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DMS-100 Family

Lines

Maintenance Guide

TL14 Standard 07.01 October 2000

DMS-100 Family

Lines

Maintenance Guide

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- Added Universal Edge 9000 (UEN) information to Chapter 1 "Maintenance overview" including the line cards the UEN supports and the LEN numbering scheme.

November 1999

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- Revisions to Chapter 6, "MTU autoloading process" information included in the LTP, LTPLTA and ALT command levels. Also added TTP level and associated MTU autoloading process information.
- Removal of "Line120" information.

September 1999

TL Standard 06.02

- Revisions to Chapter 6, "Lines related user interface commands" to add DCTLTP sublevel to LTP MAP level.
- Add DCTLTP sublevel to the "Maintenance level chart for lines".
- Change the description of Menu item 18 in the table "Overview of commands at the LTP level".
- Added "DCTLTP sublevel menu commands".
- Added a table "Overview of commands for the DCTLTP sublevel" for the LTP MAP level

February 1999

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- Added NT6X21CA line card to Table 1-1 "Line card types" in Chapter 1, "Maintenance Overview."
- Added information on diagnostic tests for the NT6X21CA line card to Chapter 8, "Trouble isolation and correction."

May 1998

TL09 Standard 05.02

- Document migrated into new template.
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February 1998

TL09 Standard 05.01

- Indicated ALT commands are not supported for VLCM (Chapter 1)
- Revision to Table 1-8 to address a CSR
- Duplicate office code (NXX) information added to Chapters 3 and 6. (features AU2589 and SD0912)

December 1997

TL08 Standard 04.02

- Revisions to Chapter 8 to address a PRS
- VLCM information added to Chapter 6
- added a new chapter to provide Off Hook Balance Test information (Chapter 11)

August 1997

TL08 Standard 04.01

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March 1997

TL07 Standard 03.01

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November 1996

BASE05 Standard 02.04

Editing changes

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BASE05 Standard 02.03

Editing changes

November 1995

BASE05 Standard 02.02

Removed a blank page in chapter 8.

May 1995

BASE05 Standard 02.01

- Added Negate Partial Ground start Option (NPGD) descriptions and table to Maintenance Overview and Trouble Isolation and Correction chapters.
- Added NT6X93EA to line card type table in Maintenance Overview.
- Revised references for consistency with current NTP numbering and titles.

July 1994

BCS35 Preliminary 01.04

Redefined procedure for testing office using STARLEN and ENDLEN parameters.

December 1993

BCS35 Standard 01.03

Added line testing information for the world line card. Made corrections to various tables. Removed information on off-hook balance test feature since the functionality is being changed and will be incorporated at a later date.

March 1993

BCS35 Standard 01.02

Updated Figure 8-31 by adding a note informing the user that any line identification devices must be disconnected prior to conducting on-hook ground checks as part of the POTS station ringer test.

March 1993

BCS35 Standard 01.01 First release of this document

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About this document

When to use this document

This document is a maintenance guide for maintenance personnel who have a basic knowledge of the Digital Multiplex System (DMS) and the lines subsystem. This document describes the operation and functions of the lines subsystem and provides information on manual and automatic lines testing. This document includes commands and displays for the manual and automatic lines maintenance menu levels. It is not to be used by operating company personnel who need specific, step-by-step procedures when performing maintenance tasks.

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the *next* software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the *same* software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *Product Documentation Directory*, 297-8991-001.

References in this document

The table below lists the documents that are required to understand the content of this NTP, or to perform the tasks this NTP describes. These documents are also referred to in the appropriate places in the body of this NTP.

In the table, the letters xxxx indicate the document layer number, for example, 8311 (Extended Peripheral Module). The document layer number denotes the

product computing module load (PCL) associated with the NTP. For more information on document numbering, refer to 297-8991-002, *North American DMS-100 Cancellation Cross-Reference Directory*.

The following documents are referred to in this document:

- *Peripheral Modules*, 297-1001-103
- *Automatic Trunk Testing Description*, 297-1001-121
- *Basic Administration Procedures*, 297-1001-300
- *Service Problem Analysis Administration Guide*, 297-1001-318
- *Translations Guide*
- *Product Documentation Directory*, 297-8991-001
- *Bit Error Rate Performance Testing*, 297-1001-533
- *Alarm and Performance Monitoring Procedures*
- *Trouble Locating and Clearing Procedures*
- *Card Replacement Procedures*
- *Routine Maintenance Procedures*
- *Operational Measurements Reference Manual*
- *DMS-100 Family Commands Reference Manual*
- *Log Report Reference Manual*
- *Datapath Modem Pools - Installation and Maintenance*, 297-2121-224
- *Datapath 3270 Network Switched Access Installation and Maintenance*, 297-2121-225
- *Data Unit - Installation and Maintenance*, 297-2121-226
- *Datapath DIALAN Service - Installation and Maintenance*, 297-2121-227
- *Integrated Services Digital Network Basic Rate Interface Maintenance Guide*, 297-2401-501
- *Data Layout Manual*, TAM-1001-011
- *Bell Communications Research Incorporated Technical Reference*, TR-TSY-00008
- *CLASS Feature: SPCS Customer Premises Equipment Data Interface*

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION

Information needed to perform a task

ATTENTION

If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER

Possibility of personal injury



DANGER

Risk of electrocution

Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING

Possibility of equipment damage



DANGER

Damage to the backplane connector pins

Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION

Possibility of service interruption or degradation

**CAUTION****Possible loss of service**

Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module.

Subscriber service will be lost if you remove a card from the active unit.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

```
>BSY
```

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

```
>BSY CTRL
```

Variables

Variables are shown in lowercase letters:

```
>BSY CTRL ctrl_no
```

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different type:

```
FP 3 Busy CTRL 0: Command request has been submitted.  
FP 3 Busy CTRL 0: Command passed.
```

The following excerpt from a procedure shows the command syntax used in this document:

- 1 Manually busy the CTRL on the inactive plane by typing

```
>BSY CTRL ctrl_no
```

and pressing the Enter key.

where

ctrl_no

is the number of the CTRL (0 or 1)

Example of a MAP response

:

```
FP 3 Busy CTRL 0: Command request has been submitted.  
FP 3 Busy CTRL 0: Command passed.
```

1 Maintenance overview

Functional description

The lines subsystem pertains to the thousands of subscriber lines that reside outside the DMS-100 switch and connect to the switch through line cards (LC), which reside within peripheral modules (PM). Every line connects to the DMS-100 switch through an LC.

On one end of the lines subsystem are telephones or other subscriber equipment. Coming out of the telephone are two wires, tip (ground) and ring (-48 V), which together form a telephone line. When a subscriber speaks, sound waves are converted by the telephone transmitter into electronic analog signals that travel over the telephone line until they reach a central office (CO). At the CO, the line connects to a line concentrating module (LCM) or other appropriate PM that houses the LC associated exclusively with that line.

Subscriber lines

A subscriber line consists of a

- loop facility connecting the subscriber station equipment directly to the switch, or through a remote terminal
- line circuit mounted on a line card in the line concentrating device (LCD)

Subscriber lines may be connected directly to peripherals in the main switch called the host, or to remotely located PMs. Remote PMs that are part of the DMS-100 Family may be remote line modules (RLM) or Remote Line Concentrating Modules (RLCM). Additional information concerning these remote units is in *Peripheral Modules*, 297-1001-103. Remote PMs may also be part of compatible subscriber carriers such as DMS-1 and SLC-96. Additional information may be found in the *Bell Communication Research Incorporated Technical Reference*, TR-TSY-00008. Subscriber lines may also be connected to a remote digital terminal (RDT) which is a remote facility that multiplexes the signals onto an optical transmission facility. The RDT described in this document is the S/DMS AccessNode remote fiber terminal (RFT).

Each type of LCD accepts a variety of line cards for a range of telecommunication services. The services that are provided, and the sets used, are as follows:

- POTS (plain old telephone service) line cards use basic telephone sets that provide basic telephone service to residential, coin, and business subscribers
- business service line cards use a variety of business sets that are proprietary to the DMS-100 switch. The M5 series of Meridian business sets are equipped with dedicated keys for activating features. The business services that use these sets require software package NTX106.
- data line cards use compatible data sets to provide switched data service. This service requires software package NTX250.

The Universal Edge 9000 (UEN) provides concentrated support for up to 512 lines (32-line multi circuit line card x 16 line card slots). Two high-speed, point-to-point serial buses, the time division multiplex (TDM) and Grace local area network (GLAN) buses, provide an interface between the 16 line card slots and the NTKX06AA.

- The GLAN bus carries upstream and downstream signaling.
- The TDM bus carries pulse code modulation (PCM) / data in both the upstream and downstream processes.

Note: The term “downstream” indicates the direction of flow from the controlling LGC, LTC, or RCC2 to each line circuit. The term “upstream” indicates the direction from each line circuit to the controlling LGC, LTC, or RCC2.

Line card description

Line cards terminate the lines subsystem inside the DMS host office. The lines' analog signals are converted into digital signals by the LC, combined with other lines' signals by the LCM and are sent into the network. The network determines a route for the speech signals and then sends them out to their respective destinations. The routed signals are sent along the telephone line of the person on the other end of the conversation and converted from analog signals back into sound waves by the telephone receiver.

Line card types vary according to the services that use them and the type of equipment in which they are mounted. Line cards are mounted in an LCD that may be located at

- host locations
- remote line locations
- remote subscriber carrier locations

Table 1-1 Line card types (Sheet 2 of 6)

LC mounting equipment	PEC	Lines per card	Description
International LCM (ILCM)	NT7A22AA	1	Four-wire line card in an NT3A11BA/CA LCC
	NT7A23AA	1	Four-wire line card in an NT3A11BA/CA LCC
	NT7A25AA	1	Enhanced two-wire line card in an NT3A11BA/CA LCC
	NT7A26AA	1	Enhanced two-wire line card in an NT3A11BA/CA LCC
	NT7A27AA	1	Enhanced two-wire line card in an NT3A11BA/CA LCC
	NT7A33AA	1	MBS line card in an NT3A11CA LCC
	NT6X17BA	1	Type A world line card with profile downloading capability (Note 2)
	NT6X18BA	1	Type B world line card with profile downloading capability (Note 3)
	NT6X21AA	1	Business set line card (Note 12)
	NT6X21AB/AC/AD	1	4.5 km (2.8 mi) business set line card (Note 12)
	NT6X21CA	1	Universal Modular P-Phone Line Card (UMPLC) (note 16)
	NT6X93AA/CA/EA	1	International type A line card used on analog facilities for single- and two-party flat rate service (notes 4 and 5)
	NT6X94AA/CA	1	International type B line card similar to NT6X93AA/CA but used for four-party flat rate and coin service (notes 4 to 6)
LM drawer	NT6X94AB	1	International type B line card used for single-party, PBX, and coin subscribers (notes 4 to 6)
	NT2X17AB/AC	1	Type A line card used on analog facilities for single- and two-party flat rate service
	NT2X17AD	1	Type A line card similar to NT2X17AB/AC, used in applications requiring 20 dB idle channel noise
	NT2X18AC	1	An earlier vintage of NT2X18AE

Table 1-1 Line card types (Sheet 3 of 6)

LC mounting equipment	PEC	Lines per card	Description
LCM drawer	NT2X18AD	1	Type B line card similar to NT2X18AE but equipped with +48 V for additional coin features (note 7)
	NT2X18AE	1	Type B line card similar to NT2X17AB but used for multiparty flat rate, coin, and ground start service
	NT6X17AA	1	Type A line card used on analog facilities for single- and two-party flat rate service
	NT6X17AB	1	Type A line card similar to NT6X17AA but used where low noise is required (note 8)
	NT6X17BA	1	Type A world line card with profile downloading capability (note 2)
	NT6X18AA	1	Type B line card similar to NT6X17AA but used for four-party flat rate and coin service
	NT6X18AB	1	Type B line card similar to NT6X18AA but equipped with +48V for additional coin features (note 9)
	NT6X18BA	1	Type B world line card with profile downloading capability (note 3)
	NT6X19AA	1	Message waiting line card (note 10)
	NT6X21AA	1	Business set line card (note 11)
	NT6X21AB/AC	1	4.5 km (2.8 mi) business set line card (note 11)
	NT6X21BC	1	UK business set line card
	NT6X21CA	1	Universal Modular P-Phone Line Card (UMPLC) (note 16)
	NT6X33AA	1	General-use line (GUL) card, providing single-party voice and signaling on an analog line
	NT6X71AA	1	Data line card
	NT6X71AB	1	Similar to NT6X71AA data line card, with profile downloading capability
	NT6X71BA	1	Single slot version of the NT6X71AB data line card, with profile downloading capability.
NT6X76AA/AC	1	Data asynchronous interface line card (note 12)	

Table 1-1 Line card types (Sheet 4 of 6)

LC mounting equipment	PEC	Lines per card	Description
S/DMS AccessNode version of an RDT	NT6X99AA	1	Datapath BERT card (notes 13 and 14)
	NT4K67AB	1	2-wire station line card
	NT4K68AA NT4K69AA	1	2-wire office line card
LCME		2	4-wire special services line card
	NT4K77AA	2	6/8-wire special services line card
	NT6X17AA	1	Type A line card used on analog facilities for single- and two-party flat rate service
	NT6X17AB	1	Type A line card similar to NT6X17AA but used where low noise is required (note 8)
	NT6X17BA	1	Type A world line card with profile downloading capability (note 2)
	NT6X18AA	1	Type B line card similar to NT6X17AA but used for four-party flat rate and coin service
	NT6X18AB	1	Type B line card similar to NT6X18AA but equipped with +48V for additional coin features (note 9)
	NT6X18BA	1	Type B world line card with profile downloading capability (note 3)
	NT6X19AA	1	Message waiting line card (note 10)
	NT6X21AA	1	Business set line card (note 11)
	NT6X21AB/AC/AD	1	4.5km (2.8 mi) business set line card (note 11)
	NT6X21CA	1	Universal Modular P-Phone Line Card (UMPLC) (note 16)
	NT6X71BA	1	Single slot version of the NT6X71AB data line card, with profile downloading capability.
	NT6X76AA/AC	1	Data asynchronous interface line card (note 12)
	NT6X99AA	1	Datapath BERT card (notes 13 and 14)

Table 1-1 Line card types (Sheet 5 of 6)

LC mounting equipment	PEC	Lines per card	Description
SLC-96 RCS	SCD 203	2	Single-party
	SCD 221	2	Multi-party
	SCD 233	1	Coin (note 15)
Small remote unit (SRU)	NT6X17BA	1	Type A world line card with profile downloading capability (note 2)
	NT6X21BC	1	UK business set line card
	NT6X71AB	1	Similar to NT6X71AA data line card, with profile downloading capability
	NT6X76AC	1	Data asynchronous interface line card
Universal Edge 9000 (UEN)	NTNP50AA	32	POTS 32 multi-circuit line card
	NTNP44AA	4	ADSL DMT 4+4 line card

Table 1-1 Line card types (Sheet 6 of 6)

LC mounting equipment	PEC	Lines per card	Description
Note 1: RCT coin line circuit cards are restricted to the first two positions in each shelf. All other RCT line cards may be installed in any card position.			
Note 2: The NT6X17BA world line card can emulate the following cards: NT6X17AC, NT6X93AA, NT6X93BA, NT6X93CA, NT6X93DA, NT6X93EA, and NT6X98AA.			
Note 3: The NT6X18BA world line card can emulate the following cards: NT6X18AA, NT6X33AA, NT6X94AB, NT6X94BB, NT6X94CA, and NT6X94DA.			
Note 4: The NT6X93 and NT6X94 international line cards are equipped with a 600 ~Symbol {W termination, rather than the 900 W termination that is in the NT6X17 and NT6X18 series line cards. Further, it uses the A-Law binary coding algorithm for converting analog speech path signals to digital signals, rather than the Mu-Law algorithm that is used in North American line cards.			
Note 5: International line cards are not used in the RLCM.			
Note 6: The NT6X94 international line cards require a NT6X95AA metering tone card in slot 0 of the odd ILCM drawer. The tone is output continuously on the +48 V bus and supplies a physical ILCM drawer. Because slot 0 is also assigned to the NT6X23AA +48 V power converter card, these two cards cannot coexist in a physical line drawer.			
Note 7: All NT2X18AD type B line cards that are mounted in a line drawer are associated with a NT2X03AA +48 V power converter card that is located in slot 31 in the drawer.			
Note 8: The NT6X17AB type A line card responds to diagnostic tests in the same way as the NT6X17AA line card.			
Note 9: All NT6X18AB type B line cards that are mounted in a line drawer may be associated with a NT6X23AA +48 V power converter card that is located in slots 0 and 16 of the odd numbered (upper) line subgroup in the drawer. A switch on the line card can be operated to control access to the +48 V supply.			
Note 10: All NT6X19AA message waiting line cards in a line drawer are associated with a NT6X20AA 150 Vdc power converter card mounted in slots 0 and 16 of the odd numbered (upper) line subgroup in the drawer.			
Note 11: The NT6X21AA Meridian business set (MBS) line card is used on loops that are up to 1820 m (6000 ft) in length, while the NT6X21AB business set line card is used on loops that are up to 4550 m (15 kft) in length.			
Note 12: The NT6X76AA/AC asynchronous interface line card occupies two vertically contiguous slots in the LCM.			
Note 13: The NT6X99AA BERT card occupies two vertically contiguous slots in the LCM.			
Note 14: Because of the high volume of messaging between the IBERT and the DMS-100 switch while a BERT test is active, it is recommended that a maximum of one IBERT card be provided for each LCM.			
Note 15: RCS coin line circuit cards are restricted to the four rightmost line card positions in each shelf when DS-1 line facilities are connected one per group (see figure 1-7).			
Note 16: The NT6X21CA UMPLC replaces the NT6X21AC, NT6X21AD, and NT6X21BC line cards.			

The types of LCD that mount line cards at host locations are

- line module (LM)
- line concentrating module (LCM)

The LCD designed to provide high density plain old telephone service (POTS) and Asymmetric Digital Subscriber Loop (ASDL) service is called the Universal Edge 9000 (UEN). The UEN uses multi-circuit line cards (MCLC).

The UE9000 DMS shelf contains:

- voice and data domains. The domains are independent in the hardware architecture, which prevents traffic conditions in one domain from degrading the operating capacity in the other domain
- shelf infrastructure that overlaps the voice and data domains to provide common resources

The UE9000 DMS shelf is self-contained and has with the following cards:

- voice domain common equipment
- data domain common equipment
- multi-circuit line
- shelf interconnect
- DSL

The international version of the LCM, called the ILCM, has the same line card capacity as the LCM, although one card position is used by a metering tone card (see Table 1-1).

The types of LCD that mount line cards that are located remotely from the host are

- remote line module
- Remote Line Concentrating Module
- enhanced line concentrating module with integrated services digital network (ISDN) (LCME)
- remote concentrator terminal (RCT)
- remote carrier urban (RCU)
- remote concentrator SLC-96 (RCS)
- Outside Plant Module (OPM)
- small remote unit (SRU) (United Kingdom market only)

1-10 Maintenance overview

The OPM, a cabinet located outdoors, contains the following equipment:

- LCM
- battery reserve power equipment
- temperature control equipment
- digital cable cross connection terminal

The card capacity of each LCD is shown in Table 1-2.

Table 1-2 Line card capacity by LCD type (Sheet 1 of 2)

LCD	Capacity
LM	32 cards per drawer 5 drawers per shelf unit 4 shelf units per LM
LCM	32 cards per subgroup 2 subgroups per drawer 5 drawers per shelf unit 2 shelf units per LCM
LCME	30 cards per subgroup 2 subgroups per drawer 4 drawers per shelf unit 2 shelf units per LCME
RFT	48 cards per drawer 2 drawers per shelf 7 shelves per RFT
RLM	32 cards per drawer 5 drawers per shelf 4 shelves per RLM
RLCM	32 cards per line subgroup 2 line subgroups per drawer 5 drawers per shelf 2 shelves per RLCM
RCT	8 cards per shelf 8 shelves per RCT 10 RCTs per group

Table 1-2 Line card capacity by LCD type (Sheet 2 of 2)

LCD	Capacity
RCU	2 line circuits per line card 4 shelves per RCU with line cards 12-20 line card carriers (LCC) per shelf 4 line cards per LCC
RCS	16 cards per shelf 4 shelves per RCS
SRU	60 cards per drawer 4 drawers 1 shelf per SRU
UEN	16 cards per shelf 4 shelves per Universal Edge equipment (UEE) frame

Locating a line card

The CKTLOC command displays in the work area to the right of the menu area. The following headers are displayed with menu item 11, and the location of the line card in the control position is displayed under the headers:

- Site-four character common language location identifier (CLLI) for the line card location
- Flr-two character building floor number where the line equipment is mounted
- RPos-one or two letters that identify the row where the line equipment bay is located, followed by one or two digits that identify the position of that bay in the row
- Bay_Id-name of the bay on which the line equipment is mounted
- Shf-shelf number in the bay where the line equipment is installed
- Description-name of the hardware device in which the line card is installed
- Slot-drawer number where the line card is installed, and the slot number where the card is placed. The two numbers are separated by a colon.
- EqPEC-product engineering code (PEC) of the line card that is in place. When the line card is part of the DMS-100 Family the prefix NT is deleted. For the WLC, the PEC code and the CARDCODE of the line are displayed.

For example, for a WLC datafiled as WL9002 in table LNINV, the PEC code of 6X17BA and cardcode of WL9002 are displayed.

The CKTLOC command identifies the physical location of the line card. This identification is not to be confused with the LEN, discussed in "LEN numbering" on page 1-17, that identifies the location of a line in memory.

In addition displaying the line card location, the CKTLOC command displays the characteristics of the line in the control position. The following header labels for the characteristics are displayed below the CKTLOC response data:

- Grd Start-states the seizure mode of the line, where:
 - No is a loop start
 - Yes is a ground start
- 2dB Loss-shows the loss (attenuation) pad setting for local to local calls (see the note below), where:
 - No means a pad not used
 - Yes means a pad is used
- Bal Network-shows that one of the following types of balance networks is used on the line to match the loading of the facility (see the note below):
 - nonloaded
 - loaded
- Man Ovr Set-shows the setting of the manual override bit that controls pad settings and balance network values (see the note below), where:
 - No means that either the on-hook or the off-hook balance network test can change the line card loss pad setting, the balance network value, or both
 - Yes means that only the off-hook balance network test can change the line card loss pad setting, the balance network value, or both.

Note: The values displayed are those from the line circuit inventory table LNINV (see data schema section in *Translations Guide*).

The paragraphs that follow along with Figure 1-1 and Figure 1-2 discuss the CKTLOC command entered for a line that terminates in a DMS-1R RCT and a set of lines that terminate in a SLC-96.

When the CKTLOC command is entered at the LTP level for a line that terminates in a DMS-1R RCT, the format of the display is consistent with other CKTLOC displays, but the interpretation of the CKTLOC information is different. As shown in Figure 1-1, there are four flat rate (FR) circuits for each DMS-1R RCT line card. The example in Figure 1-1 is for a remote subscriber

line on a DMS-1R RCT equipped with a QPP405 line card. The CKTLOC information that is displayed is interpreted as follows:

- The site identifier REM1 is the same for the LEN as for the CKTLOC.
- The information displayed under the header Flr indicates that the line card is located on floor 00.
- The display A under the header RPos indicates the line card is in bay equipment row A.
- The display RCT 2 under the header Bay_Id shows the actual labeling of the bay in which the card is located.
- The display under the header Shf is always 0 because it indicates the location of the lowest mounting plate in the RCT. A full RCT occupies a full bay.
- The display RCT 02 under the header Description identifies the third group of ten RCT (the first group is 00) where the characters 02 correspond to the *ff* value in the LEN. The display 5 under the header identifies the sixth RCT in the group (the first is RCT 0) and it corresponds to the *u* value in the LEN.
- The display 05 under the header SLOT and to the left of the colon represents the shelf in the RCT bay, and corresponds to the *dd* value in the LEN format.
- The display 04 under the header SLOT and to the right of the colon identifies the fifth circuit card in the shelf. It includes circuits 17 through

20, of which circuit 18 is the circuit in the control position in this example, and is the CC value in the LEN.

Figure 1-1 LTP level-CKTLOC display for RCT line

```

CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.      .      .      .      .      .      .      .      .      .
LTP
0 Quit_      POST      DELQ  3      BUSYQ  1      PREFIX 621
2 Post_
3          LCC PTY RNG  ....LEN..... DN      STA F S LTA TE  RESULT
4          1FR          REM1 02 5 05 18 621 1234 IDL
5 Bsy_
6 RTS_
7 Diag_
8
9 AlmStat_
10 CktLoc
11 Hold
12 Next_ Site Flr RPos Bay_Id Shf Description Slot EqPEC
13      REM1 00  A  RCT  2  0  RCT 02 5  05:04 QPP405
14
15      GRD START      2DB LOSS  BAL NETWORK  MAN OVR SET
16 Prefix_ NO          NO          NON LOADED          NO
17 LCO_
18 Level_
UserId
Time 7:45

```

When the commands POST and CKTLOC are entered at the LTP level for a set of lines that terminate in a remote concentrator SLC-96 (RCS) the display is in accordance with the example in Figure 1-2.

Figure 1-2 LTP level-CKTLOC display for an RCS line

```

CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.       .       .       .       .       .       .       .       .       .
LTP
0 Quit_      POST      DELQ      3          BUSYQ 1      PREFIX
2 Post_
3
4           LCC PTY RNG.....LEN.....DN      STA F S LTA TE RESULT
5 Bsy_      1FR          REM2 02 0 01 20 621 1234 IDL
6 RTS_
7 Diag_
8
9 AlmStat_
10 CktLoc
11 Hold
12 Next_      Site Flr  RPos  Bay_Id  Shf  Description      Slot  EqPEC
13           REM2  01  D01   RTS 02   0   RCS 02 0   B  01:15 SCD203
14
15           GRD START  2DB LOSS  BAL NETWORK  MAN OVR SET
16 Prefix_      NO          NO          NON LOADED      NO
17 LCO_
18 Level_
UserId
Time 7:45
    
```

The CKTLOC information that is displayed in Figure 1-2 is interpreted as follows:

- The site identifier REM2 is the same for the LEN as for CKTLOC.
- The information that is displayed under the header Flr indicates that the line card is located on floor 01.
- The display D01 under the header RPos indicates that the line card is in bay equipment row D and on the second bay in the row (the first bay is 00).
- The display RTS 02 under the header Bay_Id shows the actual labeling of the bay in which the line card is located.
- The display under the header Shf is always 0 because it indicates the location of the lowest RCS mounting plate. A full RCS occupies a full bay.
- The display RCS 02 under the header Description indicates that line card is part of the third group of RCS terminal (the first card is RCS 00) and the 02 portion corresponds to the value *ff* in the LEN. The card is located in the first module of the group (0) and corresponds to the value *u* in the LEN.

- The letter B identifies the shelf in which the line card is mounted (see Figure 1-8).
- The display 01 under the header Slot and to the left of the colon corresponds to the value *dd* in the LEN as identified in the following:
 - shelf A is numbered 00
 - shelf B is numbered 01
 - shelf C is numbered 02
 - shelf D is numbered 03

This is a redundant identification of the line card shelf to simplify locating the shelf.

- The display 15 under the header Slot, and to the right of the colon, identifies the card position for line circuit 20. In this example, circuit 20 corresponds to the value *cc* in the LEN.
- The code SCD203 displayed under the header EqPEC identifies the engineering code of the line card.

LEN numbering

The LEN is a group of numbers that describe the location of a line in memory sometimes called the logical location. They are preceded by a four character CLLI that identifies the site of a remotely located line, or by the characters HOST that identify the line site as the switch location. The first character of the CLLI of the remotely located line is a letter, while the remaining three characters may be letters or numbers.

The LEN is not to be confused with the circuit locate identification that is used to describe the physical location of a circuit line card in a LCD.

The LEN is formatted as *ff u dd cc*

- *ff*-is a frame number from 00 through 99. For the S/DMS AccessNode RFT, this value is a number from 0 through 511 representing the group the RFT belongs to at the site.
- *u*-is a unit number
 - from 0 through 9 if the LCD is a DMS-1R RCT, an SLC-96 RCS. For the S/DMS AccessNode RFT, this number represents the unit number within the group.
 - either 0 or 1 if the LCD is an LM or an LCM
 - from 0 through 3 if the LCD is a UEN, representing the shelf numbering in the Universal Edge equipment (UEE) frame.

- *dd* is a drawer number or line subgroup number from 00 through 19. The following LCDs are numbered differently:
 - RDT-the drawer is referred to as a *shelf* having a value from 1 through 31; however, for the S/DMS AccessNode RFT, the shelf value is from 1 through 7
 - LCME, the drawer number or line subgroup number has a value from 00 to 15
 - SRU, the drawer number or line subgroup number has a value from 00 to 07
 - UEN, the individual line cards, each of which are line subgroups (LSG), are numbered 00 to 15. Each line subgroup (line card) contains up to 32 lines
- *cc*-is a circuit number from 00 through 31. For the RDT, the circuit number is the *slot* number of the line card having a value from 1 through 99; however, for the S/DMS AccessNode RFT, the slot value is from 1 through 96. For the UEN, if the NTNP50AA POTS 32 line card is installed, up to 32 circuits are available. If the NTNP44AA ADSL DMT 4+4 line card is installed, up to four circuits are available.

When circuit numbers 00 through 09 are entered as 0 through 9, the system default interprets the unentered first character as 0 and accepts the abbreviated entry of the circuit number.

If the office has a remotely located LCD, and the LM or the LCM are uniquely numbered by site, the CLLI is required before the LEN. If the LM or LCM numbers are unique to the whole office, then the CLLI is optional.

The remote terminal of a DMS-1 subscriber carrier system is called a remote concentrator terminal (DMS-1R RCT). The DMS-1R RCT is connected to the host network module through a 1.544 mb/s digital line and a subscriber carrier module (SCM) that provides an interface with the 2.56 mb/s digital rate speech link of the DMS-100 switch. A single SCM can terminate a maximum of six DMS-1R RCTs.

The remote terminal of an SLC-96 subscriber carrier system is called a remote concentrator SLC-96 (RCS). The RCS is connected to the host network through a 1.544 mb/s digital line and a peripheral module called an SMS that provides an interface with the 2.56 mb/s digital rate speech link of the DMS-100 switch.

Remote locations that are equipped with these types of subscriber carrier terminals mount line cards in shelf slots rather than in drawer slots. However, the shelf number is assigned in the *dd* field of the LEN number to maintain its standard format. Figure 1-4 through Figure 1-8 show the use of the standard

LEN format when used with various LCDs. For all applications except the RCS, the location of the circuit in memory is directly related to the physical location of the line card. The RCS line card that is part of a specific line circuit may be identified using the mapping diagram shown in Figure 1-9. RCS line circuit numbers 24 through 31 are unassigned to simplify the relationship between the logical location and physical location of the line circuit. Figure 1-10 shows the arrangement of the shelves and slots in the S/DMS AccessNode RFT which relate to the LEN numbering for RDT lines. Figure 1-11 shows the arrangement of the drawers and card slots in the SRU which relate to the LEN numbering for SRU lines.

There is no LEN for a DPX line. The line's logical location is directly identified with the logical location of the associated trunk circuit in the serving office switch.

Figure 1-3 LM and RLM LEN numbering

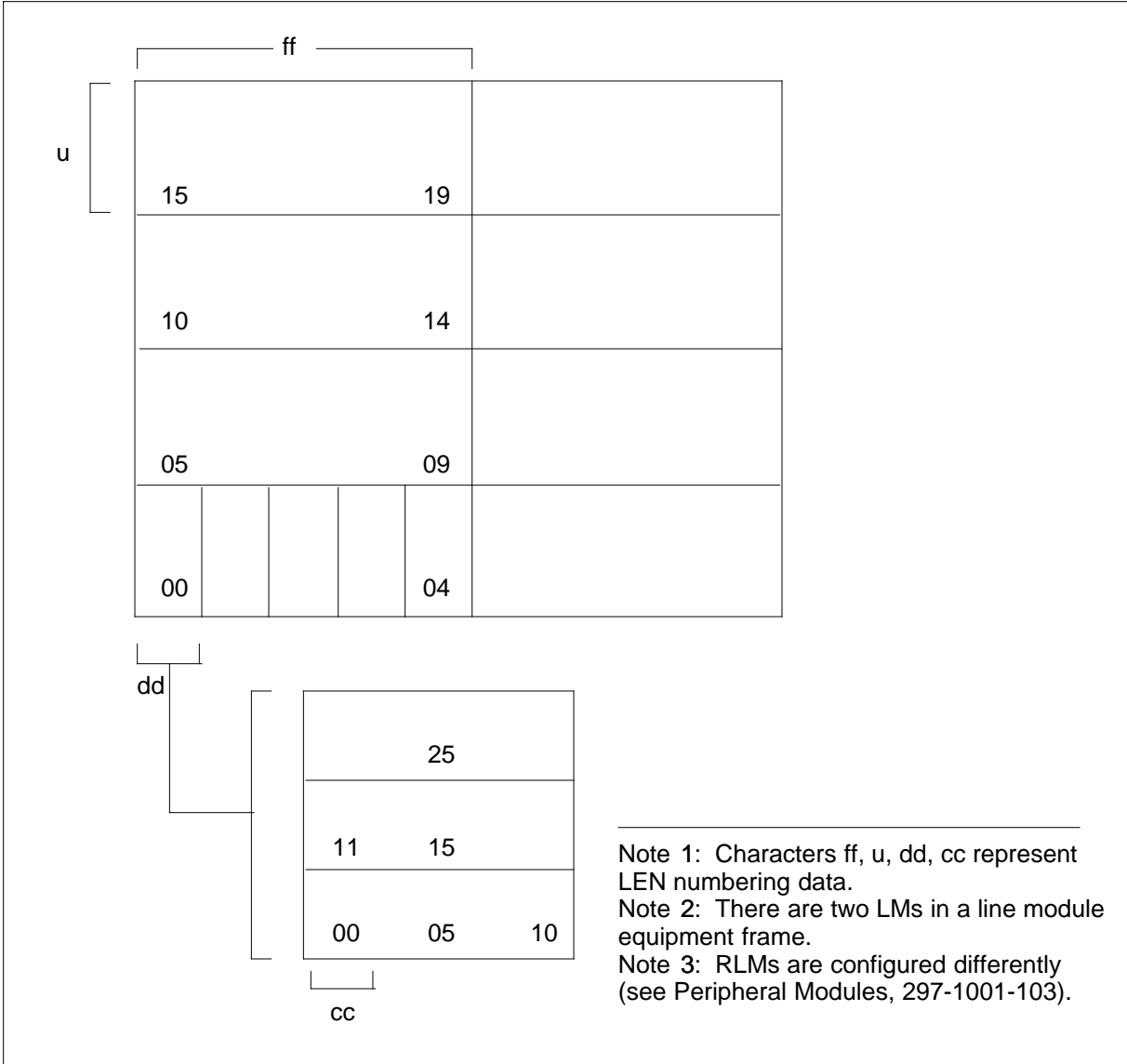


Figure 1-4 LCM and RLCM LEN numbering

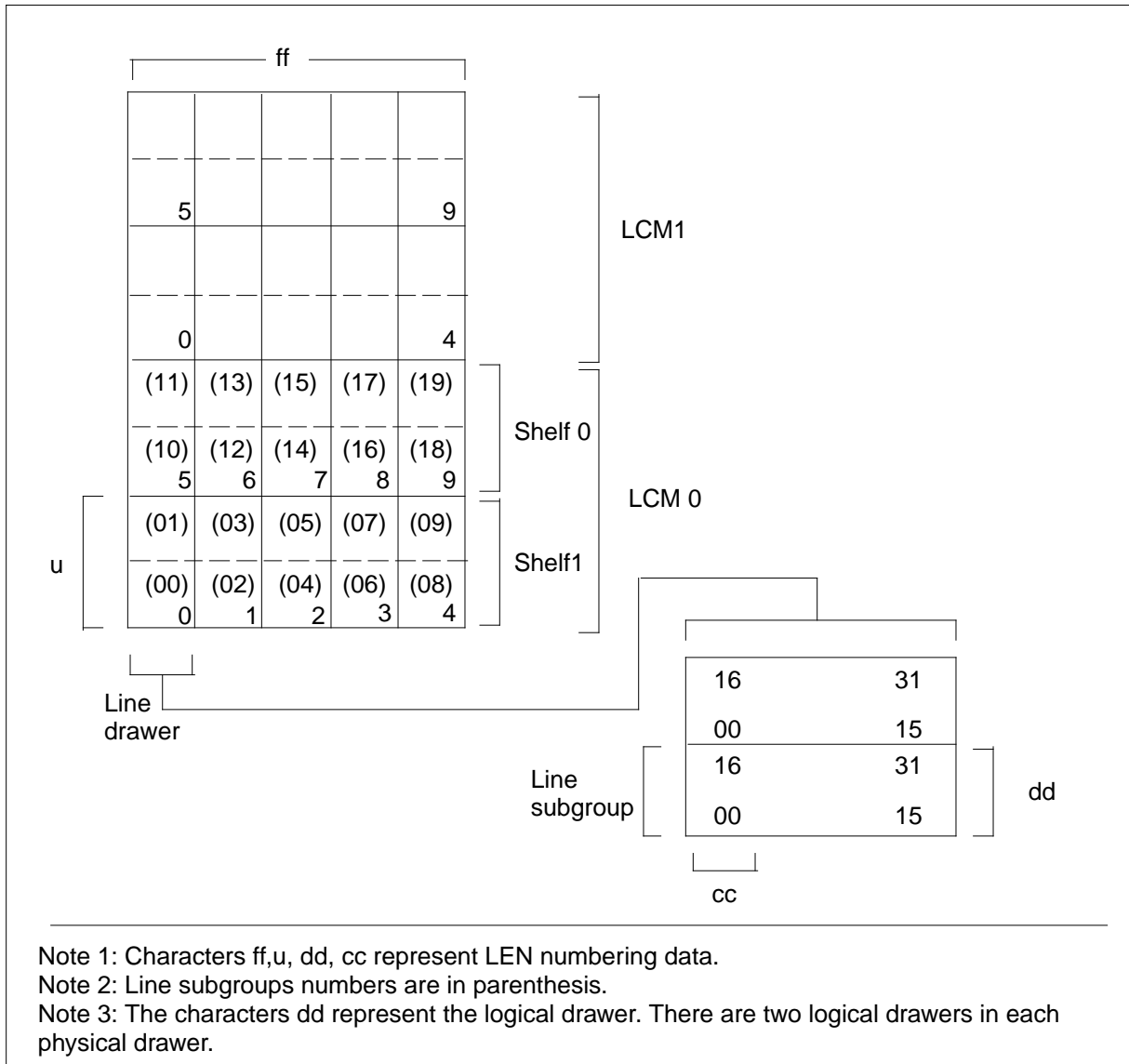
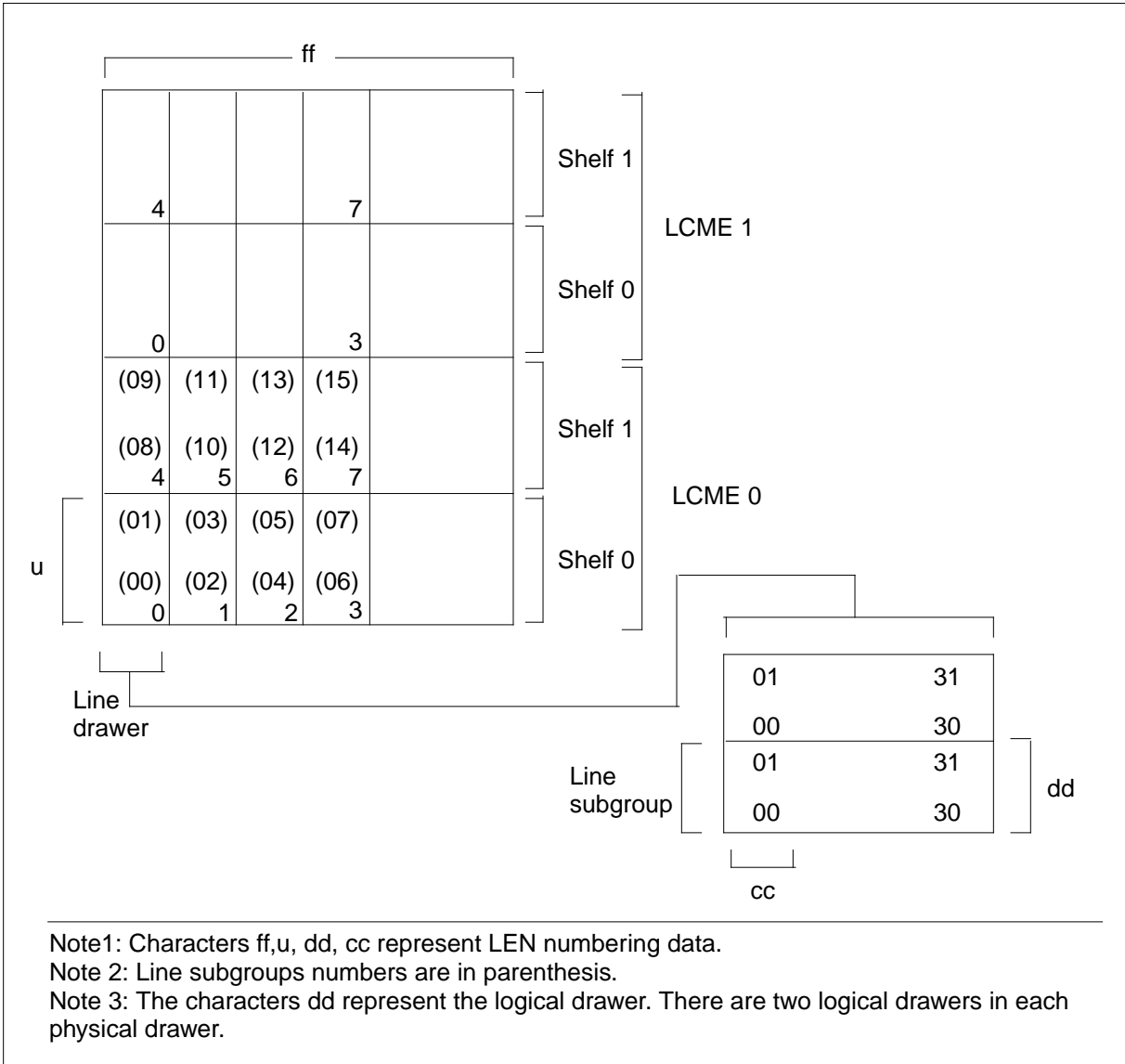


Figure 1-5 LCME LEN numbering

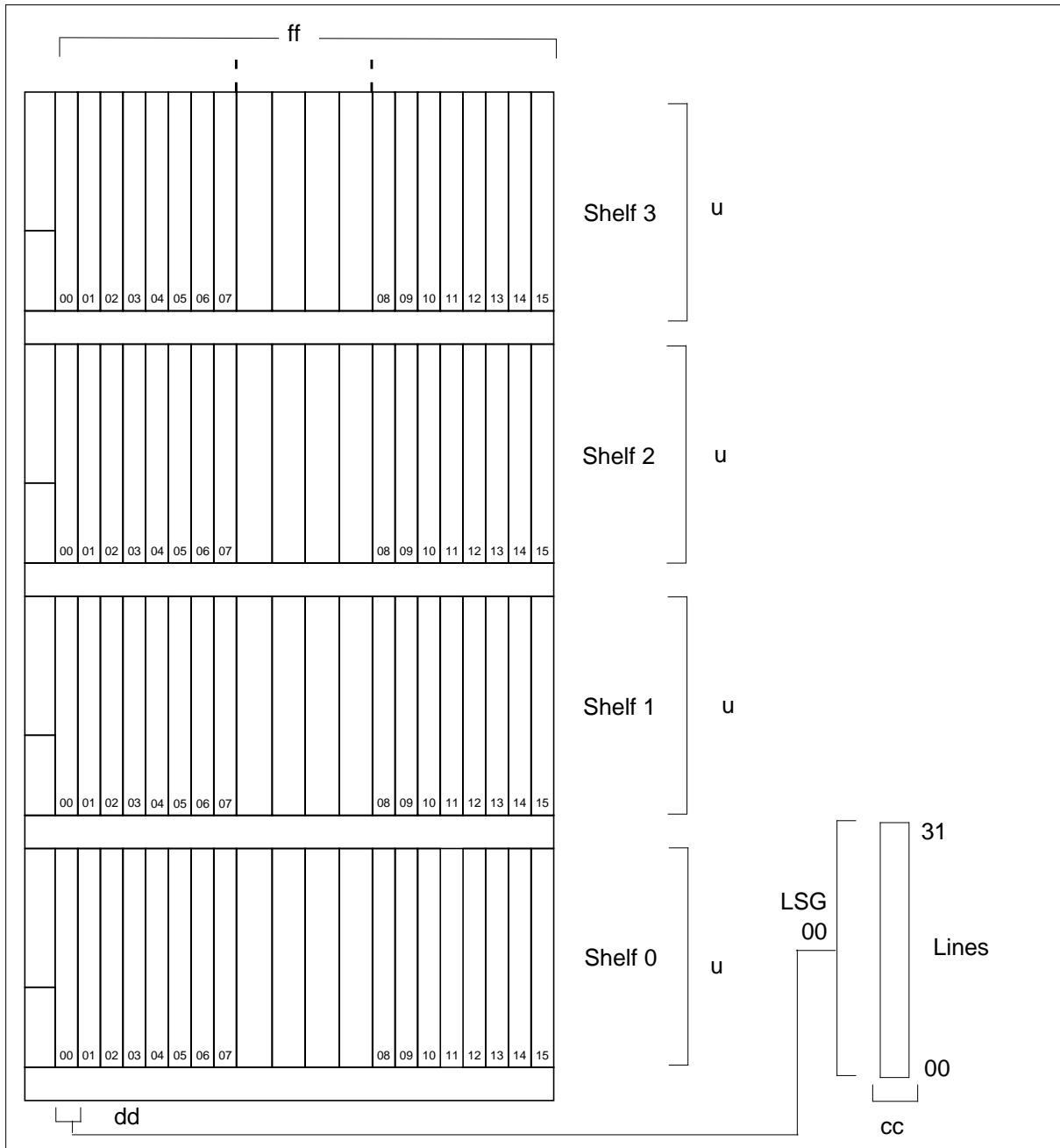


Note1: Characters ff,u, dd, cc represent LEN numbering data.

