated application

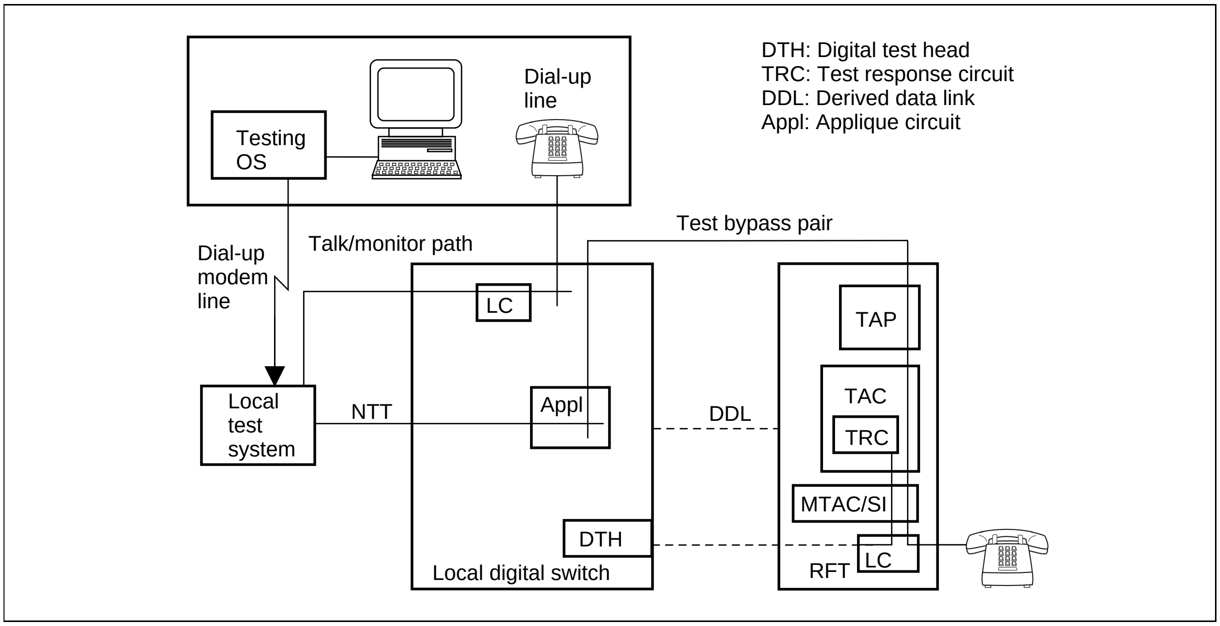
The testing operations system/local test system combinations of this type which are supported by AccessNode include:

- AT&T LMOS/MLT
- The Nortel Networks 3703 Local test cabinet (LTC)

Figure 7-22 illustrates the test layout.

Figure 7-22
NTT-TBP: PGTC emulation, in a TR08 integrated application

PC-11529



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The OS establishes a dial-up modem link to the local test system of the host switch. The OS controls tests by sending ASCII commands to the LTS.

3 The LTS performs an NTT access sequence. The switch connects the no-test trunk to a digital loop carrier (DLC) signature circuit because the line being accessed resides on a DLC. Upon detection of this signature, the LTS initiates carrier bypass (by applying +116 V on the tip). (See TR08 carrier bypass in Chapter 4 for more details.) The carrier bypass operation results in the test bypass pair being connected to the subscriber drop at the RFT and TRC being connected to the line card under test.

4 While the switch digital test head performs channel tests, the LTS can perform loop measurements over the test bypass pair.

5 The LTS requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-TBP: PGTC emulation, in a TR08 integrated application.

Equipment	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Refer to the respective product documentation for detailed switch equipment requirements.

Provisioning requirements

At the RFT user interface, use the LLTCFGCI tool to provision the RFT test access connection point (TBP, TAP 1, or TAP 2) on the TAP card; TBP is the default connection point. Refer to *Commissioning and Testing,* Volume 3.

At the local digital switch, provision the following (refer to NA002 document *XPM Translations Reference Manual*, 297-8321-815):

- Provision the metallic test access resources (for example, if the LDS is DMS SuperNode, then datafill the MTAVERT table of the DMS SuperNode for a path to test the TR08 systems).
- Provision the NTT as type MLT.

Other commissioning requirements

The following list provides additional details about setting up NTT-TBP: PGTC emulation, in a TR08 integrated application:

- At the RFT, install, terminate, and cross-connect the TAP cable. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201, and related documents.
- Install and test circuit packs. Refer to *Commissioning and Testing,* Volume 3, for TAC. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B, for line cards.
- Verify the continuity of connections by performing a line and loop test.

DMS testing, with IRTU

There are two examples of this architecture in this release:

- DMS SuperNode MAP, with IRTU (MTU emulation)
- DMS-10NA MAP, with IRTU (MTU emulation)

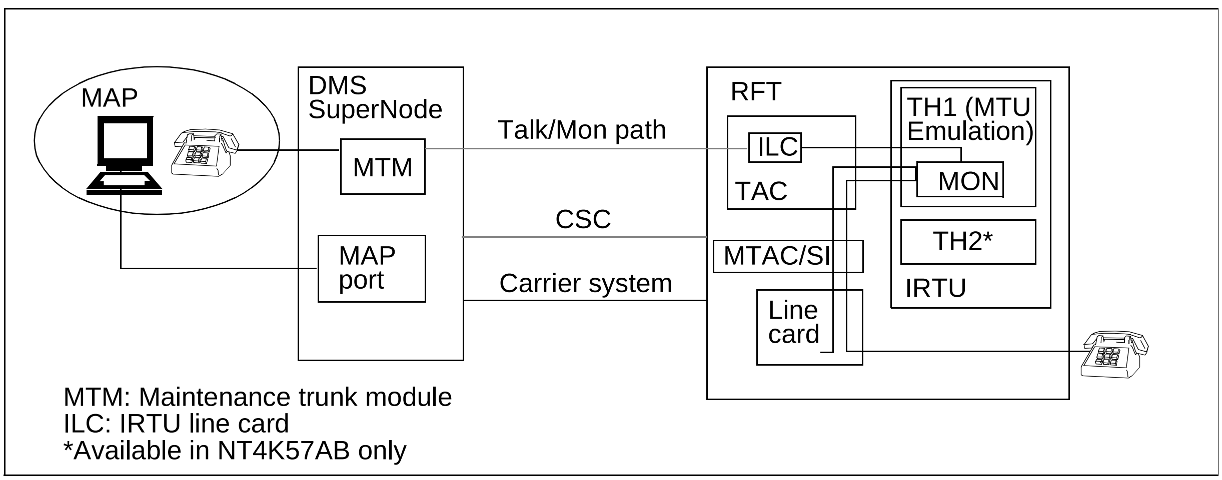
DMS SuperNode MAP testing, with IRTU (MTU emulation)

In this arrangement, the Multi-line Test Unit (MTU) functionality that usually resides in the DMS SuperNode is remoted to the RFT, much closer to the physical customer loops. The arrangement provides better test results than are possible from a lengthy test bypass pair to the central office.

Line tests are directed from the maintenance administration position (MAP) of the DMS SuperNode. Testing communications is over the common signaling channel (CSC), rather than over a control link, so IRTU line cards are used only for talk/monitor paths, one to each IRTU test head.

Figure 7-23 illustrates the test arrangement in a single host application. Figure 7-24 on page 7-56 illustrates the test arrangement in a multihosting application.

Figure 7-23
DMS SuperNode MAP testing, with IRTU (MTU emulation), single host application



AccessNode supports the following line testing menus at the MAP user interface. These test menus are summarized beginning on page 7-60:

- line test position (LTP) testing
- automatic line test (ALT)
- automatic line insulation test (ALIT)

Test functionality supported in this release is listed in Appendix B: IRTU (MTU emulation commands), and includes functions such as: test access, test direction, tests of loop quality, tone generation, and signaling.

Method of operation

The following is the sequence for performing customer line tests from LTP:

1. The craft initiates a test on a subscriber line by issuing commands from a MAP terminal. Specifically, the MAP LTP level is entered and the line "posted" to gain access to the subscriber line. After the line is posted, other commands can be issued to perform talk/monitor and other line/loop tests.
2. The SuperNode sends commands to the RFT to set up the metallic test access to the subscriber line and to reserve an IRTU test head. The IRTU test head which is used is governed by RDTINV provisioning. RDTINV provisioning can specify whether test head 1 or 2 or either can be used for MAP tests.
3. For the MAP LTP commands entered by craft which require the IRTU (refer to the tables in Appendix C: IRTU support for MAP commands) the SuperNode sends each command to the IRTU over the CSC link. The IRTU executes the command and returns results again over the CSC link.

Equipment requirements

The following table lists AccessNode equipment required at the RFT to implement DMS SuperNode MAP testing, with IRTU (MTU emulation).

Equipment	RFT
TAC, NT4K54, slot 20	1
IRTU, NT4K57, slot 21	1
MTAC, NT4K73, in CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Line cards (one monitor line per test head)	ILC line card slots must remain empty

Refer to the DMS-1 family product documentation for detailed switch equipment requirements.

Provisioning requirements

To implement this configuration, provision the following from the DMS SuperNode. Refer to NA002 document *XPM Translations Reference Manual*, 297-8321-815:

- Datafill the LNINV table for the RFT ILC services which are to provide talk/monitor functions for the IRTU. Provision them as cardcode RDTILC and cardinfo as ILC1T or ILC2T, depending on whether the line is for IRTU test head 1 or test head 2.
- Datafill the RDTINV table. Specify the MAPIF remote access point as IRTU and select IRTU test head 1 or 2.

  Note 1: The DMS SuperNode can be provisioned to access both test heads for LTP testing. However, only one test head can perform ALT testing.

  Note 2: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

Other commissioning requirements

The following list provides additional details about setting up DMS SuperNode MAP testing, with IRTU (MTU emulation):

- Modify the ABM shelf to add the IRTU, if the shelf is earlier than release (Rls) 07 and not yet modified. Refer to *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C.
- Install and test circuit packs. Refer to *Commissioning and Testing,* Volume 3, for IRTU and TAC.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test.

Limitations on DMS SuperNode MAP testing with multihosting

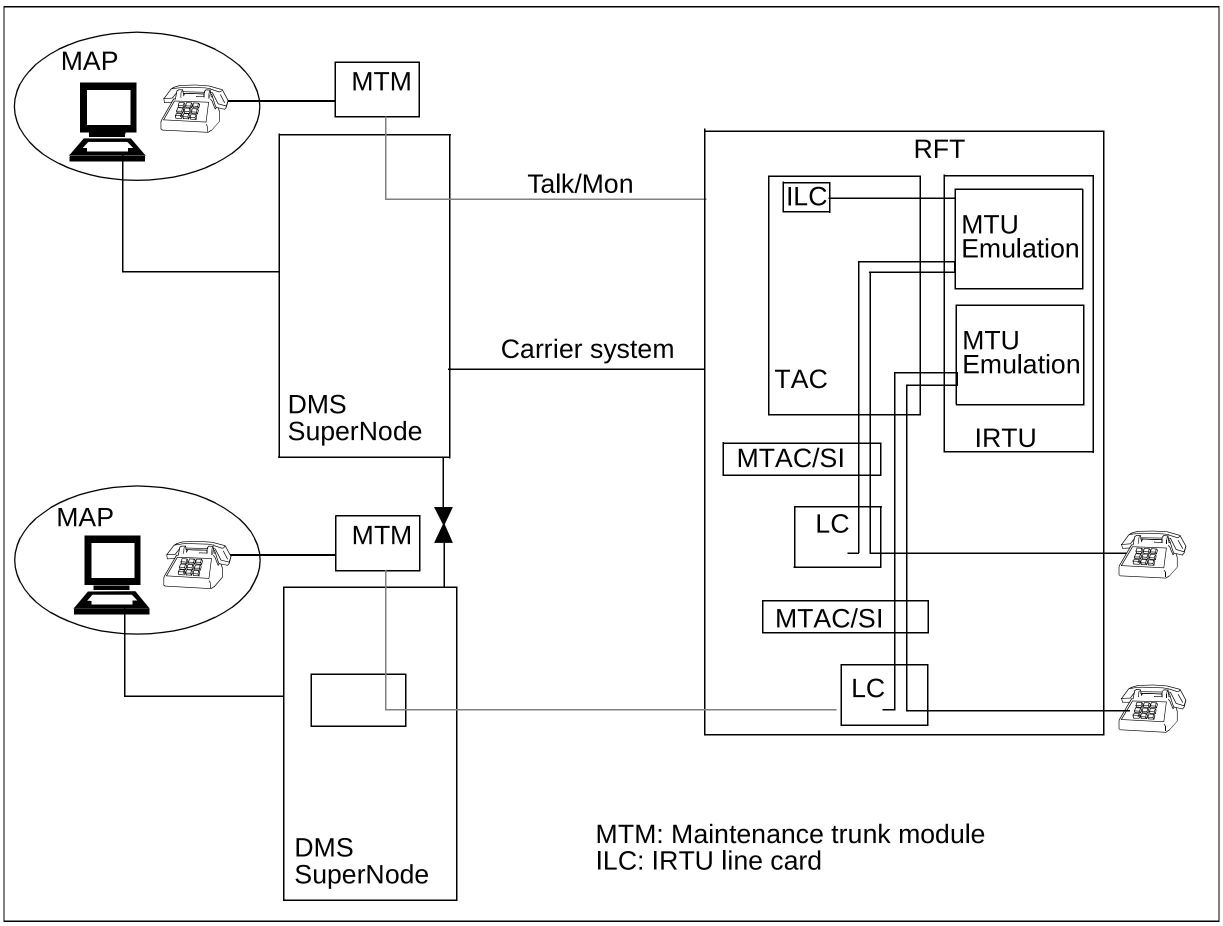
A DMS SuperNode host that has an IRTU datafilled but does not have any ILCs provisioned, as might be the case for some secondary hosts in a multihosting setup, has the following MAP LTP testing limitations:

- The MONLTA/TALKLTA function is implemented using digital bridging on the PCM side of the line card rather than metallic connection through the IRTU.
- The ORIG command is not supported.
- Dialable short using IRTU is not supported in DMS SuperNode release NA002. This feature can be provided by a test bypass pair if so provisioned in the switch. Additional information about the test bypass pair method is provided in Chapter 8, “DMS SuperNode station installation and subscriber premises testing.”

An example of the multihosting application is shown in Figure 7-24, which contrasts MONLTA operation on two hosts. For the primary host (the host that has ILCs provisioned), the monitor path is set up as follows: a PCM connection is established between the MTM headset and the ILC on the RFT. The ILC is connected to a monitor circuit on the IRTU which metallically monitors the analog VF signal. For the secondary host, (the host with no ILCs provisioned), the monitor path is set up using a PCM bridge, established from the MTM headset trunk to the line under test.

Alternatively, for a two-host multihosting configuration, metallic monitoring for MONLTA and ORIG functionality can be retained if host 1 provisions IRTU test head 1 for MAP testing (along with the corresponding IRTU line card ILC1T) and host 2 provisions IRTU test head 2 for MAP testing (along with the corresponding IRTU line card ILC2T).

Figure 7-24
DMS SuperNode MAP testing with IRTU (MTU emulation), multihosting application



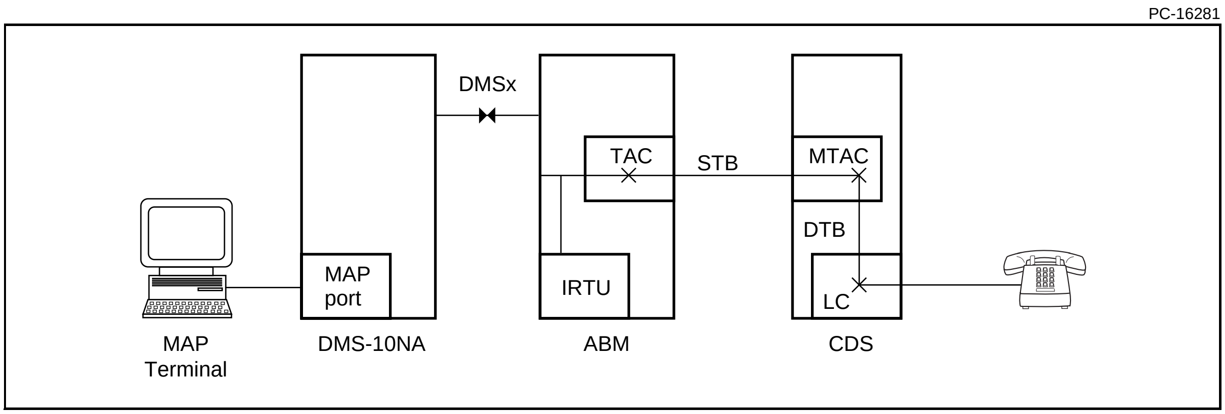
DMS-10NA MAP testing, with IRTU (LTU emulation)

In this arrangement, the AccessNode emulates a remote line concentrating module (RLCM) with a remote maintenance module (RMM), thus becoming a virtual line concentrating module (VLCM). The DMS-10NA uses its PED and ALT overlays to perform line/loop tests. The DMS-10NA signals the VLCM to connect a specific line to the line test unit (LTU) in the RMM. The DMS-10NA then requests the LTU perform certain tests and measurements and report the results back to the switch.

When the DMS-10NA requests that a line be connected to the LTU in the RMM, the AccessNode sets up a metallic connection between the line card and the integrated remote test unit (RTU) in the access bandwidth manager (ABM) shelf. The IRTU performs the requested measurements and reports the results back to the DMS-10NA.

Figure 7-25 shows the line/loop testing architecture on a copper-distribution shelf in an AccessNode.

Figure 7-25
AccessNode line/loop testing system architecture



Equipment requirements

The following table lists AccessNode equipment required at the RFT to implement DMS-10NA MAP testing, with IRTU (MTU emulation).

Equipment	RFT
TAC, NT4K54, slot 20	1
IRTU, NT4K57, slot 21	1
MTAC, NT4K73, in CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Line cards (one monitor line per test head)	ILC line card slots must remain empty

DMS-10NA requirements

For more information about the DMS Access feature on the DMS-10NA, see DMS-10 Family, 400 Series Generic, *Index to the Nortel Networks Publications*, 297-3401-000.

Switch-directed testing, with test bypass pair

This architecture is applicable to the following configuration in this release: DMS SuperNode MAP, with test bypass pair, which is described following.

DMS SuperNode MAP testing with test bypass pair

The arrangement for performing line tests from the Maintenance and Administration Position (MAP) of the DMS SuperNode is illustrated in Figure 7-26 on page 7-59. The connection between the switch and the RFT is by way of a test bypass pair. At the RFT, the test bypass pair connects to the test access path card in the upper level of the access bandwidth manager shelf.

AccessNode supports the following line testing menus at the MAP user interface:

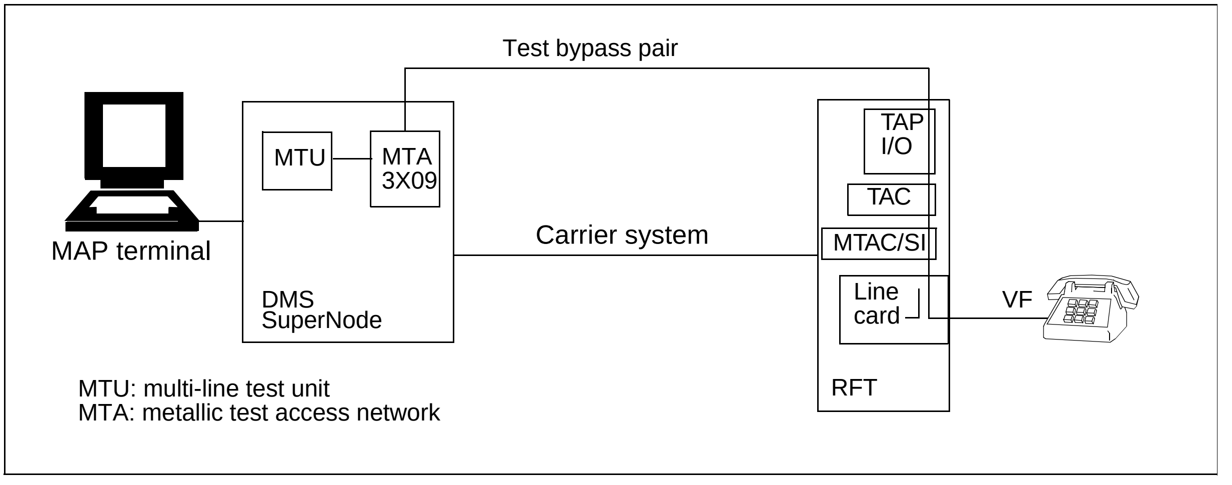
- line test position (LTP) testing
- automatic line test (ALT)
- automatic line insulation test (ALIT)

These test groups are summarized beginning on page 7-60.

Method of operation

The tester at the MAP terminal issues a test command including a line number. The switch reserves the metallic test resources (MTA vertical and metallic test equipment) and requests test bypass pair access to the line card at the RFT. The TAC reserves test resources at the RFT. The multi-line test unit (MTU) in the switch performs measurements over the metallic path.

Figure 7-26
DMS SuperNode MAP testing with test bypass pair



Equipment requirements

The following table lists AccessNode equipment required at the RFT to implement DMS SuperNode MAP testing with test bypass pair.

Equipment	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Refer to the DMS-1 family product documentation for detailed switch equipment requirements.

Provisioning requirements

To implement DMS SuperNode MAP testing with a test bypass pair, provision the following from the DMS SuperNode (refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815):

- Datafill the RDTINV table for the remote access point (TBP) at the RFT.
- Datafill the RDTINV table for the metallic test access connection in the DMS SuperNode.

  Note: For AccessNode Express, IRTU cannot be used in the RDTINV provisioning.

Other commissioning requirements

The following list provides additional details about setting up DMS SuperNode MAP testing with test bypass pair:

- Install, terminate, and cross-connect cables. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 and related documents.
- Install and test circuit packs. Refer to *Commissioning and Testing,* Volume 3.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test. Refer to DMS-1 family product documentation.

Summary of MAP line testing

AccessNode supports the following line testing menus at the MAP:

- line test position (LTP) testing
- automatic line test (ALT)
- automatic line insulation test (ALIT)

Line test position (LTP)

The DMS SuperNode MAP menu level LTP supports line/loop testing for AccessNode GR-303 CSC lines. This includes POTS, COIN, EBS, and ISDN services. The testing provided by AccessNode IRTU (MTU emulation) is equivalent to using an internal DMS SuperNode multi-line test unit (MTU) to test lines on a line concentrator module (LCM). LTP supports four sub-menus:

- LTPMAN
- LTPLTA
- LTPISDN
- LTPDATA

Tables listing the commands available on each menu, and the IRTU level of support for each command, are provided in “Appendix C: IRTU support for MAP commands.”

Automatic line test (ALT)

If an AccessNode system is integrated with a DMS SuperNode switch, it supports automatic line test (ALT). ALT allows an operating company to choose when to run tests on groups of lines. This kind of testing is usually run during periods of low traffic to minimize its impact on subscribers. The aim is to identify faults or impairments so they can be cleared before they can have any effect on grade of service. As an alternative to the ALT level of the MAP, you can schedule line tests from table ALTSCHED.

To schedule automatic line tests, use the automatic line test (ALT) level of the MAP. The ALT level is accessed from the line (LNS) level and is used to automatically test a line circuit and subscriber loop, or a group of line circuits and subscriber loops, on a scheduled basis. The following tests can be performed by ALT:

- SDIAG, a short line card diagnostic
- DIAG, the full line card diagnostic
- CKTTST, the Meridian Business Set test
- LIT, the line insulation test
- ALIT, the automatic line insulation test

Automatic line insulation test (ALIT)

If an AccessNode system is integrated with a DMS SuperNode switch, it supports the automatic line insulation test (ALIT). You schedule automatic line insulation tests from the automatic line test (ALT) level of the MAP.

The ALIT is a variety of the line insulation test (LIT). The LIT is a series of electrical tests done on a subscriber loop. The aim is to identify cable faults due to moisture. These tests are done with the loop disconnected from the line card, using the metallic test access capabilities in the RFT. The LIT can be scheduled to run automatically on a scheduled basis with the automatic line test (ALT) feature. When it is scheduled to run automatically in this way, it is referred to as an automatic line insulation test (ALIT).

Additional information about test OS configurations

This section includes additional details about testing arrangements involving Reliance TSD R-TEC equipment or Teradyne 4TEL equipment.

Reliance R-TEC

Reliance TSD (Test Systems Division), formerly R-TEC, provides testing equipment that can emulate LMOS testing. R-TEC equipment can be used in integrated and universal applications, MTA-type access. This is in contrast to the LMOS MLT, which uses PGTC-type access. AccessNode supports testing using the Reliance TSD equipment in several arrangements.

R-TEC testing with test bypass pair

There are two variants of this arrangement:

- NTT-TBP (R-TEC T-9X): MTA, in a universal application
- NTT-TBP (R-TEC T-9X): MTA, in a GR-303 integrated application

Figure 7-17 on page 7-41 and Figure 7-18 on page 7-43 provide generic views of these test arrangements. R-TEC testing uses a central-office test head called a T-9/SX Mechanized Loop Testing (MLT), and a test bypass pair.

R-TEC testing with external remote test unit

There are two variants of this arrangement:

- NTT-RTU (R-TEC T-9X): MTA, in a universal application
- NTT-RTU (R-TEC T-9X): MTA, in a GR-303 integrated application

Figure 7-9 on page 7-23 and Figure 7-10 on page 7-27 provide generic views of these test arrangements. R-TEC testing uses a central-office test head called a T-9/SX, an external remote test unit called a T-9X, and a test bus termination unit (TBTU), located at the remote fiber terminal.

R-TEC signature module

As described in *Commissioning and Testing*, Volume 3, some additional provisioning is required if your line/loop testing system is Reliance R-TEC with T-9X external remote test unit.

You must enable the R-TEC signature, which is disabled by default in the testing software. Enabling the R-TEC signature allows the test access card (TAC) to connect to the RTU signature module.

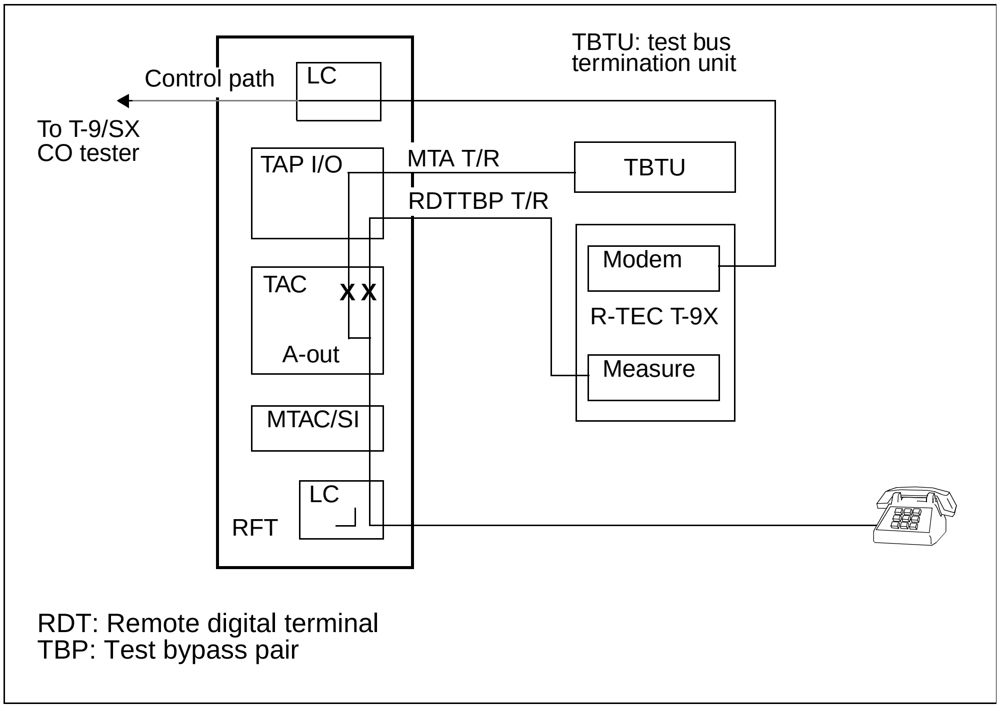
Use the following criteria to determine whether the R-TEC signature should be enabled or disabled:

- if you are performing line/loop measurements with Teradyne equipment, disable the R-TEC signature
- if you are performing line/loop measurements with R-TEC T-9X RTU equipment, enable the R-TEC signature
- the default signature applied by the test access card is set for R-TEC DISABLED

Connection of the R-TEC signature module is illustrated in Figure 7-27. When a metallic test access is requested, the R-TEC signature module (called the test bus termination unit, or TBTU) is connected through the MTA tip/ring pair on the TAP I/O card for two seconds. The TBTU signature is detected by the T-9X and triggers the T-9X RTU to originate a modem call to the central office tester.

At the end of the two seconds, the RFT disconnects the TBTU to enable the T-9X RTU to accurately make loop measurements. The test head connects to the TAP I/O card by way of the RDTTBP (remote digital terminal test bypass pair) tip/ring pair.

Figure 7-27
Connection of the R-TEC signature module (TBTU) during test setup



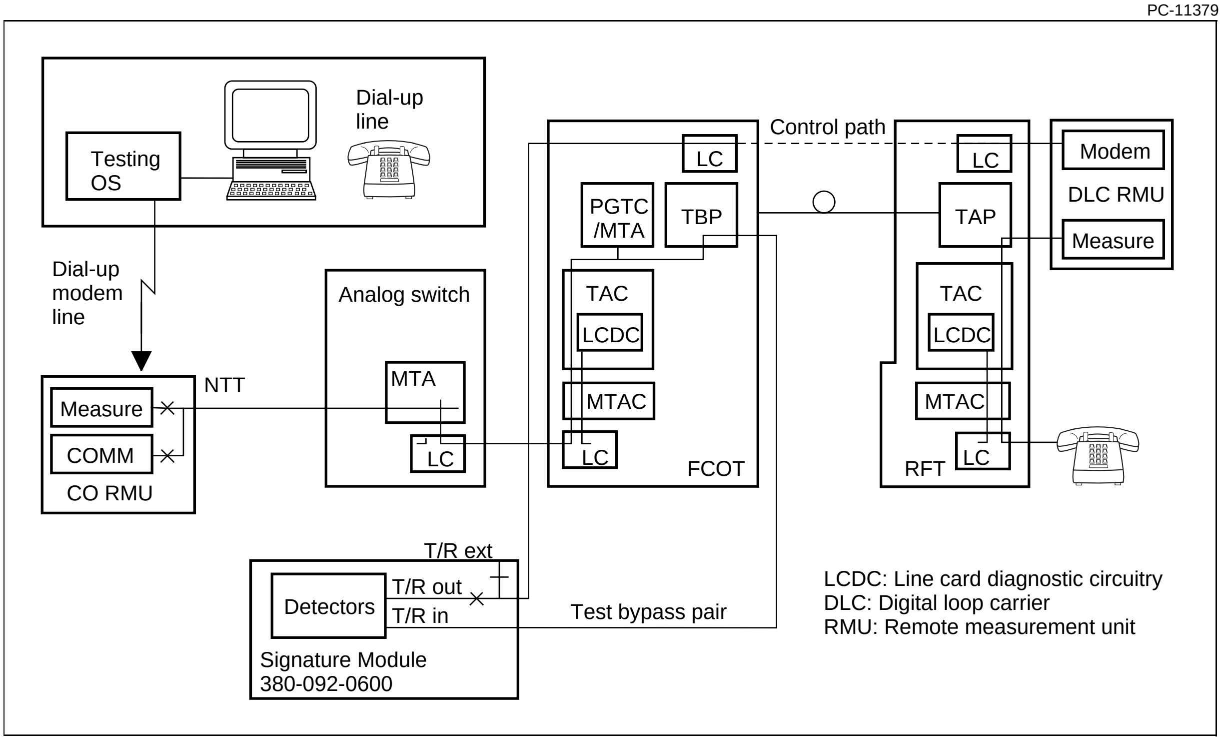
Teradyne 4TEL

Teradyne 4TEL testing equipment can be used in universal and integrated applications. The arrangement consists of a central-office test head (local test system) called a CO RMU, and either a test bypass pair, or an external remote test unit at the RFT called an RMU. The latter arrangement is described in both universal and integrated applications.