Note 2: Line subgroups numbers are in parenthesis.

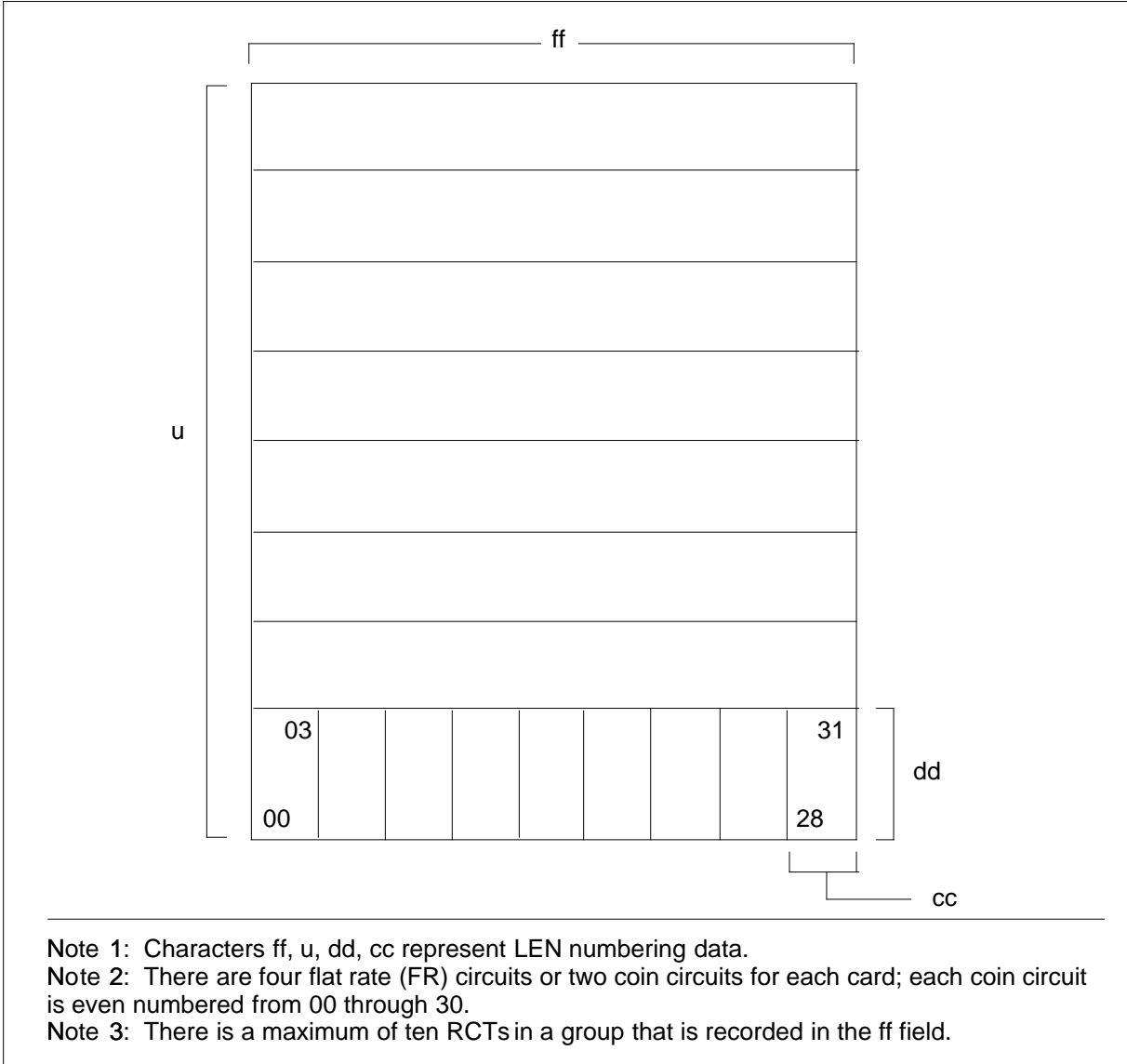
Note 3: The characters dd represent the logical drawer. There are two logical drawers in each physical drawer.

Figure 1-6 UEN numbering



- Note 1: Characters ff, u, dd, cc represent LEN numbering data.
- Note 2: The characters dd represent the line subgroup (line card slot number).
- Note 3: The number of circuits in a UEN LSG is dependant upon the number of circuits that the line card supports.
- Note 4: NTNP44 supports a maximum of 4 lines.
NTNP50 supports a maximum of 32 lines.

Figure 1-7 DMS-1R RCT LEN numbering



- Note 1: Characters ff, u, dd, cc represent LEN numbering data.
- Note 2: There are four flat rate (FR) circuits or two coin circuits for each card; each coin circuit is even numbered from 00 through 30.
- Note 3: There is a maximum of ten RCTs in a group that is recorded in the ff field.

Figure 1-8 RCS (SLC-96) LEN numbering

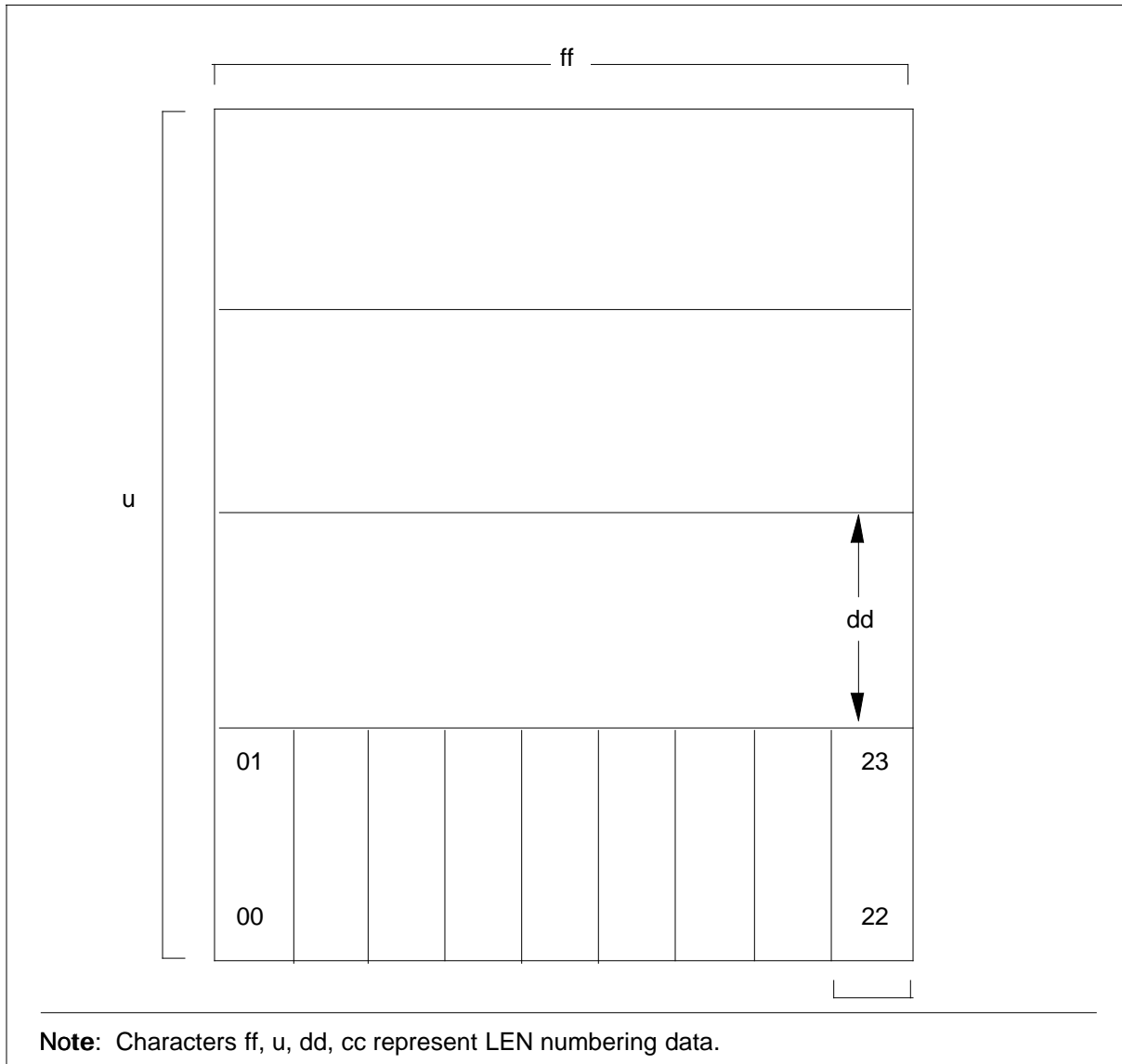


Figure 1-9 RCS (SLC-96) line card mapping

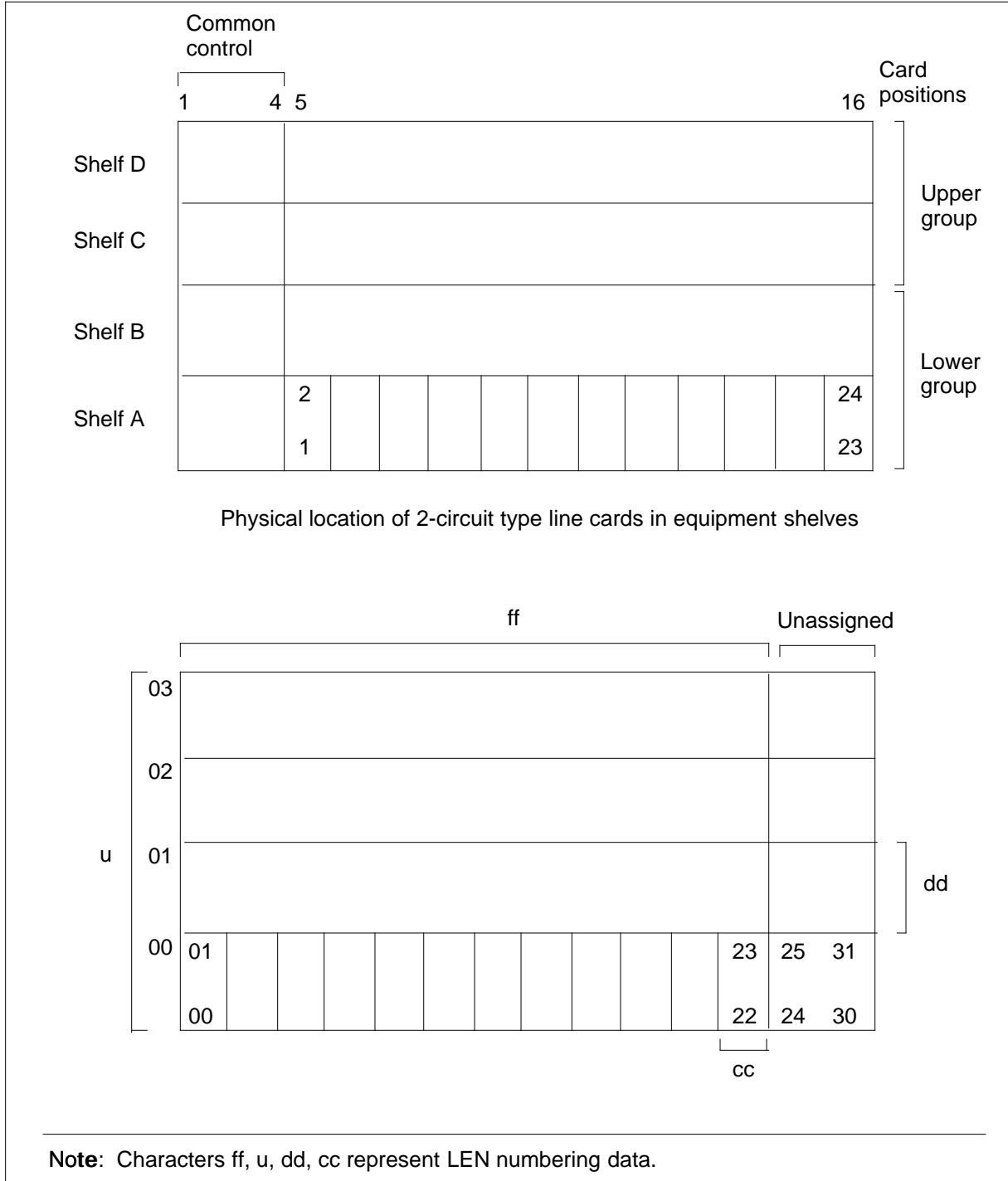
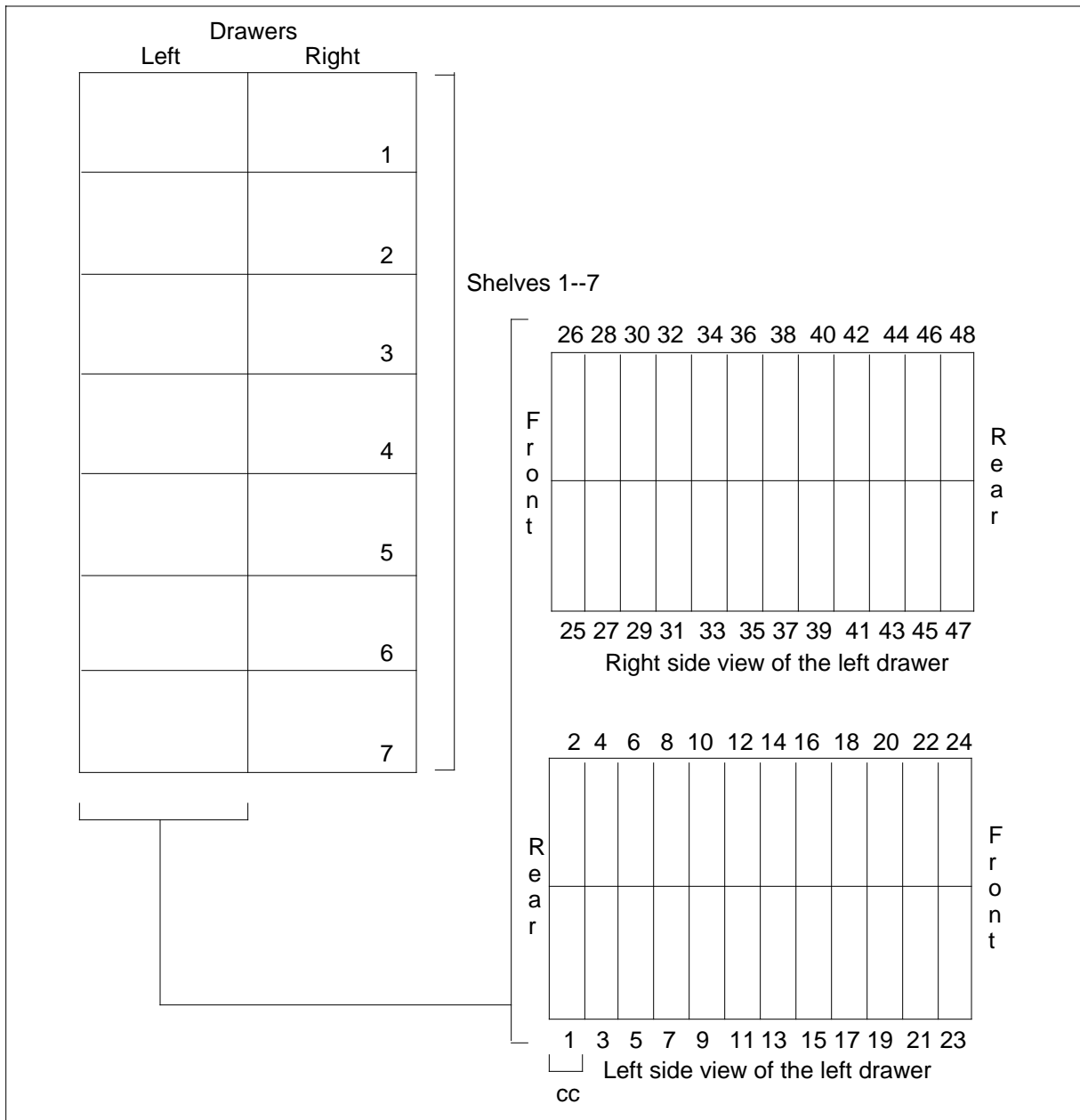


Figure 1-10 RFT line card mapping

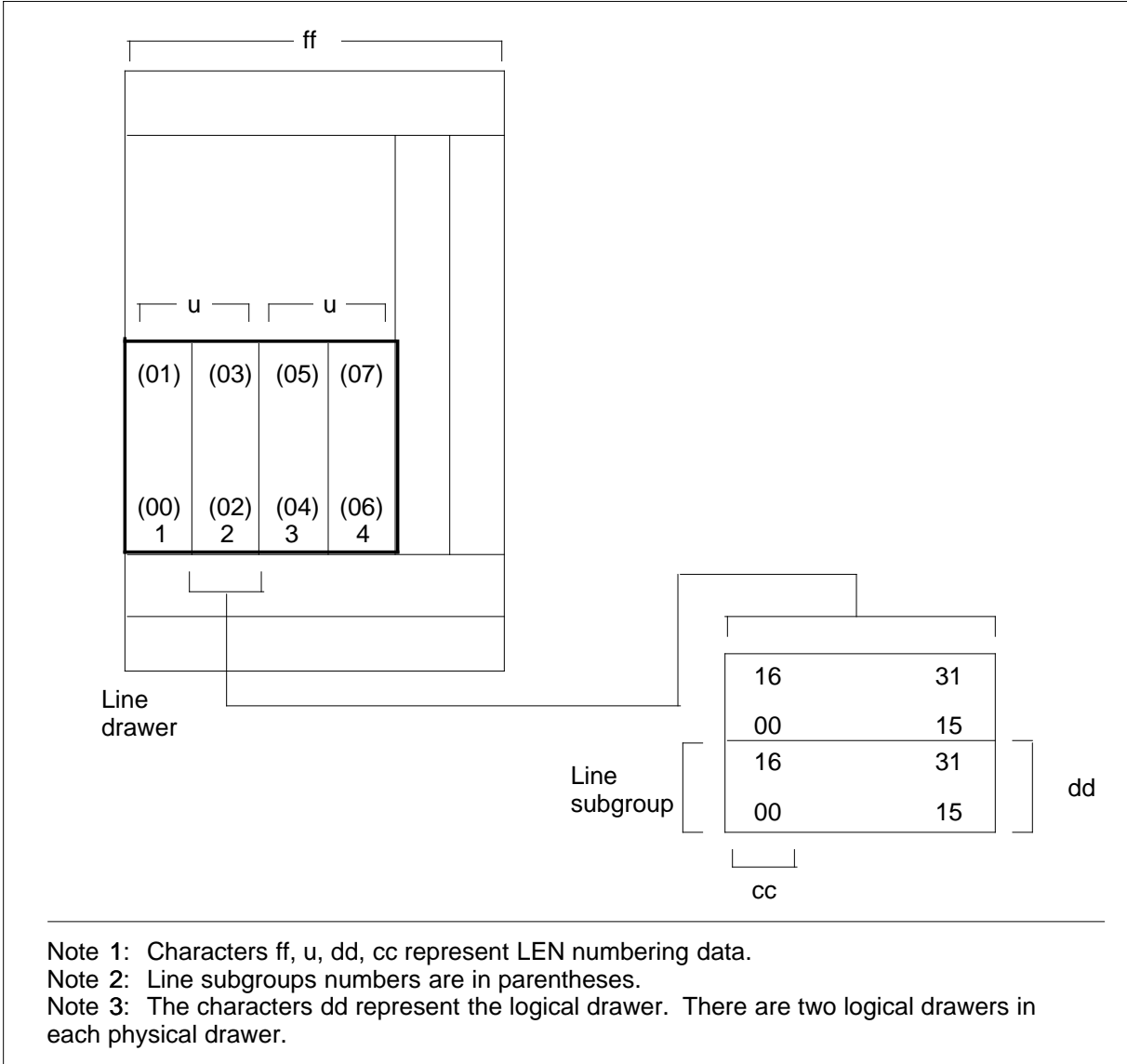


Note 1: Characters dd and cc represent the LEN numbering data, which for the RFT indicates the shelf and slot numbers.

Note 2: The shelves consist of two drawers, each drawer containing up to 96 line cards.

Note 3: The line card numbering arrangement for a drawer on the right side continues the numbering arrangement presented in the left hand drawer, where slots 49 through 72 are visible on the left side of the right line drawer and slots 73 through 96 are visible on the right side of the right line drawer.

Figure 1-11 SRU LEN numbering



Fault conditions

The fault conditions listed below may occur on lines. These faults must be isolated into one of four areas to properly isolate the fault. The four areas that make up a line are the line card, LCD, loop facility, and station equipment. The fault conditions are

- line flux cancellation error
- loop detect error
- line loopback problem
- line synchronization loss at U-loop

- line transhybrid error
- stuck test access line relay
- call cutoff problem
- line ringing failure
- missing set
- automatic line test failure
- line pad test error condition
- line noise problem
- ringing pre-trip problem
- poor line transmission or reception
- line that does not receive calls
- line that does not ring
- line with free pay phone service

Some of these faults are received as customer complaints as shown in Table 8-1, "Customer complaints" on page 8-7, and are addressed in the "Focused Line Maintenance" on page 1-34 and in the Section , "Diagnostic subtests descriptions" on page 8-141.

The lines subsystem differs from other subsystems in that it has more components (having thousands of line cards) and the effects of a failure of a line or a line card are isolated, that is, they have almost no effect on the rest of the DMS-100 switch. This means that fault detection must be different for the lines subsystem since the switch does not constantly test lines or line cards. Faults that occur in the lines subsystem are not directly noticeable until they have a cumulative effect. The ALMSTAT display enables the operating company to determine exactly what that cumulative effect is by what type of alarm is generated for a predetermined number of faults. The ALMSTAT command and the fault thresholding processing is discussed below and in more detail in Chapter 6, "Lines related user interface commands" on page -1.

Testing and troubleshooting of lines faults are done at the levels below the LNS MAP level. The next level below LNS contains the lines test position (LTP) menu commands, the automatic line testing (ALT) menu commands, and the LNSTRBL menu commands. The levels to be accessed for testing and trouble

shooting faulty lines depends on the type of LNS fault. The three types of lines faults are

- line card faults-The LTP menu level is used when testing and troubleshooting line card faults having the SDIAG, DIAG, NDIAG, or DF alarms.
- outside line faults-the LTPLTA menu level is used when testing and troubleshooting outside line faults having the PSPD, QDIAG, FAC, or MIS alarm.
- combination of line card faults and line faults-When a combination of line card faults and line faults exist having PSDF and DF alarm conditions, two levels of commands are required to clear the line card faults and outside line faults. The LTP level is used to clear the line card faults and the LTPLTA level is used to diagnose the line faults.

Lines alarm status

To determine the severity of an alarm it is necessary to access the LTP level and enter the ALMSTAT command. The ALMSTAT display shows the current number of failed lines for each fault under the *Current* header. It also shows the threshold setting for the alarm codes for each fault under the headers *Minor*, *Major*, and *Critical*. Comparing the number of failed lines with the threshold settings shows which faults have lines above a threshold. If you adjust the thresholds, you can alter the alarm appearing under the LNS heading. ALMSTAT displays are provided in chapter 6, "Lines related user interface commands" on page -1 with a further discussion of the command and its parameters.

Alarms

Alarms are generated when the quantity of LNS subsystem line failures reaches or exceeds the threshold values defined by the operating company. The LNS subsystem alarm classes, listed in order of increasing severity, are

- minor
- major
- critical

Alarm class codes are described in Table 1-3.

Table 1-3 Call processing alarms (Sheet 1 of 2)

Code	Class	Description
C	Critical	The number of alarm conditions reaches or exceeds the critical class threshold.

Table 1-3 Call processing alarms (Sheet 2 of 2)

Code	Class	Description
M	Major	The number of alarm conditions reaches or exceeds the major class threshold, but is less than the critical class threshold.
(blank)	Minor	The number of alarm conditions reaches or exceeds the minor class threshold, but is less than the major class threshold.

The following table lists call processing alarms.

Table 1-4 Call processing alarms

Alarm	Class	Description
MN C	Minor	The quantity of call processing failures exceeds the minor class threshold, but is less than the major class threshold (C indicates call processing alarm).
CR C	Critical	The quantity of call processing failures exceeds the critical class threshold (C indicates call processing alarm).
MJ C	Major	The quantity of call processing failures exceeds the major class threshold, but is less than the critical threshold (C indicates call processing alarm).

The following table lists lists lines alarms.

Table 1-5 Lines subsystem alarm status codes (Sheet 1 of 2)

Code	Status
. (dot)	The quantity of line circuits in the PLO state and the quantity of diagnostic failures are less than the threshold value.
DF	Two or more line circuits have SDIAG, DIAG, NDIAG, FAC, MSET, MCARD, BMIN, BMAJ, UCARD, or QDIAG type alarms that are in the same class (see Table 1-3)
DIAG	The threshold of line circuits that have failed the extended diagnostic has been reached or exceeded.
FAC	The threshold of line circuits that have failed a facility check has been reached or exceeded.
HZD	Indicates that a line hazard such as leakage resistance or foreign line voltage has been detected on a card. It also indicates that the cut-off relay has been operated to isolate the line card.
IMAJ	The threshold of line circuits that have reported ICMO at the major rate has been reached or exceeded.

Table 1-5 Lines subsystem alarm status codes (Sheet 2 of 2)

Code	Status
IMIN	The threshold of line circuits that have reported ICMO at the minor rate has been reached or exceeded.
LCARD	The threshold of key telephone set (keyset) lines have failed a loopback test that was activated at the line card.
LSET	The threshold of keyset lines have failed a loopback test that was activated at the keyset.
MCARD	The threshold of line circuits that have reported missing line cards has been reached or exceeded.
MSET	The threshold of line circuits that have reported missing sets has been reached or exceeded.
NDIAG	The threshold has been reached or exceeded for line circuits that have passed a short diagnostic after a previous diagnostic failure, but need an extended diagnostic to clear the diagnostic failure status.
PSPDF	On or more line circuits have reported a PSPD type alarm, and one or more line circuits have reported SDIAG, DIAG, NDIAG, FAC, MSET, MCARD, BMIN, BMAJ, UCARD, or QDIAG type alarms, where all alarm types (including the PSPD type) are in the same class (see Table 1-3).
PSPD	The threshold of lines with a permanent signal condition has been reached or exceeded. The cause may be either partial dialing of a digit sequence or an off-hook condition with no digits dialed.
QDIAG	The threshold of line circuits that are in the shower queue has been reached or exceeded.
SDIAG	The threshold of line circuits that have failed the short diagnostic has been reached or exceeded.
TCM	The threshold of TCN synchronization losses reported by the TCMMON command has been reached or exceeded.
UCARD	The threshold of utility cards that have failed the diagnostic has been reached or exceeded.
CMIN	The threshold of line circuits that have reported CP errors at the minor rate has been reached or exceeded.
CMAJ	The threshold of line circuits that have reported CP errors at the major rate has been reached or exceeded.

Diagnostic and permanent signal alarms

Diagnostic and permanent signal alarms are generated when line failures are observed as a result of diagnostic tests or system action.

The alarm fault types include

- diagnostic failure, where a line fails any of the following:
 - manually invoked short or extended diagnostic test
 - ALT short or extended diagnostic test
 - system invoked diagnostic test
- PSPD condition—a line circuit is in the PLO state, that is, it caused a permanent signal alarm because the total quantity of digits required were not received.

The threshold for each type of alarm is set independently. When failures of one type of alarm reach or exceed a threshold value, the class of alarm which has been met or exceeded is displayed at the LNS subsystem in the system status area of the MAP display. When failures in both alarm classes reach or exceed a threshold value, and the thresholds are for different alarm classes, the most severe alarm class is displayed at the LNS subsystem.

Both the fault type and the alarm class are displayed under the LNS subsystem header on the system status display (see Table 1-5). When the quantity of line failures is reduced below a threshold by maintenance action or by the fault clearing out, the alarm class is changed to the next lower severity class, and is eliminated if no other LNS alarm exists.

Call processing alarms

In offices that are equipped with the Focussed Line Maintenance (FLM) feature, call processing (CP) alarms are generated when lines fail to complete calls in the process of being established. These alarms are displayed alternately with DPS alarms under the LNS header.

When an alarm is generated because of a CP failure, the class of the alarm is displayed in the system status display area under the header LNS. No audible alarm is generated for CP failure alarms, and therefore, normal alarm silencing procedures do not apply (FLM alarms are listed in Table 1-4).

The CP alarm display is continued for period of 30 s and is then replaced with a display of the previous DPS alarm class code for 30 s. The cycle is repeated while a CP alarm exists without changing the DPS alarm status code display. When there is no CP alarm, any DPS alarm display is continuous.

Maintenance action as a result of a CP alarm display is taken by accessing the LNSTRBL level of the MAP display. Details concerning this level are provided in chapter 6, "Lines related user interface commands" on page -1.

Automatic maintenance

Focused Line Maintenance

Switches that are equipped with software package NTX272 Focused Line Maintenance (FLM), can obtain data concerning subscriber line CP failures from the MAPCI level. The feature displays conditions of significant CP failures in the system status area, and enables the lines that experience repetitive failures to be identified by accessing the LNSTRBL level so that prompt maintenance action can be taken. Log reports of these failures are normally suppressed when this feature is provided.

Switches that are equipped with FLM accumulate data about lines having call processing failures in buffers, rather than in logs. When the quantity of failures reaches or exceeds a threshold level, an indication is given in the system status display. The feature uses the buffering process and the thresholding process to do this. Information concerning these failures is obtained by accessing the LNSTRBL level as discussed below.

The example in Figure 1-12 illustrates the display that results from entering the command LISTALM at the LNSTRBL level. In this example the call processing alarm status is displayed for ten lines in the upper buffer of LCD REM2 00 0. The headers for the displayed information are as follows:

- E# is the entry number.
- ID is the LEN drawer and circuit number for the LCD that is listed.
- COUNT is the quantity of call processing faults that the line has experienced during this period in the buffer.

- LAST TROUBLE TIME is the time that the most recent call processing fault occurred.
- TROUBLE DESCRIPTION is the trouble index code from Table 1-6, describing the type of fault.

Figure 1-12 LNSTRBL level-LISTALM display

```

CC   MS   IOD  Net   PM   CCS   LNS   Trks   Ext   APPL
.    .    NO CDR 2Bsy 1MSB6 .   DIAG  8 GC   .    .
      *C*
      MN C  *C*
LNSTRBL      MN   MJ   CR           LCD: REM2 00 0
0 Quit_  CP    0    0    1
2 Disp_           E#   ID COUNT  LAST TROUBLE TIME...TROUBLE DESCRIPTION
3 StopDisp  0    4  5    7  85/09/25 02:52:44 65. lockout off
4 ListAlm_  1   11  7    6  85/09/25 01:21:19 7.  Permanent signal
5           2    0 12    2  85/09/25 00:36:37 7.  Permanent signal
6 CreatSet  3    0 29    5  85/09/25 02:13:44 48. Line card fault
7           4   14  9    6  85/09/25 01:55:36 65. lockout off
8 Suppress  5    3  4    2  85/09/25 02:45:34 65. lockout off
9 Resume_  6    1  2    2  85/09/25 02:45:34 65. lockout off
10 QSup     7   19  3    5  85/09/25 23:26:25 48. Line card fault
11          8   19 31    5  85/09/25 23:29:14 48. Line card fault
12          9    0  3   12  85/09/25 04:16:09 65. lockout off
13
14          List Alm
15          REM2 00 0           MN
16 ClrAlm_
17 ClrBuf_
18
ADMIN
Time 13:48

```

Figure 1-13 LNSTRBL level-UEN display

```

XAC   MS      IOD   Net    PM    CCS    Lns    Trks    Ext    APPL
.     .      AMA E   .     1UEN  .     HZD    4C..   .     .
      M      M      *C*
UEN   SysB   ManB   OffL   CBSy   ISTb   InSv
0  Quit      PM      0      0      2      0      2      135
2  Post_     UEN     0      0      1      0      1      0
3  ListSet
4
5  Trnsl_    UEN UEN0 010 ISTb  LinksOOS: Cside 0 Pside 0
6  Tst_     Unit0: ISTb
7  Bsy_     Unit1: ISTb
8  RTS_     LSG:  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
9  OffL_    . . S S . . . . - - . . . . .
10 LoadPM_
11 Disp_
12 Next
13 SwLd_
14 QueryPM
15
16
17
18

      userid
TIME  hh : mm

```

Buffering process

The buffering process uses a pair of buffers that are allocated to each LCD by data that is entered in table LNSMTCE (see data schema section of *Translations Guide*). One of the pair of buffers, called the upper buffer, has a capacity of ten CP trouble entries that can be displayed by accessing the LNSTRBL level of the LTP (refer to chapter 6). It stores the following data:

- identification of the line in terms of its LEN drawer and circuit ID
- the time that the most recent CP trouble occurred on the line. It is expressed by year, month, day, hour, minute, and second.

- the total quantity of CP failures that have occurred on the line while it is in the two buffers
- the trouble index code and a short description of the most recent CP fault that was experienced by the line (A list of the trouble descriptions and their index codes is provided in the following table.)

Table 1-6 Trouble index codes for LNSTRBL level (Sheet 1 of 2)

Code	Description	Code	Description
1	Vacant code announcement	40	Coin Return failed
2	No ckt available: OG trk	41	ANI test failed
3	Misdirected CAMA ann.	42	Coin present test failed
4	Unauthorized code ann.	43	CP IOmsg lost
5	Emergency announcement	44	Bad CP IOmsg
6	INWATS outside valid zone	45	ANI failed, ONI succeeded
7	Permanent signal	46	Invalid ANI request
8	Partial dial	47	Bad Keyset
9	Extra pulse	48	Line card fault
10	False start	49	DU sync lost
11	Mutilated pulse	50	Ground Loop fail
12	Mutilated digit	51	Abandon on RP INC TRK
13	Invalid ST digit received	52	Overall RP timeout
14	ANI office failure	53	Invalid RP digit
15	ANI number failure	54	Undetermined RP error
16	ANI time out	55	Excess digits
17	No start dial: OG trunk	56	DP permanent signal
18	Integrity failure	57	MF permanent signal
19	Integrity lost	58	DGT permanent signal
20	False KP	59	DP reception trouble
21	Reversed trunk	60	MF reception trouble
22	Unexpected stop dial: OG trk	61	DGT reception trouble

Table 1-6 Trouble index codes for LNSTRBL level (Sheet 2 of 2)

Code	Description	Code	Description
23	Expected stop time out: trk	62	ANI reception trouble
24	CAMA position fault	63	ONI reception trouble
25	CAMA position trouble	64	Lockout on
26	Announcement mach trouble	65	Lockout off
27	Trunk reset failed: OG trk	66	Outpulsing trouble: OG trk
28	Trunk reset: OG trk	67	Routing trouble
29	Hit detected	68	Bipolar violation
30	Pre-route abandon	69	Foreign EMF detected
31	No 5 sig violation: OG trk	70	Foreign EMF removed
32	Dig RCVR noise high	71	No 3 wc extension blocks
33	Dig RCVR noise marginal	72	No perm extension blocks
34	No interdigit pause	73	No temp extension blocks
35	Large twist	74	No conference circuit available
36	More than two frequencies	75	No MULTIBLKS or CCBS avail
37	Fluctuation on MF receiver	76	No network connection available
38	Ringng failed	77-79	Reserved
39	Coin Collect failed	77-79	Reserved

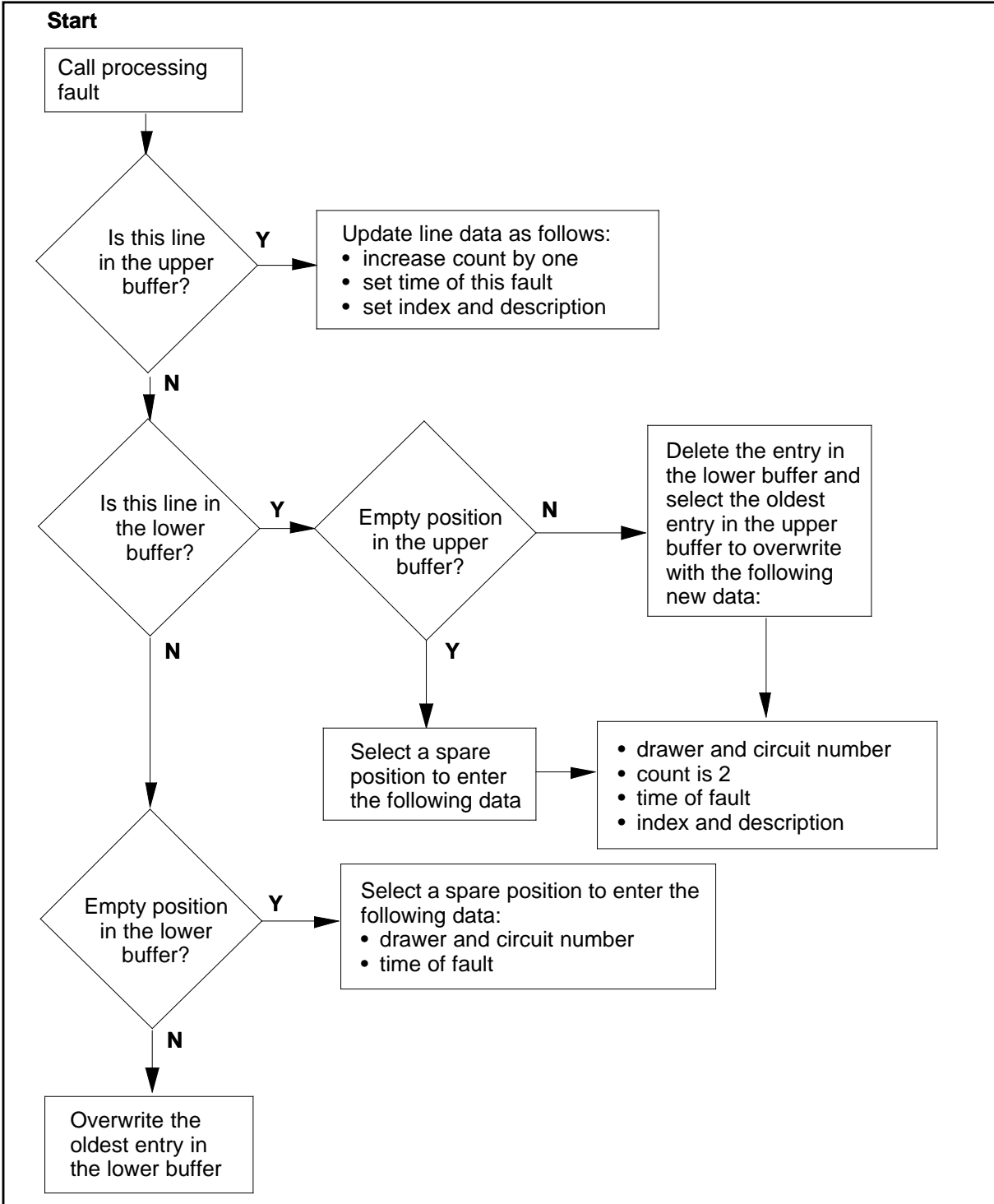
The other buffer, called the lower buffer, has a capacity of five CP trouble entries that cannot be displayed. It stores the following data:

- identification of the line in terms of its LEN drawer and circuit identification
- the time that the most recent CP trouble occurred. It is expressed by year, month, day, hour, minute, and second.

When a call processing failure occurs on a line, the data are stored in the lower buffer if that line does not have a current entry in that buffer. If the line has an entry in the lower buffer, the new data are entered in the upper and the CP failure count is established at two; the entry for that line is then deleted from the lower buffer. Subsequent CP failures update the data in the upper buffer, increasing the trouble count each time. If either buffer has all its entry positions

filled by other lines, the most recent line that experiences a CP failure overwrites the oldest entry in the buffer. Any subsequent CP failures that are experienced by the line whose entry is overwritten are treated as new sequences, starting in the lower buffer. The buffering process is shown in Figure 1-14.

Figure 1-14 Buffering process



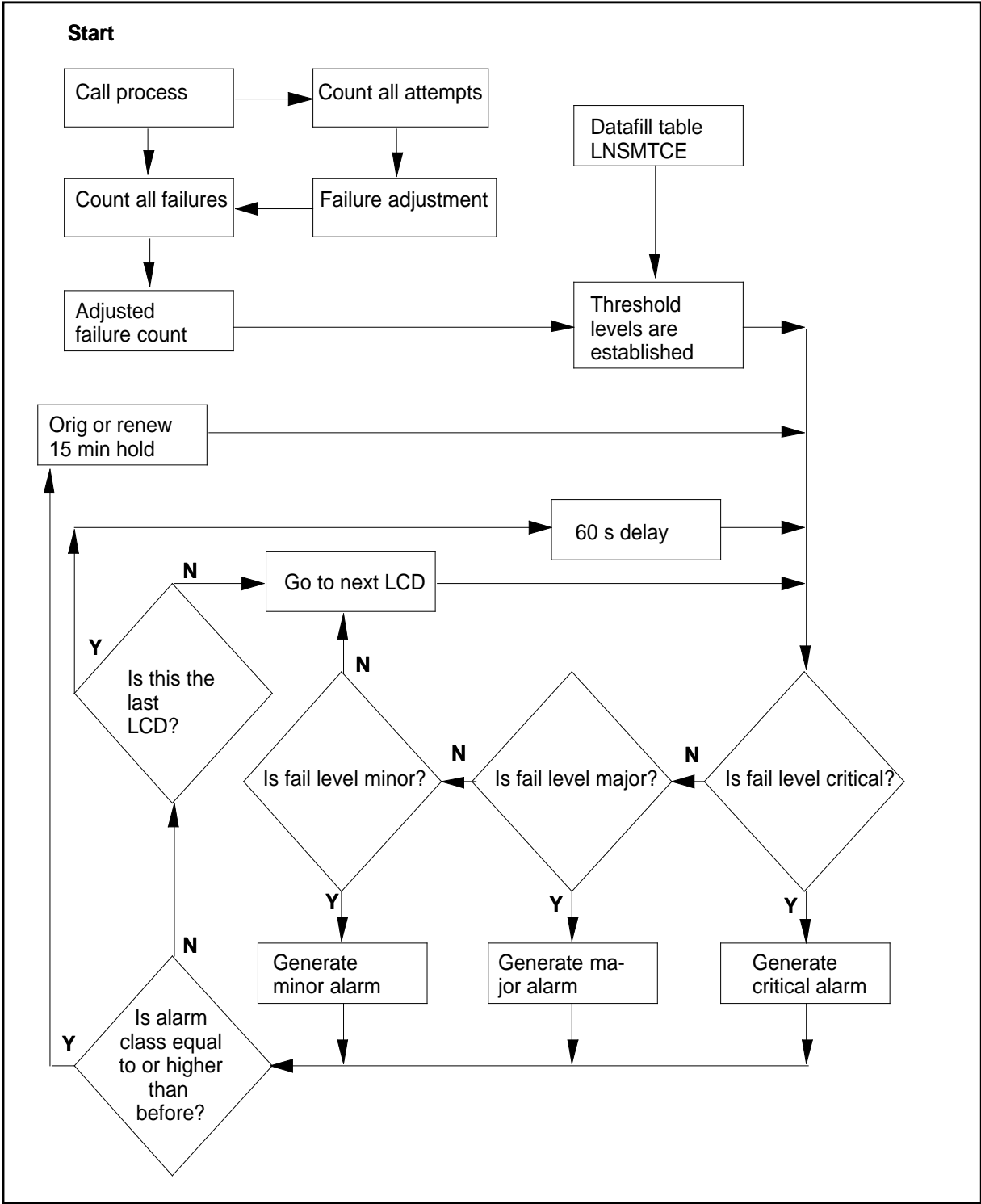
Thresholding process

The thresholding process generates an alarm when a predetermined quantity of call processing failures occurs in relation to call attempts.

The quantity of successful call attempts on an LCD (called the N value) and the quantity of CP failures on that LCD are measured. Each time the N value is reached, the quantity of CP failures is reduced by one to produce an adjusted failure count.

Every 60 s the adjusted failure count is compared to the threshold level of failures that are defined in table LNSMTCE (see data schema section of *Translations Guide*). The adjusted quantity of failures that reaches or exceeds the threshold of failures for a specific LCD determines if a minor, major, or critical class of CP alarm is generated. This process is called the thresholding process, and is shown in Figure 1-15.

Figure 1-15 Thresholding process



When a CP alarm is generated, it is maintained for a 15-min holding period. The alarm can be discontinued only by maintenance personnel, or if it is replaced by a higher class of CP alarm. When a higher class of CP alarm is generated, the previous holding period is terminated and a new 15-min holding period is started. The purpose of the holding period is to avoid momentary operation and release of alarms as conditions change and to provide maintenance personnel with an opportunity to perform maintenance.

Occasionally, when a CP alarm is generated, inspection at the LNSTRBL level of the LTP reveals an empty buffer. The empty buffer indicates that no line in the LCD had a short enough interval between failures to move it from the lower buffer to the upper buffer before it was displaced from the lower buffer by another line. This condition can be corrected by increasing the LCD Focused Maintenance alarm threshold in table LNSMTCE or by increasing the ATMPCNT value.

Automatic line testing description

Automatic line testing (ALT) tests subscriber lines without manual intervention by maintenance personnel. Line maintenance personnel define the test parameters at the ALT menu levels. The system starts the defined tests at the scheduled times. If required, ALT can be run manually without defining a schedule. The ALT menu level extends from the LNS maintenance menu level.

Line maintenance personnel can datafill table ATSCHEd (Automatic Line Testing Schedule) to define the test parameters for automatic line testing procedures. The tests are performed without manual intervention by maintenance personnel.

Note: VLCM lines do not support ALT-level commands. If you attempt to datafill table ALTSCHEd with a VLCM line or use an ALT-level command on a VLCM line, the following error message appears:

```
ALT command is not valid for VLCM line
```

The main ALT level contains commands which direct the user to a sublevel. The sublevel supports the commands to define tests. A sample of the main ALT level display is shown in Figure 1-16.

Figure 1-16 Main ALT level display

```
CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.       .       .       .       .       .       .       .       .       .

ALT
0 Quit_
2 Post_
3 ALTInfo_
4
5
6
7 Sdiag_
8 Diag_
9 LIT
10 Bal
11 Ckttst
12 BBT
13 BBTSUPDB
14 LCDCUT
15
16
17
18
  OPERATOR
  Time 10:00>
```

Tests accessed from the ALT menu level are discussed in the paragraphs that follow.

Tests performed by ALT

The extended diagnostic test (DIAG) consists of the subtests in Table 1-7. For an explanation of each of the tests that make up the DIAG and SDIAG test,

refer to the discussion of ALT diagnostic subtests in this section following Figure 1-17.

Table 1-7 Extended diagnostic subtests (Sheet 1 of 3)

Test	Types of line cards											
	1	2	3	4	5	6	7	8	9	10	11	12
Transhybrid loss	◆	◆			◆	◆	◆		◆		◆	◆
Channel loss for RCS lines										◆		
Attenuation pad	◆	◆			◆	◆	◆		◆			
Talk battery							◆					
Noise	◆	◆		◆	◆	◆	◆		◆	◆	◆	◆
Loop signal at line card		◆	◆					◆			◆	◆
Self test			◆					◆				
Loop signal at keyset		◆	◆									
Add-on and extension		◆										
Flux cancellation	◆	◆			◆	◆	◆		◆			
Echo return loss for RCS										◆		

Legend:

1. North American POTS line card (including GUL card NT6X33AA)
2. NT6X21 MBS line card
3. NT6X71 data line card
4. DMS-1R RCT subscriber carrier line card
5. NT2X18AD, NT6X18AB
6. NT6X93 international type A line card
7. NT6X94 international type B line card
8. NT6X76 AILC and NT6X99 IBERT
9. NT2X18AC, NT2X18AD, NT6X18AA
10. SLC-96 subscriber carrier line card
11. NT6X17BA Type A world line card
12. NT6X18BA Type B world line card

◆ = Test applies to numbered line card.

Table 1-7 Extended diagnostic subtests (Sheet 2 of 3)

Types of line cards												
Test	1	2	3	4	5	6	7	8	9	10	11	12
Loop detector	◆				◆	◆	◆		◆		◆	◆
Loop detector for RCT				◆								
Loop detector for RCS										◆		
Metering test							◆					◆
Two-party ANI for RCT				◆								
Equalization current detector		◆										
Buffer full flag		◆	◆									
Battery feed resistor	◆	◆			◆	◆	◆		◆		◆	◆
Reversal relay							◆		◆			◆
+48 Volt reversal relay					◆							
Ground start detector									◆			◆
Cutoff relay	◆	◆	◆		◆	◆	◆		◆			

Legend:

1. North American POTS line card (including GUL card NT6X33AA)
2. NT6X21 MBS line card
3. NT6X71 data line card
4. DMS-1R RCT subscriber carrier line card
5. NT2X18AD, NT6X18AB
6. NT6X93 international type A line card
7. NT6X94 international type B line card
8. NT6X76 AILC and NT6X99 IBERT
9. NT2X18AC, NT2X18AD, NT6X18AA
10. SLC-96 subscriber carrier line card
11. NT6X17BA Type A world line card
12. NT6X18BA Type B world line card

◆ = Test applies to numbered line card.

Table 1-7 Extended diagnostic subtests (Sheet 3 of 3)

Test	Types of line cards											
	1	2	3	4	5	6	7	8	9	10	11	12
Ring and supervision	◆				◆	◆	◆		◆		◆	◆
Ring test for RCS										◆		
Test access relay	◆	◆	◆		◆	◆	◆		◆			
Isolation relay test							◆					
Missing card test	◆			◆	◆	◆	◆		◆	◆	◆	◆
Current limit test (for world line card)											◆	◆

Legend:

1. North American POTS line card (including GUL card NT6X33AA)
2. NT6X21 MBS line card
3. NT6X71 data line card
4. DMS-1R RCT subscriber carrier line card
5. NT2X18AD, NT6X18AB
6. NT6X93 international type A line card
7. NT6X94 international type B line card
8. NT6X76 AILC and NT6X99 IBERT
9. NT2X18AC, NT2X18AD, NT6X18AA
10. SLC-96 subscriber carrier line card
11. NT6X17BA Type A world line card
12. NT6X18BA Type B world line card

◆ = Test applies to numbered line card.

The DIAG display is accessed from the main ALT menu. The DIAG display is shown in Figure 1-17.

Figure 1-17 ALTDIAG sublevel display

```

CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.       .       .       .       .       .       .       .       .       .

ALTDIAG
0 Quit_      TESTID: x              Status: a
2 Post_      prime testid: x        Linetype: 1
3           STARTLEN          ENDLEN
4 Start_     site ff u dd cc  site ff u dd cc
5 Stop       PASS      FAIL      N/A      TOTAL
6 Remove     Total      n         n         n         n
7 Define_    Current   n         n         n         n
8 Submit     MON       TUE      WED      THU      FRI      SAT      SUN
9           cont  hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
10          start hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
11 DefMAN    stop  hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
12
13 DefSCHED_
14
15 Status_
16
17 OVRride_
18
OPERATOR
Time 10:00>

```

The diagnostic subtests listed in Table 1-7 are described as follows:

- The *transhybrid loss* test measures the loss between the line card and the network. The measured loss is compared by the DMS-100 with the expected loss for the line circuit under test. Measurements that are less than, or equal to, the established threshold are reported as *Pass*. Measurements that exceed the threshold values are reported as *Fail*. Measurements are made by transmitting a tone of 304 Hz, 704 Hz, 1504 Hz, and 3204 Hz.
- The *channel loss for RCS lines* test checks the RCS line channel for loss while there is a termination across tip and ring. Measurements are made by transmitting a tone of 304 Hz tone, 704 Hz, and 3204 Hz tone. The tone signals that are sent to the line circuit are reflected to the transmission test unit (TTU) by the voice frequency transformer. The reflection is because of the impedance mismatch caused by the reflective termination between tip and ring.
- The *attenuation pad* test checks the 0, 1, 3, and 7 dB attenuation pads in the line circuit under test. Each of the attenuation pads is tested by performing a transhybrid loss test.
- The *talk battery test* checks the battery lead (B) and ground lead (A) circuit of the NT6X98 Line Card. The dc voltage between the A lead and ground

is measured to verify that the voltage is between +4 V and -4 V. The dc voltage between the B lead and ground is measured to verify that the voltage is between -42 V and -56 V.

- The *noise test* checks for the presence of noise in the line card under test. For RCS lines, this test also checks for noise in the channel. The reflective termination from the channel loss test is used. Noise levels that are less than or equal to the established threshold are reported as *Pass*, while those that exceed the threshold value are reported as *Fail*.
- The *loop signaling test at the line card* checks the operation of the signaling chip. The test is performed with the line card cut-off relay operated to prevent test signals from reaching the set. A message is sent to the signaling chip on the line card where it is looped back. The transmitted signal is compared with the received signal and reported as *OK* or *Fail*.
- The *data line card self test* checks that the circuit components are functioning according to specifications. The following components are checked:
 - external RAM
 - internal RAM
 - line card CPU
 - ROM
- The *loop signaling test at a keyset* checks the ability of a Meridian business set and its line card to exchange messages. A test message is sent to the keyset and returned to the line card where the transmitted message is compared with the received message.
- The *add-on and extension test* checks for the presence of an MBS add-on or extension and performs a loopback test. The test only runs when the loop signaling test at the keyset has passed. A message is looped at each of the eight possible MBS and add-on addresses. The datafill for each address is checked to determine if a set or add-on is expected. The transmitted message is compared with the received message.
- The *flux cancellation test* checks the flux cancellation circuitry on the POTS line card or the MBS line card. A termination of either 600 W or 900 W is placed between the tip (A) and ring (B) leads, and then a transhybrid loss test and analysis test is conducted.
- The *echo return loss for RCS lines test* measures loss using the ABSORB termination or the ABSORB/NTPG termination connected between the tip and ring of the line circuit.
- The *loop detector test* checks the ability of a POTS line circuit to recognize an off-hook condition on a loop-start line. Supervision circuitry responses are checked by the DMS-100 switch for the correct status changes. If the option NTPG is set, then this test is by-passed.

- The *loop detector test for DMS-IR RCT lines test* checks the ability of the line to detect an on-hook condition. The test results are transmitted to the host SMR.
- The *loop detector test for RCS lines test* checks the ability of the line circuit to detect off-hook and on-hook conditions.
- The *metering test* tests type B international line cards for the presence and suitability of the signal provided by the metering tone card. A metering signal is applied to the PCM side of the line card under test while the frequency amplitude and duration of the signal is measured. The type B world line card does not require an NT6X95 tones card because the tones function is included in the NT6X18BA.
- The *two party ANI test for RCT lines test* identifies the tip party on a two party line.
- The *equalization current detector test* checks the ability of the line card to detect the presence of equalization current.
- The *buffer full flag test* verifies that the keyset receives the signaling message sent from an MBS line card.
- The *battery feed resistor test* checks that both battery feed resistor values are correct. It also checks that the -48 V battery and ground feeds are present at the loop side of the line circuit. The tip (A) and ring (B) leads are terminated with a 47 Ω resistor while the dc voltage between ring (B) and Ground leads is measured using the line test equipment (LTE).
- The *reversal relay test* checks that the RV relay operates and releases. The RV or RV1 relay is operated while the tip to ground and ring to ground voltages are measured. This test is by-passed when option NTGD is set.
- The *+48 volt reversal relay test* checks that the NT2X18AD Digitone fraud prevention circuit functions properly. The RV2 relay is operated and released while the tip to ground and ring to ground dc voltages are measured with the LTE.
- The *ground start relay test* checks that the ground start circuitry functions properly. The TP relay is released and the tip and ring leads are terminated with a 47 Ω resistor. The DMS-100 switch compares the actual voltage measurement of the line card under test with the expected measurement. This test is by-passed when option NTGD is set.
- The *ground start detector test* checks the ability of the line circuit to recognize an off-hook condition on a ground start loop. The DMS-100 switch checks for on-hook and off-hook conditions using different terminations across the ring and ground leads.
- The *cutoff relay test* checks that the line circuitry functions properly. The cutoff relay is operated while the dc voltage between ring (B) and Ground leads is measured using the line test equipment.

- The *ring and supervision test* checks that ringing is sent to the tip and ring leads of the line circuit. The CO relay is operated to prevent the ringing signal from being transmitted to the station. The line card rings toward its loop and the transmission test unit (TTU) measures the reflected ringing level.
- The *ringing test for RCS lines* verifies the ringing pattern produced by the channel unit. A channel loss test and ANI ground test are conducted to ensure that proper termination is connected to the line circuit during ringing.
- The *test access (TA) relay test* checks that the test access relay on a line card releases. The test access relay is released and the dc voltage on the ring lead is measured with the LTE. Absence of voltage on the ring lead confirms release of the TA relay. Presence of -48 V on the ring lead indicates a failure.
- The *isolation relay test* verifies that there is no connection to the subscriber loop when the isolation relay is operated for international type B lines.
- On the NT6X18AA, the ground-loop mode is controlled by a switch on the card. However, on the world line card (NT6X18BA), the ground-start relay is controlled by software. When the ground start relay is released it is ground start, and loop start when it is operated.
- The *missing card test* verifies the ability of the card to read and write from the test register. A 4-bit test pattern is written to the test register on the world line card and then the test pattern is read. The DMS-100 switch fails the test if the returned pattern is not the expected pattern.
- The *current limit test* tests the drive circuitry to the current limit circuit on the world line card. The TA relay is operated, the MTU/LTU is connected to the TA bus, the line card is terminated with a 47 Ω resistor, and the line card current limit is set to 40 mA. The tip to ring voltage is measured across the 47 Ω resistor.

The short diagnostic test (SDIAG) test consists of a subset of the DIAG subtests as shown in Table 1-8.

Table 1-8 Short diagnostic subtests

Types of line cards											
Subtest	1	2	3	4	5	6	7	8	9	10	11
Transhybrid loss	◆	◆			◆	◆	◆		◆	◆	◆
Attenuation pad	◆	◆			◆	◆	◆		◆		
Noise	◆	◆		◆	◆	◆	◆		◆		
Loop signal at line card			◆					◆			
Self test			◆					◆			
Loop signal at keyset		◆									
Loop detector for RCT				◆							
Ring and supervision	◆				◆	◆	◆		◆	◆	◆
Missing card test										◆	◆

Legend:

1. North American POTS line card (including GUL card NT6X33AA)
2. NT6X21 MBS line card
3. NT6X71 Data line card
4. DMS-1R RCT subscriber carrier line card
5. NT2X18AD, NT6X18AB
6. NT6X93 international type A line card
7. NT6X94 international type B line card
8. NT6X76 AILC and NT6X99 IBERT
9. NT2X18AC, NT2X18AD, NT6X18AA
10. NT6X17BA Type A world line card
11. NT6X18BA Type B world line card

◆ = Test applies to numbered line card.

Note: SDIAG does not run on WORKING EBS lines (NT6X21 line cards).

The SDIAG display is accessed from the main ALT menu. The SDIAG display is shown in Figure 1-18.

Figure 1-18 ALTSDIAG sublevel display

```

CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.       .       .       .       .       .       .       .       .       .

ALTSDIAG
0 Quit_      TESTID: x           Status: a
2 Post_      prime testid: x     Linetype: 1
3           STARTLEN           ENDLEN
4 Start_     site ff u dd cc    site ff u dd cc
5 Stop       PASS      FAIL      N/A      TOTAL
6 Remove     Total     n         n         n         n
7 Define_    Current  n         n         n         n
8 Submit     MON      TUE      WED      THU      FRI      SAT      SUN
9           cont   hh:mm   hh:mm   hh:mm   hh:mm   hh:mm   hh:mm   hh:mm
10          start  hh:mm   hh:mm   hh:mm   hh:mm   hh:mm   hh:mm   hh:mm
11 DefMAN    stop    hh:mm   hh:mm   hh:mm   hh:mm   hh:mm   hh:mm   hh:mm
12
13 DefSCHED_
14
15 Status_
16
17 OVRride_
18
OPERATOR
Time 10:00>

```

The automatic balance selection (ABS) on-hook balance network test (BAL) determines whether a subscriber loop is loaded or unloaded. The BAL display is accessed from the main ALT menu. The BAL display is shown in Figure 1-19. For a discussion of the ABS on-hook balance test, see Section , "ABS on-hook balance network test" on page 8-78.

Figure 1-19 ALTBAL sublevel display

```
CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.       .       .       .       .       .       .       .       .       .

ALTBAL
0 Quit_      TESTID: x              Status: a
2 Post_      prime testid: x        Linetype: 1
3           STARTLEN          ENDLEN
4 Start_     site ff u dd cc      site ff u dd cc
5 Stop              PASS  FAIL  N/A  TOTAL
6 Remove      Total  n      n      n      n
7 Define_     Current n      n      n      n
8 Submit              MON   TUE   WED   THU   FRI   SAT   SUN
9           cont  hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
10          start hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
11 DefMAN     stop  hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
12
13 DefSCHD_
14
15 Status_
16
17 OVRride_
18
  OPERATOR
  Time 10:00>
```

The line insulation test (LIT) detects foreign potential and inadequate conductor leakage resistance on the loop facility. The LIT display is accessed from the main ALT menu. The LIT display is shown in Figure 1-20.

Figure 1-20 ALTLIT sublevel display

```

CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.       .       .       .       .       .       .       .       .       .

ALTLIT
0 Quit_          TESTID: x          Status: a
2 Post_         prime testid: x    Linetype: 1
3              STARTLEN          ENDLEN          Test
4 Start_       ssss ff u dd cc  ssss ff u dd cc  EMF v
5 Stop
6 Remove          PASS    FAIL    N/A    TOTAL    RG r
7 Define_       Total  n      n      n      n      TR r
8 Submit        Current n      n      n      n      CAP c
9              MON    TUE    WED    THU    FRI    SAT    SUN
10             cont  hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
11 DefMAN       start hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
12             stop  hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
13 DefSCHD_
14
15 Status_
16
17 OVRride_
18
OPERATOR
Time 10:00>

```

The keyset line circuit test (CKTTST) tests keyset lines. Keyset lines can be MBS lines, asynchronous interface modules (AIM), integrated bit error rate testers (IBERT), or data lines.

When the CKTTST is run on keyset lines, a specified number of messages are sent out toward the subscriber terminal. The messages are looped back at the line card or at the subscriber terminal and the received messages are compared with the transmitted messages. Since analog interface module (AIM) and IBERT lines do not have terminals, the messages can be looped back only at the line card.

Note: Do not press any key on an MBS or data line terminal during an ALT_CKTTST run at the terminal.

The CKTTST display is accessed from the main ALT menu. The CKTTST display is shown in Figure 1-21.

Figure 1-21 ALTCKTTST sublevel display

```

CC      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.      .      .      .      .      .      .      .      .      .

ALTCKTTST
0 Quit_      TESTID: x      Status: a
2 Post_      prime testid: x      Linetype: 1
3      STARTLEN      ENDLEN
4 Start_      site ff u dd cc      site ff u dd cc
5 Stop      PASS      FAIL      N/A      TOTAL
6 Remove      Total      n      n      n      n
7 Define_      Current      n      n      n      n
8 Submit      MON      TUE      WED      THU      FRI      SAT      SUN
9      cont      hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
10     start      hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
11 DefMAN      stop      hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm hh:mm
12
13 DefSCHD_
14
15 Status_
16
17 OVRride_
18
OPERATOR
Time 10:00>

```

Test streams

When a test is defined, the group of LENSs to be tested is split into a number of subgroup LENSs. The splitting of the LENSs into subgroups depends on the test equipment available and the number of lines to be tested. The subgroups define *streams* which allow simultaneous testing of LENSs based on the number of streams.

When tests start, a *stream* causes a process to be created. The function of the process is to run the actual test on the LENSs. An office parameter limits the total number of processes that can be created to do ALT testing in the office.

There are many different LCD types (such as LM, LCM, RCU, digital line module [DLM]) and each has its own requirements for test connections. Stream calculation (performed by ALT) depends on the LCD types associated with the LENSs that have been defined.

A one-to-one relationship exists between a stream and the LCD test equipment. The test equipment required for testing depends on the type of test to be performed.

There are two test types:

- those requiring a metallic connection
- those that do not require a metallic connection

When the LENs are defined for an ALT test, the LEN range is broken down into a number of smaller testable LEN ranges. The smaller testable LEN ranges are based on the smallest testable unit for an LCD which is an LCD test set. The break down of LCDs into LCD test sets depends on the connectivity rules for the LCD.

An LCM requires two verticals. One vertical allows metallic connections to LENs in drawers 0 through 9. Drawers 10 through 19 connect to the other vertical. The smallest testable unit for an LCM is the LENs associated with the verticals.

Two metallic connection types exist:

- single connection is the MTA vertical that is to serve a single LCD only. This connection in turn allows either one or two verticals depending on the type of LCD.
- multiple connection is the MTA vertical that is to serve a multiple of LCDs. This connection is only allowed for one vertical LCD.

Two verticals for each LCD allow two LCD test sets to use one or the other vertical. As these are two separate connections, either one or two streams can be used to test this type of LCD.

Table 1-9

LCD test set	LEN ranges for LCD
1	LCM 1 drawers 0-9
2	LCM 1 drawers 10-19

One vertical for each LCD allows one LCD test set, which can only be tested by one stream.

Table 1-10

LCD test set	LEN ranges for LCD
1	RCS 1

One vertical for multiple LCDs allows the same number of LCD test sets as the number of LCDs on the vertical. However, as tests require access through the same vertical, only one stream can be used to test each of these LCD test sets.

Table 1-11

LCD test sets	LEN ranges for LCD
1	RCT-1
2	RCT 2
3	RCT 3

Certain LCDs do not require the MTA connections to perform ALT tests (for example, BAL and SDIAG do not use the MTA). In these cases, only two tests can run concurrently for each LCD. The rule restricts to two the number of LCD test sets for non-metallic testing.

For a DLM, metallic testing is not required, and the smallest testable unit is as follows.

Table 1-12

LCD test set	LEN ranges for LCD
1	DLM 1 drawers 0-9

For an LCM having a SDIAG, the smallest testable unit is as follows.

Table 1-13

LCD test sets	LEN ranges for LCD
1	LCM 1 drawers 0-9
2	LCM 1 drawers 10-19

ALT test cycles

ALT has three testing cycles:

1. First cycle-This is the first test on a LEN for the current test session and applies to both manual and scheduled TESTIDs (for an explanation of

TESTID, see "Assigning an identifier to a scheduled test" on page 1-71). It reports to the tester process the result of the test on the LEN.

2. Retest 1-Only applies to scheduled TESTIDs. This test is performed if the first cycle test detected a faulty line. If retest 1 finds that no fault exists, the passed and failed counts are adjusted.
3. Retest 2-Only applies to scheduled TESTIDs. This test is performed if the retest 1 test is also faulty. If retest 2 finds that no fault exists, the passed and failed counts are adjusted.

Retests

Every attempt is made by ALT to ensure that retests are performed and completed. However, if test equipment or peripherals develop problems which prevent line diagnostics, the retest cannot be completed.

If retests cannot be completed for any reason, and the time for the scheduled TESTID expires, data are no longer available for the next test session to retest the lines. Between test sessions the lines not retested may be fixed by operating company personnel.

The ALT feature uses the following algorithm to determine when retesting starts.

$$(\text{Number of failed LENs in the LCD test set} \times (2 \times \text{the time to perform one retest})) + 200 \text{ s} = \text{Time required to complete retest}$$

The time required to complete the retest is compared against the time remaining for the scheduled time span. If the time required is less than the time remaining, retesting begins. The LENs not yet tested for the LCD test set are tested in the next scheduled time.

If the retest is completed before the scheduled ALT test time span expires, the status of the TESTID remains *active* until the expiration time. This prevents the TESTID from being started up again by audits or by the start-up process.

Table 1-14 provides the values that are used to determine the test time for a given test type.

Table 1-14 Time to perform one retest based on test type (Sheet 1 of 2)

Test type	Seconds to perform one retest
SDIAG	15 s
DIAG	60 s
Note: Lines which were skipped are not considered for retest.	

Table 1-14 Time to perform one retest based on test type (Sheet 2 of 2)

Test type	Seconds to perform one retest
LIT	15 s
BAL	5 s
CKTTST	0
Note: Lines which were skipped are not considered for retest.	

Note: If a currently running test is stopped or overridden from a command at the ALT level or if a date or time change stops a test, a retest is not performed.

Factors that affect testing

The factors that affect ALT testing are presented in this section

Effect of line states on ALT The state of a line determines whether an ALT test is performed or whether the test is skipped. When LENS are skipped, they are not revisited. Skipped LENS are reflected in all counts on the MAP display or in log reports.

Table 1-15 lists line states and the action that is taken for each state.

Table 1-15 Line states and appropriate actions (Sheet 1 of 2)

Line state	Meaning	Action
NEQ	Line unequipped	A LEN in this state is skipped because there is no datafill for this line card.
INB	Line offline	A LEN in this state is assumed to have a line card in the LCD circuit and ALT tests are performed.
MB	Line man busy	A LEN in this state is tested by ALT.
MB	Line man busy seized	Another maintenance process has this LEN, ALT does not test the line and skips it.
SZ	Line seized (not used)	ALT does not test the line and skips it.
CUT	Line CUT	ALT does not test the line and skips it.

Table 1-15 Line states and appropriate actions (Sheet 2 of 2)

Line state	Meaning	Action
LMB	Line LCD busy	The PM or a drawer of the LCD is in a state which does not allow testing. (For example, the PM is C-side busy [CBsy], system busy [SysB], or manually busy [ManB]). If this state is the result of either a line drawer or the PM being busy, then the LEN is skipped only if in the first cycle ALT test. When the retest is performed on failed lines and the line is in the LMB state, the previous test cycle result is retained.
SB	Line system busy	The LEN is not tested by ALT as another line maintenance process ICMO has it in a queue for testing.
LO	Line lockout	ALT skips LENs in this state.
DEL	Line deloaded	The line is in transition from CPB to CPD. The line is not tested by ALT and is skipped.
CPB	Line call processing busy	The line is not tested by ALT because the LEN is involved in a call.
CPD	Line call processing busy deload	The line is not tested by ALT because the LEN is involved in a call.
IDL	Line idle	ALT tests LENs in this state.
PLO	Line permanent lockout	ALT skips LENs in this state.
DMB	D-channel maintenance busy [for integrated services digital network (ISDN) lines]	The line is not tested by ALT because the LEN is involved in a call and the data side is being used.

VLCM line states Table 1-16 indicates the valid line states of the VLCM lines. All the states are supported.

Table 1-16 Valid line states (Sheet 1 of 2)

Line state	Interpretation
IDL	Line is in service and on-hook.
CPB	Line is involved in a call.
MB	Line has been removed from service by BSY command.
CPD	In CPD state, MB pending.

Table 1-16 Valid line states (Sheet 2 of 2)

Line state	Interpretation
LMB	VLCM is either out of service, or both its C-side links are out of service.
LO	The switch has put the line in the temporary out of service state.
PLO	Line is in off-hook state for excessive time.
DEL	Temporary state between CPD and MB.
NEQ	Line is not datafilled in LNINV table.
INB	Line is datafilled in LNINV table OR BSY INB command was performed.

Effect of line options or classifications Some lines are skipped because of options or classification and some only apply to certain types of tests as described in the following table:

Table 1-17 Line states and appropriate actions

Line state	Meaning	Action
NLT	No LIT test	Feature option on a LEN that causes the LIT test to skip the LEN. If NTL is set, the subscriber loop test will not run.
MNO	Manual network override	Set in table LNINV and causes the LEN to be skipped for the ALT BAL test type.
PBX	Line class code PBX	LENs assigned the line class code are skipped by all test types.
PBM	Line class code PBM	LENs assigned this line class code are skipped by all test types.

Hardware assigned software unassigned lines The BAL test type skips hardware assigned software unassigned (HASU) lines because the balance network test has no affect on these lines.

Line card failure flags When lines are being tested by ALT, a line card failure flag may be set against the line card. In some cases, these failure flags placed against lines are handled by a different process. Table 1-18 lists the tests

and actions for a line card with a failure flag when ALT is testing it on a first pass.

Table 1-18 Line card failure flags and appropriate actions

Failure flag	Test/action taken by ALT on first pass
D	Long diagnostic/ALT to retest
F	Facility fault/ALT to retest
S	Short diagnostic/ALT to retest
N	Needs long diagnostic/ALT to retest
m	Set missing/ALT to retest
M	Line card missing/ALT to retest
Q	Shower queue/skip (handled by the shower queue)
I	Incoming message overloading (ICMO) major/skip (handled by the ICMO queue)
i	ICMO minor/skip (handled by the ICMO queue)
U	Utility card/ALT to retest

Depending on the ALT test type being run, a LEN can be skipped because the failure flag indicates that the test to be performed cannot be done. For example, a BAL test is skipped on a LEN with an *M* failure flag because the *M* reason can only be removed by a DIAG test either from the LTP or ALT menu level.

Test equipment failure conditions The test equipment used for line testing involves two kinds of equipment. A combination of both or just one type can be used for testing.

- LTE-line test equipment, which may be either an LTU or MTU. This test equipment is a static resource. It can only connect to a limited number of lines because it requires a metallic connection. Lines which require this type of test equipment require specific datafill to identify the physical connection relationships.
- TTE-trunk test equipment, which may be either a TTU, TTT. This test equipment is a pool resource. It connects across the network to the line being tested. The next available circuit of this type is given to the testing process when a request for test equipment is made.

Figure 1-22 shows the use of line test equipment.