NTT-RTU (Teradyne RMU): MTA, universal application

Figure 7-28 on page 7-64 illustrates Teradyne 4TEL testing using an RMU at the remote location in a universal application. Signature module is used to verify that the line under test is on a digital loop carrier.

Figure 7-28
NTT-RTU (Teradyne RMU): MTA, universal application



Method of operation

The following sequence explains how testing proceeds using the Teradyne 4TEL test system in a universal application:

1 The CO RMU (the remote measurement unit located at the central office) performs a no-test trunk (NTT) access using the local switch.

2 At the end of the NTT access, the CO RMU is metallically connected to the loop side of the switch line card (looking in to the FCOT line card).

3 The CO RMU makes a loop measurement and measures the signature of the FCOT line card.

4 The CO RMU analyzes the results of the test and determines that the line is served by a carrier system.

5 The CO RMU then initiates carrier bypass by applying a one-second +130 V pulse on the tip (five seconds for a coin line).

6 The FCOT line card detects the +130 V pulse on tip and activates MTA-type bypass.

7 The communications interface board on the CO RMU listens for any tones to determine if bypass is busy.

8 The CO RMU performs tests to determine the presence of the signature module.

9 Upon detection of the signature module, the CO RMU uses its communications board to generate ringing. Ringing is passed on to the DLC RMU (the remote measurement unit located at the end of the digital loop carrier, at the RFT) when the signature module activates cut-through relays to directly connect the CO RMU to the control path (the cut-through relay connects T/R-in to T/R-out).

10 The DLC RMU detects ringing, goes off-hook, and sends carrier.

11 The CO RMU communications board detects ring trip and switches to line feed (ground on tip, battery on ring).

12 The CO RMU communications board also connects a 1200-baud modem to communicate to the DLC RMU.

13 The Signature module keeps the cut-through relays activated while loop current is present.

14 The CO RMU sends commands to the DLC RMU to perform loop measurements.

15 At the end of testing, the CO RMU instructs the DLC RMU to hang up.

16 The signature module deactivates the cut-through relays because loop current is no longer present.

17 The CO RMU issues the takedown pulse to release the carrier pulse, and then drops the NTT access.

Equipment requirements

The following table lists the AccessNode equipment required to implement NTT-RTU (Teradyne RMU): MTA, in a universal application.

Equipment, PEC	FCOT	RFT
TAC, NT4K54, slot 20	1	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS	two per CDS
Line cards (one for a control link)	Omega NT4K68	Omega NT4K67 or Epsilon NT4K65
I/O cards:		
TBP, NT4K58CA, slot 51	1	-
PGTC/MTA, NT4K58DA, slot 52	1	-
TAP, NT4K58KA, slot 53	-	1

—continued—

Equipment, PEC (continued)	FCOT	RFT
Cables:		
TBP cable, (use TAP cable)	1	-
TAP cable, NT4K85EA/EB/EC/ED	-	1
—end—		

Provisioning requirements

Using the OPC Provisioning Manager tool, provision one POTS line for a control link. Refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning,* Volume 4B.

Using the OPC PGTC/MTA Provisioning tool, provision the MTA carrier bypass method and the remote access point (TBP, TAP1, or TAP2) on the TAP I/O card. The R-TEC signature should be disabled (this is the default value). Refer to *Commissioning and Testing,* Volume 3.

Other commissioning requirements

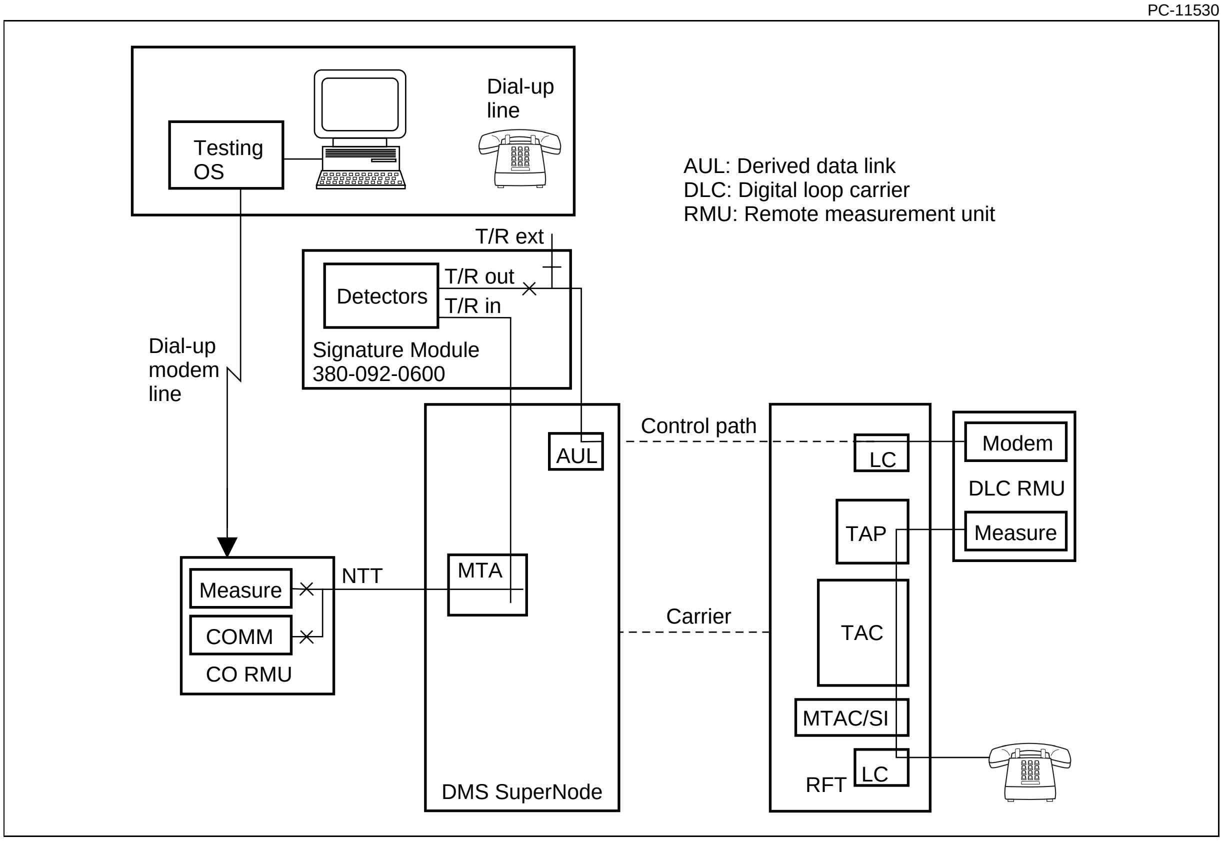
The following list provides additional details about setting up NTT-RTU (Teradyne RMU): MTA, in a universal application:

- At the RFT, install the PGTC/MTA I/O and TBP I/O cards at the FCOT and the TAP I/O card; terminate and cross-connect the associated cables. Refer to *Bay in Central Office Installation Manual—ABM,* 323-3001-201 or equivalent installation documents. Connect the RMU to the port on the TAP I/O card that is provisioned as the remote access point.
- Install and test line cards. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test.
- If necessary, troubleshoot the MTA connection. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures,* 323-3001-543, in *Maintenance*, Volume 5A.

NTT-RTU (Teradyne RMU): MTA, integrated application

Figure 7-29 on page 7-67 illustrates Teradyne 4TEL testing using an RMU at the remote location in an integrated application. A signature module is used to verify that the line under test is on a digital loop carrier.

Figure 7-29
NTT-RTU (Teradyne RMU): MTA, integrated application



Method of operation

The following sequence explains how testing proceeds using the Teradyne 4TEL test system in an integrated application:

1 The CO RMU (the remote measurement unit located at the central office) performs an NTT access using the local DMS SuperNode switch.

2 At the end of the NTT access, the CO RMU is connected metallically to the Signature module.

3 The CO RMU performs tests to determine the presence of the signature module.

4 Upon detection of the signature module, the CO RMU uses the communications board to generate a burst of ringing. The signature module activates cut-through relays to connect the automatic line.

5 The CO RMU communications board then goes off-hook to draw loop current. The presence of loop current keeps the signature module's cut-through relays activated.

6 The CO RMU communications board connects a 1200-baud modem to communicate to the DLC RMU (the remote measurement unit located at the end of the digital loop carrier, at the RFT).

7 The off-hook presented to the automatic line results in a call being placed to the DLC RMU. The DLC RMU detects ringing, goes off-hook, and sends carrier, thereby completing the modem connection to the CO RMU.

8 The CO RMU sends commands to the DLC RMU to perform loop measurements.

9 At the end of testing, the CO RMU commands the DLC RMU to hang up, after which the CO RMU hangs up.

10 The absence of loop current causes the signature module cut-through relays to be deactivated.

11 The CO RMU releases the NTT access.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-RTU (Teradyne RMU): MTA, in an integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Line cards: one for control link	one Epsilon NT4K65 or Omega NT4K67 (see note)
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1
Note: In a point-to-point system, provide one DS0 channel on a GR-303 DMS facility on a DS1/VT mapper at the FCOT. In a DS1-fed system, provide one DS0 channel on a GR-303 DMS facility on a DS1/VT mapper at the RFT. In a single-ended system, no additional DS1 equipment is required on the AccessNode.	

The RTU can be connected to the TBP or a TAP port on the TAP I/O card.

Provisioning requirements

At the DMS SuperNode, provision the following:

- Datafill the table LNINV for one control line; specify cardcode RDTPOTS.
- Datafill the table RDTINV for the metallic test access point (ERTU).

Note: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

Refer to BCS36 document *SMA Translations Guide*, 297-2741-350, or NA002 document *XPM Translations Reference Manual*, 297-8321-815 for details.

Other commissioning requirements

The following list provides additional details about setting up NTT-RTU (Teradyne RMU): MTA, in an integrated application:

- At the RFT, install the PGTC/MTA I/O and TBP I/O cards at the FCOT and the TAP I/O card; terminate and cross-connect the associated cables. Refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201 or equivalent installation documents. Connect the RMU to the port on the TAP I/O card that is provisioned as the remote access point.
- Install and test line cards. Refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test.
- If necessary, troubleshoot the MTA connection. Refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, Volume 5A.

DMS SuperNode station installation and subscriber premises testing

This chapter describes the following DMS SuperNode station installation tests supported by AccessNode:

- silent switchperson test
- station ringer test
- dialable short circuit

Each of these tests is described following.

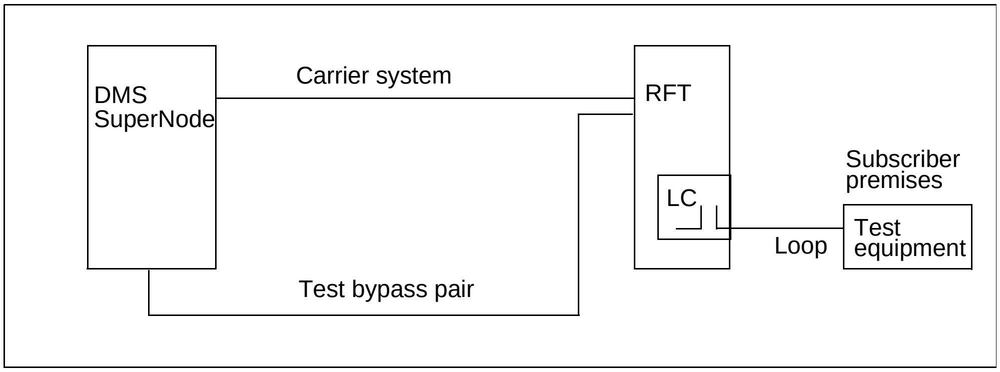
Silent switchperson test

The silent switchperson test is a station installation test that connects test equipment across a phone to detect leakage to ground. It is available only when an RFT is integrated with a DMS SuperNode switch. In this test, the subscriber loop is isolated from the AccessNode so a technician at the subscriber premises can check the subscriber loop for facility faults, without the assistance of maintenance personnel at the central office. The test performs loop testing towards the switch.

To carry out the silent switchperson test, the technician at the subscriber premises connects test equipment to the subscriber loop, and dials a service code or a seven-digit number. A confirmation tone is returned, and a relay on the line card opens to disconnect the subscriber loop from the line card. The subscriber loop remains disconnected from the line card for a provisionable time interval, which is defined as an office parameter. The technician can test the loop while it is disconnected, ensuring an open circuit to the RFT exists.

During the test, relays on the RFT line card are operated to disconnect the subscriber loop from the line card. The line remains disconnected for the duration of the test. Silent switchperson operates the test-in relay on the line card, and therefore requires the drawer test bus (DTB) to be available. No other metallic access can be active in the drawer containing a line card with active silent switchperson operation. Conversely, a silent switchperson request is denied if another metallic test access is active in the drawer.

The silent switchperson test is illustrated following:



Station ringer test

The station ringer test is a station installation test. It is available only when an RFT is integrated with a DMS SuperNode switch. In this test, the subscriber line is disconnected from the line card in the AccessNode, so the subscriber's station equipment can send digits to the central office. The test compares the digits received at the central office with known digits that are transmitted at the station. Therefore, a telephone set installer can verify the proper operation of the subscriber's station equipment by checking functions such as directory number, dialed digits (DP and DTMF), switch hook flash, and ringer operation.

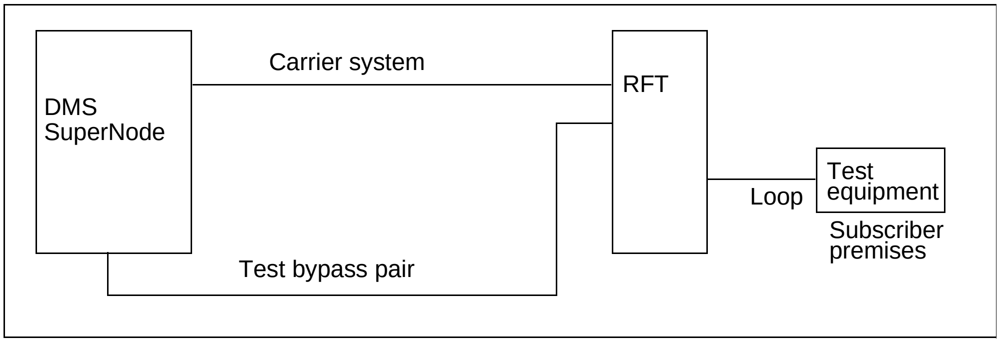
The test consists of one or more subtests. The transition between subtests is initiated by a switch hook flash. The subtests are:

- dial pulse (DP) digit collection. This subtest verifies the collection of dial pulse digits.
- DTMF digit collection. This subtest verifies the collection of dual tone multifrequency (DTMF) digits.
- coin return. This subtest verifies coin return operation for coin lines.
- Meridian Business Set (MBS). This subtest verifies the operations of the MBS (such as the blinking lamp light for visual response).
- station ringer. This subtest rings the phone when the installer goes on hook at the end of the test.

To indicate that the test is progressing, the switch returns a distinctive “go” or “no go” tone at the completion of each subtest.

To carry out the station ringer test, the technician at the subscriber premises connects test equipment to the loop pair, and enters the appropriate dialup service code.

The station ringer test is illustrated following.



During the test, the subscriber line is routed to the switch through the metallic test buses in the RFT and through the test bypass pair between the RFT and the switch. At the central office, the test bypass pair connects to the DMS SuperNode switch. At the RFT, the test bypass pair connects to the test access path card (TAP) in the upper level of the access bandwidth manager shelf.