Figure 1-22 Example of TTE equipment use

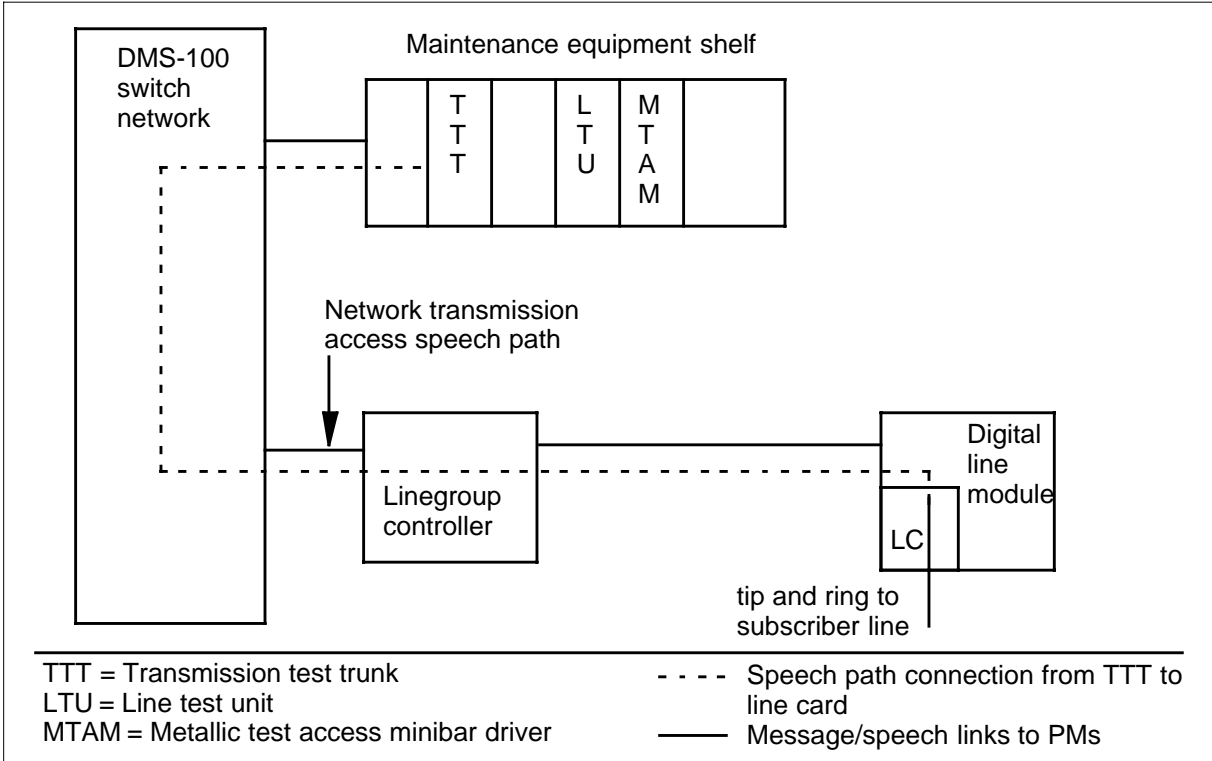
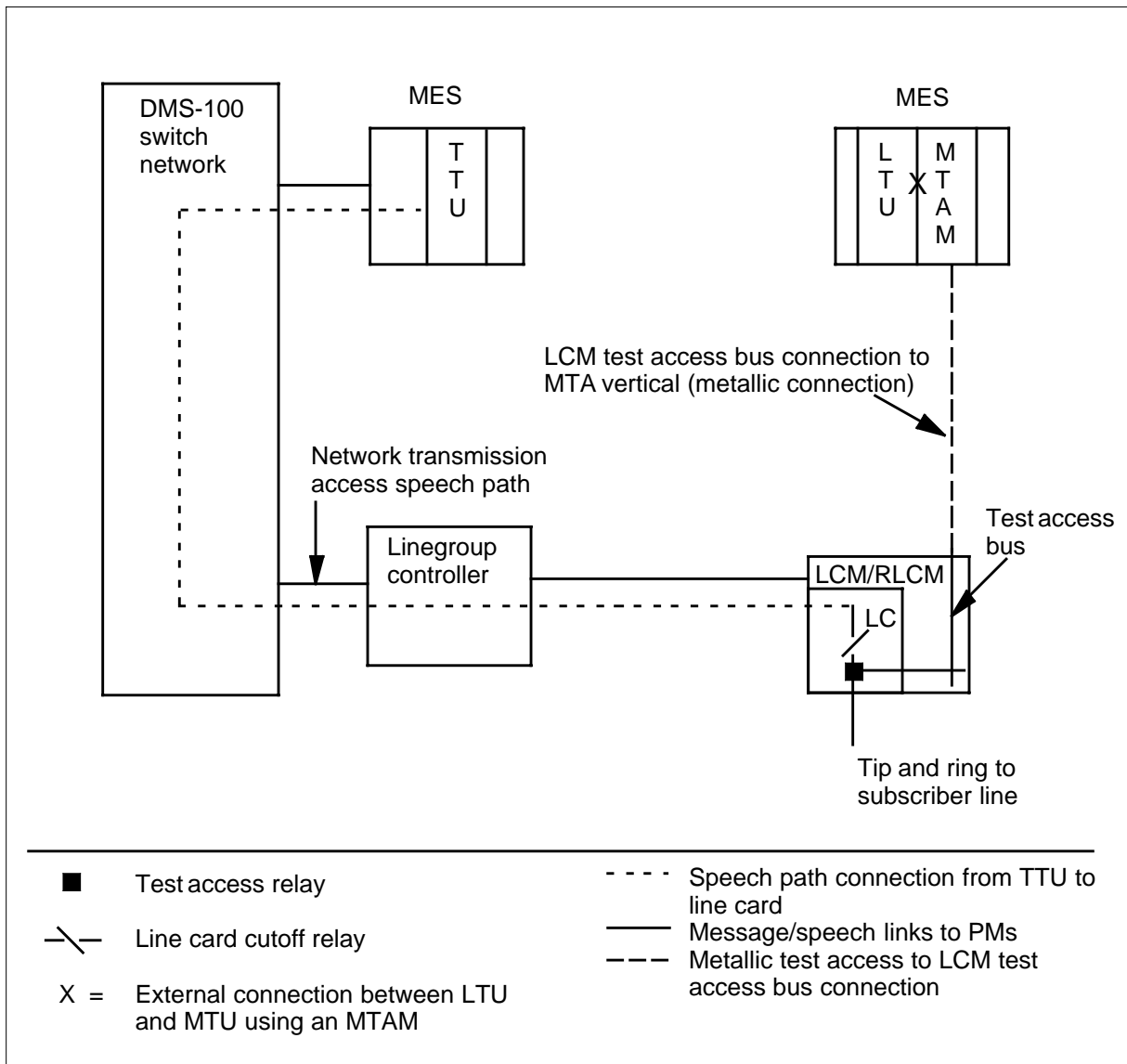


Figure 1-23 shows the use of trunk test equipment.

Figure 1-23 Example of LTE and TTE equipment use



Test equipment used for an ALT test can be faulty before testing commences or can acquire a fault during testing. A scheduled ALT test that has been started and scheduled to test at the current time has a status of *active*. Otherwise, it has a status of *inactive*. If the ALT test determines that there are equipment problems, the test status is *active with faults*. The faults can be with the test equipment being used or with a connection.

For an active ALT test status to be set to a fault state, one or more of the streams or LCD test sets must have problems. The two states for streams and LCD test sets are held and suspended. Either one makes an active ALT test status *active with faults*. These two states result in different actions to be taken by the ALT.

When a stream is in a held state, an attempt is made every 30 min to resume testing. Circuits must pass diagnostics to resume testing. A diagnostic failure keeps the stream in the held state.

For test equipment to become IDL or INI (with PM in service), the trunk audit or intervention by maintenance personnel is required to return the circuit to service.

Held streams cannot be retested. When held streams are in retest and testing resumes with insufficient time to retest all the failed lines, the remaining lines are not retested.

A suspended test stream or LCD test set means that no attempt is made to resume testing as it is likely to cause more failures because of faulty test equipment or connections. This failure requires manual intervention to determine and resolve the problem. Suspended LCD test sets do not perform retests on failed lines.

The test determines the state of each stream and LCD test set according to specific rules.

Prior to commencing any ALT test, the LTE and TTE are diagnosed. External test equipment such as metallic test access (MTA) drivers are not diagnosed. If all test equipment passes diagnostics, then testing commences. When test equipment fails a diagnostic, the equipment is made SB and a TRK106 log is generated.

When the diagnostics fail, the following actions are taken.

- When test equipment is a pooled resource, an attempt is made to select another IDL or INI and PM in-service circuit.
- When test equipment is a pooled resource and there are no more IDL or INI and PM in-service circuits, the stream requiring this test equipment is placed in a *held* state.
- When test equipment is a *static* resource, the stream is placed in a *held* state.

While ALT tests are actively running, line card failures can be caused by the following situations:

- Situation 1 test equipment unavailable for ALT (caused by busy PMs, force released, system and maintenance personnel overrides)
- Situation 2 test equipment fault
- Situation 3 faulty line cards
- Situation 4 faulty network or metallic connections occurring

In situation 1, test equipment becomes unavailable and the stream using this test equipment is placed in a *held* state.

In situations 2 and 3, the results from line card tests are used to determine the action to be taken. The line card test can pass or the display of one of following failure flags:

- D-long diagnostic
- F-facility fault
- S-short diagnostic
- N-need long diagnostic
- m-set missing
- M-line card missing
- Q-shower queue
- I-ICMO major
- i-ICMO minor
- U-utility card

In situation 4, the failure conditions are reported and acted upon. This type of fault immediately causes the test equipment to be suspected.

The following four kinds of failure conditions cause the test equipment to be suspected:

- The last four consecutive line card tests give failure flags of D, F, S, or U.
- The last eight consecutive line card tests give failure flags of D, F, S, U, or m.
- The last eight consecutive LIT tests produced failures.
- A connection request is made of the test equipment and it fails. (For example, PM goes busy during use of test equipment or no response from PM).

If test equipment is determined to be suspect, all the test equipment is rediagnosed. If the diagnostic fails, the circuit is made SB and a TRK106 log

is generated. Based on the type of equipment failing, different actions are taken:

- Where test equipment is a pooled resource, an attempt is made to select another IDL or INI and PM in-service circuit.
- Where test equipment is a pooled resource and there are no more IDL or INI and PM in-service circuits, the stream requiring this test equipment is placed in a *held* state.
- Where test equipment is a static resource, the stream is placed in a *held* state.

If the diagnostics pass and no new test equipment is selected, the currently active stream and LCD test set are identified internally as having a *1st suspicion*. Testing resumes and the *1st suspicion* is removed if a line card test passes. The next suspicion is based on the next four or eight line cards to be tested.

If the failure conditions still continue to occur, then the test equipment is suspected for the second time. The following algorithm is applied:

- The test equipment is *not* rediagnosed as it was tested previously and is expected to pass again.
- If the line card failure flags contained an *m*, both the stream and LCD test set are no longer suspected and testing resumes.
- If the LCD test set is suspended, a log is output for the LCD test set suspension.

Other LCD test sets are suspended if they use the same vertical and had to be grouped when assigned a stream.

— Test on LCD test set requires metallic connection.

The LCD test sets that share the vertical are also suspended.

— Test on LCD test set requires only a network connection.

The LCD test sets on the same LCD and assigned to the same stream are also suspended.

- The next waiting LCD test set for the stream is selected.
- The stream is identified internally as having a *2nd suspicion*.
- Testing resumes and if a line card test passes, the *2nd suspicion* is removed. (That is, the stream's test equipment is no longer suspect. However, the suspended LCD test sets have problems which cannot be identified by ALT.)

If the failure conditions still continue and this is the third time, the stream is suspended since some problem exists which ALT is unable to identify.

Early retest strategy A new retest strategy is applied on an LCD test set basis. An algorithm determines when to start retesting.

(Number of failed LENs in the LCD test set x (2 x the time to perform one retest))
+ 200 s = time required to complete retest

The time required to complete the retest is compared against the time remaining for the scheduled time span. If the time required is less than the time remaining, retesting begins. The LENs not yet tested for the LCD test set are tested in the next scheduled time.

If the retest is completed before the scheduled ALT test time span expires, the status of the TESTID remains *active* until the expiration time. This prevents the TESTID from starting up again as a result of audits or the start up process.

Lines which were skipped are not considered for retest.

Note 1: If a currently running test is stopped or overridden from a command entered at the ALT level or if a date or time change stops a test to be stopped, a retest is not performed.

Note 2: If a currently running test is temporarily suspended while an image is being taken and if that test subsequently becomes inactive, a retest is not performed.

Table 1-19 provides the values that are used to determine the test time for a given test type and line type being tested.

Table 1-19 Time to perform one retest

Test type	Line type	
	Standard	ISDN
SDIAG	15 s	200 s
DIAG	60 s	400 s
LIT	15 s	45 s
BAL	5 s	Not applicable
CKTTST	Not applicable	Not applicable

A TESTID that is set to run a line type of *all* uses the appropriate standard or ISDN value for the LEN line type under test which fails.

ALT while an image is being taken ALT automatically suspends testing temporarily while a safe image is being taken.

ALT scheduled tests that are currently *inactive* are not started while a safe image is being taken. When the safe image is completed, scheduled tests, which did not start because of the dump, are started by either the ALT hourly audit or by another ALT scheduled test starting or stopping.

ALT manual tests are started when requested; however, no lines are tested while the safe image is being taken.

No *active* or *active with faults* ALT tests, both manual and scheduled, test lines while a safe image is being taken. ALT resumes testing within 15 min upon completion of the safe image.

The counts for a TESTID do not change until testing resumes within 15 min upon completion of the safe image since no lines are being tested.

ALT tests, both manual and scheduled, which are currently *active* or *active with faults* are changed to *inactive* while a safe image is being taken. However, the resources for the tests are not deallocated until the safe image has been completed.

A retest is not performed for those ALT tests which are changed to *inactive* while a safe image is being taken. If a retest is currently in progress when the safe image begins and if there is not sufficient time to complete the retest once the safe image has been completed, the retest is not completed.

Procedures for establishing automatic line testing

Each paragraph in this section deals with a specific task. Each task is performed at a MAP terminal configured as an LTP. Each task has an explanation of the purpose of the task and a procedure for performing the task.

If the procedure for a task requires a command that can be entered with parameters, the parameters and the proper use of the command and its parameters are discussed in *DMS-100 Family Commands Reference Manual*, 297-1001-822.

Sequence of tasks for a scheduled ALT The following list shows the sequence of tasks to perform a scheduled ALT test:

1. Access the ALT level.
2. Access the required ALT sublevel.
3. Assign an identifier to the test.
4. Define the lines to be tested.

5. Define the test schedule.
 - a. If defining an LIT test, see "Defining the parameters for an LIT test" on page 1-74.
 - b. If defining a CKTTST, see "Defining the parameters for a CKTTST test" on page 1-75.
6. Store the test data.
7. Start the test.

In addition to the steps required to set up and run a scheduled ALT test, there are other procedures in this chapter that allow you to stop, override, monitor, and modify ALT tests.

Sequence of tasks for a manual ALT The following list shows the sequence of tasks to perform a manual ALT test:

1. Access the ALT level.
2. Access the required ALT sublevel.
3. Define a manual test.
4. Define the lines to be tested.
 - a. If defining an LIT test, see "Defining the parameters for an LIT test" on page 1-74
 - b. If defining a CKTTST test, see "Defining the parameters for a CKTTST test" on page 1-75.
5. Store the test data.
6. Start the test.

In addition to the steps required to set up and run a manual ALT test, there are other procedures in this chapter that allow you to stop, override, monitor, and modify ALT tests.

Assigning an identifier to a scheduled test Each scheduled automatic line test requires a unique identifier. This identification is known as the TESTID. Once a TESTID is created, commands are used to define, post, run, and monitor the test associated with the TESTID.

The TESTID can be any alphanumeric string from 6 through 12 characters long. There are two restrictions that apply to the TESTID for a scheduled test:

- The first character of the TESTID must be a letter (not a number).
- The word *manual* cannot be used as a TESTID.

The DEFSCHD command is used to assign a TESTID to the test that corresponds to the current ALT sublevel. For example, the DEFSCHD command at the LIT level will assign a TESTID to a LIT test.

Each TESTID is stored in a tuple of the ALTSCHED data table. For more information about table ALTSCHED, see the data schema section of the *Translations Guide*.

The procedure for assigning an identifier to a scheduled test is as follows:

1. Access one of the following sublevels of ALT:
 - SDIAG
 - DIAG
 - LIT
 - BAL
 - CKTTST
2. Enter the command DEFSCHD followed by the TESTID.

Defining a manual test Automatic line tests can be run manually (on demand) without having to define a test schedule.

The TESTID for a manual test is assigned by the system as the word *manual* followed by the number of the MAP device.

The DEFMAN command defines the manual test that corresponds to the current ALT sublevel. For example, the DEFMAN command entered at the LIT level of MAP device number 7, creates a TESTID entitled MANUAL07.

Note: Only one manual test is allowed for each MAP device. When a manual test is defined at a MAP device, no other TESTID can be defined until the manual test is removed from memory. (See "Removing the test parameters from memory" on page 1-77.)

The procedure for defining a manual test is as follows:

1. Access one of the following sublevels of ALT:
 - SDIAG
 - DIAG
 - LIT
 - BAL
 - CKTTST
2. Enter the command DEFMAN.
 - The MANUAL TESTID is automatically assigned for the manual test.
 - The status of the TESTID is UNDEFINED.

Defining a block of lines to be tested A block of lines indicates where to start testing and where to finish testing. A block of lines must be defined for each ALT test. A block of lines can comprise two lines or an entire office. Lines that make up the block are defined by their line equipment numbers (LEN). The STARTLEN indicates the LEN where testing is to start, and the ENDLLEN indicates the LEN where testing is to finish.

As test data are defined, the MAP display is automatically updated to display the test data.

When the test data are defined for a scheduled test, the data must be stored in memory for the test to run. (See "Storing the test data in memory" on page 1-76.) Test data for a MANUAL test are automatically stored in memory.

Before defining test data, make sure that you have used the DEFSCHD or DEFMAN command to create a valid TESTID. See "Assigning an identifier to a scheduled test" on page 1-71 and "Defining a manual test" on page 1-72.

The procedure for defining a block of lines to be tested is as follows:

1. Enter the command DEFINE or the number 7.
2. Enter the data for the block of lines to be tested.

The status of the test is UNDEFINED.

To test an entire office, either host or remote, use STARTLEN and ENDLLEN parameters. The parameters are made up of the first and last "Name" from Table SITE and "Subgroups" and "Cards" from the associated inventory table (e.g. Table RCUINV) as shown in the sample datafill below:

STARTLEN:
HOST 00 0 00 01 (HOST = Table SITE) (HOST 00 0 = Table LCMINV)
(00 = subgroup) (01 - number in subgroup)

ENDLEN:
URBN 06 0 16 31 (URBN = Table SITE) (URBN 06 0 = Table LCMINV)
(16 = subgroup) (31 - number in subgroup)

Defining a testing schedule A test schedule defines the days and times that a test is to be run.

Note: A test schedule is not required for manual tests.

As scheduling data is defined, the MAP screen is automatically updated to display the days and times of the test. When the scheduling data are defined for the test, the data must be stored in memory for the test to run. See "Storing the test data in memory" on page 1-76 for details.

Note: Once the test schedule and other test data associated with a TESTID are stored in memory, an extension schedule can be defined. See "Defining an extension test" on page 1-76 for details.

Before defining the test schedule, make sure you used the DEFSCHD command to create a TESTID for the scheduled test. See "Assigning an identifier to a scheduled test" on page 1-71 for details.

The procedure for defining a testing schedule is as follows:

1. Enter the command DEFINE.
2. Enter the word TIME followed by the start and stop times.
3. Repeat step 2 until all the scheduling data are defined.

If the block of lines has been defined, the status of the SDIAG, DIAG, and BAL, and CKTTST test changes to DEFINED because there is enough data for the test to run. The status of the LIT is UNDEFINED because this test requires more data to be defined.

Defining the parameters for an LIT test The parameters that can be specified for a LIT test are

- EMF (electromotive force) values for ac and dc (the default value is 2 V)
- critical and least critical resistance values for tip to ground, ring to ground, and tip to ring (the most critical default value is 40 kW, and the least critical default value is 200 kW).
- capacitance threshold (the default value is 0.1 μ F).

As test data are defined, the MAP display is automatically updated to display the data.

When the test data are defined, the data must be stored in memory for the test to run. See "Storing the test data in memory" on page 1-76 for details.

Before defining test data, ensure that the DEFSCHD or DEFMAN command was used to create a TESTID. See "Assigning an identifier to a scheduled test" on page 1-71 for details.

The procedure for defining the parameters for an LIT test is as follows:

1. Enter the command DEFINE.
2. Enter the parameters to define the required test data.
3. Repeat from step 1 until the required test parameters are defined.

Once the block of lines and the test schedule have been defined, the status of the test changes to DEFINED.

Defining the parameters for a CKTTST test There are three parameters that can be defined for a keyset line CKTTST:

- the number of messages to send during the test (default is the number contained in office parameter CIRCUIT_TEST_NUMBER_MESSAGES in table OFCVAR.
- the types of keyset lines to test (default is all keyset lines)
- the location of the test (default is at the terminal)

The number of messages sent during the test can be from 1 through 50.

The type of keyset lines to be tested can be

- VOICE-Meridian business set (MBS) lines
- DATA-DATA lines, AIM lines, and IBERT lines
- ALL-test all keyset lines

The location indicates where the CKTTST test is to be run:

- LINECARD-runs the CKTTST at the linecard
- TERMINAL-runs the test at the terminal unless the test is on an AIM or IBERT. On an AIM or an IBERT, the test is run at the linecard.

Note: Do not press any keys on the MBS or DATA line terminal during a CKTTST run at the TERMINAL.

As test data are defined, the MAP screen is automatically updated to display the data. When the test data are defined, the data must be stored in memory for the test to run. See "Storing the test data in memory" on page 1-76 for details.

Before defining test data, make sure you used the DEFSCHD or DEFMAN command to create a TESTID. See "Assigning an identifier to a scheduled test" on page 1-71 and "Defining a manual test" on page 1-72 for details.

The procedure for defining parameters for a CKTTST test is as follows:

1. Enter the command DEFINE.
2. Enter the parameters to define the CKTTST as required.

The status of the test is DEFINED.

Storing the test data in memory When the test data are properly defined for a scheduled test, the test data must be stored in memory for the test to be run. The test information is stored in a tuple of the ALTSCHED data table by using the SUBMIT command.

Note: If the data associated with a scheduled TESTID have to be changed after being stored in memory, the data must first be removed from memory. See "Removing the test parameters from memory" on page 1-77 for details.

After defining the appropriate data for a scheduled TESTID, enter the command SUBMIT to store the data in memory.

The status of the test changes from DEFINED to STOPPED.

Defining an extension test An extension test uses the data from a previously defined TESTID. This use of data precludes having to redefine all the test data for tests that have similar data. Only the scheduling information needs to be defined.

First, the TESTID for the scheduled test is defined using the DEFSCHD command. Then, the DEFINE command specifies the TESTID of the test having the data to be used. Then, the DEFINE command specifies the new test schedule.

The procedure for defining an extension test is as follows:

1. Use the DEFSCHD command to define a TESTID for a scheduled test. (See "Assigning an identifier to a scheduled test" on page 1-71 for detailed instructions.)
2. Enter the command DEFINE.

3. Enter the parameters to define the extension test.
4. Follow the procedures in "Defining a testing schedule" on page 1-74 to define the new test schedule.

Posting a TESTID at the MAP terminal When the information associated with a TESTID is stored in memory, the TESTID can be POSTED at the MAP terminal.

The POST command is used to post the TESTID on the MAP terminal. The POST command can be entered from the main ALT level or any of the ALT sublevels.

- If the POST command is entered at the main ALT level of the MAP terminal, the ALT sublevel associated with the TESTID is accessed.
- If the POST command is entered at an ALT sublevel, the TESTID must correspond with a TESTID at that sublevel.
- If the POST command is entered while a manual TESTID is already defined or running, go to the appropriate sublevel and remove the manual TESTID. (See "Removing the test parameters from memory" in the following section).

Enter the POST command followed by the TESTID of the test to be posted on the MAP terminal.

Removing the test parameters from memory If changes are to be made to the data associated with a TESTID stored in memory, the TESTID must first be removed from memory. The REMOVE command is used to remove the TESTID and the corresponding data from memory.

Before removing the data associated with a SCHEDULED TEST, the system prompts for a YES or NO response.

When the test data are removed from memory (table ALTSCHEM), the test data remains on the MAP screen until new data are defined or until another TESTID is posted.

Note: As long as the test data remain displayed on the MAP terminal, it can be restored in memory by using the SUBMIT command. See "Storing the test data in memory" on page 1-76 for details.

The procedure for removing test parameters from memory is as follows:

1. POST the TESTID of the test to be removed from memory.
2. Enter the REMOVE command. The system prompts for a YES or NO response.
3. To remove the test data for the posted TESTID from memory, enter YES; to keep the test data for the posted TESTID in memory, enter NO.

Starting a test When the test data are defined, the posted TESTID must be set to start at the next scheduled time.

- If the TESTID is for a scheduled test, the status of the test changes to INACTIVE and the test starts according to the defined schedule.
- If the TESTID is for a manual test, the test starts immediately after entering the START command and the status changes to an active status.

The START command has parameters for specifying

- where to restart testing. The START command is used if a test was stopped before it finished testing and not all lines were tested. Testing can be restarted just after the last LEN tested, or testing can be restarted from the beginning LEN (the default is the beginning LEN).
- what type of log report to generate at the end of the test. Either a summary log report (ALT108), or a detailed log report (ALT109) can be specified. The default is the detailed ALT109 log. For details about ALT log reports, see chapter 3, "Lines related logs" on page -1 in this document.

The procedure for starting a test is as follows:

1. Post the TESTID of the test to be set ready to start.
2. Enter the START command with the required parameters.
3. The system prompts for confirmation. To confirm, enter YES; if you don't want to confirm, enter NO.

Stopping a test A test can be stopped at any time. Even tests that have not yet started can be set so they will not run.

The STOP command sets the status of a test to STOPPED. If the STOP command is entered on a TESTID that is ACTIVE, the status changes to INACTIVE. If the STOP command is entered on an INACTIVE test, the status changes to STOPPED. To set the status of an ACTIVE test to STOPPED, the STOP command must be entered twice.

The procedure for stopping a test is as follows:

1. Post the TESTID of the test to be stopped. Make a note of the test status.
2. If the status of the test is INACTIVE, enter the command STOP, or if the status of the test is ACTIVE, enter the STOP command twice.

Checking the status of a test The status of a posted TESTID can be checked at any time by using the STATUS command. There are two ways that the status information is displayed:

- Test stream format-The test stream format represents the test equipment used to test the posted TESTID.
- LCD test set format-The LCD test set format represents the actual LENS being tested by the test equipment associated with the TESTID.

Steps for checking the status of a test

1. Post the TESTID for the required test.
2. Enter the command STATUS.

Overriding scheduled tests Scheduled tests can be overridden so that testing will not start until a specified day and time has passed. The override feature is useful for postponing tests during high-traffic periods when testing is not desirable.

The OVERRIDE command is used to override one or more scheduled tests. The override can be specified for a posted TESTID or all TESTIDs. If required, the override request can be cancelled for the posted TESTID or all TESTIDs by using the CLEAR parameter. The QUERY parameter verifies the date and time when testing will resume.

The procedure for overriding a scheduled test is as follows:

1. If only one TESTID is to be overridden, post the required TESTID. If all TESTIDs are to be overridden, access any ALT sublevel.
2. Enter the OVERRIDE command.

Checking the test data stored in memory The test data stored in memory (table ALTSCHED) can be checked at any time by using the ALTINFO command.

The ALTINFO command can be used from the main ALT level or a sublevel to list the following information:

- all TESTIDs and their corresponding status for each level of ALT (this is the default)
- all the tests that apply to a specific LEN
- all TESTIDs and their corresponding status for a specific ALT level

To check the test data stored in memory, at the ALT level, enter the ALTINFO command followed by any required parameters.

Defining the commissioning test The commissioning test is available when the ALTNOPT module is in the software load. The commissioning test can be defined for manual TESTIDs and DIAG TESTIDs.

The commissioning test consists of two subtests

- ring test checks the ringing capability of the line drawer
- dial tone checks that dial tone can be drawn on lines that have a directory number assigned

Before defining the commissioning test, a manual TESTID or a TESTID for a DIAG test must be defined.

Enter the DEFINE command with the COMM parameter.

Escalation to manual maintenance

When automatic maintenance fails to correct a fault in the lines subsystem, the DMS-100 switch provides trouble indicators which reveal that a fault condition still exists. Alarms are examples of trouble indicators. Some OMs and logs also indicate a fault condition and a failure of automatic maintenance. Manual intervention becomes necessary by maintenance personnel at the MAP terminal in order to isolate and clear the fault.

Trouble tests

Trouble tests are conducted manually to locate faults that are identified by the following:

- subscriber reports
- call processing test reports
- ALT reports or failures
- routine maintenance

Most of the trouble tests are conducted from the LTP level and from the following subtending levels:

- LTPLTA
- LTPMAN
- IBNCON
- LTPDATA

Commands for most of the tests are included in menus at each level, together with commands for maintenance actions used in conducting the tests. The commands for these tests are listed in chapter 6, "Lines related user interface commands" on page -1.

2 Preventive maintenance strategies

Description of routine maintenance procedures

Routine maintenance procedures of tasks performed according to a predefined schedule. Refer to *Alarm and Performance Monitoring Procedures*

for the procedures used to complete the following maintenance tasks:

- performing a manual line test—this test contains tests that are used to test specific lines at times that are not scheduled for automatic line testing.
 - extended diagnostic tests (DIAG)
 - short diagnostic tests (SDIAG)
 - on-hook balance network tests (BAL)
 - line insulation tests (LIT)
 - keyset line circuit tests (CKTTST)
- performing an automatic line test—each of the following tests are accessed from the main ALT menu:
 - extended diagnostic tests (DIAG)
 - short diagnostic tests (SDIAG)
 - on-hook balance network tests (BAL)
 - line insulation tests (LIT)
 - keyset line circuit tests (CKTTST)
- Return cards or assemblies for replacement or repair.

Routine maintenance schedules

Operating company personnel should perform these routine maintenance procedures at regular intervals. Table 2-1 contains a list of routine maintenance tasks and their performance intervals.

Table 2-1 Routine maintenance tasks and intervals

Performance interval	Maintenance task
As required	Perform manual line test
As required	Perform automatic line test
As required	Return cards or assemblies for replacement or repair

Fault isolation

Maintenance action is required whenever a fault condition is detected in the lines subsystem. Operating company personnel use fault isolation procedures to determine which component is causing the fault and to remove the fault condition or report it to the appropriate maintenance support organization.

Fault isolation procedures for the lines subsystem are provided in chapter 8, "Trouble isolation and correction" on page -1.

Maintenance tools

Maintenance tools available for the lines subsystem include commands available at the MAP and maintenance tools. A description of the commands is provided in chapter 6, "Lines related user interface commands" on page -1 and a description of maintenance tools is provided in chapter 8.

3 Lines related logs

Log reports

The output reporting system generates many log reports. Since it is not economically feasible to have a printer device for each log type and because the system generates the log reports in real time, the log reports are all intermingled on the log device.

Monitoring the printer for background information that may have occurred hours before a particular event is difficult. Therefore, it becomes essential to use the individual subsystem buffers where log reports of the same log type can be viewed.

For example, if a fault occurs in the lines subsystem, the maintenance personnel may want to dump the contents of the lines subsystem logs and then scan those logs for any information for relative to lines faults. This action provides the necessary background information to aid in isolation of the fault.

Table 3-1, "Lines related logs" on page 3-2 lists the log reports that are useful in the maintenance of the lines subsystem. Each log report is listed along with its possible causes and an appropriate response by the craftsperson. Key log reports are discussed in greater detail following the table.

Duplicate office code feature

In offices with the duplicate office code (Duplicate NXX) feature, the following changes appear in many automatic line test (ALT) and LINE logs:

- DNs that were seven digit numbers or 10- or 11-digit numbers.
- In the LEN/DN line (second line of most log reports), the LEN prefix does not precede the line equipment number.

Table 3-1 Lines related logs (Sheet 1 of 6)

Log name	Causes	Response
LINE100	Diagnostic tests are complete and are successful	Information only
LINE101	Metering card not datafilled	Indicates metering pulse test detected an inconsistency in the line data. Datafill in table LENLINES indicates that the NT6X94AA line under test supports a (subscriber premises meter) SPM or a coin phone. Datafill in table LNINV indicates that a NT6X95AA metering tone card does not exist in slot 0 of the odd line subgroup for the LCM drawer containing the line under test. Check data. See data schema section of <i>Translations Guide</i> for correct datafill.
	Metering card not responding	Indicates metering tone card (NT6X95AA) did not respond, either because the card is faulty or is not present in the drawer. Check card or replace card, depending on when the failure was encountered. See <i>Alarm and Performance Monitoring Procedures</i> for both procedures.
	Metering card set to 16KHz	Indicates metering pulse test for a NT6X94AA line card detected a metering pulse with a frequency of 16 kHz. The NT6X95AA metering tone card is dip switch settable to supply either 12 kHz or 16 kHz. The dip switch is set to 16 kHz. Change dip switch setting. See <i>Alarm and Performance Monitoring Procedures</i> for procedure.
LINE102	Line lockout on	Check the LINE log report buffer for line trouble report for the same line equipment. Follow the action to be taken for the trouble report(s) generated.
LINE103	Line lockout off	Information only

Table 3-1 Lines related logs (Sheet 2 of 6)

Log name	Causes	Response
LINE104	Integrity lost	Check LINE log buffer for the following diagnostic reports generated as a result of a system request: LINE100 and LINE101. If the system has not initiated diagnostic testing, isolate the fault by performing line diagnostics on the suspect line equipment from the LTP level. See chapter 8 for diagnostic tests that can be run on line equipment.
LINE105	Permanent signal	Check the LINE log buffer for the following diagnostic reports generated as a result of a system request: LINE100 and LINE101. If the system has not initiated diagnostic testing, isolate the fault by performing line diagnostics on the suspect line equipment from the LTP level. Refer to chapter 8 for diagnostic tests that can be run on line equipment.
LINE106	Dial pulse reception on a line	Check the LINE log buffer for the following diagnostic reports generated as a result of a system request: LINE100 and LINE101. If the system has not initiated diagnostic testing, isolate the fault by performing line diagnostics on the suspect line equipment from the LTP level. Refer to chapter 8 for diagnostic tests that can be run on line equipment.
LINE107	Line insulation test (LIT) failed	Refer to chapter 8 for diagnostic tests and procedures that can be applied to subscriber loops and circuits, and DS-1 lines.
LINE108	Digitone reception	Check the LINE log buffer for the following diagnostic reports generated as a result of a system request: LINE100 and LINE101. If the system has not initiated diagnostic testing, isolate the fault by performing line diagnostics on the suspect line equipment from the LTP level. Refer to chapter 8 for diagnostic tests that can be run on line equipment.
LINE109	Outgoing trunk	Check LINE log buffers for diagnostic reports and trouble reports for the same line. If either a failed diagnostic report or trouble report is found, follow the Action to be Taken for that report.
LINE110	Foreign EMF detected	Perform line diagnostics on suspect line equipment from the LTPLTA level to isolate the fault. Refer to chapter 8 for diagnostic tests that may be run on line equipment. Either a LINE100 or a LINE101 log report will be generated.

3-4 Lines related logs

Table 3-1 Lines related logs (Sheet 3 of 6)

Log name	Causes	Response
LINE112	Stuck coin detected during coin operation on a line connected to a coinbox, and the system fails to remove it.	Release the coin. See coinbox manufacturer's maintenance manual for coin release procedure.
LINE113	Ringling failed	Check the LINE log buffer for the following diagnostic reports generated as a result of a system request: LINE100 and LINE101.
LINE118	System failed to make the metallic connection between the line circuit pack and the test equipment using a metallic test access (MTA).	Repeat the action that generated the LINE118 log. If no further LINE118 log is generated, no action is required. If the diagnostic test fails, an indication will appear on the MAP display. Replace the MTA card. If the test passes, return to service (RTS) the MTA card and run the diagnostic again.
LINE132	A line hazard is detected.	Information only. The log gives details about the line hazard and is useful in clearing the alarm.
LINE133	A line hazard has cleared.	Information only
LINE138	A call is routed to a treatment after being call processing busy (CPB).	LINE138 usually follows LINE102 and LINE trouble reports. Check LINE log report buffer for trouble report(s) for the same line equipment. Follow the Action to be taken for trouble report(s) generated.
LINE170	Diagnostics initiated on the world line card using the command string DIAG D entered at the LTP level, and all diagnostics passed.	Information only
LINE171	Diagnostics initiated on the world line card using the command string DIAG D entered at the LTP level, and diagnostics failed.	Information only. If the world line card fails diagnostics and the card must be returned for repair, a printout of the diagnostics results must be attached.
LINE204	Hit detected Bad keyset message DU sync lost CP IOMSG lost Bad CP IOMSG Ground loop fail	Check the LINE log buffer for the following diagnostic reports generated as a result of a system request: LINE100 and LINE101. If the system has not initiated diagnostic testing, isolate the fault by performing line diagnostics on the suspect line equipment from the LTP level. Refer to chapter 8 for diagnostic tests that can be run on line equipment.

Table 3-1 Lines related logs (Sheet 4 of 6)

Log name	Causes	Response
LINE205	Function key hits exceeds four key hits in two seconds Babbling peripherals Faulty phone set or line card	Check the LINE log buffer for LINE100 and LINE101 log reports. If the system has not initiated diagnostic testing, isolate the fault by performing line diagnostics on the suspect line equipment from the LTP position of the MAP terminal.
LINE209	CP error threshold exceeded Line diagnostic failed Line removed from service by system	If the problem is not remedied by system diagnostics, contact the next level of maintenance.
ALT100	Short diagnostic (SDIAG) test of line equipment fails.	Perform line diagnostics on the suspected line equipment from the LTP level to isolate the fault. Refer to chapter 8 for diagnostics tests that can be run. Either LINE100 or LINE101 is generated.
ALT101	Extended diagnostic (DIAG) test of line equipment fails.	Refer to the following references to isolate and correct failures indicated by ALT101: data schema section of <i>Translations Guide</i> , for all failures related to datafill. Refer to <i>Routine Maintenance Procedures</i> , for all failures related to CC or PM, and for more information concerning line testing. Refer to <i>Alarm and Performance Monitoring Procedures</i> for all failures related to line equipment.
ALT103	LIT performed on line equipment fails.	Perform line diagnostics on the suspect line equipment from the LTP level to isolate the fault. Refer to chapter 8 for diagnostic tests that can be run on line equipment. Either LINE100 or LINE101 will be generated.
ALT104	LIT performed on line equipment fails.	Perform line diagnostics on the suspect line equipment from the LTP level to isolate the fault. Refer to chapter 8 for more information on diagnostic tests for line equipment. Either LINE100 or LINE101 will be generated.

Table 3-1 Lines related logs (Sheet 5 of 6)

Log name	Causes	Response
ALT105	MTA cannot be made between the line circuit pack and the test equipment.	<p>Rerun the test from the ALT level. If ALT105 is generated a second time with the same LEN, check to see if another test is running that may be using the MTA vertical.</p> <ul style="list-style-type: none"> — If another test is running, wait until it is completed and then rerun the ALT test for the suspect line equipment. If ALT105 is generated a third time, contact the next level of maintenance. — If another test is not running, contact the next level of maintenance.
ALT106	LIT measuring the capacitance (ac continuity) on line equipment fails.	Perform line diagnostics on the suspect line equipment from the LTP level to isolate the fault. Refer to chapter 8 for more information on diagnostic tests. Either LINE100 or LINE101 will be generated.
ALT107	Test equipment fails diagnostic	For ALT to continue testing, the test equipment has to pass diagnostics and be IDL or INI, and the PM has to be in service.
	Test equipment unavailable	Make test equipment available to allow ALT to run.
	External equipment problem	Make MTA equipment available to allow ALT to run. This problem also involves any connections that require the MTA data.
	Unable to do Test Eq diagnostic	If this problem persists, contact the next level of maintenance.
	Diagnostic result message	If this problem persists, contact the next level of maintenance.
	ALT test processes exceeded	Check the schedule times. Ensure that not too many test processes are being requested. Office parameter ALT_NO_OF_ALT_TEST_PROCS may be recalculated because the office has expanded.
	Test stopped	The user has stopped the test, the test can be restarted.

Table 3-1 Lines related logs (Sheet 6 of 6)

Log name	Causes	Response
	Line concentrating device (LCD) test set suspended	Line cards are consistently failing on the LCD test set. Perform manual tests to locate the possible reason for such a high number of failures. Test the MTA driver and vertical test access bus connections. Check for cable cuts.
	Test stream suspended	Line cards are consistently failing on the LCD test set. Perform manual tests to locate the possible reason for such a high number of failures. Test the MTA driver and vertical test access bus connections. Check for cable cuts, if the INFO text is <i>death of test process</i> , contact the next level of maintenance.
	LTP interrupt	No user action required.
	LCD test set store unavailable	The switch is likely to have severe problems because of lack of store. Contact the next level of maintenance.
ALT108	Give results from a line LCD test set.	Information only
ALT109	A test is completed a LCD test set.	Use this log for identifying line equipment numbers which had problems when ALT tested the LCD test set.
ALT110	A test stream is completed. This report provides counts for a stream completion.	Information only
ALT111	A line test completes and provides a progress update of the test.	Information only
SECU127	The Security (SECU) subsystem generates this report when a START, STOP, REMOVE, or OVERRIDE command is used in the ALT levels.	Information only

Call processing logged failures

Switches that are equipped with software package NTX272, Focused Maintenance, as discussed in Section , "Focused Line Maintenance" on page 1-34, can record data concerning call processing faults in buffers rather than record the data in log reports. The content of the buffers are made available to maintenance personnel by using the LTP to access the LNSTRBL level

through the LNS subsystem. When this feature is provided, the following logs are suppressed. They may be restored by setting table LOGCLASS to ignore the suppression (see data schema section of *Translations Guide*).

- LINE102
- LINE103
- LINE104
- LINE105
- LINE106
- LINE108
- LINE109
- LINE110
- LINE111
- LINE204
- LINE209

ALT logutil reports

ALT108 log reports

ALT108 logs are also referred to as *summary* log reports because they summarize test results. Each ALT108 log reports the total number of line equipment numbers (LEN) which passed, failed, or did not apply to a specific test. Refer to *Log Report Reference Manual* for more information about ALT108 report fields and test result codes.

The following is an example of an ALT108 log report:

```
ALT108 APR10 00:12:23 5764 INFO
TESTID: LNMTCJOHN Stream: 0 Test type: SDIAG Line type:
ALL
LCD test set: HOST 00 0 00 00 - HOST 00 0 09 31
      PASS          FAIL          N/A          TOTAL
      245           11           64           320
```

ALT109 log reports

ALT109 logs are also referred to as *full* logs reports. An ALT109 log reports a test result code for each LEN tested. Refer to *Log Report Reference Manual* for more information about ALT109 report fields and test result codes.

World line card diagnostic logs

LINE170

A LINE170 log report is produced when the DIAG D command string is entered at the LTP level of the MAP display and the line card has passed the

diagnostic test. This log provides the measured information during the line card diagnostic test.

The following is an example of an LINE170 log report:

```
*** LINE170 JAN01 11:27:33 1090 PASS LN_DIAG
DIAGNOSTIC RESULT
LEN HOST 00 00 00 15 DN 7221231
CARD TYPE:          6X17BA
TEMPLATE NAME:      WL94CA
MISSING CARD:       PASS
RINGING TEST:       PASS
NOISE TEST:         PASS 20DB
CURRENT LIMIT TEST: PASS
TRANSMISSION TEST: PASS
LOOP SUPERVISION TEST: PASS
REVERSAL RELAY TEST: PASS
GND START RELAY TEST: PASS
```

LINE171

A LINE171 log report is produced when the DIAG D command string is entered at the LTP level of the MAP display and the line card has failed the diagnostic test. This log provides the measured information during the line card diagnostic test.

The following is an example of an LINE171 log report:

```
*** LINE171 JAN01 11:27:33 1090 FAIL LN_DIAG
DIAGNOSTIC RESULT
LEN HOST 00 00 00 15 DN 7221231
CARD TYPE:          6X17BA
TEMPLATE NAME:      WL94CA
MISSING CARD:       PASS
RINGING TEST:       PASS
NOISE TEST:         PASS 20DB
CURRENT LIMIT TEST: PASS
TRANSMISSION TEST: PASS
LOOP SUPERVISION TEST: FAIL
REVERSAL RELAY TEST: PASS
GND START RELAY TEST: FAIL
```


4 Lines related operational measurements

Table 4-1 describes the basic functions of operational measurements (OM) associated with the lines system. It describes the register group and individual registers in the group, when the measurement was created, related registers and logs, and if applicable a method of validating the register output. For detailed explanations of other individual OMs, refer to *Operational Measurements Reference Manual*. For detailed information about how to activate these OMs, refer to *Basic Administration Procedures*, 297-1001-300, and *Service Problem Analysis Administrationr Guide*, 297-1001-318.

Table 4-1 Lines operational measurements (Sheet 1 of 2)

Group	Information
LINEHAZ	<p>Description: Measures the number of subscriber loops in an office with a line hazard condition.</p> <p>Associated logs: LINE132, LINE133</p>
LMD	<p>Description: Counts call attempts and call attempt failures.</p> <p>Associated logs: LINE104, LINE 105, LINE106, LINE108, LINE109, and LINE138.</p>
OFZ	<p>Description: Summarizes the composition of traffic that arrives at an office, the initial routing of outgoing traffic. Registers count calls depending on the source of the call (trunk or line) and the intended destination (rather than the actual destination).</p> <p>Associated logs: None</p>

4-2 Lines related operational measurements

Table 4-1 Lines operational measurements (Sheet 2 of 2)

Group	Information
OTS	<p>Description: Counts calls by source (line) and destination.</p> <p>Associated logs: LINE104, LINE105, LINE106, LINE108, LINE109, LINE138 and LINE204.</p>
TRA125M1, TRA125M2, TRA250M1	<p>Description: Provides information about line usage, counts, originations, and terminations on selected subscriber lines or groups of line.</p> <p>Associated logs: None</p>
TRMTRS	<p>Description: Counts calls that are routed to a treatment because of a failure that is the result of a shortage of software or hardware resources.</p> <p>Associated logs: LINE138</p>
TROUBLEQ	<p>Description: Provides information on the operation of trouble queues. Trouble queues are ordered lists of line equipment that require troubleshooting. If the system detects a fault on a line, the line is identified as requiring maintenance testing and is placed in the appropriate trouble queue until the tests can be run.</p> <p>Associated logs: LINE100, LINE101, LINE204, and LINE205</p>

Operating company personnel can use OMs to identify trouble in the lines system and identify the source of the trouble based on which OM group and registers exceed their thresholds. The following table identifies the possible causes for those listed OM registers that exceed thresholds. This table may be used as a trouble locating chart.

Table 4-2 Lines trouble locating chart (Sheet 1 of 2)

OM group	Register	Possible cause
LMD	TERMBLK	Link troubles or traffic overloads
LMD	ORIGBLK	
TRMTRS	TRSNBLH	
TRMTRS	TRSNBLN	
LMD	ORIGFAIL	
LMD	ORIGFAIL	Set, cable assignment or processor resources troubles, line card, receiver troubles
LMD	ORIGABDN	
TROUBLEQ	TRBQATT	

Note: The balance network in line card may not be set right. Perform ALT balance test. The diagnostic should be run on lines to identify faulty line cards.

Table 4-2 Lines trouble locating chart (Sheet 2 of 2)

OM group	Register	Possible cause
TROUBLEQ	TRBQOVFL	
LMD	PERCLFL	Set, cable assignment or processor resources troubles, ring generator troubles.
OTS	ORGLKT	Line load control, PM processing error, PM overload, links busied out
OFZ	ORIGLKT	
LMD	STKCOINS	Stuck coin in coin box station
OFZ	LNMBPC	Excessive line or line card diagnostics
TROUBLEQ	TRBQATT	
TROUBLEQ	TRBQOVFL	
<p>Note: The balance network in line card may not be set right. Perform ALT balance test. The diagnostic should be run on lines to identify faulty line cards.</p>		

5 Lines related data structures

This information is not applicable to this product for this BCS.

6 Lines related user interface commands

User interface

Maintenance is performed by operating company personnel by means of a user interface. The user interface consists of the MAP terminal (maintenance and administration position) and the software required to convert human information to machine information, and for machine information to be communicated to maintenance personnel.

Input functions are user commands for activities to

- test equipment
- determine equipment configuration
- request status
- alter equipment status
- display equipment location

Output functions include

- menu of selectable input commands
- display of equipment status
- display of equipment location
- display of system results
- display of results of user requests

Most of the trouble tests are conducted from the line test position (LTP) MAP level and from the following sublevels:

- LTPLTA
- LTPMAN
- IBNCON

- LTPDATA
- DCTLTP

Commands for most of the tests are included in menus at each level, together with commands for maintenance actions used in conducting the tests. The commands for these tests are listed in the respective table associated with the section discussing the menu level. Refer to chapter 8, "Trouble isolation and correction" on page -1 for more specific information on the use of the commands relating to the troubleshooting and isolation of line problems.

This document also lists all the commands and responses for the virtual line concentrating module (VLCM).

The automatic lines testing (ALT) function of the DMS-100 switch is accomplished through the ALT level and ALT sublevels. The commands are presented later in this chapter; however, the various levels and scheduled tests conducted at ALT sublevels are discussed in chapter 1 under Section , "Automatic line testing description" on page 1-43 .

MTU Auto Load Process

The MTU autoloading process allows the DMS to automatically load the MTU firmware when a calibration test fails.

To enable the autoloading process to find the MTU firmware load, the location of the firmware load must be datafilled in table PMLOADS. The load name must then be datafilled in tuple MTULDINFO in table OFCVAR. A datafill example is given below:

```
>table pmloads
TABLE: PMLoads
>pos mtulh04
      MTULH04
      MTULH04S01DPMLoads
      MTULH04S01DPMLoadSBKP N

>table ofcvar
TABLE: OFCVAR
>pos mtuldinfo
      MTULDINFO MTULH04
```

The MTU autoloading process will begin as a result of manual line testing at the LTP or LTPLTA map level, automatic line testing or execution of the TST command from the TTP level.

The following LTP command is supported by MTU autoload:

- Diag

The following LTPLTA commands are supported by MTU autoload:

- VDC
- VAC
- RES
- CAP
- LNTST

MTU autoload also supports the ALT process.

Duplicate office code features

The following features are duplicate office code features:

- AU2589, Duplicate NXX Line Maintenance
- SD0912, LTP Result Field Expansion

Duplicate NXX

With this feature, the line maintenance software supports a ported number with a different area code (serving numbering plan area [SNPA]) and the same office code as a directory number (DN) already datafilled in the switch.

Duplicate NXX Line Maintenance affects the following DN-related line maintenance functions: MAP displays, commands, and responses to commands. These line maintenance functions include the following:

- the LTP MAP level and its sublevels: LTPDATA, LTPLTA, and LTPMAN
- LCDCUT

In the affected commands, DNs can be entered as full national DNs. In the affected MAP displays and responses to commands, if there is sufficient space, displayed DNs include the area code, office code, and station code.

At the LTP MAP level, DNs are displayed as follows:

- If the full DN is ten digits or less, the DN is shown as
<area code> <office code> <station code>
Example: 905 863 1234
- If the full DN is 11 digits, the DN is shown as
<area code> <office code> <station code>
Example: 255 12345678

- If the full DN is 12 digits, the DN is shown as
<area code> <office code> <station code>
Example: 822123456789
- If the full DN is more than 12 digits and the office code plus station code is less than 12 digits, the DN is shown as
<office code> <station code>
Example: 863 1234

If a DN has more than 12 digits, the POST PRINT command can display all DN information.

- If the office code plus station code is 12 digits, the DN is shown as
<office code> <station code>
Example: 123456123456
- If the office code plus station code is more than 12 digits, the DN is shown as
<station code>
Example: 123456

Duplicate NXX Line Maintenance also introduces the following changes to the LTP MAP level and MAP sublevels you access from the LTP level (LTPDATA, LTPLTA, and LTPMAN):

- For the ORIG command, if you enter a local DN that is not unique, the MAP response indicates the DN is not unique.
- For the CONNECT and EQUIP commands, if you enter a local DN that is not unique, the MAP response requests the full national DN.
- For the POST PRINT command, the MAP response provides a full national DN that can contain up to 15 digits.
- The MAP responses for the BERT, BPVO QUERY, CONNECT, EQUIP, HOLD, and LOOPBK QUERY commands provide a full national DN (up to 12 digits).
- For LCDCUT (line concentrating device cutover), the POSTLN D and DEFMAN BYDN commands always require a full national DN.
- When you enter a seven-digit billing DN for a datapath loop extension (DPX) in the TRKGRP table, a warning message appears. This warning message indicates that the DN currently exists.
- The addition of a duplicate NXX to a DMS-100 switch can result in a duplicate of a current seven-digit billing DN for a DPX line. A duplicate of a current DN can cause undesirable results.

LTP Result Field Expansion

This feature alters the line test position (LTP) MAP display to do the following:

- eliminate the overwriting of the common language location identifier (CLLI) characters in the RESULT field
- provide sufficient space to show the area code (SNPA) and directory number (DN) for posted or held lines

This feature changes fields in the LTP MAP display to show the entire CLLI and the external circuit (trunk group) number.

LTP Result Field Expansion makes the following changes to the LTP MAP display:

- The "LEN" header for the posted line equipment number (LEN) is moved from line 6 to line 5.
- The maximum number of characters for a LEN is 21.
- The "DN" header and directory number (DN) is moved from line 6 to line 7.
- The maximum number of characters for a DN is 12.
- The hold position titles are changed from "HOLD" to "H".
- The posted and held external trunk number for the linked circuit is right-justified.
- If the sum of the CLLI and external trunk number is 21 characters, no space separates the fields.
- For modem pools in the hold positions, if the sum of the CLLI and external trunk number is
 - less than 15, the fields are separated by a space
 - more than 14, a plus (+) sign is used as a separator (to indicate that part of the CLLI was overwritten)
 - 15 and the last character is a letter, the fields are not separated by a space
 - 15 and the last character is a number, the last character is replaced by a plus sign

The previously described changes provide the capability to display full national directory numbers (area code + office code + station code). These changes apply to the responses and displays generated by the POST, HOLD, and LEVEL commands at the LTP MAP level.

User interface for the lines subsystem

This section highlights the commands used for maintaining lines from the LNS MAP level. Figure 6-1 shows the LNS menu level.

Figure 6-1 LNS level menu display

```
CC      CMC      IOD      Net      PM      CCS      Lns      Trks      Ext
.      .      .      .      .      .      .      .      .

LNS
0 Quit
2
3 LTP
4 ALT
5 LNSTRBL
6
7
8
9
10
11
12
13
14
15
16
17
18      userid
TIME hh : mm>
```

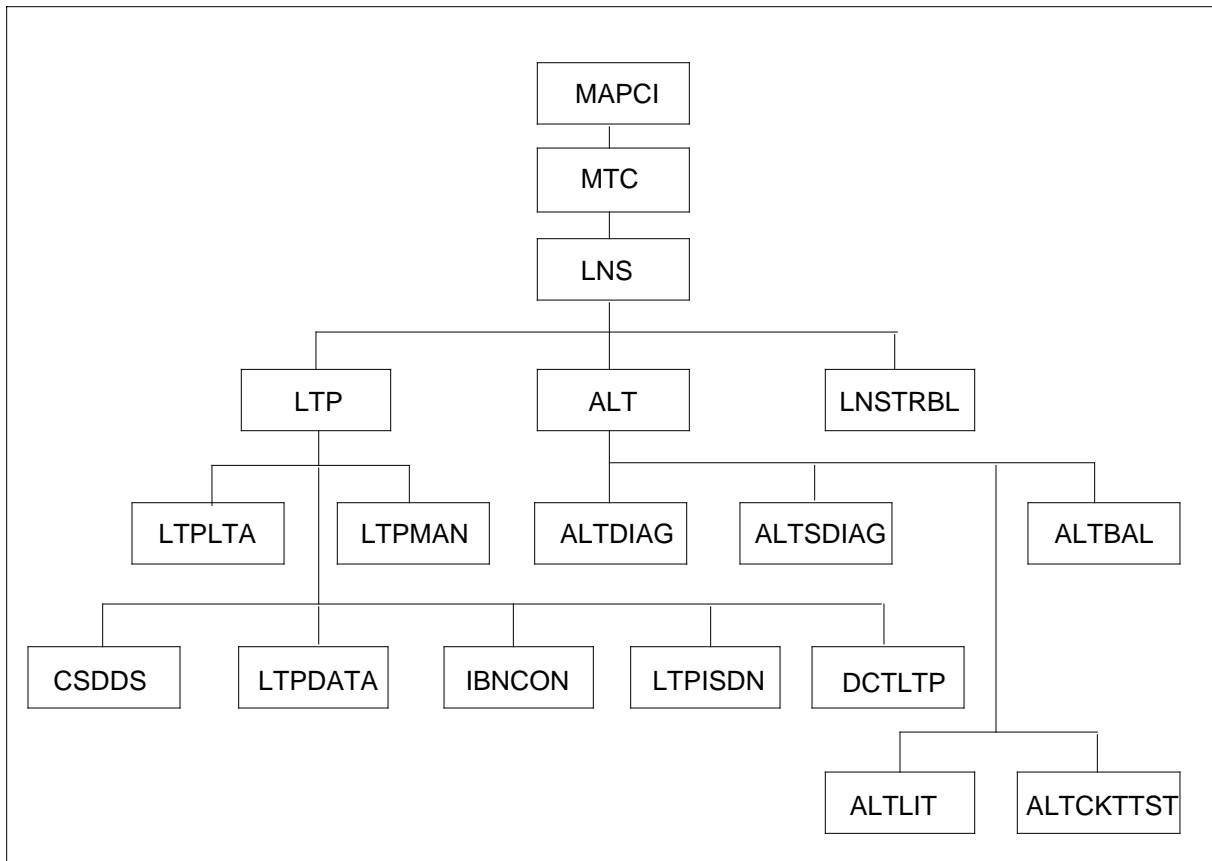
Figure 6-2, "Maintenance level chart for lines" on page 6-7 and Figure 6-3, "Line maintenance commands" on page 6-8 show the association between the various line sublevels. The tables in this section list all the commands that appear in each line sublevel menu. Descriptions of nonmenu commands (that is, commands that do not appear in the menu) for each line sublevel are also provided. Menu sublevel LTPISDN is not addressed in this document. For information on the LTPISDN sublevel, see *Integrated Services Digital Network Basic Rate Interface Maintenance Guide, 297-2401-501*.

The CSDDS sublevel, which is accessible only if software package NTX061AA is installed is also available to the user for line maintenance.

For more information on the commands discussed in this chapter, along with the appropriate parameters and responses, refer to *DMS-100 Family Commands Reference Manual, 297-1001-822*.

Figure 6-2 shows the maintenance level chart for lines.

Figure 6-2 Maintenance level chart for lines



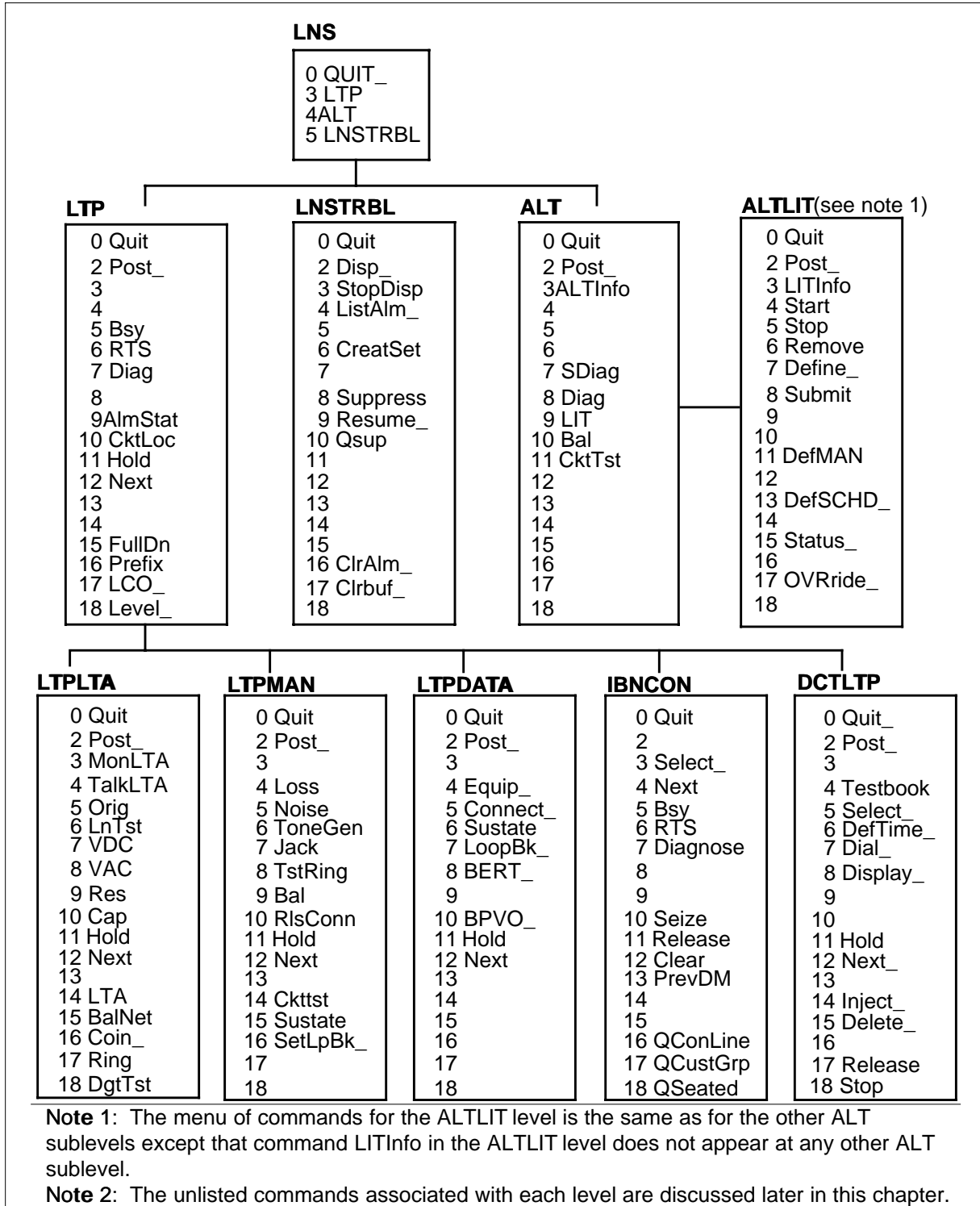
User interface for AccessNode lines

User interface for AccessNode lines involves commands from various MAP levels depending on the type of testing desired or, in some cases, the type of line to be tested.

Following the command overview tables, there are tables that list the commands available at the various MAP levels for AccessNode line maintenance. Each command is described in terms of whether it is supported and whether a specific configuration is required. For more information on the line testing configurations required for these commands, refer to Section , "Fault isolation tests" on page 8-9.

Figure 6-3 shows the lines maintenance commands for the line levels and sublevels.

Figure 6-3 Line maintenance commands



CI level command

An overview of the line maintenance command at the CI level of the MAP is provided in Table 6-1.

Table 6-1 Overview of the command at the CI level

Command	
QBNV	The QBNV command is used at the CI level to display a range of lines in the line concentrating module (LCM) with existing balance network value (BNV) and the recommended BNV.

LTP level menu commands

An overview of the line maintenance commands at the LTP level of the MAP is provided in Table 6-2, "Overview of commands at the LTP level" on page 6-9.

In the LTP MAP level, the only command the MTU autoloading process supports is Diag. The output of the Diag command provides no indication of the autoloading process request. If the Diag command fails, the user must check for TRK360 logs to determine if autoloading began.

The following LTP level commands are not supported for the virtual line concentrating module (VLCM) lines:

- Diag
- LCO

If you attempt to use an LTP-level command that is not supported on a VLCM line, one of the following error messages displays:

```
<command> is not valid on a VLCM line
<command> is not valid on a POTS/COIN line
```

Table 6-2 Overview of commands at the LTP level (Sheet 1 of 2)

Menu item	Command	Description
0	Quit_	The QUIT command is used to leave the current level and return to a higher level.
2	Post_	Posts a line or set of lines to the LTP.
3-4		Not used
5	Bsy	The BSY command changes the state of the line in the control position, or optionally all lines that are posted, to a specified state.

Table 6-2 Overview of commands at the LTP level (Sheet 2 of 2)

Menu item	Command	Description
6	RTS	The RTS command changes the state of the line in the control position, or optionally the complete set of posted lines, from MB to IDL.
7	Diag	The DIAG command performs an extended diagnostic on a line in the control position that is in the MB or IDL state, and displays the results on the LTP screen.
8		Not used
9	AlmStat	The ALMSTAT command interrogates the alarm system of the LNS subsystem and displays the status of alarms in the full switch by type of alarm, when used without parameters. The command is used with parameters to display all or selected alarms at specified units in the host or remote sites, or to change the thresholds of the alarm classes in the full switch.
10	CktLoc	The CKTLOC command locates and identifies the circuit card used for the line circuit in the control position, and displays circuit characteristics.
11	Hold	The HOLD command moves the line in the control position to a spare hold position, and the next line from the posted set, if any, to the control position.
12	Next	The NEXT command moves the line in a specified HOLD position to the control position, or replaces the line in the control position with the line in a specified hold position; and exchanges, saves, or drops the replaced line from LTP control.
13-15		Not used
16	Prefix	The PREFIX command clears the LTP of prefix digits. Optionally it sets or changes prefix digits.
17	LCO	The LCO command operates or releases the cutoff relay that is in the line circuit in the control position; or, optionally, operates or releases the cutoff relay in all the lines in the posted set.
18	Level_	The Level command gives the user access to the sublevels LTPLTA, LTPMAN, LTPDATA, IBNCON, and DCTLTP at the MAP.

LTP level unlisted commands

Table 6-3 Overview of unlisted commands at the LTP level

Command	Description
LTP_AUX_GATE_COM	The LTP_AUX_GATE_COM command is used automatically by the system and is not available for manual use.
LTP_AUX_COM	The LTP_AUX_COM command is used automatically by the system and is not available for manual use.
DATA_SCREEN	The DATA_SCREEN command is used automatically by the system during the command code screening process and is not available for manual use.
DAV_SCREEN	The DAV_SCREEN command is used by the system during the command code screening process and is not available for manual use.
EBSMSG	The EBSMSG command enables or disables the electronic business set (EBS) warning message and prompt.
FRLS	The FRLS command forcibly disconnects a line circuit from test equipment or any other circuit and changes its state to MB.
POTSDIAG	<p>The POTSDIAG command modifies the line diagnostic to allow certain POTS line cards to use a termination with a modified metallic test unit (MTU) to perform a terminated transhybrid loss test.</p> <p>Note 1: The termination used is an 1800Ω resistance in parallel with a 10μF capacitance.</p> <p>Note 2: This command affects the diagnostics for the following line cards: NT6X17AA, NT6X17AB, NT6X18AA, NT6X18AB, and NT6X19AA.</p>
RECORD_DTSTR	The RECORD_DTSTR command enables or disables the storing of DTSTR information.
VOICE_SCREEN	The VOICE_SCREEN command is used automatically by the system during the command code screening process and is not available for manual use.
HAZSUSP (N)	The HAZSUSP command suspends the testing of the lines in the Shower Queue, Hazardous (HAZ) audit list, and Ring-ground (RG) audit list. The optional parameter [N] is the number of minutes that operating company personnel can suspend the testing of lines.



CAUTION

Loss of service

Because semipermanent connections (SPC) are generally used for data connections, do not inadvertently release a connection since this will cause data loss.



CAUTION

Traps may result

Do not enter the FRLS command while other line maintenance functions are in progress (such as line testing from the LTPLTA sublevel) or software traps may result indicating that the previous test could not be completed.

LTP level commands for AccessNode lines

By using the line test position (LTP) level of the MAP, the operating company can run various tests for lines off the AccessNode. Note that the functions of these commands can be conceptually divided as those used for

- integrated testing and which are not configuration dependent
- integrated testing and which are configuration dependent
- setting up nonintegrated testing and which are not configuration dependent
- setting up nonintegrated testing and which are configuration dependent

Table 6-4 includes the types of line cards that are supported. When the command is supported by plain old telephone service (POTS), coin, and Meridian business set (MBS) lines, the word *All* appears in the *Line types* column.

Table 6-4 LTP level commands for testing AccessNode lines (Sheet 1 of 2)

Command	Line types	Configuration notes
Quit	All	Not applicable
Post_	All	Not applicable
Bsy	All	Not applicable
RTS	All	Not applicable
Diag	All	Uses a transmission test unit (TTU) and a multiline test unit (MTU)
AlmStat	All	Not applicable

Table 6-4 LTP level commands for testing AccessNode lines (Sheet 2 of 2)

Command	Line types	Configuration notes
CktLoc	All	Not applicable
Hold	All	Not applicable
Next	All	Not applicable
Prefix	All	Not applicable
LCO_	None	Not supported. The line cutoff function would have the effect of busying out one of the S/DMS AccessNode test buses.
Level_	All	Not applicable
FRLS	All	Not applicable
POTSDIAG	None	Not supported. This test would require that the S/DMS AccessNode apply a nonstandard termination to the line card under test.
RECORD_DTZR	All	Not applicable

IBN console sublevel menu commands

An overview of the line maintenance commands at the IBN console sublevel of the MAP is provided in Table 6-5. The IBNCON level is accessible only if software package NTX100AA is installed.

The following IBN console sublevel commands are supported for the virtual line concentrating module (VLCM) lines:

- Quit_
- Post

Table 6-5 Overview of commands at the IBNCON sublevel (Sheet 1 of 2)

Menu item	Command	Description
0	Quit_	The QUIT command is used at the IBNCON sublevel in the same way as described in the LTP level.
2		Not used
3	Select_	The SELECT command selects an IBN attendant console or a set of consoles.

Table 6-5 Overview of commands at the IBNCON sublevel (Sheet 2 of 2)

Menu item	Command	Description
4	Next	The NEXT command selects the next attendant console from the set of consoles that was selected.
5	Bsy_	The BUSY command changes the state of an attendant console from UNJK to MB, and optionally to OFFL.
6	RTS_	The RTS command changes the state of the attendant console to UNJK, CPB or SB.
7	Diagnose	The DIAGNOSE command initiates a test of the attendant console and its voice and data loops, or optionally only the loops are tested.
8-9		Not used
10	Seize	The SEIZE command changes the state of the console in the control position from the state MB or OFFL to the state SZD.
11	Release	The RELEASE command removes the currently seized console from access by maintenance action.
12	Clear_	The CLEAR command clears the MAP display of data, concerning the currently selected console, and removes the selected set, if any, from maintenance control.
13	PrevDM	The PREVDM command displays the CLLI of the digital modem that was allocated to the console in the control position before its state was changed to MB.
14-15		Not used
16	QConLine	The QCONLINE command displays details concerning the voice and data lines that are connected to the selected console.
17	QCustGrp	The QCUSTGRP command displays customer group and subgroup identification data corresponding to a specified console line.
18	QSeated	The QSEATED command checks if the headset or handset is plugged into the jack of the console in the control position when it is in the state SZD.

IBNCON sublevel unlisted commands

Table 6-6 Overview of unlisted commands at the IBN console sublevel

Command	Description
BSY	The BSY command denotes the menu command BUSY.
FRLS	The FRLS command causes the attendant console to be forcibly released from the state CPB and placed in the state MB.
SENDMSG	The SENDMSG command is used by the NT support group and is not intended for use by an operating company.
WAITFMSG	The WAITFMSG command is used by the NT support group and is not intended for use by an operating company.

IBNCON sublevel commands for AccessNode lines

Table 6-7 lists the commands available at the IBNCON sublevel for testing an IBN console from AccessNode lines.

Table 6-7 AccessNode lines IBNCON sublevel commands (Sheet 1 of 2)

Command	Supported?	Configuration dependent?
Quit	Yes	No
Select_	Yes	No
Next	Yes	No
Bsy	Yes	No
RTS	Yes	No
Diagnose	Yes	Yes
Sieze	Yes	No
Release	Yes	No
Clear	Yes	No
PrevDM	Yes	No
QConLine	Yes	No

Table 6-7 AccessNode lines IBNCON sublevel commands (Sheet 2 of 2)

Command	Supported?	Configuration dependent?
QCustGrp	Yes	No
QSeated	Yes	No

LTPDATA sublevel menu commands

Table 6-8, "Overview of commands at the LTPDATA sublevel" on page 6-16 shows the commands available at the LTPDATA sublevel.

The following LTPDATA sublevel menu commands are not supported for VLCM lines:

- Equip_
- Connect_
- Sustate
- LoopBk_
- BERT_
- BPVO_

If you attempt to use an LTPDATA sublevel command that is not supported on a VLCM line, one of the following error messages displays:

```
<command> is not valid on a VLCM line
<command> is not valid on a POTS/COIN line
```

Table 6-8 Overview of commands at the LTPDATA sublevel (Sheet 1 of 2)

Menu item	Command	Description
0	Quit_	The QUIT command is used at the LTPDATA sublevel in the same way as it is described in the LTP level.
2	Post_	The POST command is used at the LTPDATA sublevel in the same way as it is described in the LTP level.
3		Not used
4	Equip_	The EQUIP command defines and seizes data line test and monitor equipment and lines.
5	Connect_	The CONNECT command connects any or all of test equipment, monitor equipment, or a digital trunk, to a posted data line.

Table 6-8 Overview of commands at the LTPDATA sublevel (Sheet 2 of 2)

Menu item	Command	Description
6	Sustate	The SUSTATE command reports on the loop status of the subscriber data line.
7	LoopBk_	The LOOPBK command activates or releases loopback at specified locations on a data line, or displays current loopback locations.
8	BERT_	The BERT command measures the transmission quality of a data line or a modem pool.
9		Not used
10	BPVO_	The BPVO command determines the quantity of bipolar violations in the DLC loop of posted data lines that exceed a threshold value.
11	Hold	The HOLD command is used at the LTPDATA level in the same way as it is described in the LTP level.
12	Next	The NEXT command is used at the LTPDATA sublevel in the same way as it is described in the LTP level.
13-18		Not used

LTPDATA sublevel unlisted command

Table 6-9 shows the unlisted command available at the LTPDATA sublevel.

Table 6-9 Overview of unlisted commands at the LTPDATA sublevel

Command	Description
BERTTime	The BERTTIME command is used to set a maximum test time or query what the value is.

LTPLTA sublevel menu commands

Table 6-10, "Overview of commands at the LTPLTA sublevel" on page 6-18 shows the commands available at the LTPLTA sublevel.

The following LTPLTA commands are supported by the MTU autoloading process:

- VDC
- VCA
- RES

- CAP
- LNTST

If one of the above commands fails, the autoloading process displays the following message:

```
MTU <circuit> failed calibration, autoloading initiated.  
Check TRK360 logs for autoloading status.
```

The above message indicates that the autoloading process began. A second TRK360 log generates after the autoloading process completes correctly. The delay between the first and second TRK360 logs while the MTU autoloading process completes is between 13 and 15 minutes.

The only four LTPLTA sublevel menu commands that are supported for VLCM lines are

- Quit
- Post_
- Hold
- Next

If you attempt to use an LTPLTA sublevel command that is not supported on a VLCM line, one of the following error messages displays:

```
<command> is not valid on a VLCM line  
<command> is not valid on a POTS/COIN line
```

Table 6-10 Overview of commands at the LTPLTA sublevel (Sheet 1 of 2)

Menu item	Command	Description
0	Quit	The QUIT command is used at the LTPLTA sublevel in the same way as it is described at the LTP level.
2	Post_	The POST command is used in the LTPLTA sublevel in the same way as it is described at the LTP level.
3	MonLTA	The MONLTA command connects a headset circuit to the line in the control position for listening purposes.
4	TalkLTA	The TALKLTA command connects a talk circuit to a subscriber on a subscriber line, and optionally connects a talk battery so that the tester can converse with the subscriber when the CO relay is operated.

Table 6-10 Overview of commands at the LTPLTA sublevel (Sheet 2 of 2)

Menu item	Command	Description
5	Orig	The ORIG command configures the loop side of a line circuit in either the off-hook mode or the on-hook mode, or alternates between modes. Optionally, from one to 20 digits can be sent through a line circuit.
6	LnTst	The LNTST command performs resistance, capacitance, and voltage tests on a line.
7	VDC	The VDC command performs a dc voltage measurement on a subscriber loop.
8	VAC	The VAC command performs an ac voltage measurement on a subscriber loop.
9	RES	The RES command performs resistance measurements on a subscriber loop.
10	CAP	The CAP command performs a capacitance measurement on a subscriber loop.
11	Hold	The HOLD command is used at the LTPLTA sublevel in the same way that it is described at the LTP level.
12	Next	The NEXT command is used at the LTPLTA sublevel in the same way that it is described at the LTP level.
13		Not used
14	LTA	The LTA command connects the LTA to a line card, or releases the LTA from a line card.
15	BalNet	The BALNET command performs a balance network test on a subscriber loop that is in either the on-hook or off-hook mode.
16	Coin_	The COIN command sends a +130 V pulse on the subscriber loop to operate the coin collect mechanism in the coin station, or a -130 V pulse to operate the coin return mechanism.
17	Ring	The RING command places ringing voltage on the loop of a subscriber line.
18	DgtTst	The DGGTST command tests the DIGITONE pad or dial on the subscriber station.

LTPLTA sublevel commands for AccessNode lines

Table 6-11 contains a list of LTPLTA sublevel commands for testing AccessNode lines. This level of the MAP verifies such parameters as

impedance, capacitance, and voltage. When the command is supported by POTS, coin, and MBS lines, the word *All* appears in the *Line types* column.

Table 6-11 LTPLTA sublevel commands for testing AccessNode lines

Command	Supported?	Line types	Configuration dependent?
Quit	Yes	All	No
Post_	Yes	All	No
MonLTA (see note 1)	Yes	All	Yes
TalkLTA	Yes	All	Yes
Orig	Yes	POTS, Coin	Yes
LnTst	Yes	All	Yes
VDC	Yes	All	Yes
VAC	Yes	All	Yes
Res	Yes	All	Yes
Cap	Yes	All	Yes
Hold	Yes	All	No
Next	Yes	All	No
LTA (see note 2)	Yes	All	No
BalNet (see note 3)	No	Not applicable	Not applicable
Coin_	Yes	Coin	Yes
Ring	Yes	POTS, Coin	Yes
DgtTst	Yes	POTS, Coin	Yes
<p>Note 1: The S/DMS AccessNode can provide a bridged metallic test access connection. In a future release, the S/DMS AccessNode will provide a bridged digital test access connection.</p> <p>Note 2: The parameters for this command match what the S/DMS AccessNode can offer.</p> <p>Note 3: The S/DMS AccessNode balance network and pad group functions are not included in the functionality of this command.</p>			

LTPMAN sublevel menu commands

Table 6-12, "Overview of commands at the LTPMAN sublevel" on page 6-21 shows the commands available at the LTPMAN sublevel.

The only four LTPMAN sublevel menu commands that are supported for VLCM lines are

- Quit
- Post_
- Hold
- Next

If you attempt to use an LTPMAN sublevel command that is not supported on a VLCM line, one of the following error messages displays:

```
<command> is not valid on a VLCM line
<command> is not valid on a POTS/COIN line
```

Table 6-12 Overview of commands at the LTPMAN sublevel (Sheet 1 of 2)

Menu item	Command	Description
0	Quit	The QUIT command is used at the LTPMAN sublevel in the same way as described in the LTP level.
2	Post_	The POST command is used at the LTPMAN sublevel in the same way as described in the LTP level.
3		Not used
4	Loss	The LOSS command measures the insertion loss of a test tone sent from the subscriber end of a loop to its line circuit.
5	Noise	The NOISE command measures the C-message weighted circuit noise on a subscriber loop.
6	ToneGen	The TONEGEN command transmits a tone on a subscriber loop.
7	Jack	The JACK command connects a jack-ended trunk to a subscriber line, or a jack to a subscriber loop while bypassing the line card.
8	TstRing	The TSTRING command tests the ringing relay in the line card for proper functioning.

Table 6-12 Overview of commands at the LTPMAN sublevel (Sheet 2 of 2)

Menu item	Command	Description
9	Bal	The BAL command performs an on-hook balance network test on a subscriber loop. The command optionally updates the balance network value and the loss pad value in the line circuit according to test results.
10	RlsConn	The RLSCONN command releases test equipment that is connected to a line.
11	Hold	The HOLD command is used at the LTPMAN sublevel in the same way as described in the LTP level.
12	Next	The NEXT command is used at the LTPMAN sublevel in the same way as described in the LTP level.
13		Not used
14	Ckttst	The CKTTST command sends test messages to test the posted line.
15	Sustate	The SUSTATE command determines the status of the MBS that is connected to the Business Set line in the control position.
16	SetLpBk_	The SETLPBK command sets up the specified loopback on the entity in the control position. The SETLPBK command is only valid for RCU lines.
17-18		Not used

LTPMAN sublevel commands for AccessNode lines

Table 6-13, "LTPMAN sublevel commands for testing AccessNode lines" on page 6-23 contains a list of commands available at the LTPMAN sublevel of the MAP for testing AccessNode lines. This sublevel is used mainly to verify parameters such as noise, signal loss, tone generation, and ringing voltage.