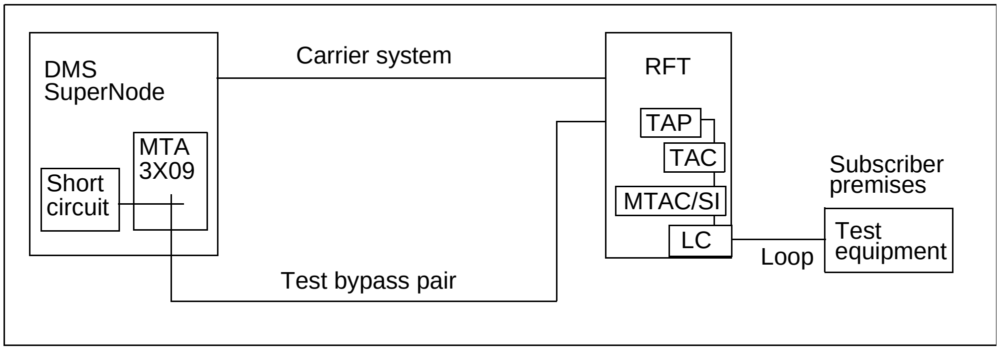
Dialable short circuit

Dialable short circuit is one of the station installation tests available when an RFT is integrated with a DMS SuperNode switch. In this test, the tip and ring leads of the line under test are shorted together to verify loop continuity by measuring the resistance from the subscriber premises to the central office.

To carry out the dialable short circuit test, the technician at the subscriber premises connects test equipment to the subscriber loop, and enters the appropriate dialup service code. The switch responds with a confirmation tone. A relay on the line card then opens, to disconnect the subscriber line from the line card, and the switch applies the short circuit. The line remains disconnected from the line card during the test. The short circuit remains in effect for a provisionable time interval, which is defined as an office parameter.

The DMS SuperNode provides the short circuit through a test bypass pair. During the test, the subscriber line is routed to the switch through the metallic test buses in the RFT and through the test bypass pair between the RFT and the switch. At the central office, the test bypass pair connects to the DMS SuperNode switch. At the RFT, the test bypass pair connects to the test access path card (TAP) in the upper level of the access bandwidth manager shelf.

The dialable short circuit is illustrated following.



GR-303 MVI line and loop testing

This chapter describes AccessNode testing capabilities on GR-303 MVI lines and loops.

Remote testing systems

The following is a summary of line and loop testing arrangements supported for lines terminating on a GR-303 MVI host switch. Not all listed arrangements are described in this document; only a representative sample is provided.

- NTT–RTU
  provides no-test-trunk (NTT) access to the local digital switch with loop access from an external remote test unit (ERTU) or IRTU. Supported test configurations include:
  - CALRS/LTC and integrated remote test unit (IRTU) using DRTU emulation, with DS1 tandem ILCs for monitor and control lines (refer to “NTT-IRTU: DRTU emulation, in a GR-303 MVI integrated application” on page 9-3 for details about this configuration)
  - LTC and IRTU (DRTU emulation) and DS1 tandem ILCs
  - CALRS/ELTU and model 3704 DRTU using metallic test access
  - AT&T LMOS and Reliance Test Systems Division (TSD) RTEC T-9/SX Mechanized Loop Tester, using metallic test access
  - Teradyne 4TEL central office remote measurement unit (RMU) and 220/225 RMU, using metallic test access
  - Nortel Networks Local Test Cabinet (LTC), model 3703, and model 3704 DRTU, using metallic test access
  - Nortel Networks Local Test Cabinet (LTC), model 3703, and model 3704 DRTU, using PGTC emulation (refer to “NTT-RTU: PGTC emulation, in a GR-303 MVI integrated application” on page 9-6 for details on this configuration)

- NTT–TBP provides no-test-trunk (NTT) access to the local digital switch with loop access over a test bypass pair (TBP).
  - CALRS/ELTU, using metallic test access
  - AT&T LMOS and Mechanized Loop Tester (MLT), using PGTC emulation (refer to “NTT-TBP: PGTC emulation, in a GR-303 MVI integrated application” on page 9-9 for details on this configuration)
  - Nortel Networks Local Test Cabinet (LTC), model 3703, using metallic test access
- GR-303 MVI switch-directed loop testing, over a test bypass pair. Additional details are provided on “Switch-directed testing, with test bypass pair” on page 9-12.

In general, support for testing of GR-303 MVI lines is the same as for testing of GR-303 DMS lines, with the following exceptions:

- testing with the integrated remote test unit (IRTU) in multi-line test unit (MTU) emulation mode is not supported on GR-303 MVI lines
- testing with the integrated remote test unit (IRTU) in digital remote test unit (DRTU) emulation mode, using GR-303 IRTU line cards (ILCs) for monitoring and control, is not supported on GR-303 MVI lines (Tandem ILCs must be used; see “NTT-IRTU: DRTU emulation, in a GR-303 MVI integrated application” on page 9-3)

Other line test capabilities

Other line testing capabilities for GR-303 MVI lines include:

- #5ESS supports the bypass pair integrity test, which uses a test diode on the test access path (TAP) I/O card at the RFT. Refer to“Bypass pair integrity test” on page 9-15.
- Metallic loop testing can be performed from the jack access feature on the local craft access panel of the RFT. Refer to“Metallic jack access” on page 9-15.
- Line card diagnostics can be performed using the line card equipment screen in the RFT user interface. Refer to “Line card diagnostics” on page 9-16.

Line and loop testing support is provided for the following GR-303 MVI services given in Table 9-1.

Table 9-1
Line and loop testing of GR-303 MVI services

Service	Metallic loop	PCM channel	Diode Protocol test
MVIPOTS	yes	yes	yes
MVICOIN	yes	yes	yes
MVIUVG	yes	yes	yes
MVILRB	yes	yes	yes
ISDN_U (GR303_ISDN)	yes	no	yes
Note: The diode protocol test is not supported on DMS-100.			

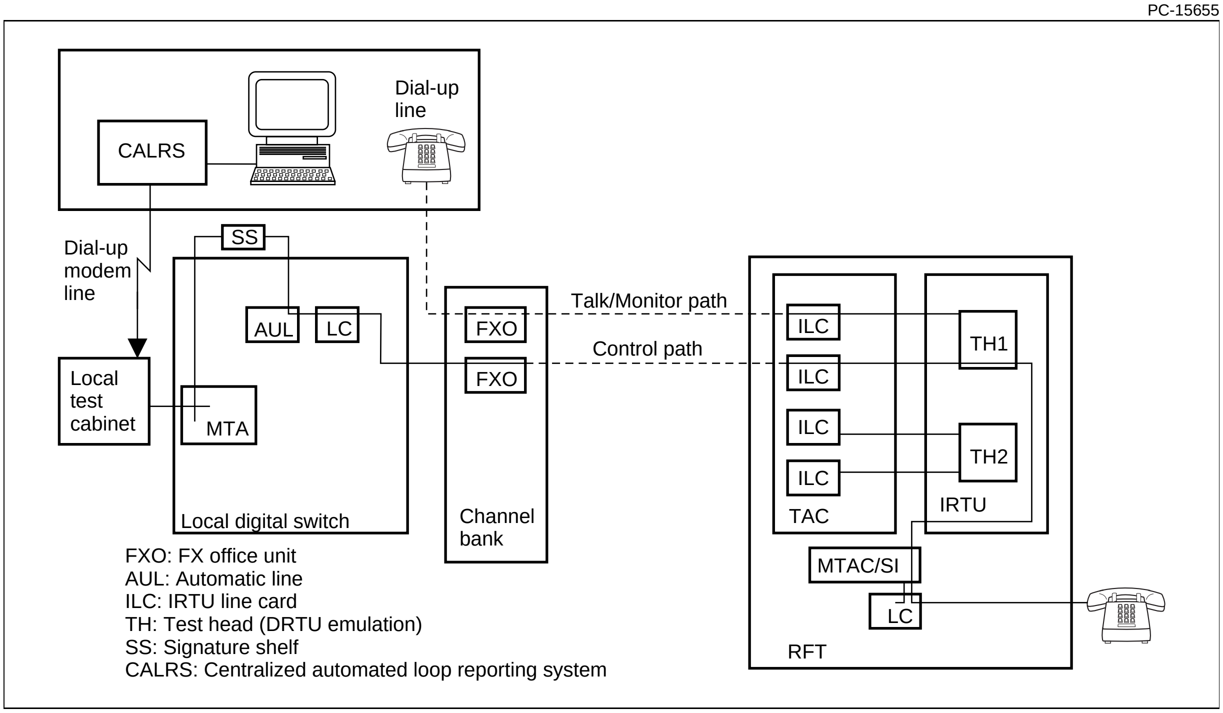
NTT-IRTU: DRTU emulation, in a GR-303 MVI integrated application

The configuration described is the Nortel Networks Centralized Automated Loop Reporting System (CALRS) with Enhanced Line Test Unit (ELTU). Figure 9-1 on page 9-4 illustrates the test layout for IRTU (DRTU emulation), with DS1 tandem control circuits, utilizing one IRTU test head.

About the IRTU The integrated remote test unit (IRTU) is a circuit pack on the AccessNode common-equipment shelf at the RFT.

About CALRS The Centralized Automated Loop Reporting System (CALRS) is an operations system (OS) that uses one of several central-office test heads, such as the model 3703 Local Test Cabinet (LTC), or an Enhanced Line Test Unit (ELTU).

Figure 9-1
NTT–IRTU (DRTU emulation) in a GR-303 MVI integrated application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The local test cabinet (LTC) performs an NTT access sequence. The switch connects the no-test trunk to a digital loop carrier (DLC) signature circuit because the line being accessed resides on a DLC. Upon detection of this DLC signature, the LTC initiates carrier bypass (by applying +116 V to tip).

3 The carrier bypass operation results in the IRTU being connected to the subscriber drop at the RFT and test response circuit (TRC) being connected to the line card under test.

4 Upon request, the IRTU establishes the callback connection to the OS test position. (The IRTU does not autonomously establish the callback.)

5 The OS performs tests on the line, and requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists the AccessNode equipment required to implement NTT-IRTU (DRTU emulation): in an integrated application with DS1 tandem.

Equipment	RFT
IRTU, NT4K57, slot 21	1
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf

The equipment required at the central office to implement this configuration on a single digital switch includes the following:

- at the FCOT in a point-to-point AccessNode topology: spare DS0s on a DS1 facility for DS1 tandem circuits
- a PCM channel bank, equipped with two foreign exchange office (FXO) channel units
- a digital switch equipped with sufficient MTA capacity, one automatic line, and two POTS line cards (refer to the switch product documentation for equipment details)

Provisioning requirements

To test services on an integrated AccessNode system using DS1 tandem lines to the IRTU, provision the following:

- Using the OPC Connection Manager tool, assign one DS1 facility for DS1 tandem circuits (refer to *Provisioning and Operations Procedures*, 323-3001-310, in *Operations, Administration, and Provisioning*, Volume 4B).
- Using the OPC Provisioning Manager tool, provision two line card services on DS1 tandem circuits (one dial-up control path, and one talk/monitor path; refer to *Line Card Provisioning Procedures*, 323-3001-315, in *Operations, Administration, and Provisioning*, Volume 4B).
- Provision the RFT for test access path connection to the IRTU (refer to *Commissioning and Testing*, Volume 3).

At the local digital switch, perform the required datafill equivalent to the following details for the DMS SuperNode (refer to DMS document *XPM Translations Reference Manual*, 297-8321-815):

- Datafill the LNINV table for the RFT line cards for talk/monitor and control paths to the RTU. Provision cardcode as RDTPOTS. Prepare a service order (SERVORD) to provision lines with loop start residential (LSR) parameters. DGT (Touch Tone capability) must be specified as an option.
- Datafill the TRKGRP table: provision the NTT as BASIC.
- Datafill the MTAVERT table to assign a vertical to the RFT network element. Provision the Vertsel parameter to S, the Selector to L, and the Linemod to NExx 1 0, where xx is the NE ID of the RFT.
- Datafill the RDTINV table: specify the NTT access as ERTU, and specify the remote access point (TAP 1, or TAP 2).

  Note: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

- Datafill the LNINV table for an automatic line, used to ring down the RTU control path to establish an NTT access.

Other commissioning requirements

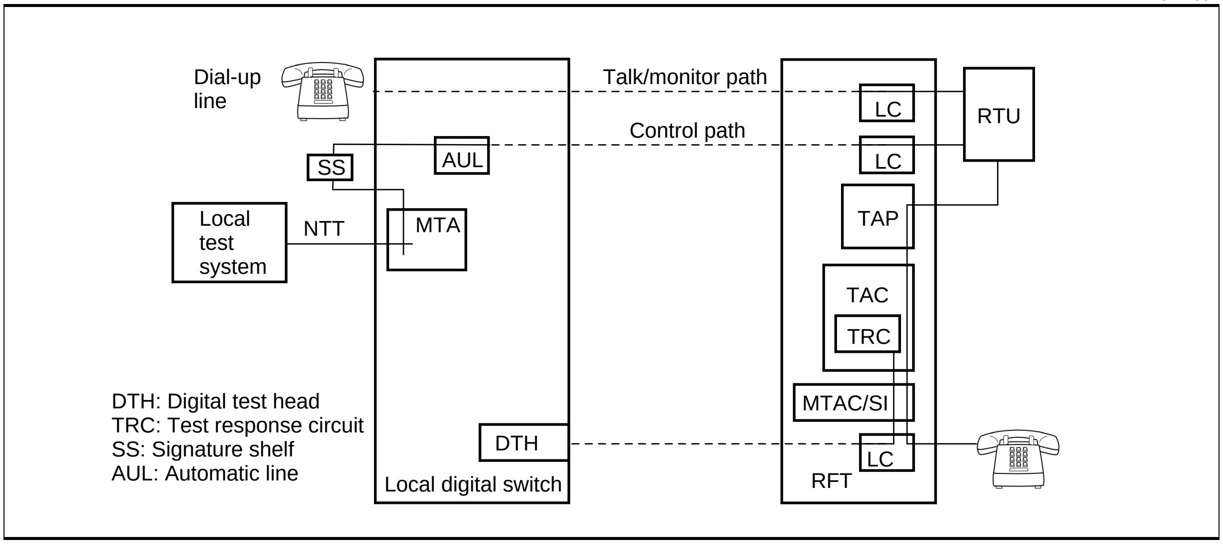
The following list provides additional details about setting up NTT-IRTU (DRTU emulation) in an integrated application with DS1 tandem:

- Install, terminate, and cross-connect DS1 cables (refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201, and related documents).
- Modify the ABM shelf to add the IRTU, if the shelf is earlier than release (Rls) 07 and not yet modified (refer to *System Expansion Procedures*, 323-3001-324, in *Operations, Administration, and Provisioning*, Volume 4C).
- Install and test circuit packs (refer to *Commissioning and Testing*, Volume 3, for DS1/VT mappers, IRTU, and TAC; refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B, for line cards).
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test (refer to *Commissioning and Testing*, Volume 3).

NTT-RTU: PGTC emulation, in a GR-303 MVI integrated application

The configuration described is the Nortel Networks 3703 Local Test Cabinet with model 3704 DRTU (LTC/DRTU). Figure 9-2 on page 9-7 illustrates the test layout using LTC/DRTU.

Figure 9-2
NTT-RTU: PGTC emulation, in a GR-303 MVI integrated application (LTC/DRTU)



Method of operation

The following sequence is used to perform a customer line test:

1 The LTC performs an NTT access sequence. The switch connects the no-test trunk to a digital loop carrier (DLC) signature circuit because the line being accessed resides on a DLC. Upon detection of this DLC signature, the LTC initiates carrier bypass (by applying +116 V on the tip). The carrier bypass operation results in the external RTU being connected to the subscriber drop at the RFT and test response circuit (TRC) being connected to the line card under test.

2 While the switch digital test head performs channel tests, the RTU can perform loop measurements. For LTC/DRTU, the control path uses the metallic path, which would normally connect the MTA vertical to a test bypass pair, to connect instead to an automatic line that rings down the DRTU modem (see Figure 9-2).

3 LTC sends test commands, and the RTU makes the requested measurements on the loop. The RTU returns test results to the LTC.

4 The LTC requests teardown of the connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-RTU: PGTC emulation, in a GR-303 MVI integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
Line cards per test head (one control and one talk/monitor path)	two, Epsilon NT4K65 or Omega NT4K67
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Provisioning requirements

At the RFT user interface, provision the RFT for test access path or test bypass pair connection, as appropriate (see *Commissioning and Testing*, Volume 3)

At the local digital switch, perform the required datafill equivalent to the following details for the DMS SuperNode (refer to DMS document *XPM Translations Reference Manual*, 297-8321-815):

- Datafill the LNINV table for the RFT line cards for talk/monitor and control paths to the RTU. Provision cardcode as RDTPOTS. Prepare a service order (SERVORD) to provision lines with loop start residential (LSR) parameters. DGT (Touch Tone capability) must be specified as an option.
- Datafill the TRKGRP table: provision the NTT as MLT.
- Datafill the MTAVERT table to assign a vertical to the RFT network element. Provision the Vertsel parameter to S, the Selector to L, and the Linemod to NExx 1 0, where xx is the NE ID of the RFT.
- Datafill the RDTINV table: specify the NTT access as ERTU, and specify the remote access point (TBP, TAP 1, or TAP 2).

  Note: For AccessNode Express, IRTU can not be used in the RDTINV provisioning.

- Datafill the LNINV table for an automatic line, used to ring down the RTU control path to establish an NTT access.

Other commissioning requirements

The following list provides additional details about setting up NTT-RTU: PGTC emulation, in a GR-303 MVI integrated application:

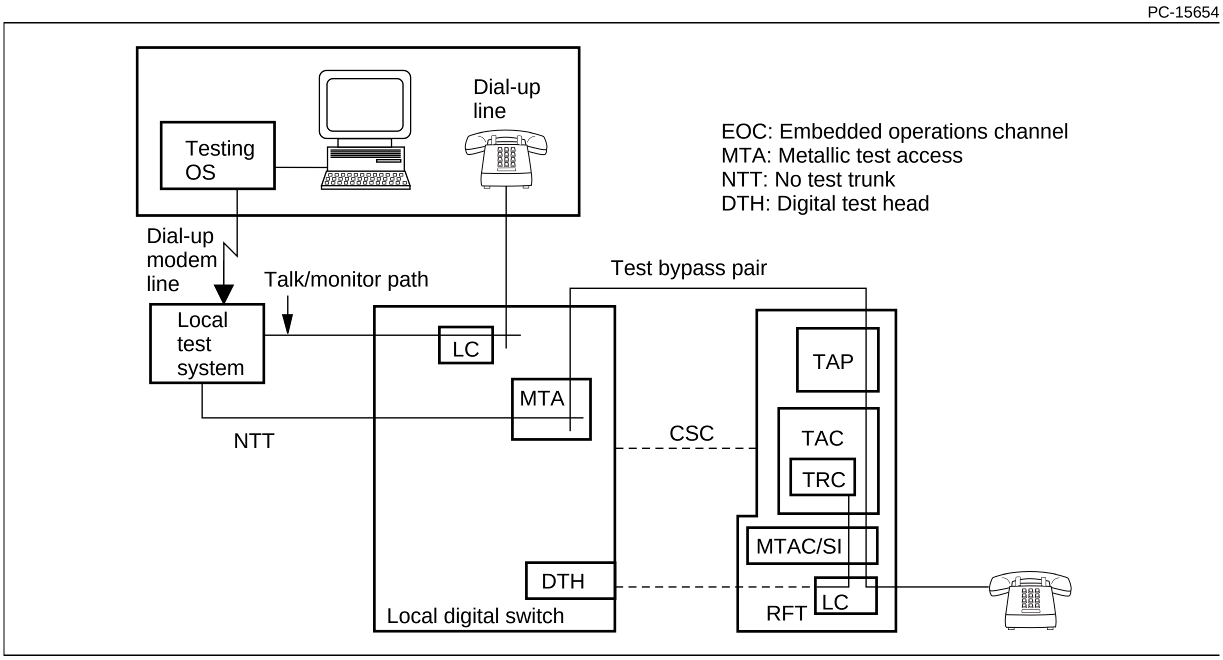
- Install and terminate the TAP I/O card and cable (refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201, or equivalent installation documents).
- Cross-connect the RTU to the chosen port on the TAP I/O card: TBP, TAP 1, or TAP 2 (refer to the TAP I/O cable pinout table in *Commissioning and Testing*, Volume 3).
- Install and test the RFT line card for the control link to the RTU test head (refer to *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B) and the switch line card (refer to switch documentation).
- At the central office, for an LTC/DRTU arrangement, set up the off-hook routing card connections to the automatic line.
- Verify the continuity of connections by performing a line and loop test.

NTT-TBP: PGTC emulation, in a GR-303 MVI integrated application

The testing configuration described is the AT&T LMOS/MLT (Mechanized Loop Testing system). Figure 9-3 on page 9-10 illustrates the test layout.

At the RFT, the test bypass pair terminates on the test access path (TAP) I/O card. When a loop test on a line card is requested, the test bypass pair is connected to the analog side of the line card, under the control of the TAC. In an integrated application, the test bypass pair connects to a digital switch at the central office.

Figure 9-3
NTT-TBP: PGTC emulation, in a GR-303 DMS integrated application



Method of operation

The following sequence is used to perform a customer line test:

1 The tester at the operations system (OS) test position enters the number of the subscriber line to be tested.

2 The MLT controls tests by sending commands to the loop test system (LTS) over an AT&T data communications network.

3 The LTS performs an NTT sequence, and initiates carrier bypass.

4 The switch MTA connects the no-test trunk to the RFT’s test bypass pair.

5 The switch sets up metallic test access at the RFT by sending messages over the embedded operations channel (EOC) channel.

6 The switch connects the test tone unit (TTU) to the carrier channel of the line under test.

7 The LTS makes the requested measurements on the loop over the test bypass pair.

8 The switch performs signaling and transmission tests on the line (carrier channel) using the TTU and the TAC test response circuit.

9 The LTS requests teardown of connections when testing is finished.

Equipment requirements

The following table lists AccessNode equipment required to implement NTT-TBP: PGTC emulation, in a GR-303 MVI integrated application.

Equipment, PEC	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slot MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Provisioning requirements

At the RFT user interface, provision the RFT for test bypass pair connection (refer to *Commissioning and Testing*, Volume 3)

At the local digital switch, perform datafill equivalent to the RDTINV table for the metallic test access point (TBP) for the DMS SuperNode (refer to DMS document *XPM Translations Reference Manual*, 297-8321-815).

> ***Note:*** For AccessNode Express, IRTU cannot be used in the RDTINV provisioning.

Other commissioning requirements

The following list provides additional details about setting up NTT-TBP: PGTC emulation, in a GR-303 MVI integrated application:

- Install, terminate, and cross-connect the TAP I/O card and cable (refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201, and related documents).
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test (refer to *Commissioning and Testing*, Volume 3).
- If necessary, troubleshoot the PGTC connections (refer to PGTC/MTA troubleshooting in *Alarm and Trouble Clearing Procedures*, 323-3001-543, in *Maintenance*, 5A).

Switch-directed testing, with test bypass pair

This architecture is applicable to the following configuration in this release:

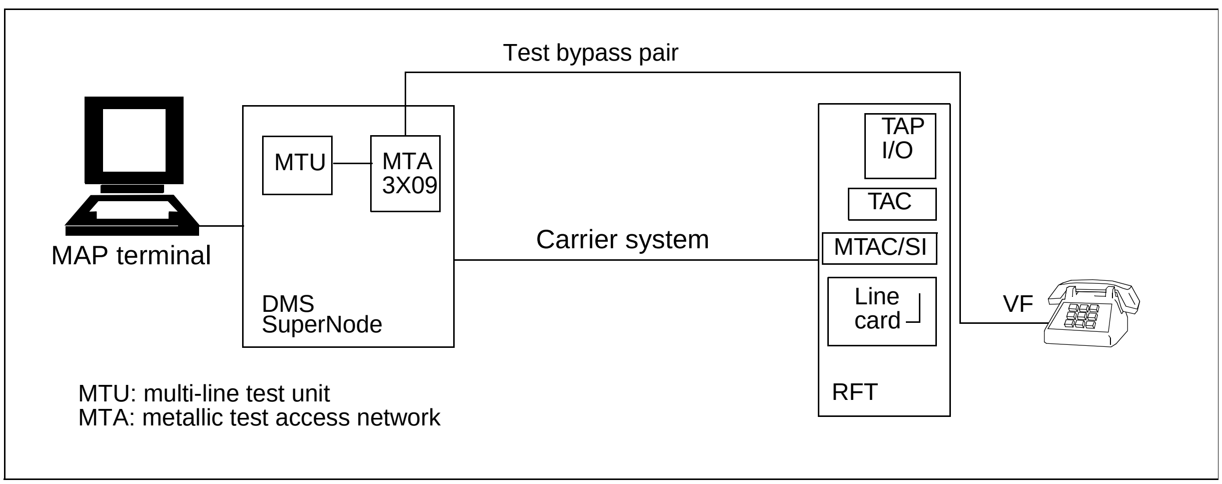
- GR-303 MVI with test bypass pair
- GR-303 DMS with test bypass pair

Note: This section describes the GR-303 DMS test arrangement. The GR-303 MVI local digital switch arrangement would be similar. Refer to the switch product documentation for more information from the switch perspective. The AccessNode RFT perspective described following is the same for both configurations.

GR-303 DMS testing with test bypass pair

The arrangement for performing line tests from the Maintenance and Administration Position (MAP) of the DMS SuperNode is illustrated in Figure 9-4. The connection between the switch and the RFT is by way of a test bypass pair. At the RFT, the test bypass pair connects to the test access path card in the upper level of the access bandwidth manager shelf.

Figure 9-4
DMS SuperNode MAP testing with test bypass pair



AccessNode supports the following line testing menus at the MAP user interface:

- line test position (LTP) testing
- automatic line test (ALT)

Each of these test groups is summarized in “Summary of DMS-100 MAP line testing” on page 9-14.

Method of operation

The tester at the MAP terminal issues a test command including a line number. The switch reserves the metallic test resources (MTA vertical and metallic test equipment) and requests test bypass pair access to the line card at the RFT. The TAC reserves test resources at the RFT. The multi-line test unit (MTU) in the switch performs measurements over the metallic path.

Equipment requirements

The following table lists AccessNode equipment required at the RFT to implement switch-directed testing with test bypass pair.

Equipment	RFT
TAC, NT4K54, slot 20	1
MTAC, NT4K73, CDS slots MTA A and MTA B	two per CDS
SI, NTNP23, UE9000 slot 1	one per UE9000 shelf
I/O cards:	
TAP, NT4K58KA, slot 53	1
Cables:	
TAP cable, NT4K85EA/EB/EC/ED	1

Refer to the switch product documentation for detailed switch equipment and provisioning requirements.

Provisioning requirements

At the RFT user interface, provision the RFT for test bypass pair connection (refer to *Commissioning and Testing,* Volume 3).

To implement DMS SuperNode MAP testing with a test bypass pair, provision the following from the DMS SuperNode (refer to document *XPM Translations Reference Manual*, 297-8321-815):

- Datafill the RDTINV table for the remote access point (TBP) at the RFT.
- Datafill the RDTINV table for the metallic test access connection in the DMS SuperNode.

  Note: For AccessNode Express, IRTU cannot be used in the RDTINV provisioning.

Other commissioning requirements

The following list provides additional details about setting up switch-directed testing with test bypass pair:

- Install, terminate, and cross-connect cables (refer to *Bay in Central Office Installation Manual—ABM*, 323-3001-201, and related documents).
- Install and test circuit packs (refer to *Commissioning and Testing*, Volume 3).
- Verify the AccessNode connections to the line/loop test system by performing a line and loop test (refer to switch product documentation).

Summary of DMS-100 MAP line testing

AccessNode supports the following line testing menus at the MAP:

- line test position (LTP) testing
- automatic line test (ALT)

Line test position (LTP)

The DMS SuperNode MAP menu level LTP supports line/loop testing for AccessNode GR-303 MVI lines. This includes POTS, COIN, and ISDN services. LTP supports four sub-menus:

- LTPMAN
- LTPLTA
- LTPISDN
- LTPDATA

Automatic line test (ALT)

If an AccessNode system is integrated with a DMS SuperNode switch, it supports automatic line test (ALT). ALT allows an operating company to choose when to run tests on groups of lines. This kind of testing is usually run during periods of low traffic to minimize its impact on subscribers. The aim is to identify faults or impairments so they can be cleared before they can have any effect on grade of service. As an alternative to the ALT level of the MAP, you can schedule line tests from table ALTSCHED.

To schedule automatic line tests, use the automatic line test (ALT) level of the MAP. The ALT level is accessed from the line (LNS) level and is used to automatically test a line circuit and subscriber loop, or a group of line circuits and subscriber loops, on a scheduled basis. The following tests can be performed by ALT:

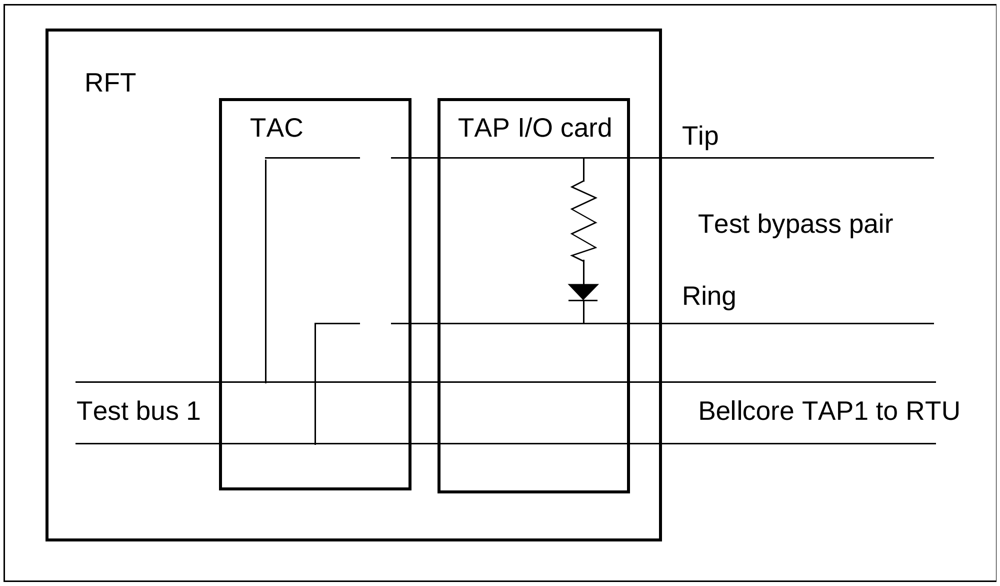
- SDIAG, a short line card diagnostic
- DIAG, the full line card diagnostic

- LIT, the line insulation test
- ALIT, the automatic line insulation test

The LIT is a series of electrical tests done on a subscriber loop. The aim is to identify cable faults due to moisture. These tests are done with the loop disconnected from the line card, using the metallic test access capabilities in the RFT. The ALIT is an automatic (scheduled) version of the line insulation test (LIT).

Bypass pair integrity test

AccessNode supports the bypass pair integrity test, also called the diode protocol test, conducted by a remote test unit under the control of a 5ESS host switch. This test applies a polarity from tip to ring across the test bypass pair, as illustrated following.

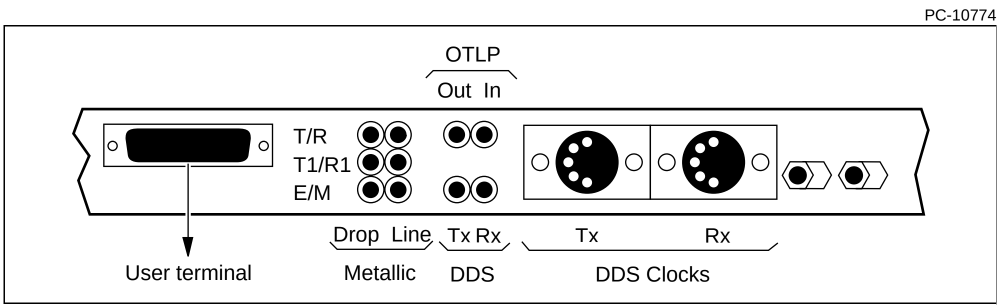


Note: This test is not supported on the DMS-100.