When the command is supported by POTS, coin, and MBS lines, the word *All* appears in the *Line types* column.

Table 6-13 LTPMAN sublevel commands for testing AccessNode lines

Command	Supported?	Line types	Configuration dependent?
Quit	Yes	All	No
Post_	Yes	All	No
Loss (see note 1)	Yes	All	Yes
Noise (see note 1)	Yes	All	Yes
ToneGen (see note 1)	Yes	All	Yes
Jack (see note 2)	Yes	All	Yes
TstRing	Yes	POTS, Coin	Yes
Bal (see note 3)	No	Not applicable	Not applicable
RlsConn	Yes	All	No
Hold	Yes	All	No
Next	Yes	All	No
CktTst	Yes	MBS	No
Sustate	Yes	MBS	No
SetLpBk_	No	Not applicable	Not applicable
<p>Note 1: Uses external equipment.</p> <p>Note 2: To test the subscriber lines between the attendant console and the S/DMS AccessNode, a trunk module is required.</p> <p>Note 3: The S/DMS AccessNode balance network and pad group functions are not included in the functionality of this command.</p>			

DCTLTP sublevel menu commands

Table 6-14 shows the commands available for DCTLTP (data call tester line test position) sublevel.

Table 6-14 Overview of commands at the DCTLTP sublevel (Sheet 1 of 3)

Menu item	Command	Description
0	Quit_	Use the Quit command at the DCTLTP sublevel the same way as the description of the Quit command at the LTP level.
2	Post_	Use the Post command at the DCTLTP sublevel the same way as the description of the Post command at the LTP level.
3		Not in use.
4	Testbook	Use the Testbook command to complete the functions that follow: <ul style="list-style-type: none"> • to access a testbook or display information on the active testbook • to count the number of testbooks • to list a specific number of testbook IDs from the list of testbook IDs • to move the list index up or down a specific number of items in the list of the testbook IDs
5	Select_	Use the Select command to complete the functions that follow: <ul style="list-style-type: none"> • Select a particular IBERT for use in additional dial commands for the S option. The IBERT is an ILC or DTU. • Select an outgoing trunk or trunk group and trunk member for use in subsequent dial commands that use the S option. • Select the posted item (trunk group or member ILC) for use in subsequent dial commands that use the S option. • Select an incoming trunk for translations purposes with optional bearer capability when it is different from the default of 56KDATA. • Select an originating trunk for translations purposes with optional bearer capability when it is different from the default of 56KDATA. • Select a default translation agent (default incoming trunk and member) that applies for all DCT testbooks in the office. • Deselect all previous selections. • Display selections.

Table 6-14 Overview of commands at the DCTLTP sublevel (Sheet 2 of 3)

Menu item	Command	Description
6	DefTime_	<p>Use the DefTime command to complete the functions that follow:</p> <ul style="list-style-type: none"> • Set the test duration of <ul style="list-style-type: none"> — all subsequent dial commands issued in the same MAP session — all test calls started by the current executing dial command in the active testbook • Set the start time to apply to the next dial command in the same MAP session. • Set the wait time on busy trunks. • Set the delay time in between test calls. • Reset test duration, start time, busywait, or delay to default times. • Query the DefTime settings.
7	Dial_	<p>Use the Dial command to complete the functions that follow:</p> <ul style="list-style-type: none"> • Sequential dial of one or more NSs from table DCTDIAL, and perform BERT testing on each one. Options include: <ul style="list-style-type: none"> — specify a repetition factor — request that BERP testing be dropped for free IBERTS if none is available — request the use of preselected trunk resources, IBERT resources, or both • Temporarily halt the execution of the current executing dial command. • Resume the execution of a halted dial command. • Abort the current executing dial command after the current test call is over.
8	Display_	<p>Use the Display command to complete the functions that follow:</p> <ul style="list-style-type: none"> • Display current selections and settings for trunk, IBERT, duration, busywait, and delay. • Display the test results of a particular test in the active testbook and optionally choose to display test summaries. • Display test results as they occur (real-time) for the current and subsequent tests in an active originating testbook. • Display one of the current tests for TERMRES testbooks. • Stop the display of real-time errors.

Table 6-14 Overview of commands at the DCTLTP sublevel (Sheet 3 of 3)

Menu item	Command	Description
9		Not in use.
10		Not in use.
11	Hold	Use the Hold command at the DCTLTP sublevel the same way as the description of the Hold command at the LTP level.
12	Next_	Use the Next command at the DCTLTP sublevel the same way as the description of the Hold command at the LTP level.
13		Not in use.
14	Inject_	Use the Inject command to inject up to 16 bit errors in the current test.
15	Delete_	Use the Delete command to delete all or a subset of the test results for the active testbook. Also use the Delete command to delete test results with no errors within a specific test range.
16		Not in use.
17	Release	Use the Release command to terminate the current test call of the active testbook.
18	Stop	Use the Stop command to terminate the current test call and all remaining test calls in the dial sequence in the active testbook.

LNSTRBL level menu commands

Table 6-15 shows the commands available at the LNSTRBL level.

Table 6-15 Overview of commands at the LNSTRBL level (Sheet 1 of 2)

Menu item	Command	Description
0	Quit	The QUIT command is used at the LNSTRBL level in the same way as it is described in the LTP level.
2	Disp_	The DISP command displays call processing trouble entries in the upper buffer that is allocated to a LCD.
3	StopDisp	The STOPDISP command discontinues the periodic updating of the call processing trouble displays that were initiated by the command DISP.
4	ListAlm_	The LISTALM command displays a list of LCD that have call processing fault alarms, and the class of alarm that exists in each LCD.
5		Not used

Table 6-15 Overview of commands at the LNSTRBL level (Sheet 2 of 2)

Menu item	Command	Description
6	CreatSet	The CREATSET command posts a set of call processing trouble upper buffer entries.
7		Not used
8	Suppress	The SUPPRESS command causes specified trouble types to be ignored by the buffering process and by alarm generation
9	Resume_	The RESUME command discontinues the suppression of specified types of call processing troubles.
10	QSup	The QSUP command lists the code number and description of the types of troubles which are currently suppressed.
11-15		Not used
16	ClrAlm_	The CLRALM command clears the call processing alarms in a specified LCD and resets attempt and failure counters to zero.
17	ClrBuf_	The CLRBUF command deletes part or all of the contents of the upper buffer that is allocated to a specified LCD.
18		Not used

TTP level menu commands

This section contains information for the autoload process on the TTP MAP level when the MTU is in the control position. The MTU autoload process will begin if the TST command generates a TEST FAIL response. The ACTION REQUIRED field of the TRK360 log will display the following output:

```
Auto Loading
```

This output indicates that the MTU autoload process began. A second TRK360 log generates after the autoload process completes correctly. The delay between the first and second TRK360 logs while the MTU autoload process completes is between 13 and 15 minutes.

ALT level menu commands

This section contains all of the commands associated with the main automatic line testing (ALT) menu. The commands are in the order that they appear on the MAP display.

The autoload process initiates at the beginning of a scheduled ALT test if the MTU fails a calibration test when it is first seized. The autoload process tries

to reload the MTU firmware. This process allows the MTU to return to service, and the scheduled ALT test to continue.

Note: ALT level menu commands are not supported for VLCM lines.

Table 6-16 shows the commands available at the ALT level.

Table 6-16 Overview of the commands at the ALT level

Menu item	Command	Description
0	Quit	The QUIT command causes the system to leave the current level and return to a higher level of the MAP.
2	Post_	The POST command posts the scheduled ALT TESTID that is stored in memory (in Table ALTSCHED)
3	ALTInfo	The ALTINFO command checks test data stored in memory (Table ALTSCHED)
4-6		Not used
7	SDiag	The SDIAG command accesses the SDIAG sublevel of ALT. If a TESTID is not entered as a parameter, a new TESTID must be defined with the DEFSCHD or DEFMAN command.
8	Diag	The DIAG command accesses the DIAG sublevel of ALT. If a TESTID is not entered as a parameter, a new TESTID must be defined with the DEFSCHD or DEFMAN command.
9	LIT	The LIT command accesses the LIT sublevel of ALT. If a TESTID is not entered as a parameter, a new TESTID must be defined with the DEFSCHD or DEFMAN command.
10	Bal	The BAL command accesses the BAL sublevel of ALT. If a TESTID is not entered as a parameter, a new TESTID must be defined with the DEFSCHD or DEFMAN command.
11	CktTst	The CKTTST command accesses the CKTTST sublevel of ALT. If a TESTID is not entered as a parameter, a new TESTID must be defined with the DEFSCHD or DEFMAN command.
12-18		Not used

ALT commands for AccessNode lines

As explained in Section , "Automatic line testing description" on page 1-43, the automatic line test is used to run specific tests on specific lines. The schedule for these tests is defined by operating company personnel in table

ALTSCHED. These tests are available at the ALT level. Table 6-17 lists the commands available at this level.

Note: The commands at the ALT level that involve specific tests (SDIAG, DIAG, LIT, and BAL) are used to set the schedule to run these tests; the actual running of these tests occurs according to the schedule set.

Table 6-17 ALT level commands for AccessNode lines

Command	Supported?	Configuration dependent?
Quit	Yes	No
Post_	Yes	No
ALTInfo	Yes	No
SDiag	Yes	Yes
Diag	Yes	Yes
LIT	Yes	Yes
Bal	Not supported	Not applicable
CktTst	Yes	No

MAP commands at ALT sublevels

This section contains the commands associated with the following ALT sublevels:

- SDIAG
- DIAG
- LIT
- BAL
- CKTTST

Because each ALT sublevel has the same menu of commands, this section applies to each of the sublevels unless specified otherwise. The commands are in the order that they appear on the MAP menu.

Table 6-18 shows the commands available at the ALT sublevels.

Table 6-18 Overview of commands at the ALT sublevels (Sheet 1 of 2)

Menu item	Command	Description
0	Quit	The QUIT command causes the system to leave the current level and return to a higher level of the MAP.
2	Post_	The POST command posts the scheduled ALT TESTID that is stored in memory and corresponds to the current sublevel.
3	LITInfo	The LITINFO command displays the system default values for the LIT parameters. Note: This command only applies to the ALTLIT menu level.
4	Start	The START command sets the posted scheduled ALT test in a state such that it is ready to run at the next scheduled time.
5	Stop	The STOP command stops a test and changes the status of the TESTID.
6	Remove	The REMOVE command removes the data associated with the posted TESTID from memory (table ALTSCHED). If the TESTID is for a scheduled test, the system prompts for a YES or NO confirmation.
7	Define_	The DEFINE command defines test data for the specified TESTID.
8	Submit	The SUBMIT command submits the defined test data for the posted TESTID into memory (table ALTSCHED).
9-10		Not used
11	DefMAN	The DEFMAN command is used to assign a TESTID to the test that corresponds to the current ALT sublevel. For example, the DEFMAN command entered at the LIT level of MAP device number 7, will be assigned a TESTID of MANUAL07.
12		Not used
13	DefSCHD_	The DEFSCHD command is used to assign a TESTID to the scheduled test that corresponds to the current ALT sublevel.
14		Not used
15	Status_	The STATUS command checks the status of the posted TESTID.
16		Not used

Table 6-18 Overview of commands at the ALT sublevels (Sheet 2 of 2)

Menu item	Command	Description
17	OVRride_	The OVERRIDE command overrides a scheduled test so that testing will not start until a specified day and time has passed.
18		Not used

VLCM commands and responses

This section describes the modified commands, the parameters and responses applicable to the virtual line concentrating module (VLCM).

BSY in VLCMDIR

The BSY command allows users to busy a VLCM (BSY PM) and busy a line drawer of a VLCM (Bsy DRWR). BSY is a menu command.

Table 6-19 BSY command parameters and variables

Command	Parameters and variables
BSY	Parms: <DEVICE> {PM, DRWR <DRWR_NO> {0 TO 19} } [<NOWAIT> {NOWAIT}] [<ALL> {ALL}]
Item	Description
<DEVICE>	Busy the whole PM.
DRWR to19	Busy a DRWR
[<NOWAIT>]	An optional parameter
[<ALL>]	An optional parameter

Usage examples

The following table provides an explanation of an additional response to the BSY command for VLCM.

Table 6-20 Responses for the BSY command (Sheet 1 of 2)

MAP output	Meaning and action
VLCM REM OO 1 Bsy Passed	<p>Meaning: None</p> <p>Action: None</p>

Table 6-20 Responses for the BSY command (Sheet 2 of 2)

MAP output	Meaning and action
VLCM REM 00 1 Drwr 0 Bsy Passed	<p>Meaning: None</p> <p>Action: None</p>

RTS in VLCMDIR

The RTS command allows users to return a VLCM to service (RTS PM) and return a line drawer of a VLCM to service (RTS DRWR). RTS is a menu command.

Table 6-21 RTS command parameters and variables

Command	Parameters and variables
RTS	Parms: <DEVICE> {PM, DRWR <DRWR_NO> {0 TO 19} } [<NOWAIT> {NOWAIT}] [<ALL> {ALL}]
Item	Description
<DEVICE>	RTS the whole PM. RTS a DRWR.
[<NOWAIT>]	An optional parameter.
[ALL]	An optional parameter.

Usage examples

The following table provides an explanation of an additional response to the RTS command for VLCM.

Table 6-22 Responses for the RTS command

MAP output	Meaning and action
VLCM REM 00 1 RTS Passed	<p>Meaning: None</p> <p>Action: None</p>
VLCM REM 00 1 Drwr 0 RTS Passed	<p>Meaning: None</p> <p>Action: None</p>

QUERYPM in VLCMDIR

The QUERYPM command is a menu command and supports the FLT option:
QueryPM FLT.

Table 6-23 QUERYPM command parameters and variables

Command	Parameters and variables
QUERYPM	Parms: [<OPTION>] {FLT, DRWR}
Item	Description
[<OPTION>]	This parameter queries any fault that exists in the VLCM.

Usage examples

The following table provides an explanation of an additional response to the QUERYPM command for VLCM.

Table 6-24 Responses for the QUERYPM command

MAP output	Meaning and action
<pre> PM Type: VLCM Int. no.: 9 Status index: 7 Node_No:4 VLCM REM1 02 0 Memory size - unit 0: 4m, Unit 1: 4M ESA equipped: No, Intraswitching is off. Loadname: VLCMLOAD Node Status: FALSE Unit0 Status: FALSE Unit1 Status: FALSE Site Flr RPos Bay_id Shf Description Slot EqPEC REM1 01 K03 VLCM 02 04 VLCM 02 0 VLCMPC VLCMPC Services : NEUTRAL </pre>	<p>Meaning: None</p> <p>Action: None</p>

LTP MAP in VLCMDIR

The LTP MAP level command can be used to POST, BSY and RTS VLCM lines. LTP MAP is a menu command.

Table 6-25 LTP MAP command parameters and variables (Sheet 1 of 2)

Command	Parameters and variables
LTPMAP	No change

Table 6-25 LTP MAP command parameters and variables (Sheet 2 of 2)

Command	Parameters and variables
Item	Description
None	None

Usage examples

The following table provides an explanation of an additional response to the LTP MAP command for VLCM.

Table 6-26 Responses for the LTP MAP command

MAP output	Meaning and action
The following response will be displayed when the invalid commands are invoked:	
<pre>...command is not appropriate for a VLCM line.</pre>	
For more information, see "LTP Line Maintenance Commands".	
	Meaning: None
	Action: None

DEFINE in VLCMDIR

The DEFINE command is used to access the commands associated with Automatic Line Testing. DEFINE is a menu command and is applicable to the following sublevels.

Table 6-27 DEFINE command parameters and variables

Command	Parameters and variables
DEFINE	MAPCI;MTC;LNS;ALT;SDIAG MAPCI;MTC;LNS;ALT;DIAG MAPCI;MTC;LNS;ALT;LIT MAPCI;MTC;LNS;ALT;BAL MAPCI;MTC;LNS;ALT;CktTst DEFINE - SPECIFY TEST PARAMETERS
Item	Description
None	None

Error messages

The following table contains an explanation of the warning messages for the DEFINE command for VLCM.

Table 6-28 Error messages for the DEFINE command

MAP output	Meaning and action
ALT command is not valid for VLCM lines	
Meaning: None	Action: None

DEFMAN in VLCMDIR

The DEFMAN command is used to access the commands associated with Automatic Line Testing. DEFMAN is a menu command and is applicable to the following sublevels.

Table 6-29 DEFMAN command parameters and variables

Command	Parameters and variables
DEFMAN	MAPCI;MTC;LNS;ALT;SDIAG MAPCI;MTC;LNS;ALT;DIAG MAPCI;MTC;LNS;ALT;LIT MAPCI;MTC;LNS;ALT;BAL MAPCI;MTC;LNS;ALT;CktTst
	DEFINE - SPECIFY TEST PARAMETERS
Item	Description
None	None

Error messages

The following table contains an explanation of the warning messages for the DEFMAN command for VLCM.

Table 6-30 Error messages for the DEFMAN command

MAP output	Meaning and action
ALT command is not valid for VLCM lines	
	Meaning: None
	Action: None

DEFSCHD in VLCMDIR

The DEFSCHD command is used to access the commands associated with Automatic Line Testing. ALT MENU is a menu command and is applicable to the following sublevels.

Table 6-31 DEFSCHD command parameters and variables

Command	Parameters and variables
DEFSCHD	MAPCI;MTC;LNS;ALT;SDIAG MAPCI;MTC;LNS;ALT;DIAG MAPCI;MTC;LNS;ALT;LIT MAPCI;MTC;LNS;ALT;BAL MAPCI;MTC;LNS;ALT;CktTst DEFINE - SPECIFY TEST PARAMETERS
Item	Description
None	

Error messages

The following table contains an explanation of the warning messages for the DEFSCHD command for VLCM.

Table 6-32 Error messages for the DEFSCHD command

MAP output	Meaning and action
ALT command is not valid for VLCM lines	Meaning: None Action: None

7 Lines related card requirements

Description of circuit card removal and replacement procedures

There are no special considerations for circuit card removal and replacement with line cards. For information on line card replacement procedures, see *Card Replacement Procedures*.

Description of other equipment removal and replacement procedures

There are no special considerations for removing and replacing equipment other than line cards.

8 Trouble isolation and correction

This chapter provides an overview of the faults encountered in the lines subsystem and the troubleshooting methods used to clear these faults. In addition, various tests and testing configurations are provided to give Operating Company personnel several options for solving line faults.

Description of troubleshooting procedures

Troubleshooting procedures for lines faults include the following:

- fault locating and clearing
- fault isolation tests
- diagnostic tests
- product specific test tools

The troubleshooting procedures employed in this chapter include the items listed above. These procedures are in addition to tools that exist in the DMS-100 switch that include monitoring log reports, operational measurements (OM), and monitoring the status of lines and threshold levels for lines alarms.

Note: It must be remembered that the DMS-100 switch does not take any steps to correct or clear lines alarms. Therefore, it is imperative that operating company personnel monitor lines fault alarms and alarm codes.

Locating and clearing faults

Faults are located with the following:

- operational measurements (OMs)
- log reports
- alarms
- customer complaints

The following standard troubleshooting steps are used when locating and clearing faults in line cards:

Procedure 8-1

- 1 Put the line card into the control position to execute commands.
- 2 Busy the line card.
- 3 Test the line card.
- 4 Locate the line card (if the line card failed testing).
- 5 Reset or replace the line card (if the line card failed testing).
- 6 Return the working line card to service.

The following troubleshooting steps are used for locating and clearing faults in lines at the LTPLTA and LTPMAN menu levels:

Procedure 8-2

- 1 Put the line in the control position.
- 2 Busy the line.
- 3 Test the line using the four types of tests: resistance, capacitance, ac voltage, and dc voltage.
- 4 Report the failed line or return a healthy line to service. Lines are outside the DMS-100 switch and cannot be repaired. Instead, the failed line should be reported to the appropriate department or outside plant, according to the operating company's standard procedures.

OMs

OMs, which monitor and count events in the lines subsystem, detect both actual and potential system troubles. The OM thresholding feature monitors and reports lines activity. These reports should be performed routinely (daily or weekly) and should be a primary method of trouble detection. For more information on OMs, refer to chapter 4, "Lines related operational measurements" on page -1.

Log reports

Log reports are used for analysis, providing detailed information on call errors, diagnostic results, and system status. Logs also indicate trouble conditions, especially when any of the following conditions exist:

- sudden increase in volume of logs
- the message *not printed* reports
- large number of similar logs

Refer to chapter 3, "Lines related logs" on page -1 for more information on logs related to lines.

Alarms

The LTP level is used primarily to troubleshoot line cards that failed diagnostic testing. The LTP status display initially has no information in it. The system has to first be told which particular lines of the thousands attached to the switch you want information on. The status line must be monitored for the failure indicator (F) which tells the craftsperson the kind of testing the control position LC has failed. In addition, the ALMSTAT command display shows the current number of failed lines for each fault under the header *Current*. The display also shows the threshold setting for the alarm codes for each fault under the headers *Minor*, *Major*, and *Critical*. The alarm codes are described in Table 1-3, "Call processing alarms" on page 1-30.

The LTP level command ALMSTAT, when entered without parameters, causes a list of alarm type labels to be displayed in the area between menu item 12 and menu item 18 as shown in Figure 8-1.

Figure 8-1 LTP level ALMSTAT display

```

CC      CMC      IOD      Net      PM      CCS      Lns      Trks      Ext
.       .       .       .       .       .       .       .       .

LTP
0 Quit_
2 Post_
3
4
5 Bsy_
6 RTS
7 Diag_
8
9 AlmStat_
10 CktLoc
11 Hold
12 Next_
13
14
15
16 Prefix_
17 LCO_
18 Level_
OPERATOR
Time 10:00>

```

See figure 8-2 for the ALMSTAT display response a rea.

The types of alarms that are listed are as follows:

- D identifies the quantity of lines that fail the extended diagnostic
- F identifies the quantity of lines that fail the facility check
- S identifies the quantity of lines that fail the short diagnostic

- N identifies the quantity of lines that passed the short diagnostic, after a previous diagnostic failure, but need to pass the extended diagnostic to clear the alarm
- m identifies the quantity of lines that fail a diagnostic when the keyset is unplugged, or seems to be unplugged.
- M identifies the quantity of lines that fail a diagnostic when the line card is not in place or is improperly seated.
- Q identifies the quantity of lines that are in the shower queue
- I identifies the quantity of lines that are incoming message overloaded (ICMO); where the ICMO rate is equal to, or greater than the threshold value established for major ICMO.
- i identifies the quantity of lines that ICMO; where the ICMO rate is equal to, or greater than, the threshold value established for minor ICMO, but is less than the threshold value established for I.
- LSET (l) indicates a failure when a keyset circuit test or a loop signaling test is run at the terminal
- LCARD (L) indicates a failure when a keyset circuit test or a loop signaling test is run at the line card
- T indicates a failure from the TCMMON command when the number of Time Compressed Multiplex (TCM) synchronization losses between the Data Line Card and the Data Unit are greater than or equal to the threshold set in table OFCENG.
- U identifies the quantity of utility cards that fail a peripheral module (PM) diagnostic.
- PSPD identifies the quantity of lines that are in the PLO state.
- C identifies the quantity of lines on which the call processing (CP) error rate is equal to, or greater than the threshold value established for the major CP error alarm.
- c identifies the quantity of lines on which the CP error rate is equal to, or greater than, the threshold value established for a minor CP error alarm, but is less than the threshold value established for C.
- H identifies the quantity of lines on which a line hazard condition (such as foreign line voltage or leakage resistance) has been detected.

Figure 8-2, "LTP level office ALMSTAT display" on page 8-6 lists the alarm type labels displayed to the left of the headers *Current*, *Minor*, *Major*, and *Critical*. The number of alarms that are current in the full office is displayed in line with the alarm type and beneath the header. The established thresholds are displayed in line with each alarm type, and under the applicable header. The number of working lines and stations in the office is also displayed below the

alarm status information, together with dial tone speed recording (DTSR) information, by type of signaling.

Figure 8-2 LTP level office ALMSTAT display

OFFICE TOTALS					
OFFICE LINE FAILURE TOTALS					
		OFFICE	OFFICE	OFFICE	OFFICE
		CURRENT	MINOR	MAJOR	CRITICAL
Ext Diag Fail	(D)	0	10	20	30
Facility Fault	(F)	0	10	20	30
Short Diag Fail	(S)	0	10	20	30
Needs Ext Diag	(N)	0	10	20	30
Set Missing	(m)	0	10	20	30
Linecard Missing	(M)	0	100	150	200
Shower Queue	(Q)	1	100	150	200
Major ICMOLINE	(IMAJ)	0	100	150	200
Minor ICMOLINE	(IMIN)	0	100	150	200
Loop Sig Set	(LSET)	0	100	150	200
Loop Sig Card	(LCARD)	0	100	150	200
TCM sync loss	(T)	0	100	150	200
Loop Performance	(P)	0	100	150	200
Minor CPERROR	(CMIN)	0	10	30	50
Major CPERROR	(CMAJ)	0	10	30	50
Utility Card	(U)	0	100	150	200
State = PLO	(PSPD)	1	10	20	30
State = HAZ (Hazard)		1			
OFFICE LINE TOTALS					
The number of working lines (total)		in this office is: 120			
The number of working DTMF lines		in this office is: 31			
The number of working dial pulse lines		in this office is: 19			
The number of working IVD terminals		in this office is: 0			
The number of working EBSSs (total)		in this office is: 9			
The number of working PSET terminals		in this office is: 1			
The number of working DISP terminals		in this office is: 2			
The number of working Data Units		in this office is: 11			
The number of working ISDN loops		in this office is: 4			
The number of working BCLID Data Links		in this office is: 6			
OFFICE DIAL TONE DELAY (DTSR) INFORMATION					
Present time	Oct31	10:54:23			
Active time	Oct31	10:27:00			
Holding time	Oct31	10:27:00			
Dial Tone Delay Counts And Percentages					
Pulse Signalling					
	Attempted	Delayed	Percentage		
Active	49	0	0.0*		
Holding	75	0	0.0*		
DTMF Signalling					
	Attempted	Delayed	Percentage		
Active	49	0	0.0*		
Holding	75	0	0.0*		
Keypad Signalling					
	Attempted	Delayed	Percentage		
Active	0	0	0.0*		
Holding	0	0	0.0*		

Customer complaints

Customer complaints are trouble indicators in which a subscriber has a service problem, and a specific alarm is not produced at the MAP terminal. Table 8-1 lists typical customer complaints and some possible trouble sources.

Table 8-1 Customer complaints (Sheet 1 of 3)

Trouble category	Symptom	Possible trouble source
Can't call	No dial tone	Open cable pair, heat coil or main distribution frame (MDF) jumper Defective line card or wrong loop option Line in wrong state (manual busy [MB] or cutoff [CUT]) Incorrect datafill Sleepy lines (Idle state, no dial tone) Defective line concentrating module (LCM), Remote Line Concentrating Module (RLCM), line module (LM), or line group controller (LGC)
	Slow dial tone	Office overloaded Insufficient Digitone receivers Shortage of speech links Shortage of call processing resources Deny originations (pegs OM group CP_ORIGDENY)
	Dial tone returns	Wait deny (pegs OM group CP_WAITDENY) Defective line card Rough movement of line drawer Network module crosspoint trouble Datafill or software trouble Switching processors in LCM, LGC, or digital trunk controller (DTC)
	No ringing signal	Ringing generator trouble or option error Defective line drawer Ring pretrip condition in cable pair Defective bus interface card (BIC)

Table 8-1 Customer complaints (Sheet 2 of 3)

Trouble category	Symptom	Possible trouble source
Can't call (continued)	Reaching reorder tone or announcement	Defective dial (such as mutilated digits) Defective cable pairs of MDF jumper Datafill troubles No circuits Defective line card Defective receiver High touch tone level from private branch exchange (PBX)
Can't be called	Bells don't ring	Defective set, too many sets, or exceeds loop requirements Defective cable pair or MDF jumper Defective ring generator or option Defective line drawer Incorrect datafill Ring trip condition on line Software trouble
	Reach busy (line not being used)	Line in wrong state (CUT or MB) Datafill trouble Software trouble Line on call forwarding

Table 8-1 Customer complaints (Sheet 3 of 3)

Trouble category	Symptom	Possible trouble source
Transmission noise	Noisy	Defective set Defective line card Defective cable pair or MDF Line card balance network not set Defective PM (such as LGC, LCM, RLCM, or LM) Defective office ground or battery Defective speech links Defective network modules Defective trunk, carriers, or echo return loss Defective ring generator
Cut-off	Cuts off (returns to dial tone)	Defective line card Rough movement of line drawer Switching processors in LCM, LGC, or DTC Reinitializing peripheral modules Network module troubles Defective trunks or carrier Warm or cold CPU restarts

Fault isolation tests

The primary consideration when investigating a line fault is to isolate the fault to one of the following items that make up a line:

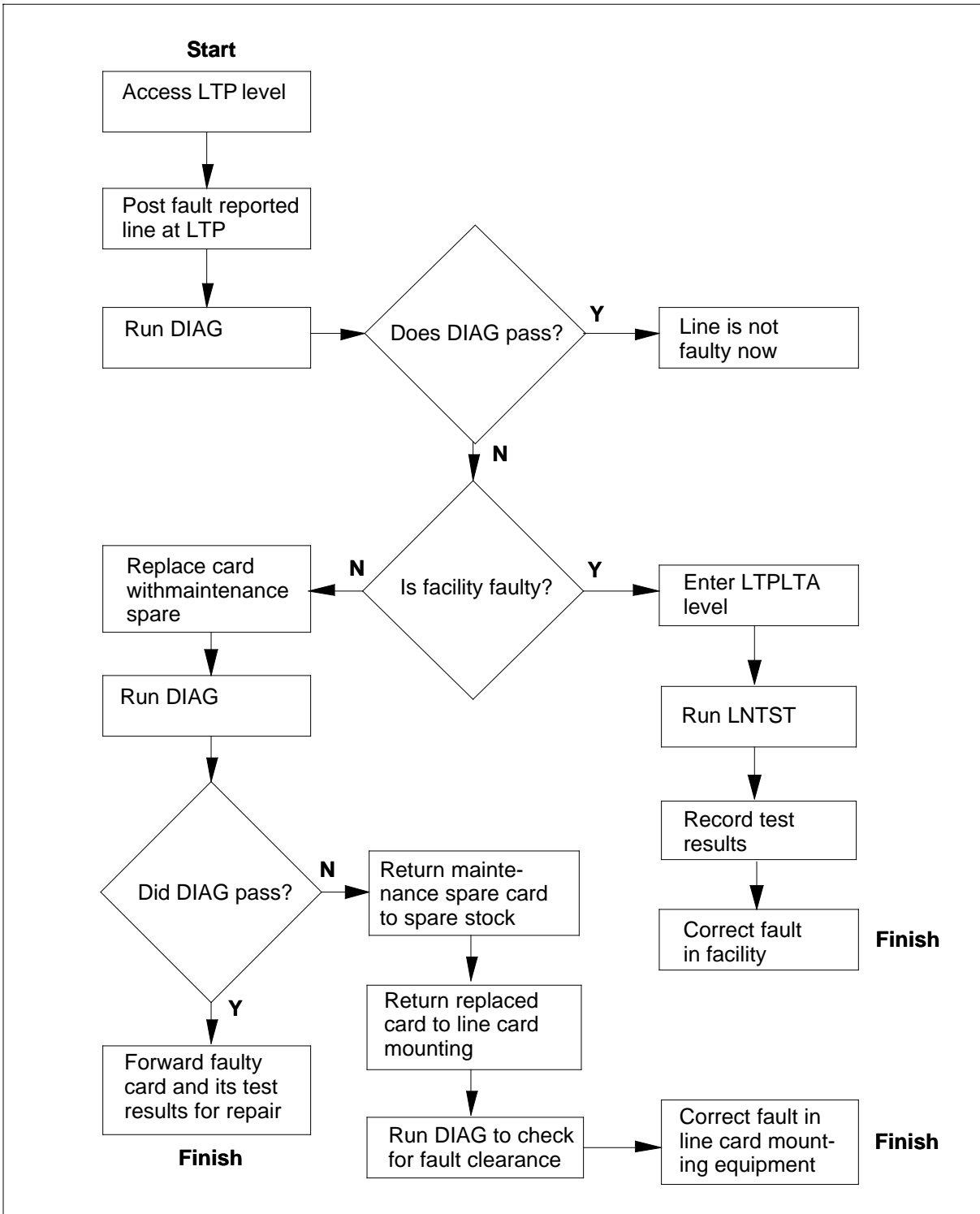
- line card
- LCD
- loop facility
- station equipment

Figure 8-3, "Fault isolation" on page 8-11 shows the sequence of steps used in the fault isolation technique. During line card testing the line diagnostic detailed report is reactivated. When an outside facility fault is indicated, the test results that are obtained are given to outside plant maintenance personnel for their use in correcting the fault. When an LCD fault is indicated, the test results are given to switch maintenance personnel for their use in correcting the fault.

Line test results are interpreted for use in isolating the faults. For example

- a line card fault is indicated if the following failures are reported from the extended diagnostic:
 - transhybrid loss
 - attenuation pad
 - noise
- an MBS line card fault is indicated if the test for signaling fails when the signaling is looped at the line card
- a LINE204 log reports a Bad Keyset Msg fault that is attributed to:
 - operation of an invalid key, if no unknown extensions or add-ons are indicated
 - a datafill fault in a translations table, or an add-on by the subscriber if unknown extensions or add-ons are indicated

Figure 8-3 Fault isolation



States

The state of a DMS-100 component is an indicator of its readiness to respond to call processing or maintenance action. A list of line states is provided in Table 8-2.

Table 8-2 Line states (Sheet 1 of 2)

Code	Line state	Description
CPB	Call processing busy	The line is in use by a subscriber (call processing is taking place).
CPD	Call processing deload	The line is in use by a subscriber, and a maintenance request to place the line in the deloaded (DEL) state is pending. The state changes momentarily to DEL when call processing ends, and then to state MB.
CUT	Cutoff	The cutoff relay in the line circuit is operated, disconnecting the subscriber loop from the line circuit.
DEL	Deloaded	The line is removed from availability for call processing by a maintenance order, in preparation for testing activity. This is a temporary state after the state CPD and before the state MB.
DMB	-	Applicable to ISDN lines. See <i>Integrated Services Digital Network Basic Rate Interface Maintenance Guide</i> , 297-2401-501.
HAZ	Hazard	A line hazard condition (foreign line voltage, leakage resistance) has been detected; the line's cutoff relay is operated.
IDL	Idle	The line is in service and available to process calls.
INB	Installation busy	The line is not available for call processing for one or more of the following reasons: <ul style="list-style-type: none"> • some required data has not been assigned • a data change has been made • a LTP operator has entered an instruction During this state tests can be conducted.
LMB	Line module busy	Call processing cannot take place because the LM or the LCM is out of service.
LO	Lock-out	The line has been removed from service by the DMS-100 switch, preventing call processing. Manual action is required to change the state.
MB	Maintenance busy	The line has been removed from service by maintenance personnel or by the DMS-100 switch. Call processing cannot take place.

Table 8-2 Line states (Sheet 2 of 2)

Code	Line state	Description
NEQ	Not equipped	The LEN has not been datafilled. Call processing cannot take place.
PLO	PSPD lock-out	This is a particular variety of the state LO. The line has been removed from service by the DMS-100 switch because of a PSPD condition. Call processing cannot take place until the condition no longer exists and the DMS-100 switch restores the line state to IDL.
SB	-	The line has been removed from service by the DMS-100 switch because of incoming message overloading.
SZ	-	Future line state

States are changed automatically by the DMS-100 switch or manually by maintenance personnel. For example, a line in state IDL is automatically changed by the DMS-100 switch to state CPB when the station goes off hook. An example of a manual state change is the change of an attendant console state from UNEQ to IDL when the new console is placed initially in service. States are changed manually by placing the line or the attendant console that is to be tested in the control position, and using either the BSY command or the RTS command. The permissible manual line state transitions are shown in Table 8-3.

Note: The remote fiber terminal (RFT) is a stand-alone node responsible for maintaining its resources. Line card and line state changes at the RFT are not propagated back to the DMS-100 switch. This means that when the operating company personnel uses the RFT user interface to changes the RFT line state to OOS (out-of-service) as seen at the RFT, and the line goes OOS, the line state at the MAP terminal is not updated to indicate that the line has been taken OOS at the remote end and the line state still displays as IDL.

Table 8-3 Line state transitions (Sheet 1 of 2)

From	To CPD	CUT	DEL	IDL	INB	MB
CPB	X			X		X
CPD			X			
CUT				X	X	X
DEL				X	X	X
IDL		X				X

Table 8-3 Line state transitions (Sheet 2 of 2)

From	To CPD	CUT	DEL	IDL	INB	MB
INB		X				X
LMB				X	X	X
LO		X		X	X	X
MB		X		X	X	
PLO		X		X	X	

Stuck test access relay on a line card

If the test access (TA) relay on a line card is held operated (stuck) by a fault in the line card, it causes the battery and ground potential from the faulty card to be connected to the test access bus which serves 320 lines. As a result, all diagnostics (SDIAG or DIAG) will fail that are performed after a TA relay failure.

A symptom of a stuck TA relay in a line card is a series of ALT101 output reports indicating failure of the extended diagnostic from the ALT level, when all the reports relate to one TA bus group on one LM or LCM. The drawers specified in the reports are numbered from 00 through 09 or from 10 through 19. (For details about ALT, refer to Section , "Automatic line testing description" on page 1-43.)

If the TA relay remains closed (stuck), all subsequent line diagnostic tests on the same TA bus in an LM or LCM will fail. All failure responses will be either:

- Cut Off relay
- Flux cancel

To locate the faulty line card in LMEs and LCMEs, use the following procedure:

Procedure 8-3

- 1 Post all lines with a *D* failure flag.
- 2 Test these lines until the diagnostic response TEST ACC RLY is seen.
- 3 Remove the line card(s) with this failure message.
- 4 Retest the other line cards with *D* failure flags. They should all pass.

If the previous procedure does not work, use the procedure that follows.

Procedure 8-4***An alternative method to identify a line card with a stuck TA***

- 1 Post a line that has reported Facility Fault.
- 2 Enter the command string MONLTA;ORIG at the LTPLTA level without parameters, to obtain a dial tone.
- 3 Wait for the line to time out.
- 4 Consult the line maintenance subsystem report LINE138 called Info Trmt. The posted line that timed out is identified and the line circuit with the stuck TA relay is identified. Both lines are in the call processing busy (CPB) state or in the permanent signal partial dial (PSPD) lock-out (PLO) state.

Line card fault correction

If the line tests determine that a line card is faulty, the following procedure is used to correct the fault without affecting other line circuits in the drawer:

Procedure 8-5

- 1 Locate the faulty line card and identify its type by entering the CKTLOC command at the LTP level.
- 2 Replace the faulty line card as follows:
 - a Place the line in the MB state.
 - b Withdraw the line drawer from its module.
 - c Replace the faulty card with a good one.
 - d Return the line drawer to its module.
- 3 Test the line circuit.
- 4 Return the line circuit to service.

Line testing description

Line testing uses resident tests at a line test position (LTP) to identify and locate line faults. Any of the LTPs located at the host, or located remotely, may be used to access the lines maintenance subsystem, in which the line tests reside.

Subscriber line testing

Subscriber line testing determines if line circuits and the associated loop are capable of functioning within design limits. If the line is found to be faulty, line testing will determine if the fault lies in the line circuit or in the attached loop. When the fault is located in the loop it is usually referred to outside plant personnel for maintenance action. When the fault is located in the line circuit, the line card is replaced and the line is retested to verify that the fault has been cleared.

Station testing

Station testing is used to determine if a station is capable of functioning properly while it is connected to a loop and line circuit.

Manual line testing

Manual line testing is initiated as a result of a subscriber report, an ALT failure, or routine maintenance procedures. Maintenance is performed at the LTP using any of the ALT, LTP, LTPMAN, LTPDATA, or LTPLTA levels of the line maintenance (LNS) subsystem (automatic line testing is discussed in Chapter 1). Tests of business console lines are conducted at the IBNCON level, and customer switched digital data lines are tested at the CSDDS level. Manual line testing at LTP, LTPMAN, and LTPDATA is performed by posting the line to be tested in the control position.

An example of the LNTST command entered at the LTPLTA level is shown in figure 8-4. The LTPLTA level display retains the system status, posted set information, and data on the line in the control position in the same way as the LTPMAN level display.