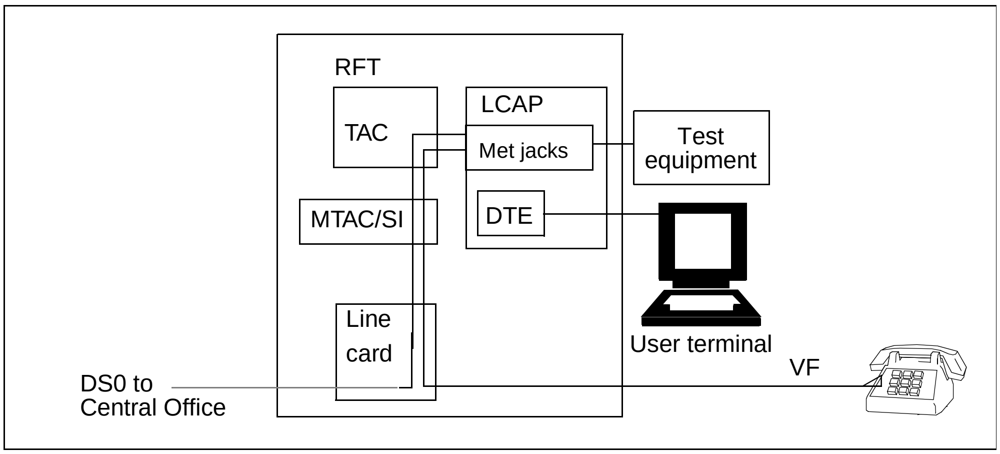
Metallic jack access

The metallic jack access feature provides a jack-access point to the metallic loops on the VF sides of the line cards. Jack access can be used to perform loop measurements and transmission tests during circuit setup or fault-location, on any supported customer service. Jack access test procedures are included in the document *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning,* Volume 4B.

Test equipment is connected to the jacks on the NT4K16 local craft access panel (LCAP). Jacks are provided for 2-wire, 4-wire, and 6/8-wire circuits, as shown following. The figure also shows the DTE user interface port for connecting a VT100-type terminal.



A typical metallic jack access test arrangement is illustrated following.



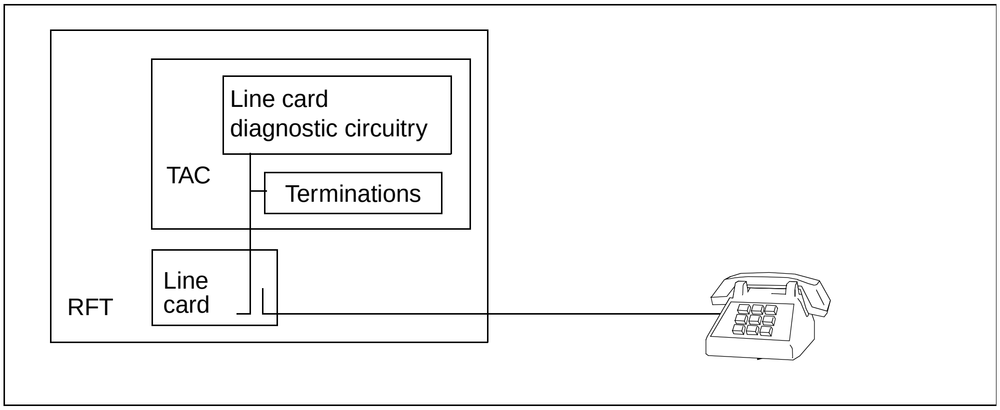
Line card diagnostics

Line card diagnostics allow for the detection and isolation of line card faults. The results of the diagnostics are sent to the event-reporting system and can be displayed as logs.

Out-of-service diagnostic testing can be initiated in the following ways:

- Diagnostics are automatically executed whenever a line card is inserted into a slot in a copper-distribution drawer.
- From the Line Card Equipment screen in the network element user interface, diagnostics initiated on an in-service line card are rejected, but the ResetLC command permits full diagnostics to execute. (This results in the suspension of customer service until the diagnostic testing has been completed and service software has been downloaded once again to the line card.) The procedure is described in *Line Card Testing Procedures*, 323-3001-316, in *Operations, Administration, and Provisioning*, Volume 4B.

Out-of-service diagnostics include a thorough testing of the analog circuitry using line card diagnostic circuitry (LCDC) on the TAC, as illustrated in the next figure. Full line card diagnostics may temporarily block other types of testing. When the TAC is unavailable, a shorter suite of line card diagnostics is performed.



Appendix A: DRTU commands

Commands are listed alphabetically. A description is provided for each command, along with its command syntax and response syntax.

ACT (Activity time-out)

Description

This command modifies the activity time-out of the DRTU. If a specified time elapses, during which the DRTU has not sensed any incoming commands, the DRTU returns to the idle condition.

For each new testing session, the DRTU starts with the default time. ACT allows the testing system to modify the default time for the current testing session.

ACT may be issued at any time that a continuous function is not active.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

ACT xx<CR>

where

xxx is the time-out: **10** to **60** minutes

Response syntax

The response has nine characters:

ACT SS<CR><LF>>

where

SS is the command status

CAN (Cancel)

Description

This command halts a continuous command such as sounder. CAN suspends any active continuous test, then opens the DRTU tip and ring from the test appearance.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within three seconds of receipt of the command carriage return.

Command syntax

CAN xx<CR>

where

xx	is the time-out: **10** to **60** minutes

Response syntax

The response has nine characters:

CAN SS<CR><LF>>

where

SS	is the command status

The response is generated even if there is no active test to cancel.

CLB (Callback)

Description

This command establishes a dialup connection FROM the DRTU towards a craftsperson. The DRTU then establishes a voice path from the callback line to the test tip and ring, allowing the DRTU to provide some voice functions. CLB operates in DTMF dialing mode only. The DRTU dials all indicated digits. If no digits are provided, the DRTU assumes that a loop off-hook is all that is required. This is useful in off-hook routing situations.

CLB is a prerequisite for all voice commands. CLB accepts a total of 16 digits and/or waits.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within 17 seconds of receipt of the command carriage return.

Command syntax

CLB M,DD…DD<CR>

where

M	is the mode control parameter: For DTMF signaling: **T** (default) For release of callback loop: **R**
DD…DD	is the dialed digit string: For dialed digits: **0** to **9**, *****, **#**, **A**, **B**, **C**, **D** For 1-second delay before next digit is dialed: **W** (default is no digits, loop seizure)

Response syntax

The response has nine characters:

CLB SS<CR><LF>>

where

SS	is the command status

CLS (Callback with acknowledgment)

Description

This command establishes a dialup connection FROM the DRTU towards a craftsperson with a positive acknowledgment required to complete the command. The DRTU then establishes a voice path from the callback line to the test tip and ring, allowing the DRTU to provide some voice functions.

The positive acknowledgment is the DTMF pound (#) key and must be depressed for more than 300 milliseconds.

CLS operates in DTMF dialing mode only. The DRTU dials all indicated digits. If no digits are provided, the DRTU assumes that a loop off-hook is all that is required. This is useful in off-hook routing situations.

CLS is a prerequisite for all voice commands.

CLS will accept a total of 16 digits and/or waits.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within 17 seconds of receipt of the command carriage return.

A two-minute time-out starts at the output of the W status in which the acknowledgment DTMF # key must be pressed or the command will time out and the callback path will be torn down. A cancel (CAN) command also causes the callback path to be torn down during this timing phase. No other commands are accepted during this timing phase except a cancel (CAN) command.

Once the callback has been established, the release is done through the CLB release option. Refer to the CLB command for implementation.

Command syntax

CLS M,DD…DD<CR>

where

M	is the mode control parameter: For DTMF signaling: **T** (default)
DD…DD	is the dialed digit string: For dialed digits: **0–9**, *****, **#**, **A**, **B**, **C**, **D** For 1-second delay before next digit is dialed: **W** (default is no digits, loop seizure)

Response syntax

When the command is accepted, there shall be an immediate response to indicate acceptance and show that callback has dialed and is waiting for acknowledgment. Thereafter, a second response will follow after an outside event has occurred; either receiving the acknowledgment or the callback time-out occurs.

The response has 11 characters:

CLS SS,Y<CR><LF>>

where

SS	is the command status
Y	is the ringing status: Waiting for acknowledgment: **W** Acknowledgment received: **A** Time-out without acknowledgment: **T**

COI (Coin collect/return)

Description

This command applies a ramping voltage to the line, such that a pay-station collect/return relay may be tested. COI allows a parameter indicating the particular coin function, and a parameter for terminal selection.

Valid testing directions: OUT.

The last prompt character of the response must be transmitted by the DRTU within 11 seconds of receipt of the command carriage return.

Command syntax

COI M,TT<CR>

where

M	is the coin option: For coin return (–V): **R** For coin collect (+V): **C** (default)
TT	is the terminal selection: Tip to ring: **TR** Tip to ground: **TG** (default) Ring to ground: **RG**

Response syntax

The response has 14 characters:

COI SS,R,CC<CR><LF>>

where

SS	is the command status
R	is the one-character relay trip status: For relay activated: **R** For relay not activated: **N**
CC	is the two-character current: **00** to **65** milliamps

DIR (Testing direction)

Description

This command sets the logical and physical testing direction of the DRTU. The DRTU tests in three logical testing directions on a potentially active line:

- inwards (IN) towards the line card
- outwards (OUT) towards the subscriber
- BRIDGED

Several other commands are valid only in certain testing directions; DIR controls that validity.

Each time DIR is executed, the test direction steering hardware is set to the matching condition:

- IN connects the DRTU circuitry to the IN test pair
- OUT connects the DRTU circuitry to the OUT test pair
- BRIDGE connects the IN and OUT test pairs to each other and to the DRTU circuitry

The direction hardware simultaneously sets the SLEEVE lead to the following conditions:

- IN ==> lead at low resistance, negative battery feed
- OUT ==> lead at high resistance, negative battery feed
- BRIDGE ==> lead at open

Note: The sleeve leads are used in conjunction with the MTAU (see MTA command), and are not applicable for the physical or emulated DRTU.

Movement from one condition to another is allowed as long as a continuous function is not in progress.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

DIR D<CR>

where

D	is the direction: For out testing: **O** For in testing: **I** For bridge testing: **B** (default)

Response syntax

The response has nine characters:

DIR SS<CR><LF>>

where

SS	is the command status

DSL (Dial on subscriber line)

Description

This command outpulses a user-selected string of digits into the subscriber line card. The digits are dialed as either DP or DTMF at fixed speeds of 10 pps for DP and 7 pps for DTMF.

DSL allows a string of up to 16 digits, including delays. DSL operates in the same manner as CLB and uses the same parameters. DSL can be executed multiple times to get a longer digit string.

This command provides a continuous voice path from the test pair to the callback pair when the dialing mode is DTMF.

DSL provides a voice path from the test pair to the callback pair during the interdigital period when dialing mode is DP.

The voice path is maintained after the dialing mode is complete.

This command requires that the PDT command be active.

DSL can be terminated by the CAN command, loss of control modem carrier, or time-out of the dialup port.

Valid testing directions: IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within 17 seconds of receipt of the command carriage return.

Command syntax

DSL M,DD...DD<CR>

where

M	is the mode control parameter: For DTMF signaling: **T** (default) For dial pulse signaling: **D**
DD…DD	is the dialed digit string: For dialed digits: **0**–**9**, *****, #, **A**, **B**, **C**, **D** For 1-second delay before next digit is dialed: **W** (default is no digits, loop seizure)

Response syntax

The response has nine characters:

DSL SS<CR><LF>>

where

SS	is the command status

EPX (Echoplex)

Description

This command places the communication channel into an echoplex mode which forces the DRTU to echo each character it receives. During echoplex, a received carriage return <CR> is automatically echoed along with a line feed <LF> (that is, <CR><LF> is echoed).

EPX is intended for use with a ‘dumb’ terminal and gives the user some simple command line editing capabilities. All edit functions must occur prior to the carriage return.

The command takes effect only *after* the acceptance response has been generated.

EPX mode automatically turns off after loss of modem carrier or inactivity time-out on the controlling port.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

The following keys are used for editing:

Delete (7F hex)	deletes the previous character from the receive buffer and sends **/** and the deleted character to the terminal
Backspace (CTRL-D) (04 hex)	deletes a character
CTRL-U (15 hex)	deletes the entire command string from the receive buffer and sends a new **/**, carriage return <CR>, line feed <LF>, and prompt **>** to the terminal

Note: The hex values are for seven bits, excluding parity.

All characters sent to the terminal are uppercase.

Except for the editing characters, non-printing characters outside the range of 20–7E hex are echoed as ?.

A character with a parity error is echoed as ?.

If a string contains a parity error, it will result in a PE status code response, even if the error is deleted and a correct character is re-entered.

While command execution is in progress, the echoplexed port echoes received characters, although they may not be recognized by the command interpreter.

These characters are interpreted as editing functions *only* in the echoplex mode. All other characters are accepted as valid text characters.

Command syntax

EPX C<CR>

where

C	For echoplex: **Y** For no echoplex: **N**

Response syntax

The response has nine characters:

EPX SS<CR><LF>>

where

SS	is the command status

KHZ (KiloHertz tone)

Description

This command applies a 1004-Hz tone to the subscriber appearance under test. This tone complies with section 7, paragraph 7.04 of the *Notes on The Network*, 1980, AT&T (blue book).

The tone can be applied with battery feed or with a loop seizure. This is determined by the testing direction set by the DIR command.

The nominal parameters of the tone are:

level	–16 dBm
frequency	1004 Hz
impedance	900 Ω

The KHZ command is used only to *apply* the tone, and is a continuous test. KHZ is halted *only* by the CAN (cancel) command.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

KHZ<CR>

Response syntax

The response has nine characters:

KHZ SS<CR><LF>>

where

SS	is the command status

LAS (Send last response)

Description

This command is used by a controller for recovery from a parity error condition.

If an error occurs when the DRTU sends a response towards a testing system that is programmed to check for parity errors, then the testing system sends the LAS command towards the DRTU prior to any other new command.

The LAS command can be executed repeatedly and gets the same response each time.

The DRTU maintains a “last response” buffer, and transmits the contents of it when the LAS command is received. The buffer is initialized to the following string:

LAS OK<CR><LF>>

This buffer is modified only by execution of a new command and subsequent most recent response.

Valid testing directions: OUT, IN, BRIDGE.

Response time is variable, depending upon the length of the previous response. The response *starts* within 0.5 seconds of the receipt of the requesting carriage return <CR>.

Command syntax

LAS<CR>

Response syntax

The DRTU sends a complete response from the most recent command, other than the LAS command. The response does not have any extra characters. For example:

WHO DRTU,Vx.y,sd,cf<CR><LF>>

LCD (Loop condition)

Description

This command applies a selected ground and battery condition to the test tip and ring.

LCD sets up a hardware condition that remains in effect until:

- the cancel (CAN) command is issued, after which the loop conditioning is placed to OPEN
- the LCD OPEN command is issued, after which the loop conditioning is placed to OPEN
- some other command execution requires a change in the hardware state, after which the loop conditioning is removed; loop conditioning is *not* replaced after the new command executes

  Note: There is *no* response indication of this change in hardware condition.

Movement from one LCD condition to another is allowed, and does not require CAN to remove the previous condition.

Valid testing directions: OUT.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

LCD TT<CR>

where

TT is the configuration:

For open tip and ring:	**OPEN** (default)
For short tip and ring:	**SHRT**
For grounded tip, open ring:	**TG**
For grounded ring, open tip:	**RG**
For battery tip, open ring:	**TB**
For battery ring, open tip:	**RB**
For battery tip, grounded ring:	**TBRG**
For battery ring, grounded tip:	**RBTG**
For grounded tip and ring:	**TGRG**
For battery tip, battery ring:	**TBRB**

Response syntax

The response has nine characters:

LCD SS<CR><LF>>

where

SS is the command status

LOG (Login)

Description

This command turns off a timer in the dialup port. Normally, once the dialup port detects originate modem carrier, it starts a 90-second timer. If this timer expires, the dialup port returns to the on-hook condition, and the DRTU logically resets to the idle state.

During the 90-second interval, commands may be executed. If the timer expires, that expiration is handled as if the modem carrier had been lost. Successful execution of the LOG command is used to turn off the timer and allow an unlimited testing duration.

The LOG command uses a parameter, and interacts with the WHO command. The WHO command provides a numeric seed to the user. This seed is also used by the LOG command. Since the WHO command generates a different seed each time the dialup port is accessed or the LOG command is executed, there is a new login code required.

Both the user and the LOG command must use the seed to generate a mathematical equation that converts the seed to a valid login code. This conversion is difficult for a human and therefore prevents unauthorized login. The LOG command affects only a timer in the DRTU; it is not a functional prerequisite for any commands.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

LOG wxyz<CR>

where

wxyz	is the hex-ASCII digit representation of the 16-bit login numeric word: **0** to **9**, **A**, **B**, **C**, **D**, **E**, **F**, hex digits

Response syntax

The response has nine characters.

LOG SS<CR><LF>>

where

SS	is the command status

MCX (Modem carrier detect time-out)

Description

This command modifies the loss of modem carrier time-out of the DRTU. If a specified time elapses, during which the DRTU has not sensed any modem carrier, the DRTU returns to the idle condition.

For each new testing session, the DRTU starts with the default time. This time can then be modified by the user for the current testing session.

This command can be executed at any time that a continuous function is not active.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

MCX xx<CR>

where

xx	is the time-out: **1** to **60** seconds (default is 10 seconds)

Response syntax

The response has nine characters:

MCX SS<CR><LF>>

where

SS	is the command status

MTA (Metallic test access activate)

Description

Note: DRTU emulation does not currently support this command. If this command is issued, it returns as unrecognized (UC). This command may be provided in a future release to allow for MTAU control.

PDT (Plunge for dialtone)

Description

This command applies a loop or groundstart seizure to the subscriber pair.

This command goes through a sequence of hardware states to apply the seizure, both of which terminate in a loop closed state. The groundstart uses timed steps in the sequence.

During this test, the voice path from the test pair is connected to the callback port.

This command requires that the callback path be established.

PDT can be terminated by the cancel (CAN) command to release the seizure, or DSL to pulse digits on the seizure, or will be released due to a dialup port time-out or loss of control modem signal.

Valid testing directions: IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU after the seizure sequence has executed. This takes less than 2.5 seconds.

Command syntax

PDT M<CR>

where

M	is the seizure parameter: For loopstart: **L** (default) For groundstart: **G**

Response syntax

The response has nine characters:

PDT SS<CR><LF>>

where

SS	is the command status

REC (DP/DTMF receive)

Description

This command invokes a DP Receiver or DTMF Receiver in the DRTU. The CLB command must precede REC only if the receive mode is DTMF. Once invoked, the receiver is connected to the subscriber's line, and will collect dialed digits.

The termination impedance is approximately 900 ohms, and the voice path is completed when in DTMF mode. There is no voice path in the DP mode—the Callback line only *monitors* the line under test.

> ***Note:*** The REC command is designed to send dialtone over the duration of the command (that is, until it is cancelled). This dialtone can be heard on the line under test as well as the callback line.

For a valid command, the initial response occurs after the receiver has been configured. All succeeding responses are transmitted as they occur.

Valid testing directions: OUT.

REC is considered to be a continuous function and must be canceled (with the CAN command) prior to execution of other commands.

The last prompt character of the initial response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

REC M<CR>

where

M	is the receiver selection: For dialpulse: **D** (default) For DTMF: **T**

Response syntax

An initial response is generated to show that the command has been accepted and that execution has started. Thereafter, each digit received generates one intermediate response with the data pertaining to the digit.

The response has nine characters:

REC SS<CR><LF>>

where

SS	is the command status

Succeeding responses—dialpulse

The response has 19 characters:

REC SS,D,SP,BK<CR><LF>>

where

SS	is the command status
D	is the 1-character digit receive: **0** to **9**
SP	is the 4-character digit speed (pps): **05.0** to **15.0**
BK	is a 2-character digit break (%): **55** to **70**

Note 1: For digit 1, there is no succeeding digit speed or break.

Note 2: For any measurement that is outside the indicated ranges, the response is:

REC OK,E<CR><LF>>

Succeeding response—DTMF

The response has 11 characters:

REC SS,D<CR><LF>>

where

SS	is the command status
D	is the 1-character digit received: For valid: **0** to **9**, *****, **#**, **A**, **B**, **C**, **D** For invalid: **E**

REM (Remote device activate)

Description

This command applies a high DC (130 V) voltage to the test tip for a duration of six seconds to operate some types of metallic bypass equipment or remote isolation devices.

Valid testing directions: OUT.

The last prompt character of the response must be transmitted by the DRTU within seven seconds of receipt of the command carriage return.

Command syntax

REM M,T<CR>

where

M	is the polarity selection: For positive voltage: **P** (default) For negative voltage: **N**
T	is the terminal selection: For tip to ring: **TR** For tip to ground: **TG** (default) For ring to ground: **RG** For tip+ring to ground: **TRG**

Response syntax

The response has 11 characters:

REM SS,M<CR><LF>>

where

SS	is the command status
M	is an ASCII **M**, indicating metallic test path

REV (Reverse tip and ring)

Description

This command reverses the tip and ring within the DRTU. It also makes the internal connection normal tip-to-tip.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

REV M<CR>

where

M — is the configuration:
For reserved tip and ring: **R** (default)
For normal tip and ring: **N**

Response syntax

The response has nine characters:

REV SS<CR><LF>>

where

SS — is the command status

RNG (Ring subscriber)

Description

This command rings a subscriber, and upon detection of answer, provides talk battery and voice connection to the callback pair. The DRTU monitors the subscriber loop for an off-hook condition during the ringing, and terminates the ringing when off-hook is detected.

The normal sequence of use of this command is to issue the prerequisite CLB command, and get that path established. Then the user executes the RNG command and waits for the subscriber to answer. If there is no answer, the DRTU suspends the ringing after one minute, and finishes command execution.

If the subscriber answers, the DRTU halts ringing, sets up the voice path internally, and finishes command execution with a hookswitch status response.

This command is considered to be continuous and must be cancelled prior to execution of other commands.

There is no supervision of the subscriber loop after either a time-out, or the subscriber has answered.

Valid testing directions: OUT.

The last prompt character of the response must be transmitted by the DRTU within 61 seconds of receipt of the command carriage return.

Command syntax

RNG C,F,V<CR>

where

C is the ringing code: **1** to **5** (default is 1)

Code	On	Off	On	Off	On	Off
1	2.0	4.0				
2	1.5	0.5	1.5	2.5		
3	1.5	0.5	0.5	3.5		
4	1.5	0.5	0.5	0.5	0.5	2.5
5	1.5	0.5	0.5	0.5	1.5	1.5

F is the 2-character frequency code, one of the following: (default is D1)

Code	Freq. (Hz)	Code	Freq. (Hz)	Code	Freq. (Hz)
S1	16	D1	20	H1	16 1/3
S2	30	D2	30	H1	25
S3	42	D3	40	H3	33 1/3
S4	54	D4	50	H4	50
S5	66	D5	60	H5	66 2/3

V is the supervision voltage code:
For positive 48-V supervision: **P**
For negative 48-V supervision: **N** (default)

Response syntax

When the command is accepted, there shall be an immediate response to indicate acceptance and show that ringing has been applied. Thereafter, a second response follows after an outside event has occurred; either the subscriber answers, or the ringing time-out occurs.

The response has 11 characters:

RNG SS,Y<CR><LF>>

where

SS is the command status

Y is the ringing status:
For off-hook detected: **A**
For time-out without any answer: **N**
For initial on-hook: **O**

SLF (Selftest)

Description

This command invokes a test of the program store and XFM within the DRTU. If the unit can be instructed to do a selftest, then the majority of the logic in the control card is running. The results indicate any failure found.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within 60 seconds of receipt of the command carriage return.

Command syntax

SLF<CR>

Response syntax

The response has 30 characters:

SLF SS,V,P,X<CR><LF>>

where

SS	is the command status
V	is the 8-character software version: **V1.0-025**
P	is the 6-character processor result (see note 1): For normal: **OK**
X	is the 4-character (IRTU) XFM result (see note 2): For normal: **OK** For problem with (IRTU) XFM: **FAIL**

Note 1: This command refers to the controller circuit pack in the physical DRTU, which maps into the TAC for the emulated DRTU. Since a problem on the TAC causes the DRTU emulation task to be unable to respond, OK is the only response.

Note 2: A FAIL return code for the IRTU indicates that the required test head could not be acquired for DRTU emulation. This does not necessarily indicate an IRTU circuit pack failure. The IRTU might be unequipped or the required test head might be out of service. If a FAIL is returned, the IRTU screen on the MAPCI should be consulted to determine the problem.

SND (Sounder)

Description

This command applies sounder tone to the subscriber’s loop. Sounder is used to trace on-hook troubles. The sounder may be applied to the metallic pair across tip and ring, or longitudinally across tip+ring to ground.

Sounder is applied with a loop seizure.

This command can only *apply* sounder; the cancel command (CAN) must normally be used to remove the sounder.

Removal of sounder also opens the tip-ring connection to the test pair (this is done within the DRTU).

The output level of sounder is +6 dBm for DRTU emulation on the IRTU. (It is –6 dBm for the DRTU.)

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

SND X<CR>

where

X	is the configuration: For metallic sounder: **M** (default) For longitudinal sounder: **L**

Response syntax

The response has nine characters:

SND SS<CR><LF>>

where

SS	is the command status

TER (Terminate line)

Description

This command terminates the test appearance with a nominal 900-ohm termination. The termination approximates a “quiet” term for use in noise measurements.

TER only *places* the termination on the line, and is considered to be a continuous test. The cancel command (CAN) must be used to remove the termination.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

TER<CR>

Response syntax

The response has nine characters:

TER SS<CR><LF>>

where

SS	is the command status

TLK (Talk)

Description

This command causes a voice connection to be established within the DRTU between the callback tip-ring pair and the test pair. This voice connection is bidirectional, allowing conversation to take place between the subscriber and the craftsperson.

TLK applies battery feed and a nominal 900-ohm termination to the subscriber loop, or a loop seizure for use during IN or BRIDGE testing. This is controlled by the testing direction.

The CLB command is a prerequisite for successful execution of the TLK command.

TLK is a continuous function and must be cancelled (using CAN) prior to the execution of other commands.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

```
TLK<CR>
```

Response syntax

The response has nine characters:

```
TLK SS<CR><LF>>
```

where

SS is the command status

TST (Test verify measurements)

Description

This command invokes a measurement sequence for tip-ring (TR), tip-ground (TG) and ring-ground (RG) pairs.

TST is intended for use by a higher level processor that can parse a long string.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within eight seconds of receipt of the command carriage return.

Command syntax

TST<CR>

Response syntax

The response has 84 characters:

TST SS,ATR,ATG,ARG,DTR,DTG,DRG,RTR,RTG,RTG,
CTR,CTG,CRG,RP,DS,FLT<CR><LF>>

where

SS	is the command status
and all other characters	are listed in Table 10-1

Table 10-1
TST Response syntax

Character	Definition	Size
ATR, ATG, ARG	AC volts in Volts (see note 1)	3 characters/field
DTR, DTG, DRG	DC volts in Volts (see note 2)	4 characters/field
RTR, RTG, RRG	Resistance in kΩ (see note 3)	5 characters/field
CTR, CTG, CRG	Capacitance in µF (see note 4)	6 characters/field
RP	Ringer presence code (see note 5)	1 character
DS	Distance in miles (see note 6)	4 characters
FLT	Fault algorithm, set to ASCII spaces	3 characters

Note 1: AC voltage— 3 characters, maximum 200 V, represented by one of the following, right justified: 0, xx, xxx, OVR.

Note 2: DC voltage— 4 characters, maximum 200 V, positive or negative, represented as one of the following, right justified: 0, xx, xxx, OVR, -OVR, -xxx.

Note 3: Resistance— 5 characters, ‘network’ (as if viewed from a 2-terminal measurement VOM into a 3-legged network), represented by one of the following, right justified: x.xxx, xx.xx, xxx.x, xxxx., INF, NMM.

Note 4: Capacitance—6 characters, ‘component’ (as if the readings were for individual physical capacitors), leading character for each value is a space (positive capacitance) or a ‘*’ (negative capacitance), represented by one of the following, right justified: x.xxx, xx.xx, *x.xxx, *xx.xx, OVR, NMM.

Note 5: Ringer presence code—1 character for the combinations of ringers present on the tested line, represented by 0 to 9 as defined in Table 10-2.

Note 6: Distance—4 characters, in miles and tenths of miles, maximum 25.5 miles or NMM if the capacitance measurements are unavailable.

Table 10-2
Ringer presence codes

Pair	Ringer state							
	0	1	2	3	4	5	6	7
t-r	N	Y	N	Y	N	Y	N	Y
t-g	N	N	Y	Y	N	N	Y	Y
r-g	N	N	N	N	Y	Y	Y	Y

ringer state 8: at least one UNK (unknown)

ringer state 9: at least one NMM (no measurement)

VFY (Test verify measurement)

Description

This command is equivalent to the TST command except for the formatting of the information transmitted from the DRTU. A technician accessing the DRTU with a terminal can use this command instead of the TST command to obtain a detailed, tabular display of test results.

Valid testing directions: OUT, IN, BRIDGE.

The last prompt character of the response must be transmitted by the DRTU within 15 seconds of receipt of the command carriage return.

Command syntax

VFY<CR>

Response syntax

The response has 282 characters (in quotes) as shown in Table 10-3.

Table 10-3
Response syntax characters

Response	Characters
‘VFY SS<CR><LF><LF>’	9
‘^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^’	32
‘^^^^^^^^^^T-R^^^^^^^^^^T-G^^^^^^^^^^R-G’	39
‘<CR><LF><LF>’	3
‘ACV^^^^^^^NNN^^^^^^^^^^NNN^^^^^^^^^^NNN’	39
‘<CR><LF>’	2
‘DCV^^^^^^NNNN^^^^^^^^^NNNN^^^^^^^^^NNNN’	39
‘<CR><LF>’	2
‘RES^^^^^NNNNN^^^^^^^^NNNNN^^^^^^^^NNNNN’	39
‘<CR><LF>’	2
‘CAP^^^^NNNNNN^^^^^^^NNNNNN^^^^^^^NNNNNN’	39
‘<CR><LF>’	2
‘RINGERS^^^NNN^^^^^^^^^^NNN^^^^^^^^^^NNN’	39
‘<CR><LF>’	2
‘DISTANCE^IN^MILES^^NNNN’	23
‘<CR><LF>>’	3

Note 1: SS is the command status.

Note 2: N…N represents the same information specified for the TST command.

Note 3: ^ represents ASCII spaces.

WHO (Who are you)

This command determines the identity of the DRTU. It provides a quick response of the unit name and software version.

This command is not a login, although it provides a login key for use with the next LOG command. It allows a machine or user to verify continuity to a DRTU.

The login seed is a random two-digit number that is different each time the DRTU is initially accessed via the dedicated or dialup port. This value is remembered by the DRTU, so that it can be used as a computational seed by the LOG command.

The seed generated by the WHO command changes each time that:

a. the DRTU detects loss of modem carrier on the active port

b. an activity time-out occurs and the controlling port is released

Multiple WHO commands within a single test session always yield the same login seed unless (a) or (b), from the above list, occurs.

WHO interrogates the three system identity pins (strappable configuration pins) at the rear connector. The presence or lack of a ground on each pin provides a three-bit code, which is interpreted as a specific system. The IRTU does not have these external strappable pins. Instead, the IRTU always returns configuration 7 for the WHO command configuration code. This configuration indicates that the DRTU emulation has 4-wire access (IN and OUT) and that the DRTU emulation will default to BRIDGED mode upon initial access. This configuration allows IN, OUT, and BRIDGED testing that is controlled by the DIR command.

The WHO command also returns the alphanumeric software version number of the DRTU firmware. For the IRTU in this release, the value returned is always 1.0-025, since this is the DRTU firmware version that is being emulated.

The last prompt character of the response string is transmitted by the DRTU within one second of receipt of the command carriage return.

Command syntax

WHO<CR>

Response syntax

The response has 29 characters:

WHO SS,DRTU,Vxy,sd,cf<CR><LF>>

where

SS	is the command status
DRTU	is a literal ASCII uppercase string
V	is a literal ASCII uppercase string
xy	is the 7-digit alphanumeric software version number: **1.0-025**
sd	is a 2-digit seed used in conjunction with the LOG command, and different each time the DRTU is initially accessed: **00** to **99**
cf	is a single digit representing the DRTU configuration and depends on the hardware setting of the strappable pins of the DRTU. DRTU emulation always returns **7** for this value. The following table represents the possible settings for the 3704 DRTU.