Figure 8-4 LTPLTA level display

```

CC      CMC      IOD      Net      PM      CCS      Lns      Trks      Ext
.      .      .      .      .      .      .      .      .

LTPLTA
0  Quit      POST 2      DELQ      BUSYQ      PREFIX 621
2  Post_
3  MonLTA    LCC PTY RNG.....LEN.... DN      STA F S LTA TE RESULT
4  TalkLTA   1FR      HOST 14 1 13 01 621 7348 IDL . OUT MTU
5  Orig_
6  LnTst      HOLD1      621 8945 CPB      621 3215
7  VDC_      HOLD2      621 0063 IDL
8  VAC_      HOLD3      621 1092 CPB      RCVRDGT      2
9  Res_
10 Cap_      TEST OK
11 Hold
12 Next_      RES      CAP      VAC      VDC
13           TIP      999.0K  0.000UF  0      0
14 LTA_      RNG      999.0K  0.000UF  0      0
15 BalNet_
16 Coin_      TIP TO RNG 999.0K  0.020UF
17 Ring_
18 DgtTst

      userid
TIME  hh : mm>

```

Note: In the example shown in Table 8-4 all resistance measurements are reported as 999.0 k Ω. The value 999.0 kΩ is reported for all resistance measurements of 999.0 kΩ and higher. The tip to ring capacitance

measurement is .020 \times F. The tip to ring resistance values for MBS lines will be from 100 through 180 k Ω .

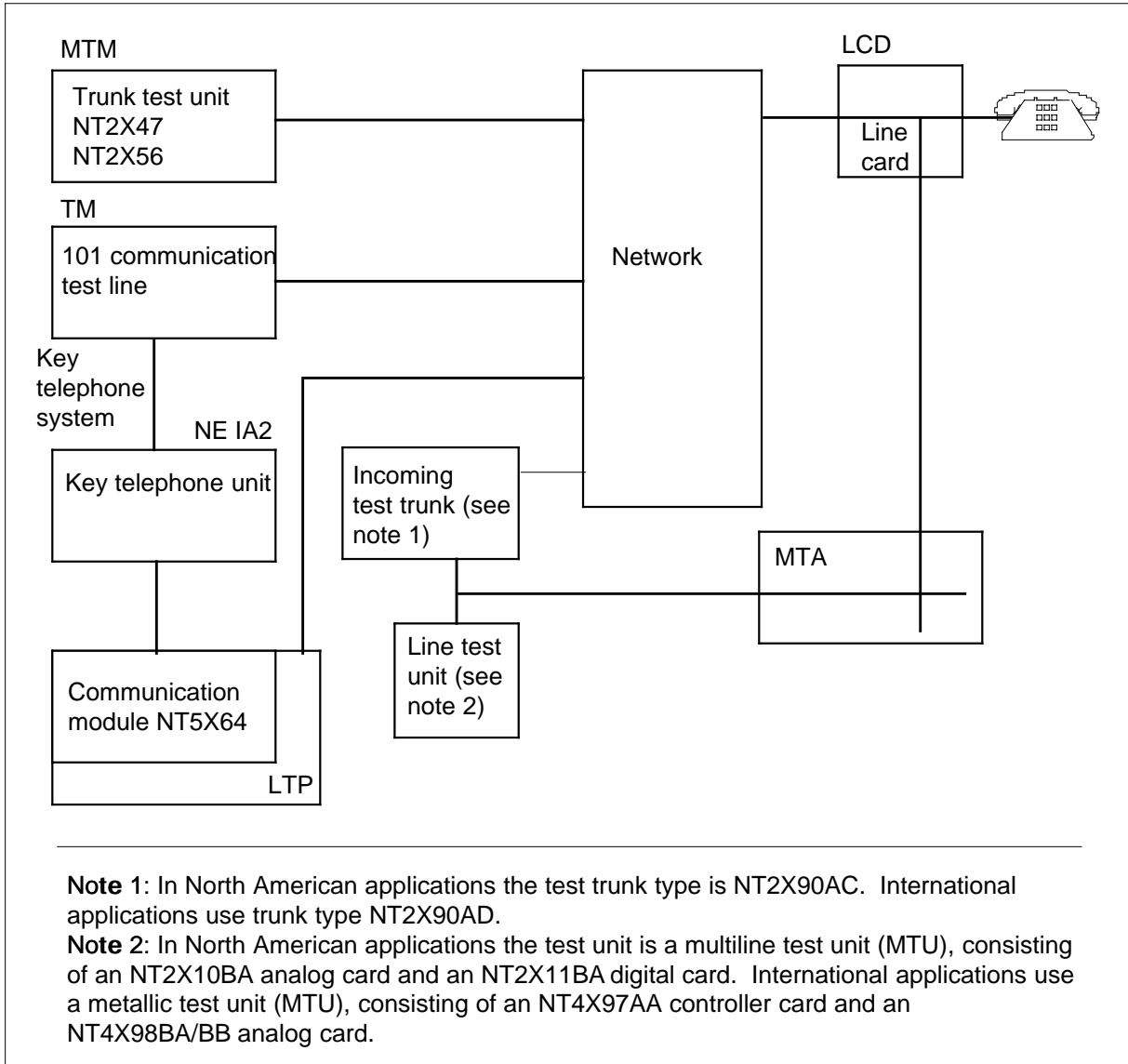
The indicators used in the example in Figure 8-4 are defined as follows:

- TEST OK indicates that the tests were performed and measurements were returned. There is no analysis (for example, range checking) of the returned measurements. The operating company personnel are required to analyze the measurements returned by the line test.
- RES,CAP,VAC,VDC are headers for line test measurements where the resistance measurements are in ohms, the capacitance measurements are in microfarads, and the voltage measurements are in volts.
- TIP is the line identifier for test measurements from the tip lead of the subscriber loop to ground.
- RNG is the line identifier for test measurements from the ring lead of the subscriber loop to ground.
- TIP to RNG is the line identifier for test measurements from the tip lead to the ring lead of the subscriber loop.

More information on line testing follows throughout this chapter.

The LTP is used to activate tests on subscriber lines and to connect metallic test unit (MTU) and transmission test unit (TTU) equipment to measure the results of the tests. Table 8-5 shows the configuration of line testing elements.

Figure 8-5 Line testing configuration



Individual call testing

Individual call testing of POTS and MBS lines is conducted automatically to determine if the following conditions apply:

- line card is in place
- test register is functioning
- message signaling is successful

Failure of any of these conditions causes the line to be registered in the *shower queue* (a system originated diagnostic schedule) and released for a second call

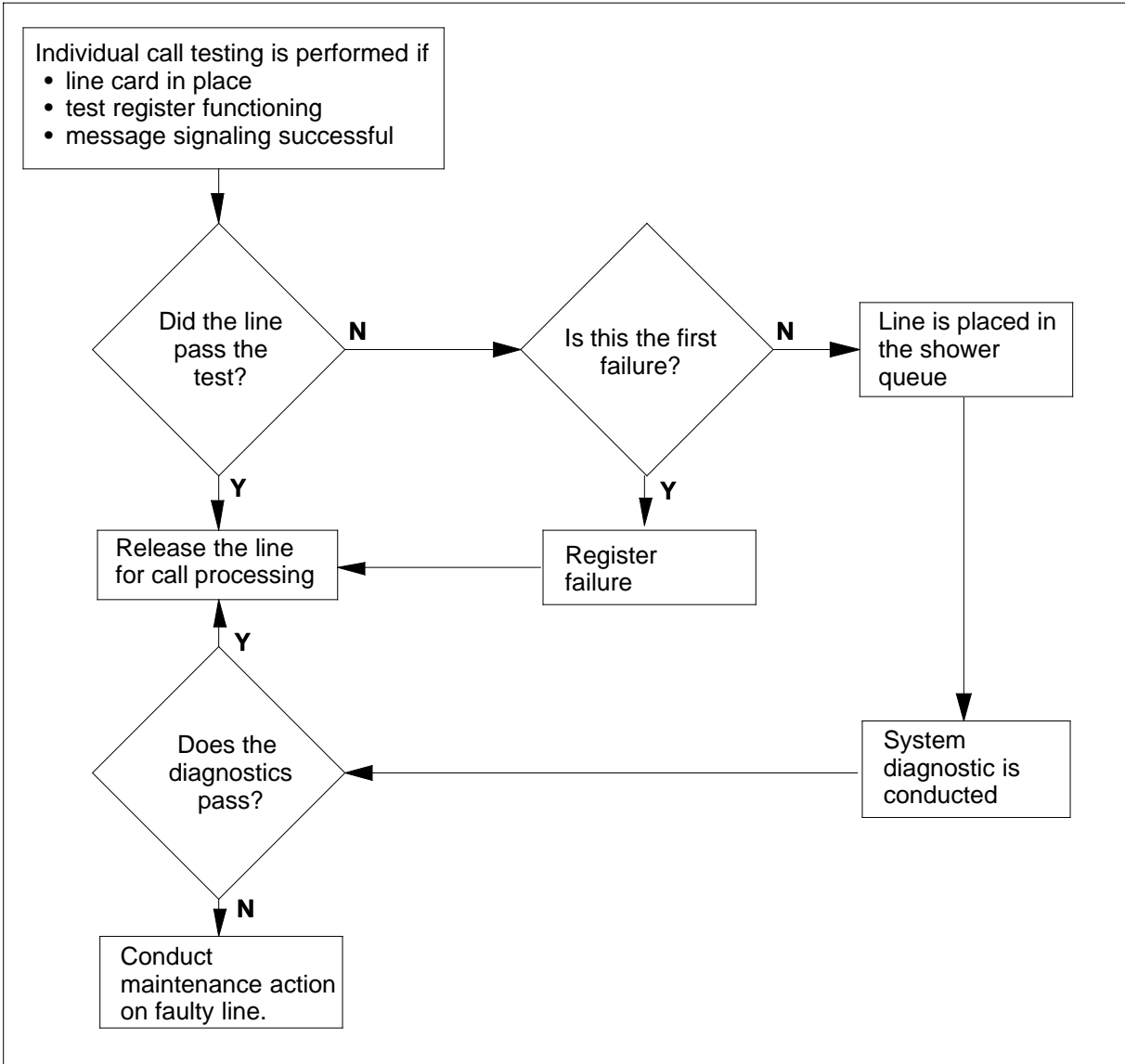
attempt. If any of the tests fail a second time, the line is subjected to diagnostic tests for fault identification.

Table 8-4 lists the types of faults that cause a shower queue registration, and their possible causes. Shower queue results are reported to the log system. The shower queue process is depicted in Figure 8-6, "Shower queue process" on page 8-20.

Table 8-4 Shower queue line faults

Fault	Possible cause
Permanent signal	Permanent signal on dial pulse line
Dial pulse reception	Partial dial
	Extra pulse
	Mutilated pulse
Digital reception	Partial dial
	Extra pulse
	Mutilated pulse
	Permanent signal
Ringing bus	Ringing failed
	Coin collect failed
	Coin return failed
	Coin test failed
	Coin present failed
ICMO	LCM Report ICMO
	LGC report malicious ICMO
	LTC report malicious ICMO

Figure 8-6 Shower queue process



Access from a test desk

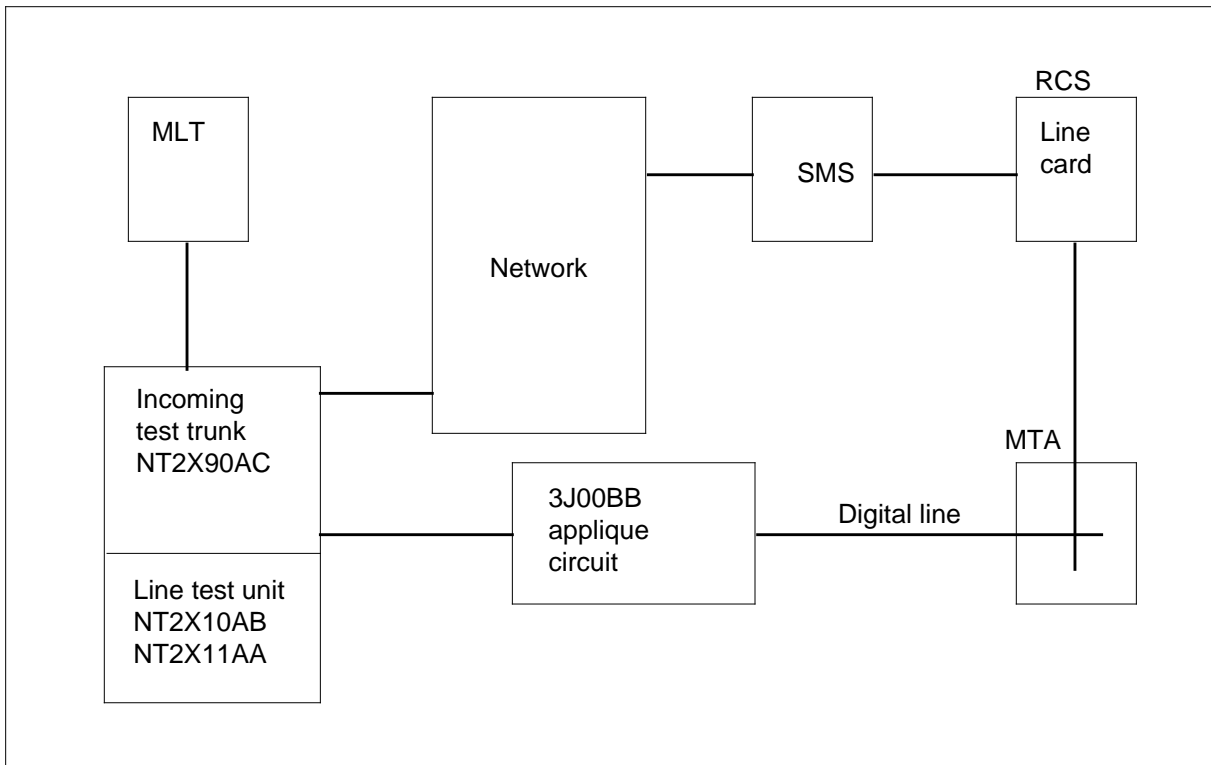
A tester at a test desk such as Centralized Automated Loop Reporting System (CALRS), #14 local test desk, or #3 local test cabinet, can access a DMS-100 line circuit by dialing a seven digit number through a test trunk. The trunk provided is a NT2X90 circuit card in an MTM.

The seven digit number represents the frame, unit, drawer, and circuit of the line that is being accessed and is in the format *ff u dd cc*. Additional information concerning this format is provided in Section , "LEN numbering" on page 1-17

Testing SLC-96 subscriber carrier lines from a test desk

The sleeve of a MLT test trunk is used to control the operating of the trunk during tests of SLC-96 subscriber carrier lines. The sleeve can be opened and subjected to different levels and polarity of current. High current levels are from 21 through 210 mA, while low current levels are from 6 through 18 mA.

Figure 8-7 SLC-96 line testing configuration using MLT



When a SLC-96 subscriber carrier line is tested from a mechanized loop tester (MLT) (see Figure 8-7) the following sequence of events takes place:

1. The NT2X90 test desk trunk is seized by the MLT. The switch detects the seizure, prepares for digit collection, and grounds the sleeve of the test desk trunk.
2. The digits of the telephone number for the line to be tested are dialed by the accessing testing system, and collected and processed by the switch. One of the following conditions results:
 - the number is intercepted if it is not in service
 - busy tone is returned if the number is busy
 - a 56.2 k Ω loss is connected across the tip and ring conductors of the test trunk to indicate that the line is idle and that it is served by a SLC-96 carrier system.

3. The testing system removes the subscriber loop from the line under test and applies +116 Vdc to the tip conductor. The ring conductor is connected to ground if the line under test is a coin line, or to neither ground nor voltage if the line is a flat rate line.
4. The switch then removes the 56.2 k Ω loss from the tip and ring conductors of the test trunk and one of the following conditions results:
 - a 60 IPM busy tone is received to indicate a RCS major alarm. The indication is discontinued by a high negative current that is applied to the sleeve of the test desk trunk, disconnecting the testing system.
 - a 120 IPM reorder tone is received to indicate that the metallic test pair is in use. The indication is discontinued by a high negative current that is applied to the sleeve of the test desk trunk, disconnecting the testing system.
 - a metallic test pair is connected to the subscriber loop in the RCS, and the tip of the test trunk is grounded, if a metallic test pair is idle and no major alarm is present.
5. The test desk removes the +75 V and the ground that was applied to the line in event 3.
6. The switch removes the tip ground from the test trunk and connects the trunk to the metallic test pair.
7. The switch conducts the extended diagnostic on the line under test.
8. Test results are requested by opening the sleeve of the test trunk circuit.
9. The test results are reported as described in Table 8-35, "+48 V reversal relay voltage measurements" on page 8-151
10. The test connection is released by connecting high negative current to the sleeve of the test trunk circuit.

Testing RCU lines at the basic test desk

The basic test desk configuration for RCU lines testing does not require an LTA card. The RCU lines testing configuration permits the metallic pairs from the test desk location to be connected to the line card or to the subscriber loop. Then call originator tests can be conducted on the line circuit, and line condition tests can be conducted on the subscriber loop.

Enhanced test desk The enhanced test desk configuration for RCU lines testing supplements the basic test desk configuration with

- LTA card to supply simulated operating conditions
- signal distributor and an applique circuit to extend the test result to an MLT

- external receiver and an applique circuit to enable DTMF tests to be performed
- TTU to verify that the test termination is properly applied

RDT subscriber line testing from no test trunk (NTT)

Subscriber loop testing for RDT lines can be initiated from the remote maintenance center using various loop test systems. The loop test systems connect to the local digital switch (LDS) using the no test trunk interface. As of NA008/XPM81, RDTs support no test trunk line testing. The term NTT refers to a standard protocol that allows an external test system to gain access to and test lines and loops on a switch. Mechanized loop testing (MLT) and test desk are types of NTT testing where a special access code is dialed to gain access to the subscriber loop. The switch runs the extended diagnostic on the line under test and the test results are reported back to the test equipment.

POTS, coin, and multiparty line testing using MLT and test desk

MLT and test desk testing are supported only on POTS, coin, and multiparty lines. When the line under test is seized by the test system, a 56.2 Kohm load (equivalent to the on-hook dc signature) is applied between the tip and ring of the test trunk. This load indicates to the test system that

- the line is idle
- the dialed number is located in a loop carrier system
- a metallic access to that line is given to the test system through the test trunk

The test system then prepares to receive the diagnostic results from the switch through DC voltage signatures.

EBS or ISDN line testing using MLT and test desk

In case of an EBS or ISDN lines, the dc signature is disabled by the SuperNode switch to indicate that test system will not receive the diagnostic results and therefore only metallic access of that line is given. When an RDT is serving a combination of POTS, coin, multiparty, EBS, and ISDN lines, the dc signature is provided for only POTS, coin, and multiparty lines and is disabled for EBS and ISDN lines. The test system receives the test results of extended diagnostic and metallic access for POTS, coin, and multiparty lines and a metallic connection for EBS and ISDN lines.

To control the NTT dc signature, table RDTINV, field NTTOPT is datafilled as follows:

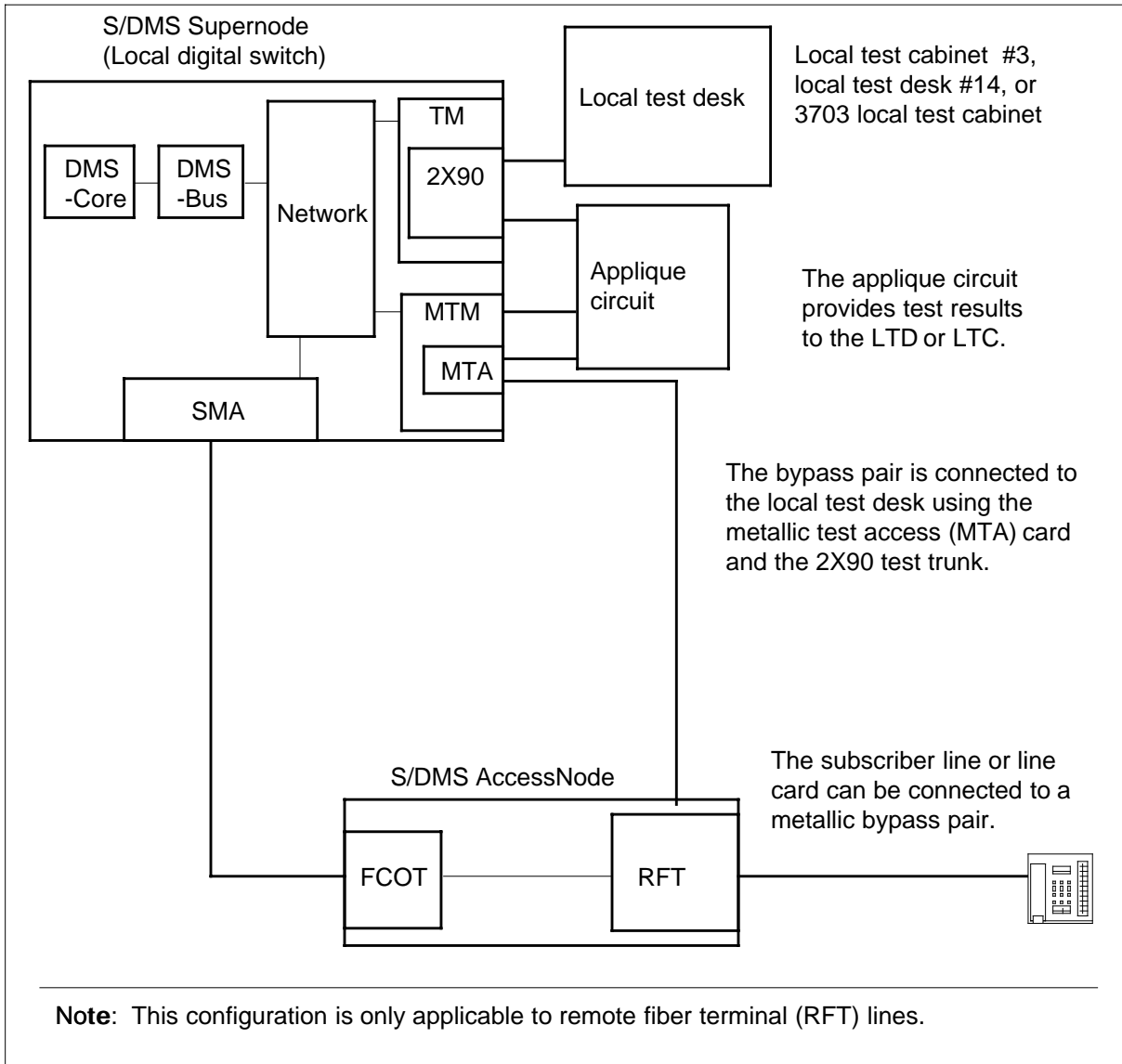
- If the NTTOPT field is set to "N", then the NTT signature is disabled for all line types served by that RDT.
- If the NTTOPT field is set to "Y", the NTT dc signature is enabled for POTS, coin, and multiparty lines. In addition, during software upgrades from an old release to a new release, the field is set to "Y".

The NTT dc signature can be controlled on an individual RDT basis. The NTT signature can then be disabled for all line types on an individual RDT basis.

Testing RDT lines from a local test desk

Examples of local test desks (LTD) are the local test cabinet (LTC) #3, LTD #14, and 3703 LTC. In the subscriber carrier module-100 access (SMA) configuration, testing of remote digital terminal (RDT) lines can be performed by using a metallic bypass as shown in Figure 8-8.

Figure 8-8 Local test desk configuration for RDT lines

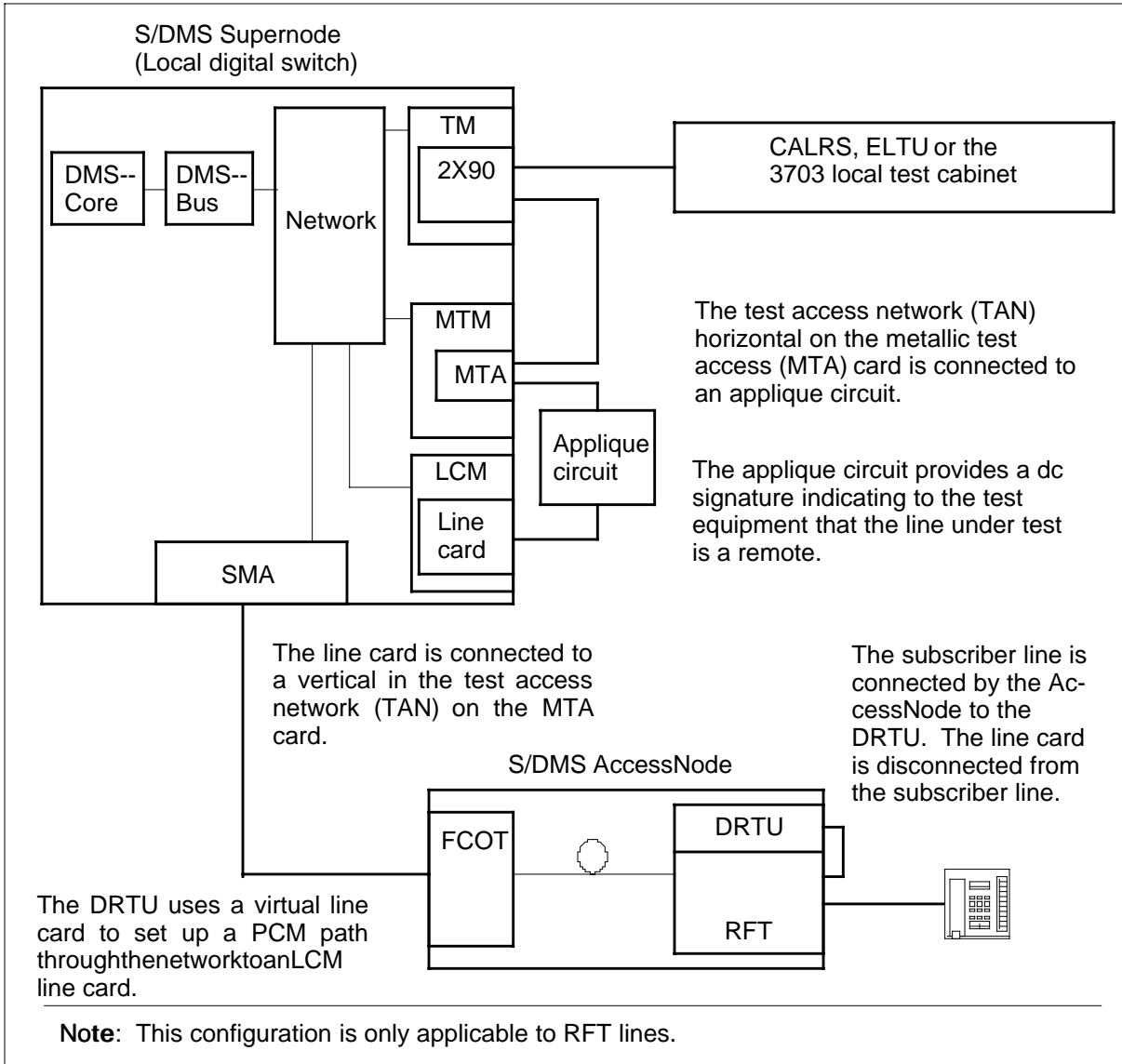


Testing RDT lines on a CALRS test desk or ELTU

External test systems include the Centralized Automated Loop Reporting System (CALRS) and the external line testing unit (ELTU). In the SMA configuration, these tests can be performed by using the digital remote test unit (DRTU) and a metallic bypass. Figure 8-9 shows the configuration.

Note: This configuration is also used for the 3703 local test cabinet.

Figure 8-9 CALRS or ELTU configuration for testing RDT lines



Testing Meridian business sets from a local test desk

When a LTD accesses MBS sets on NT6X21 line cards, the following features are activated:

- The LTD has two methods of accessing a line to be tested. If the line is idle, it sets the test access relays to *Out_Mode*, which activates the cutoff relay to disconnect the line from the line card so tests can be done on the line out to the subscribers phone. If the line is CPB, the relays are set to *Bridge_Mode*, which means the LTD trunk is bridged onto the busy line without interrupting the voice path of the call in progress. For MBS testing, it is not sufficient to check only the line state of the DN dialed by the LTD. Even if the DN under test is idle, there may be an active call on one of the

other keys, and if the cutoff relay is activated this call will be cut off. The LTD checks the line state of all keys on the EBS, and Out_Mode access is given only if all DN's are idle. Otherwise, the test relays are set to Bridge_Mode.

- When testing one DN on an MBS set, ensure that all other DN's on the set appear busy to incoming calls and are routed to a busy treatment (60 IPM tone).
- The LTD is able to address a specific line using the LEN instead of the DN. This ensures the primary DN on the set is accessed when the LEN is dialed.
- When the test is complete, run the lamp audit to update the MBS liquid crystal displays (LCD) after the line under test is released. This is because when an EBS set is accessed in Out_Mode, power is removed from the set and the display goes blank. After releasing the test access relay and waiting 6 s, the set powers up and the EBS lamp audit is activated.

Mechanized loop tester for RDT lines

In the SMA configuration, these tests can be performed either with or without the remote measurement unit (RMU). Figure 8-10 shows the configuration without the RMU.

Figure 8-10 MLT (without RMU) for RDT lines

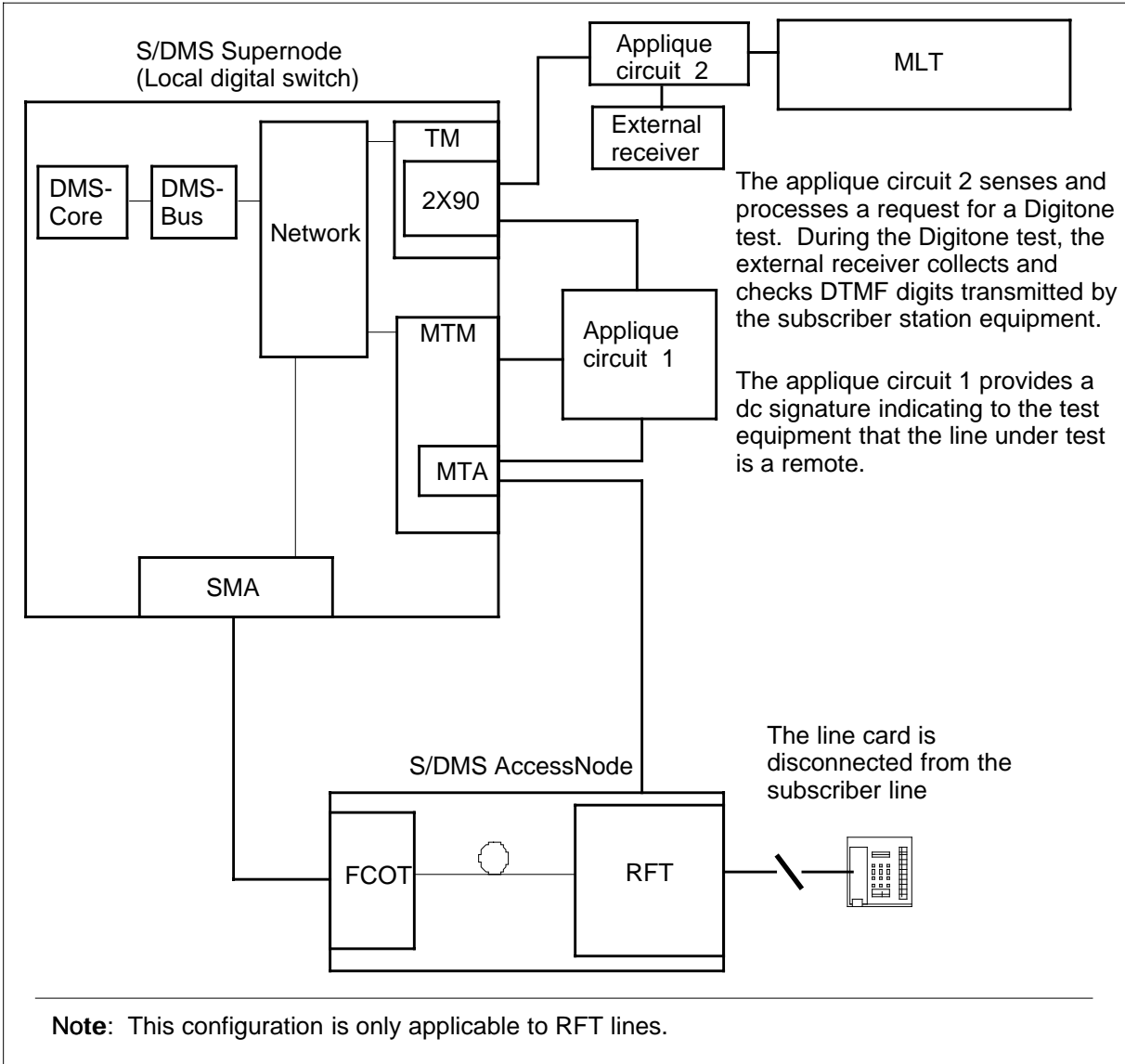
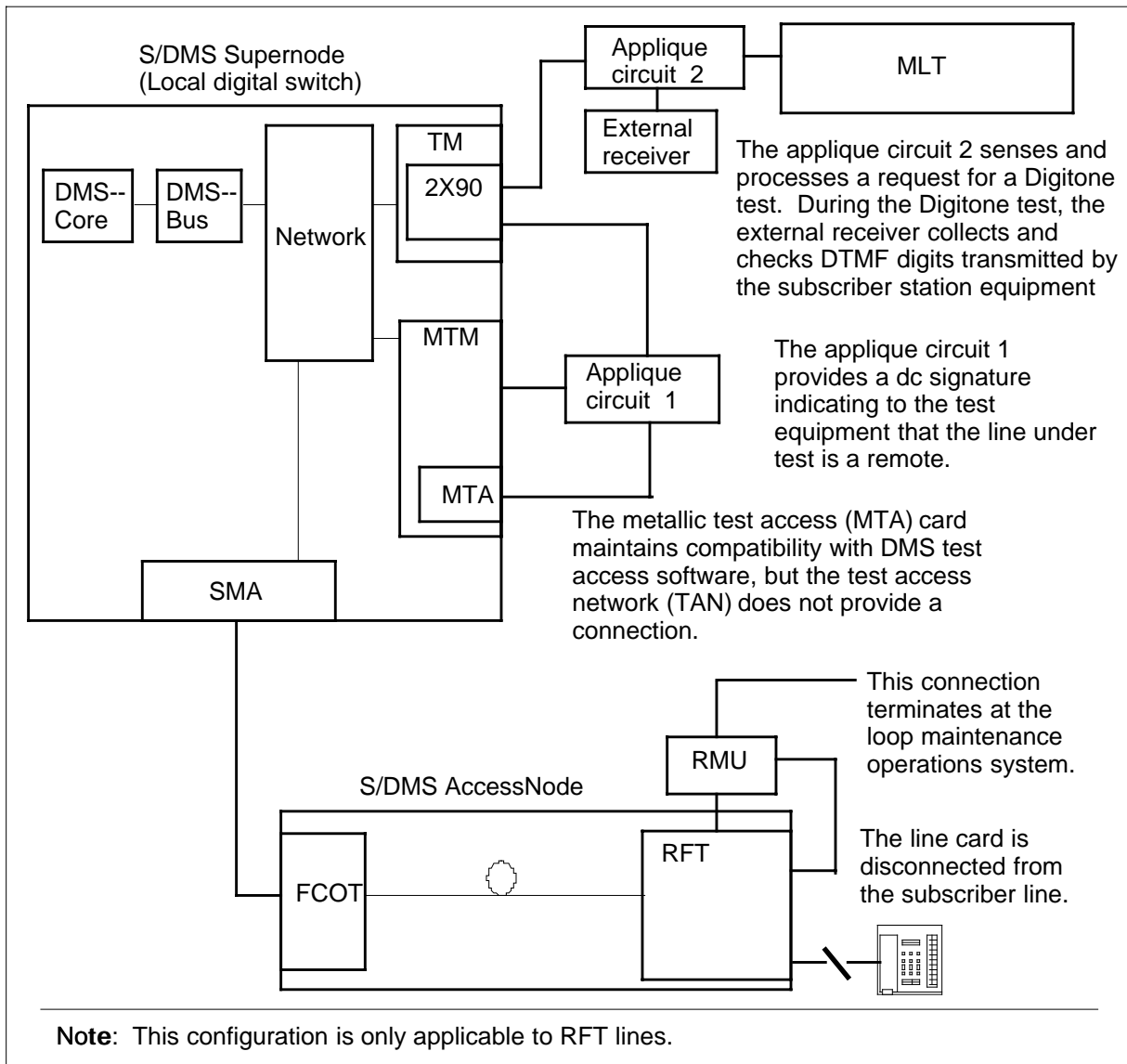


Figure 8-11 shows the configuration with the RMU.

Figure 8-11 MLT (with RMU) for RDT lines



Control position

The control position is the location in memory where all maintenance actions on a subscriber line, or on an Integrated Business Network (IBN) console, must take place. The control position for a line accommodates one posted line for maintenance action by a tester using commands at the LTP, LTPMAN, LTPDATA, or LTPLTA menu levels.

The following information on the line in the control position, continuously updated and displayed in the upper part of the CI output area:

- line class code
- party
- site
- LEN
- DN
- state
- seizure indicator
- line test access (LTA) connection mode
- terminating equipment

The control position for a console accommodates one console selected for maintenance action by a tester using commands at the IBNCON level. The following information on the console in the control position, is continuously updated and displayed in the lower part of the CI output area:

- customer group number
- customer group name
- console number
- console location identifier
- connected digital modem number
- state

The IBNCON level is accessible to switches equipped with software package NTX100. At the IBNCON level, maintenance action can be taken on IBN attendant consoles. Digital modems and 3-port conference circuits used by the consoles are tested from the trunk test position (TTP). Console testing is discussed in Section , "Attendant console testing" on page 8-72.

In the example in Figure 8-12, a display of headers is shown in line with menu item 11, and menu item 12 line shows of the result of entering the SELECT

command and parameters for consoles in the CPB state. The results displayed under the headers have the following meanings:

- No. indicates the console that is selected is number 0
- GROUP identifies the customer group and subgroup of the selected attendant console. In this example, the customer group CLLI is COMKODAK and the subgroup number is 0.
- CONSOLE identifies the attendant console CLLI, the associated digital modem CLLI, and the digital modem number. In this example, the console CLLI is ATTCLGA, the digital modem CLLI is DMODEM, and the digital modem number is 13.

STATE identifies the current state of the attendant console. In this example the console state is CPB. A list of console states is provided in Table 8-5, "Attendant console states" on page 8-32.

Figure 8-12 IBNCON level display

```

CC      CMC      IOD      Net      PM      CCS      Lns      Trks      Ext
.       .       .       .       .       .       .       .       .
IBN Console
0 Quit_   POST      DELQ      BUSYQ     PREFIX
2
3 Select_ LCC PTY RNG.....LEN.....DN STA F S LTA TE RESULT
4 Next
5 Busy
6 RTS
7 Diagnose
8
9
10 Seize
11 Release No. Group          Console          State
12 Clear   0 COMKODAK          0 ATTCLGA DMODEM 13      CPB
13 PrevDM
14
15
16 QConLine
17 QCustGrp
18 QSeated
  ADMIN
Time 20.01
    
```

Table 8-5 Attendant console states (Sheet 1 of 2)

Code	Line state	Description
NRDY	Not Ready	The attendant console has been unjacked and is going through a 60-s timeout period. No call processing activity or maintenance activity (except force release) can occur.
CPB	Call Processing Busy	The attendant console is jacked in and is in service. Call processing can take place. The console cannot be seized for maintenance purposes.
SZD	Seized	The attendant console has been seized for maintenance activity by operating company personnel. A digital modem has been allocated and maintenance activity can take place. Call processing cannot occur.
UNJK	Unjacked	The attendant console is in service but the headset or handset has been unjacked and the 60-s timeout has occurred. Neither call processing nor maintenance activity can take place.
OFFL	Offline	The attendant console is hardware and software equipped but is not in service. Call processing cannot take place.

Table 8-5 Attendant console states (Sheet 2 of 2)

Code	Line state	Description
MB	Manual Busy	The console has been removed from service by the tester using the FRLS command. Call processing cannot take place.
SB	System Busy	The attendant console has been removed from service by system maintenance action.
UNEQ	Unequipped	The attendant console has not been software equipped (datafilled).
DEL	Deloaded	A temporary state assigned to an attendant console, upon completion of call processing, if maintenance personnel have requested the console while it was in the CPB state.