Configuration	CF-C	CF-B	CF-A
7	open	open	open
6	open	open	ground
5	open	ground	open
4	open	ground	ground
3	ground	open	open
2	ground	open	ground
1	ground	ground	open
0	ground	ground	ground

Appendix B: IRTU (MTU emulation commands)

When line testing is performed from the DMS SuperNode, the integrated remote test unit (IRTU) residing in the AccessNode emulates a multi-line test unit (MTU), as described in Chapter 7. In addition, the IRTU has some command enhancements to emulate other switch test equipment including monitor circuitry, test tone unit (TTU), and short circuit. Test commands are listed below in functional groupings. These commands are implemented in the underlying message interface and do not reflect commands available at the MAP. Following the list, Table 11-1 on page 11-3 presents the commands alphabetically with a short description of each command.

- Emulate MTU commands
  - ACRING (AC Ring Generator Test)
  - BATT (Apply Battery to Loop)
  - BATTR (Battery Tip and Ring Test)
  - CAPT (Capacitance Test)
  - CON900 (Continuous 900 ohm Termination)
  - EBS (Measure Loop Parameters with Battery)
  - FACEP (Foreign AC EMF Test)
  - FDCEP (Foreign DC EMF Test)
  - FEMF (Foreign AC and DC EMF Test)
  - GRDST (Ground Start Test)
  - ISDN (Measure Loop Parameters of ISDN Loop)
  - LDET (Loop Detector Test)
  - LIT (LTU Type Line Insulation Test)
  - OUTPULSING (Outpulsing)
  - RCAPT (LTU Type Repeated Capacitance Test)
  - REBS (Repeated Measure Loop Parameters with Battery)
  - RESET (Warm Reset)

- — REST (Resistance Test)
- — RFACEP (Repeated AC Voltage)
- — RFDCEP (Repeated DC Voltage Test)
- — RISDN (Repeated Measure Loop Parameters of ISDN Loop)
- — RREST (LTU Type Repeated Resistance Test)
- — STOP TEST (Stop Test)

IRTU enhancements:

- Generate tone
  - — GENTONE (Generate Tone)
- Establish monitor
  - — ANSWER (Answer Monitor/Talk Path)
  - — HANGUP (Hang-up Monitor/Talk Path)
- Short circuit
  - — INSCKT (Insert Short)
  - — REMSCKT (Remove Short)
- Emulate DRTU commands
  - — TALK (Apply Talk Connection)
  - — DIR (Change Direction)
- Test access
  - — CONN-TACC (Connect Test Access)
  - — DISC-TACC (Disconnect Test Access)

Table 11-1
Description of testing commands associated with the IRTU running MTU emulation

Command	Type	ID	Description
ACRING	LTU	2DH	**AC Ring Generator Test** Measures the AC voltage with respect to ground, on either tip or ring. Since ringing voltage is not continuous, the IRTU does not begin its measurement until a voltage threshold specified in the command is exceeded. The IRTU searches for this threshold indefinitely, so the software that initiated the test session must time out and reset the IRTU if a return message is not received in a reasonable length of time. • If a test signal is active, then the ACRING command is rejected. • If the test bus supervision is 900 Ω, the ACRING command is rejected.
ANSWER	IRTU		**Monitor/Talk Path Answer** Establishes a talk path between the IRTU and the subscriber loop under test. • If a test signal is active, the ANSWER command is rejected. • If talk path already exists on the line under test, the ANSWER command has the affect of removing the talk path connection but leaving the monitor intact.
BATT	MTU	54H	**Apply Battery to loop** Connects battery voltage (-52 V nominal on ring and ground on tip) to the loop. • If a test signal is active, the BATT command is rejected. • The IRTU leaves the battery applied until receiving a STOP TEST, RESET, or CON900 command.
BATTR	MTU	27H	**Battery Tip and Ring Test** Provides a DC voltage measurement on Tip and Ring.
CAPT	LTU	35H	**Capacitance Test** Measures ac voltages and dc voltages on both tip and ring, and resistance and capacitance for all combinations of tip, ring, and ground. CAPT operates similarly to the FACEP command.
CON900	LTU	29H	**Continuous 900 ohm Termination** Provides a continuous 900 Ω termination across tip and ring. If a test signal is active, the CON900 command is rejected.
CONN-TACC	IRTU		**Connect Test Access** Establishes analog access to MTUs.

—continued—

Table 11-1 (continued)
Description of testing commands associated with the IRTU running MTU emulation

Command	Type	ID	Description
DIR	IRTU		**Emulate DRTU Direction** Changes the test direction to either split towards facility, split towards equipment, or bridged. • To maintain EBS phone settings, battery is always supplied in a bridged or split towards equipment direction. When the test direction changes to split towards facility, the test bus supervision is idled while battery remains applied to the equipment side of the circuit under test to keep EBS phone settings. • The IRTU verifies the polarity of the circuit under test when battery is moved from a split towards equipment direction to a bridged direction.
DISC-TACC	IRTU		**Disconnect Test Access** Ends a test session. It removes any ongoing measurement and stimulus, and releases any monitor/talk connection in progress.
EBS	MTU	57H	**Measure Loop Parameters with battery** Measures all loop parameters. Throughout the test, the MTU emulation applies battery voltages on the loop for maintaining the volume setting of the EBS phone. If a test signal is active, the EBS command is rejected.
FACEP	LTU	30H	**Foreign AC EMF Test** Measures the foreign ac potential for both ring and tip on the line under test. • If the test bus supervision is 900 Ω, the ACV command is rejected. • If a test signal is active, the FACEP command is rejected. • The FACEP command can be preempted only by the RESET command.
FDCEP	LTU	31H	**Foreign DC EMF Test** Measures dc voltages for both ring and tip on the line under test. DCV operates similarly to the FACEP command.
FEMF	LTU	32H	**Foreign AC and DC EMF Test** Measures ac and dc voltages for both tip and ring on the line under test. FEMF operates similarly to the FACEP command.

—continued—

Table 11-1 (continued)
Description of testing commands associated with the IRTU running MTU emulation

Command	Type	ID	Description
GENTONE	IRTU		**Generate Tone** Transmits a sinusoidal test tone on the circuit under test. • The level of the transmitted test signal is specified in tenths of dBm. • The default level of the transmitted test signal is 0 dBm. • The frequency of the transmitted test signal is specified in Hertz. • The default frequency of the transmitted test signal is 1004 Hertz. • The test head is capable of generating a tone with a frequency selectable from 300 Hz to 10 KHz in 1-Hz increments at a level from -40 to +10 dBm0 in 0.1 dB increments. • The tone can be applied when the circuit is either bridged or split. • The tone remains until the test session is aborted with a DISC-TACC command. • The IRTU accepts only the GENTONE, DIR, BATT, DISC-TACC, and STOP TEST commands while a tone is active.
GRDST	LTU	23H	**Ground Start Test** Verifies the operation of the ground start detection by applying a termination from ring to ground. Do this as follows: 1. Apply 18 kΩ for 500 ms 2. Switch to 900 Ω If a test signal is active, the GRDST command is rejected.
HANGUP	IRTU		**Monitor/Talk Path Hang Up** Removes any monitor or talk path connections between the IRTU and the subscriber loop. If no monitor exists, the IRTU returns a response indicating that the command was successfully completed.
INSCKT	IRTU		**Insert Short Circuit** Places a short on the tip and ring leads. INSCKT does not interact with any other commands except the REMSCKT and DISC-TACC commands.
ISDN	MTU	56H	**Measure Loop Parameters of ISDN loop** Measures all loop parameters of the ISDN loop including ac voltages, frequency of ac, dc voltages, resistance, capacitances of all tip, Ring, and ground pair combinations. ISDN operates like the FACEP command.

—continued—

Table 11-1 (continued)
Description of testing commands associated with the IRTU running MTU emulation

Command	Type	ID	Description
LDET	MTU	22H	**Loop Detector Test** Applies off-loop termination (1.6K) for 2 seconds. Simulates digit “1” by removing 1.6K ohms for 60 seconds. Reapplies 1.6K ohms across tip/ring for 2 seconds, and then ends test.
LIT	LTU	33H	**LTU Type Line Insulation Test** Measures ac voltages and dc voltages on both tip and ring and resistance for all combinations of tip, ring, and ground on the line under test. LIT operates similarly to the FACEP command.
OUTPULSING	LTU	2CH	**Outpulsing** Outpulses the digits provided using IRTU relays to switch between 900 Ω and open circuit with a 61% break ratio, applies the interdigit pause specified in the message, and leaves the continuous 90-Ω termination applied. • If a test signal is active, the OUTPULSING command is rejected. • The OUTPULSING command can be preempted only by the RESET command.
RCAP	LTU	44/45H	**LTU Type Repeated Capacitance Test** Measures ac and dc voltages, resistance and capacitance for all combinations of tip, ring, and ground on the circuit under test. RCAP operates similarly to the RFACEP command.
RDCV	LTU	41H	**Repeated DC Voltage** Measures dc voltages for both tip and ring on the circuit under test. RDCV operates similarly to the RFACEP command.
REBS	LTU	47H	**Repeated Measure Loop Parameters with battery** Repetitively measures all loop parameters. Throughout the test, the MTU emulation applies battery voltages on the loop for maintaining the volume setting of the EBS phone. • If a test signal is active, the REBS command is rejected. • If the test bus supervision is not battery, the REBS command is rejected.
REMSCKT	IRTU		**Remove Short Circuit** Removes a short circuit condition on the tip and ring leads. The REMSCKT command is accepted only when a short circuit condition is active.

—continued—

Table 11-1 (continued)
Description of testing commands associated with the IRTU running MTU emulation

Command	Type	ID	Description
REST	LTU	34H	**Resistance Test** Identical to LIT. RES operates similarly to the FACEP command.
RESET	MTU	80H	**Warm Reset** Resets the portion of the IRTU that performs Emulate MTU commands. If a test signal is active, the RESET command is rejected except in the case of a tone or outpulse signal.
RFACEP	LTU	40H	**Repeated AC EMF Test** Repetitively measures the foreign ac potential for both ring and tip on the line under test. • If the test bus supervision is 900 Ω, the RFACEP command is rejected. • If a test signal is active, the RFACEP command is rejected.
RISDN	MTU	46H	**Repeated Measure Loop Parameters of ISDN loop** Repetitively measures all loop parameters of the ISDN loop including ac voltages, frequency of ac, dc voltages, resistances, capacitances of all tip, ring, and ground pair combinations. RISDN operates similarly to the RFACEP command.
RRES	LTU	42/43H	**LTU Type Repeated Resistance Test** Measures ac voltages and dc voltages on both tip and ring, and resistance for all combinations of tip, and ring, and ground on the circuit under test. RRES operates similarly to the RFACEP command.
STOP TEST	LTU	15H	**Stop Test** Terminates repetitive emulate MTU tests and removes all terminations applied by any preceding emulate MTU commands • If a short circuit condition or tone exists on the line under test, the STOP TEST command is rejected • The STOP TEST command terminates an emulate MTU repetitive measurement command.
TALK	IRTU		**Apply Talk Connection** Establishes a talk connection with the subscriber loop. The talk path can be removed by a HANGUP, ANSWER, or DISC-TACC command.

—end—

Appendix C: IRTU support for MAP commands

When line testing is performed from the DMS SuperNode, the integrated remote test unit (IRTU) residing in the AccessNode emulates a multi-line test unit (MTU), as described in Chapter 7. In addition, the IRTU supports commands that enable it to emulate other switching test equipment including monitor circuitry, test tone unit (TTU), and short circuit.

MAP-LTP menu commands are listed in the following tables. Tables are in the following order:

- Table 12-1 on page 12-2 lists LTP commands
- Table 12-2 on page 12-3 lists LTPMAN commands
- Table 12-3 on page 12-4 lists LTPLTA commands
- Table 12-4 on page 12-5 lists LTPISDN commands
- Table 12-5 on page 12-6 lists LTPDATA commands

For each command and line type listed in the first two columns of each table, column 3 shows whether test equipment is required for the command to function properly. The test equipment arrangement is either:

- Metallic test equipment located in the switch connected to the RFT by way of a test bypass pair (TBP), or
- An IRTU running MTU emulation

A “Yes” in the third column means that either (1) or (2) is required. A “No” in the column means that neither (1) nor (2) is required; the command functionality is not dependent on the test equipment arrangement.

> ***Note:*** At the time of issue, these tables reflect the level of support provided DMS SuperNode NA002 and NA003 software. Information in these tables can change with each new DMS SuperNode software release, refer to the most current DMS SuperNode documentation to verify the current level of support.

Table 12-1
MAP-LTP menu commands

Command	Line types	TBP or IRTU required
Quit	All	No
Post	All	No
Bsy	All	No
Rts	All	No
Diag	All except MBS	No
Diag	MBS	Yes (see note)
almstat	All	No
cktloc	All	No
hold	All	No
next	All	No
prefix	All	No
lco	line cutoff not supported on RDT (RFT) lines	No
level	All	No

Note: The test bypass pair is required to maintain battery on the set. If the IRTU is provided, a TBP is not required.

Table 12-2
MAP-LTPMAN menu commands

Command	Line types	TBP or IRTU required
Quit	All	No
post	All	No
loss	All except ISDN	No
noise	All except ISDN	No
tonegen	All except ISDN	No
tonegen metallic	All	Yes
jack	All except ISDN	No
jack metallic	All except ISDN	Yes (see note)
tstring	POTS, coin	Yes
bal	POTS, coin (Not applicable for AccessNode)	No
rlsconn	All	No
hold	All	No
next	All	No
ckttst	MBS, ISDN	No
sustate	MBS, ISDN	No
dchcon	ISDN	No
setloopbk	ISDN	No
Note: The test bypass pair is required. The IRTU does not support this command.		

Table 12-3
MAP-LTPLTA menu commands

Command	Line types	TBP or IRTU required
quit	All	No
post	All	No
monlta	POTS, coin, EBS	Yes ***(Note 1)***
talklta	POTS, coin, EBS	Yes ***(Note 1)***
orig	POTS, coin	Yes
lntst	All	Yes
vdc	All	Yes
vac	All	Yes
res	All	Yes
cap	All	Yes
hold	All	No
next	All	No
lta	All	Yes
balnet	POTS, coin (Not applicable for AccessNode)	No
coin	coin	Yes ***(Note 2)***
ring	POTS, coin	Yes ***(Note 2)***
dgttst	POTS, coin	Yes ***(Note 2)***

Note 1: A monitor/ talk circuit is required; for POTS and coin services, it can be implemented in one of three ways:
(1) by connecting a test bypass pair from the switch, or
(2) by using the IRTU with an IRTU line card (ILC) when the service being tested is on the primary host switch, or
(3) by bridging to the PCM channel of the line card under test when the service being tested is on a secondary host switch.
For EBS services, PCM channel bridging cannot be used; instead, use a metallic connection as provided in method (1) or (2).

(See page 7-55 for more information about PCM channel bridging in a multihosting application.)

Note 2: A talk circuit is required; see Note 1 for implementation choices.

Table 12-4
MAP-LTPISDN menu commands

Command	Line types	TBP or IRTU required
quit	All	No
post	All	No
sustate	ISDN, MBS	No
bchcon	Supported for ISDN as of NA003 release	No
ltloopbk	Supported for ISDN as of NA003 release	No
dchcon	ISDN	No
hold	ISDN	No
next	ISDN	No
tstsgnl	Not supported	No
tei	ISDN	No
qloop	ISDN	No
qlayer	ISDN	No
qphinfo	Not supported	No
rlayer	ISDN	No
test	Not supported	No

Table 12-5
MAP-LTPDATA menu commands

Command	Line types	TBP or IRTU required
quit	All	No
post	All	No
equip	Supported for ISDN as of NA003 release	No
connect	Supported for ISDN as of NA003 release	No
sustate	ISDN, MBS	No
loopbk	ISDN	No
bert	ISDN	No
berttime	Not supported	No
bpvo	Not supported	No
hold	All	No
next	All	No

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