Hold position

The line in the control position may be transferred temporarily to one of three hold positions so that it is retrievable and not dropped from the posted set. The following details of the hold line are displayed:

- DN
- current state
- connected circuits
- line
- trunk and CLLI
- service circuit and pseudo CLLI
- internal test circuit and pseudo CLLI

Posting lines**Subscriber lines**

Lines that are posted in the LTP, LTPMAN, LTPDATA, or LTPLTA menu levels are identified to all four levels. Although only one line can be placed in the control position at a time, any of the posted lines can be placed there when required.

Lines may be posted individually or in sets of more than one line. Individual lines are posted by specifying one of the following circuit identifiers:

- DN
- LEN

A set of lines is posted by specifying one of the following location identifiers or condition identifiers:

- location identifiers
 - LEN
 - DN
 - CLLI
 - group name and number
 - card
- condition identifiers
 - trouble buffer
 - state
 - deloaded queue
 - busy queue
 - diagnostic failures
 - LIT failures
 - shower queue

When posting a set of lines, all the members of that group are posted. For example, in the case of posting by line drawer, all 32 lines in the drawer are posted regardless of their availability status. When there is only one line in a set, it is treated as an individual line. Any previously posted lines are dropped from LTP control and are no longer posted.

When a set of lines is posted by location identifier, the first line of the set is placed in the control position, and the number of remaining lines in the set is displayed to the right of the label POST.

When a set of lines is posted by condition identifier, the first line of the set is placed in the control position, and the code for the specified condition identifier is displayed to the right of the label POST.

Dial tone speed recording circuits

The two DTSR circuits associated with each LM may be posted, although they are not truly lines. These DTSR circuits are assigned pseudo-functional references of LM line drawer number 20 or LCM line subgroup number 20, and line circuit numbers 00 and 01. The circuits are assigned IDL or CPB states automatically by the DMS-100 switch during DTSR activity, and MB or INB states by the tester using the BSY command in the LTP menu. In the case of an LCM, dial tone speed recording is performed on a call by call basis; therefore, no DTSR circuit is required.

Nailed-up special service circuits

Nailed-up special service circuits are used primarily for foreign exchange service. They can also be used by subscribers to access their computers from remote locations. When nailed-up special service circuits are posted, the identification of each end point is displayed. However, maintenance actions are conducted at PM maintenance levels.

Semi-permanent connections

A semi-permanent connection (SPC) is used typically for a computer data link. A semi-permanent connection has a line class code (LCC) of SPC which appears under the LCC header on the MAP display. Exercise extreme caution when using the maintenance commands on a semi-permanent connection at the LTP, LTPMAN and LTPLTA menu levels. These maintenance commands are listed in Table 8-6.

Table 8-6 Semi-permanent connections maintenance commands

BAL	JACK	MONLTA	TALKLTA
BALNET	LCO	NOISE	TONEGEN
CAP	LNTST	ORIG	TSTRING
DGTTST	LOSS	RES	VAC
DIAG	LTA	RING	VDC

Datapath extension lines

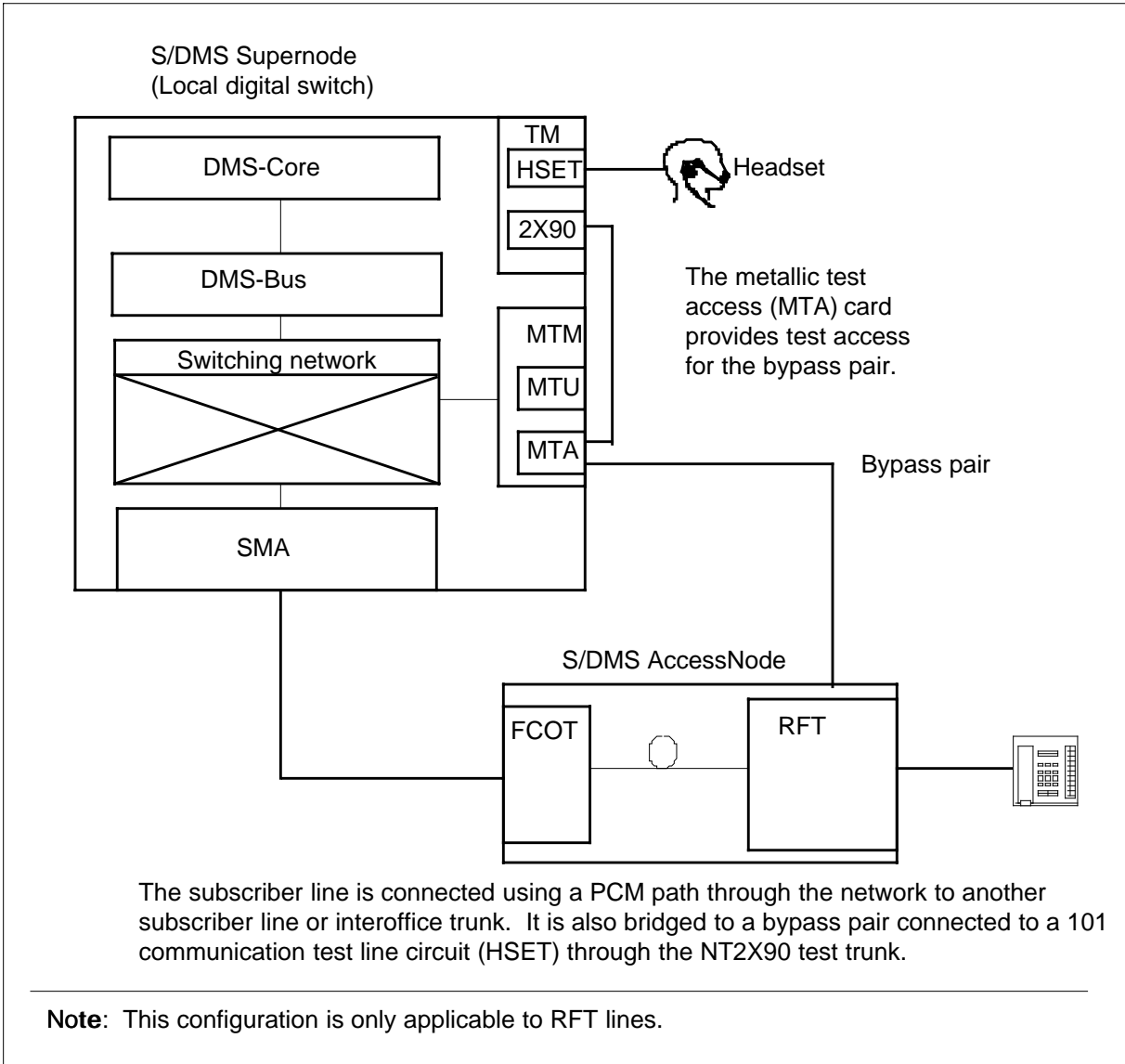
Datapath lines that are connected through datapath extension (DPX) facilities can be posted by:

- directory number
- trunk group CLLI
- all datapath extension (DPX) lines in the serving switch

Monitoring RDT subscriber lines

The MONLTA command connects a headset circuit to a subscriber line so that the craftsperson can listen to a line. In the SMA configuration, these tests can be performed by using a metallic bypass. Figure 8-13 shows the metallic bypass configuration.

Figure 8-13 MONLTA configuration for RDT lines



Line tests

Line tests are used for POTS, MBS, and data lines to:

- determine if a fault exists
- isolate the fault
- verify that the maintenance action has corrected the fault.

Table 8-7 and Table 8-8 list tests that are used to maintain subscriber lines. All of the tests may be performed manually from the LTP level. Those that are marked with a diamond (◆) may also be performed automatically on selected

lines according to a schedule that is established by the central office at the ALT level of the MAP display.

Table 8-7 Line card tests (Sheet 1 of 2)

Test	A	B	C	D	E	F	G	H	I	J
◆ Diagnostic (see table 8-8)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
◆ Subscriber loop	Y	Y	Y	Y		Y	Y	Y	Y	Y
◆ Balance network off-hook	Y	Y				Y	Y	Y	Y	Y
◆ Loss	Y			Y	Y	Y	Y	Y	Y	Y
◆ Noise	Y			Y	Y	Y	Y	Y	Y	Y
◆ Line (see note)	Y			Y	Y	Y	Y	Y	Y	Y
◆ Coin	Y			Y	Y	Y	Y			
◆ ANI				Y	Y					
◆ Coin presence					Y					
◆ Digit test	Y			Y	Y	Y	Y	Y	Y	Y
◆ Originate	Y					Y	Y	Y	Y	Y

Legend:
 Y Test applies
 A North American POTS line card (including GUL card NT6X33AA)
 B NT6X21 MBS line card
 C NT6X71 data line card
 D DMS-1 RCT subscriber carrier line card
 E SLC-96 subscriber carrier line card
 F NT6X93 international type A line card
 G NT6X94 international type B line card
 H NT6X17BA world line card
 I NT6X18BA world line card
 J NT6X21CA Universal Modular P-Phone Line Card (UMPLC)

Note: Includes ac and dc voltage, resistance, and capacitance tests.
 ◆ Indicates that the test may also be performed automatically at the ALT level.

Table 8-7 Line card tests (Sheet 2 of 2)

Test	A	B	C	D	E	F	G	H	I	J
◆ Ring	Y			Y	Y	Y	Y	Y	Y	Y
◆ SSMAN	Y	Y	Y			Y	Y	Y	Y	Y
◆ SRT for POTS	Y			Y	Y	Y	Y	Y	Y	Y
◆ SRT for business set		Y								
◆ SRT for data set			Y							
<p>Legend:</p> <p>Y Test applies</p> <p>A North American POTS line card (including GUL card NT6X33AA)</p> <p>B NT6X21 MBS line card</p> <p>C NT6X71 data line card</p> <p>D DMS-1 RCT subscriber carrier line card</p> <p>E SLC-96 subscriber carrier line card</p> <p>F NT6X93 international type A line card</p> <p>G NT6X94 international type B line card</p> <p>H NT6X17BA world line card</p> <p>I NT6X18BA world line card</p> <p>J NT6X21CA Universal Modular P-Phone Line Card (UMPLC)</p> <p>Note: Includes ac and dc voltage, resistance, and capacitance tests.</p> <p>◆ Indicates that the test may also be performed automatically at the ALT level.</p>										

Table 8-8 Line card diagnostic tests (Sheet 1 of 4)

Test	A	B	C	D	E	F	G	H	I	J
Transhybrid loss	Y ♦	Y ♦				Y ♦	Y ♦	Y ♦	Y ♦	
P-phone transhybrid loss										Y ♦ 3
Missing card	Y			Y	Y			Y ♦	Y ♦	Y ♦ 3
Channel loss for RCS lines					Y					
Attenuation pad	Y ♦	Y ♦				Y ♦	Y ♦			
Talk battery							Y			
Ring and supervision (see note 1)	Y ♦					Y ♦	Y ♦	Y ♦	Y ♦	
Noise (see note 1)	Y ♦	Y ♦		Y ♦	Y	Y ♦	Y ♦	Y	Y	Y ♦ 3

Legend:

Y Test applies

A North American POTS line card (including GUL card NT6X33AA)

B NT6X21 MBS line card

C NT6X71 data line card

D DMS-1 RCT subscriber carrier line card

E SLC-96 subscriber carrier line card

F NT6X93 international type A line card

G NT6X94 international type B line card

H NT6X17BA world line card

I NT6X18BA world line card

J NT6X21CA Universal Modular P-Phone Line Card (UMPLC)

Note 1: Requires table OFCOPT, parameter NRTEST set to YES.

Note 2: These tests apply to NT6X76 AILC and NT6X99AA IBERT card.

Note 3: For NT2X18AC, NT2X18AD, and NT6X18AA line cards.

Note 4: For NT2X18AD and NT6X18AB line cards

♦ SDIAG subtests (also indicates that the test may also be performed automatically at the ALT level)

3 Indicates that the system can perform the test automatically at the ALT level, LTP level, and the shower queue.

Table 8-8 Line card diagnostic tests (Sheet 2 of 4)

Test	A	B	C	D	E	F	G	H	I	J
Loop signal at line card (see note 2)		Y	Y ♦							Y ♦ 3
Self test (see note 2)			Y ♦							
Loop signal at keyset		Y ♦	Y							Y
Add-on and extension		Y								
Flux cancellation	Y	Y				Y	Y			Y
Echo return loss for RCS					Y					
Loop detector	Y					Y	Y	Y	Y	Y
Loop detector for RCT				Y ♦						
Loop detector for RCS					Y					
Legend:										
Y Test applies										
A North American POTS line card (including GUL card NT6X33AA)										
B NT6X21 MBS line card										
C NT6X71 data line card										
D DMS-1 RCT subscriber carrier line card										
E SLC-96 subscriber carrier line card										
F NT6X93 international type A line card										
G NT6X94 international type B line card										
H NT6X17BA world line card										
I NT6X18BA world line card										
J NT6X21CA Universal Modular P-Phone Line Card (UMPLC)										
Note 1: Requires table OFCOPT, parameter NRTEST set to YES.										
Note 2: These tests apply to NT6X76 AILC and NT6X99AA IBERT card.										
Note 3: For NT2X18AC, NT2X18AD, and NT6X18AA line cards.										
Note 4: For NT2X18AD and NT6X18AB line cards										
♦ SDIAG subtests (also indicates that the test may also be performed automatically at the ALT level)										
3 Indicates that the system can perform the test automatically at the ALT level, LTP level, and the shower queue.										

Table 8-8 Line card diagnostic tests (Sheet 3 of 4)

Test	A	B	C	D	E	F	G	H	I	J
Metering test							Y		Y	
Two-party ANI for RCT				Y						
Equalization current detector		Y								
Buffer full flag		Y	Y							Y
Battery feed resistor	Y	Y				Y	Y			Y
Current limit test for world line card								Y	Y	
Reversal relay	Note 3								Y	
+48 volt reversal relay	Note 4									
Legend:										
Y Test applies										
A North American POTS line card (including GUL card NT6X33AA)										
B NT6X21 MBS line card										
C NT6X71 data line card										
D DMS-1 RCT subscriber carrier line card										
E SLC-96 subscriber carrier line card										
F NT6X93 international type A line card										
G NT6X94 international type B line card										
H NT6X17BA world line card										
I NT6X18BA world line card										
J NT6X21CA Universal Modular P-Phone Line Card (UMPLC)										
Note 1: Requires table OFCOPT, parameter NRTEST set to YES.										
Note 2: These tests apply to NT6X76 AILC and NT6X99AA IBERT card.										
Note 3: For NT2X18AC, NT2X18AD, and NT6X18AA line cards.										
Note 4: For NT2X18AD and NT6X18AB line cards										
♦ SDIAG subtests (also indicates that the test may also be performed automatically at the ALT level)										
3 Indicates that the system can perform the test automatically at the ALT level, LTP level, and the shower queue.										

Table 8-8 Line card diagnostic tests (Sheet 4 of 4)

Test	A	B	C	D	E	F	G	H	I	J
Ground start relay	Note 3								Y	
Cutoff relay	Y	Y	Y			Y	Y			
Cutoff relay (test for open)										Y
Cutoff relay (test for closed)										Y
Ringing test for RCS					Y					
Test access relay	Y	Y	Y			Y	Y			
Test pads in line card										Y
Isolation relay test							Y			
Legend:										
Y Test applies										
A North American POTS line card (including GUL card NT6X33AA)										
B NT6X21 MBS line card										
C NT6X71 data line card										
D DMS-1 RCT subscriber carrier line card										
E SLC-96 subscriber carrier line card										
F NT6X93 international type A line card										
G NT6X94 international type B line card										
H NT6X17BA world line card										
I NT6X18BA world line card										
J NT6X21CA Universal Modular P-Phone Line Card (UMPLC)										
Note 1: Requires table OFCOPT, parameter NRTEST set to YES.										
Note 2: These tests apply to NT6X76 AILC and NT6X99AA IBERT card.										
Note 3: For NT2X18AC, NT2X18AD, and NT6X18AA line cards.										
Note 4: For NT2X18AD and NT6X18AB line cards										
♦ SDIAG subtests (also indicates that the test may also be performed automatically at the ALT level)										
3 Indicates that the system can perform the test automatically at the ALT level, LTP level, and the shower queue.										

Most manual line tests are performed at the LTP level of the lines maintenance subsystem by switch maintenance personnel using a MAP (maintenance and

administration position) terminal. The test results are displayed on the MAP monitor after the tests are performed.

If diagnostics on world line cards are initiated using the command string DIAG D entered at the LTP level of the MAP terminal, a LINE170 (test passed) or LINE171 (test failed) log report will be produced that identifies which tests pass or fail. For more information on the LINE170 and LINE171 log reports, see chapter 3, "Lines related logs" on page -1.

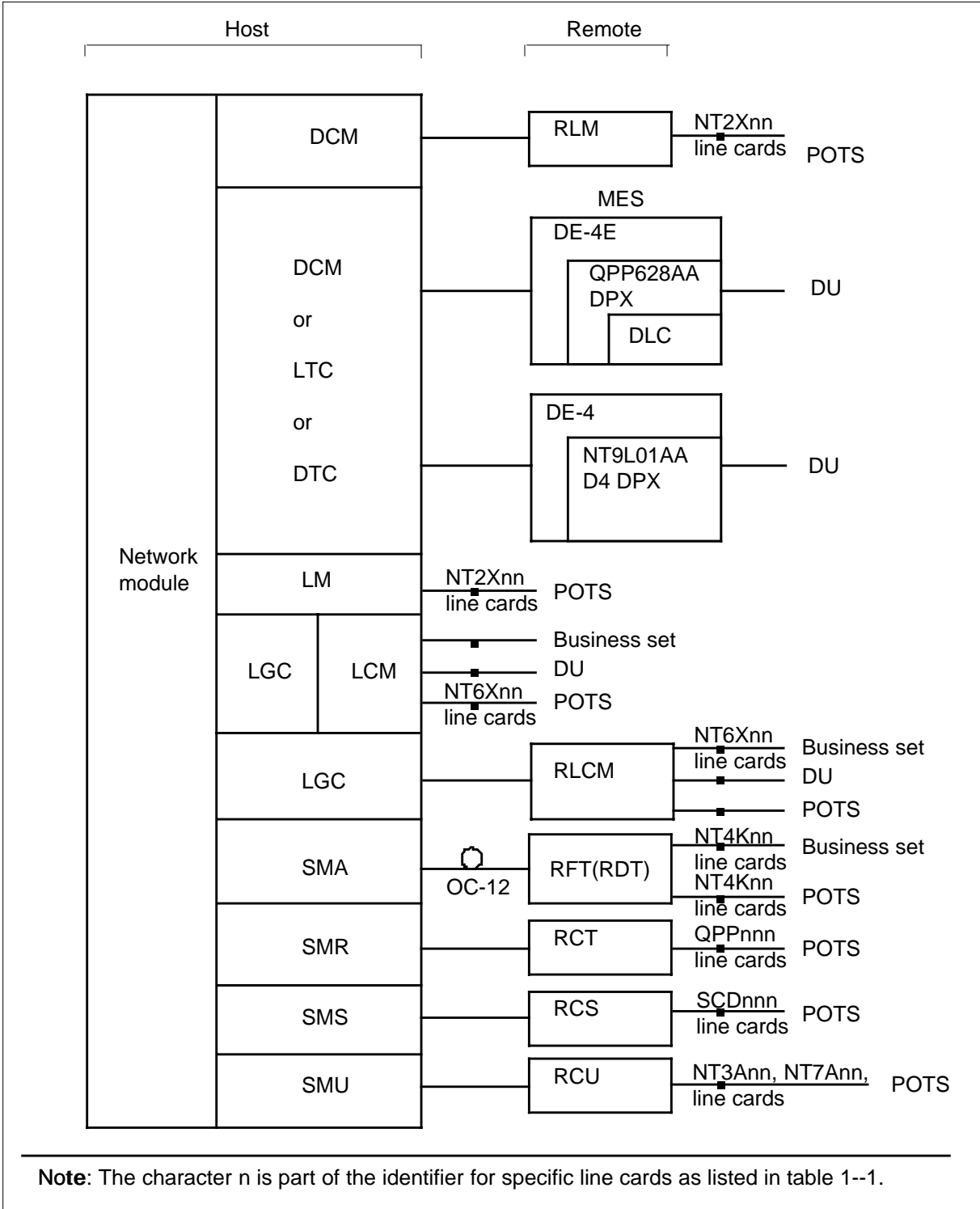
The silent switchman (SSMAN) test and the station ringer test (SRT) are performed at the subscriber station by installation and repair personnel. In some cases the SSMAN test is used by cable repair personnel to locate a facility fault. Results of these tests are audibly observed, while some types of station equipment also permit them to be observed visually.

Automatic line tests are performed on groups of line circuits and subscriber loops at the ALT level of the lines maintenance subsystem. The tests are conducted on a scheduled basis, with tester involvement being limited to prescribing the tests and setting their time and frequency. The tests are normally scheduled to be performed during periods of low traffic so that the impact on service is minimized. Results of automatic and manual tests that are performed at the ALT level are reported to the log system. For details about automatic line testing, refer to Section , "Automatic line testing description" on page 1-43.

Access is gained to subscriber line tests and associated maintenance actions through the LNS subsystem, and its subtending levels LTP, ALT, and LNSTRBL. Levels LTPDATA, LTPMAN, IBNCON, CSDDS, and LTPLTA subtend from the LTP menu level.

Figure 8-14 shows the types of subscriber line configurations.

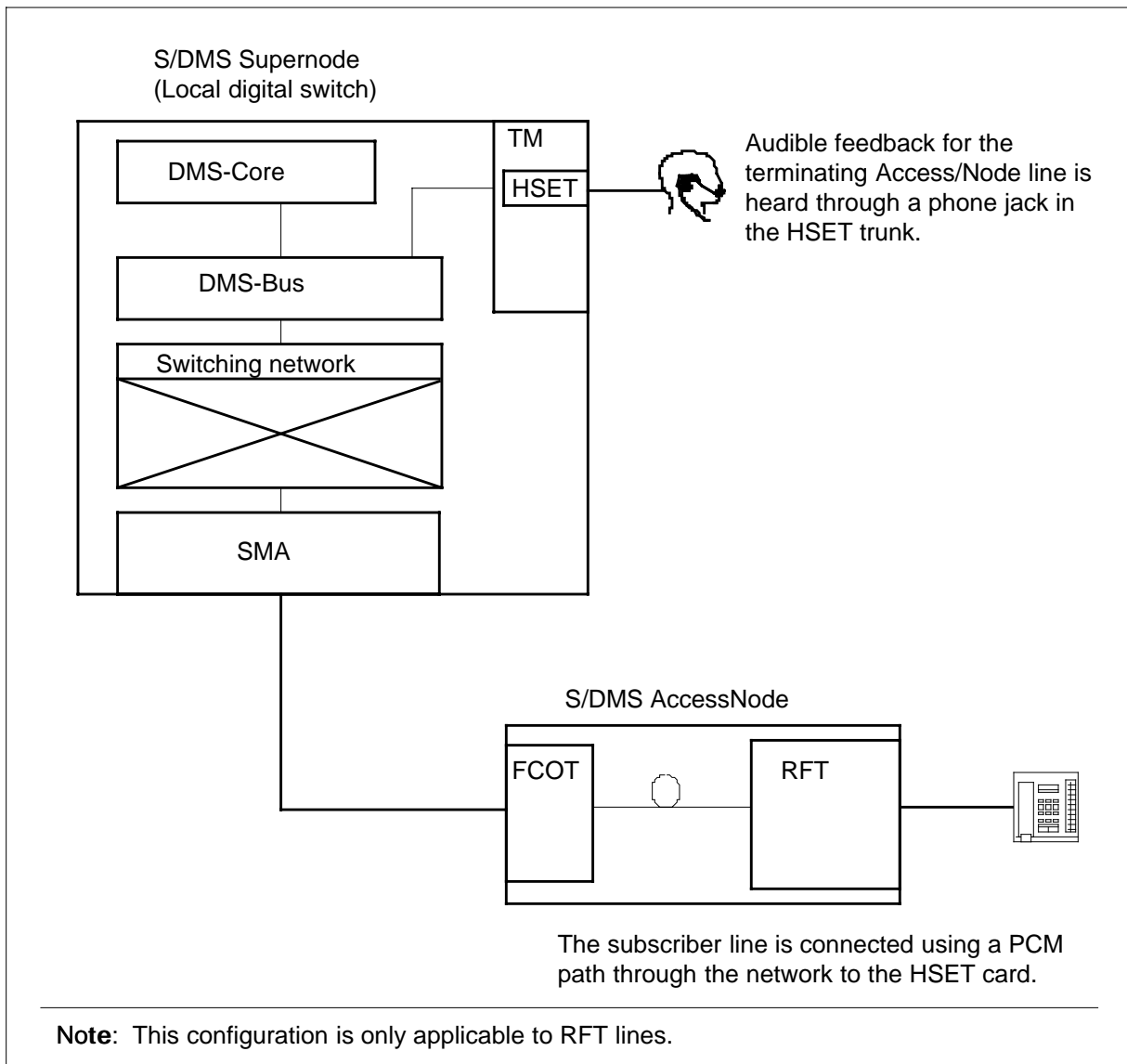
Figure 8-14 Subscriber line configurations



RDT line signaling tests

The TALKLTA, COIN, RING, DGGTST commands initiate tests that are similar to the ORIG test. A headset is used to test for certain signaling conditions. For these tests, however, the actual terminal equipment is used. Figure 8-15 shows the configuration used.

Figure 8-15 RDT line signaling test configuration



Testing a line

The sequence of steps that are taken in a typical subscriber line test is as follows:

Procedure 8-6

- 1 Post the line or set of lines being tested.
- 2 Remove the line or lines from subscriber accessibility.
- 3 Conduct maintenance action on the line in the control position.
- 4 Return the line in the control position to service.

Table 8-10 contains procedures for testing subscriber lines; figure 8-16 is an action diagram to help in using the steps. Additional information concerning states is provided in "States" on page 8-12.

Table 8-9 Line testing procedure (Sheet 1 of 3)

Step	Action	Observation
1	Enter the POST command and a parameter. (See note 1.)	<p>The lines in the specified set are identified in memory.</p> <p>The first line of the posted set is placed in the control position.</p> <p>The number of lines remaining in the posted set is displayed to the right of the <i>Post</i> label.</p>
2	Enter the command string BSY ALL.	<p>The state of all lines in the posted set is changed from idle (IDL) to manual busy (MB).</p> <p>All lines in the posted set that are in the call processing busy (CPB) state are placed in the busy queue (BQ) and their state is changed to call processing deloaded (CPD) (Step 5). (See Note 2.)</p> <p>The number of lines in the BQ is displayed to the right of the label <i>Busyq</i>.</p>
<p>Note 1: The appropriate parameter for use with the command POST is selected from those discussed in <i>DMS-100 Family Commands Reference Manual</i>, 297-1001-822.</p> <p>Note 2: When a CPB line is moved to the BQ it is removed from the posted set.</p> <p>Note 3: If the posted set is not empty when the command string POST DQ is entered, the remaining lines in the set are removed from posting.</p> <p>Note 4: The purpose of the command string POST BQ is to display details of lines in the BQ. No maintenance action can be taken on CPB lines. When this command string is entered, any of the posted lines could be released by the subscriber who is currently using them and be seized by another subscriber.</p> <p>Note 5: The BQ lines return to the CPB state, and the DQ lines return to the IDL state, if the LNS subsystem is exited.</p> <p>Note 6: This table is to be used in conjunction with Figure 8-16.</p>		

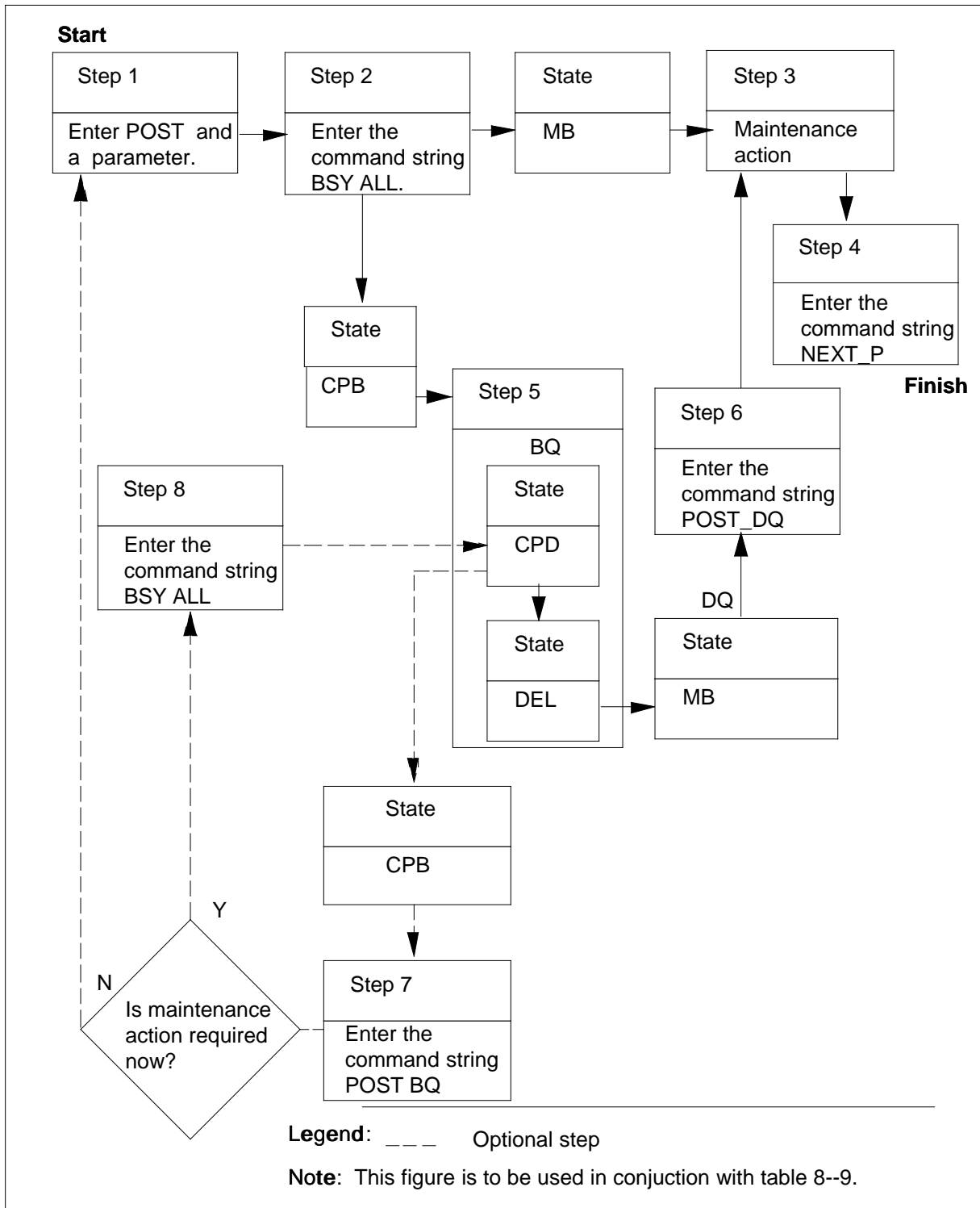
Table 8-9 Line testing procedure (Sheet 2 of 3)

Step	Action	Observation
3	Enter maintenance commands.	Maintenance action is taken as required.
4	Enter the command string NEXT_P.	<p>The line that is in the control position is removed from the posted set.</p> <p>The next line in the posted set is placed in the control position for maintenance action.</p> <p>The number of posted lines that is displayed to the right of the <i>Post</i> label is reduced by one.</p>
5	The line in the CPD state is released by the user	<p>The line state is changed momentarily to deloaded (DEL).</p> <p>The line is relocated to the deloaded queue (DQ).</p> <p>The state of the line is changed to MB.</p> <p>The number of lines in the BQ that is displayed to the right of the label <i>busyq</i> is decremented by one.</p> <p>The number of lines in the DQ that is displayed to the right of the label <i>delq</i> is incremented by one.</p>
6	Enter the command string POST_DQ. (See note 3.)	<p>The lines in the DQ are the posted set and their MB state is unchanged.</p> <p>The first line in the posted set is placed in the control position.</p> <p>The number of posted lines remaining is displayed to the right of the label <i>Post</i>.</p> <p>The number of lines displayed to the right of the label <i>DelQ</i> is erased. (Go to steps 3 and 4.)</p>
<p>Note 1: The appropriate parameter for use with the command POST is selected from those discussed in <i>DMS-100 Family Commands Reference Manual</i>, 297-1001-822.</p> <p>Note 2: When a CPB line is moved to the BQ it is removed from the posted set.</p> <p>Note 3: If the posted set is not empty when the command string POST DQ is entered, the remaining lines in the set are removed from posting.</p> <p>Note 4: The purpose of the command string POST BQ is to display details of lines in the BQ. No maintenance action can be taken on CPB lines. When this command string is entered, any of the posted lines could be released by the subscriber who is currently using them and be seized by another subscriber.</p> <p>Note 5: The BQ lines return to the CPB state, and the DQ lines return to the IDL state, if the LNS subsystem is exited.</p> <p>Note 6: This table is to be used in conjunction with Figure 8-16.</p>		

Table 8-9 Line testing procedure (Sheet 3 of 3)

Step	Action	Observation
7	Enter the command string POST_BQ. (See note 4.)	<p>The lines in the BQ are posted.</p> <p>The state of lines in the posted set is changed from CPD to CPB.</p> <p>The first line in the posted set is placed in the control position. (See Note 4.)</p> <p>If maintenance is required, go to step 8.</p> <p>If maintenance is not required, go to step 1.</p>
8	Enter the command string BSY ALL.	The posted set is returned to the BQ and its state is changed from CPB to CPD. (Go to step 5.)
<p>Note 1: The appropriate parameter for use with the command POST is selected from those discussed in <i>DMS-100 Family Commands Reference Manual</i>, 297-1001-822.</p> <p>Note 2: When a CPB line is moved to the BQ it is removed from the posted set.</p> <p>Note 3: If the posted set is not empty when the command string POST DQ is entered, the remaining lines in the set are removed from posting.</p> <p>Note 4: The purpose of the command string POST BQ is to display details of lines in the BQ. No maintenance action can be taken on CPB lines. When this command string is entered, any of the posted lines could be released by the subscriber who is currently using them and be seized by another subscriber.</p> <p>Note 5: The BQ lines return to the CPB state, and the DQ lines return to the IDL state, if the LNS subsystem is exited.</p> <p>Note 6: This table is to be used in conjunction with Figure 8-16.</p>		

Figure 8-16 Line testing action diagram



Testing SLC-96 subscriber carrier lines

When testing SLC-96 system lines, a maximum of ten RCS terminals can share the same MTA, providing they are on the same site and are identified with the same frame number in the LEN format *ff u dd cc*.

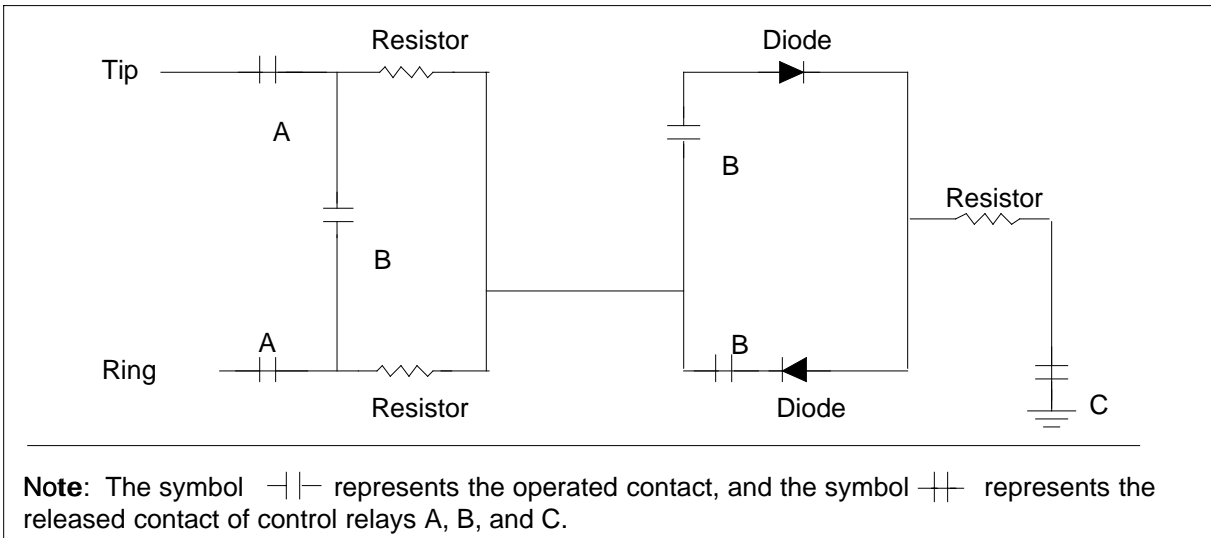
Line circuits that are served from RCS remote terminals are equipped with one relay that carries out both MTA and cutoff functions. For this reason only an *out* connection can be made; the loop is connected to a metallic test pair and the line card is connected to a passive test termination.

Four types of passive test terminations are configured using a remote terminal termination circuit, (see Figure 8-17) by operating relays in the circuit. The test terminations are described as follows:

- Absorb test termination is a 900 Ω resistor connected between the tip and ring of the line circuit to absorb an incoming test signal.
- Reflect test termination is a short circuit connected between the tip and ring of the line circuit to reflect an incoming test signal.
- Absorb/positive tip party ground (PTPG) test termination is a 900 Ω resistor connected between the tip and ring of the line circuit to absorb an incoming test signal, and the termination circuit is conditioned to detect a positive dc voltage on the tip or the ring.

Reflect/negative tip party ground (NTPG) test termination is a short circuit connected between the tip and ring of the line circuit to reflect an incoming test signal, and the termination circuit is conditioned to detect a negative dc voltage on the tip or the ring.

Figure 8-17 SLC-96 RCS line test termination circuit



Testing RCU subscriber carrier lines

Testing of RCU lines can be conducted at the MAP terminal, at the RCU, or at a test desk (see Section , "Testing RCU lines at the basic test desk" on page 8-22. Tests are conducted at the MAP terminal in the same way as for other lines, displaying results as they apply to RCU lines. Response messages indicate commands that do not apply to RCU lines, or are treated differently than for other lines.

Testing at the RCU Tests are conducted at the RCU using a NT3A36 maintenance (MTC) card that is located in the power shelf. The faceplate of the card is equipped with controls and displays required to access a line for testing and to report test results. An optional NT3A60 line test access (LTA) card may also be inserted in the power shelf. The LTA card is used to provide a termination in the line card under test, and to simulate operating conditions during the end-to-end diagnostic.

Line tests conducted at the RCU are limited to testing the line card. Access can be gained to the subscriber loop to attach external test equipment. The CC located at the host office retains control of testing by confirming test process initiation at the RCU, and aborting RCU initiated tests when priority functions demand it.

Special service module maintenance The following line tests are supported from the LTP menu level for special service module (SSM) channel units:

- manual busy (BSY) a channel unit
- return to service (RTS) a channel unit
- single-end bus extender loopback test on a channel unit
- single-end pulse amplitude modulation (PAM) bus loopback test

Channel units are posted at the LTP level in the same way as RCU lines. The two single-end tests are run together in response to the DIAG command entered for a posted SSM channel unit. If the SSM is part of a special connection in table SPECCONN, the SSM must be busy before entering the DIAG command.

Entering maintenance commands that are not supported for SSMs will generate the following response:

```
COMMAND IS NOT APPROPRIATE FOR SSM CHANNEL UNIT
```

The CKTLOC command CKTLOC at the LTP level can be used to locate the posted SSM. The following example shows the response to the CKTLOC command entered for a 4-wire, voice channel unit.

```
Site Flr RPos Bay_Id Shf Description Slot EqPEC
REM1 00 A RTU 0 0 RCU 00 0 06:21 SSM4WV
GRD START 2DB LOSS BAL NETWORK MAN OVR SET
NO NO NON LOADED NO
```

The only field that changes for locating an SSM is the SLOT field. The number preceding the colon represents shelf number 6 or 7. The number following the colon represents the channel unit.

The SSM channel unit states are the same as nailed-up special connections on RCU foreign exchange with battery (FXB) lines. SSM channels states are described as follows:

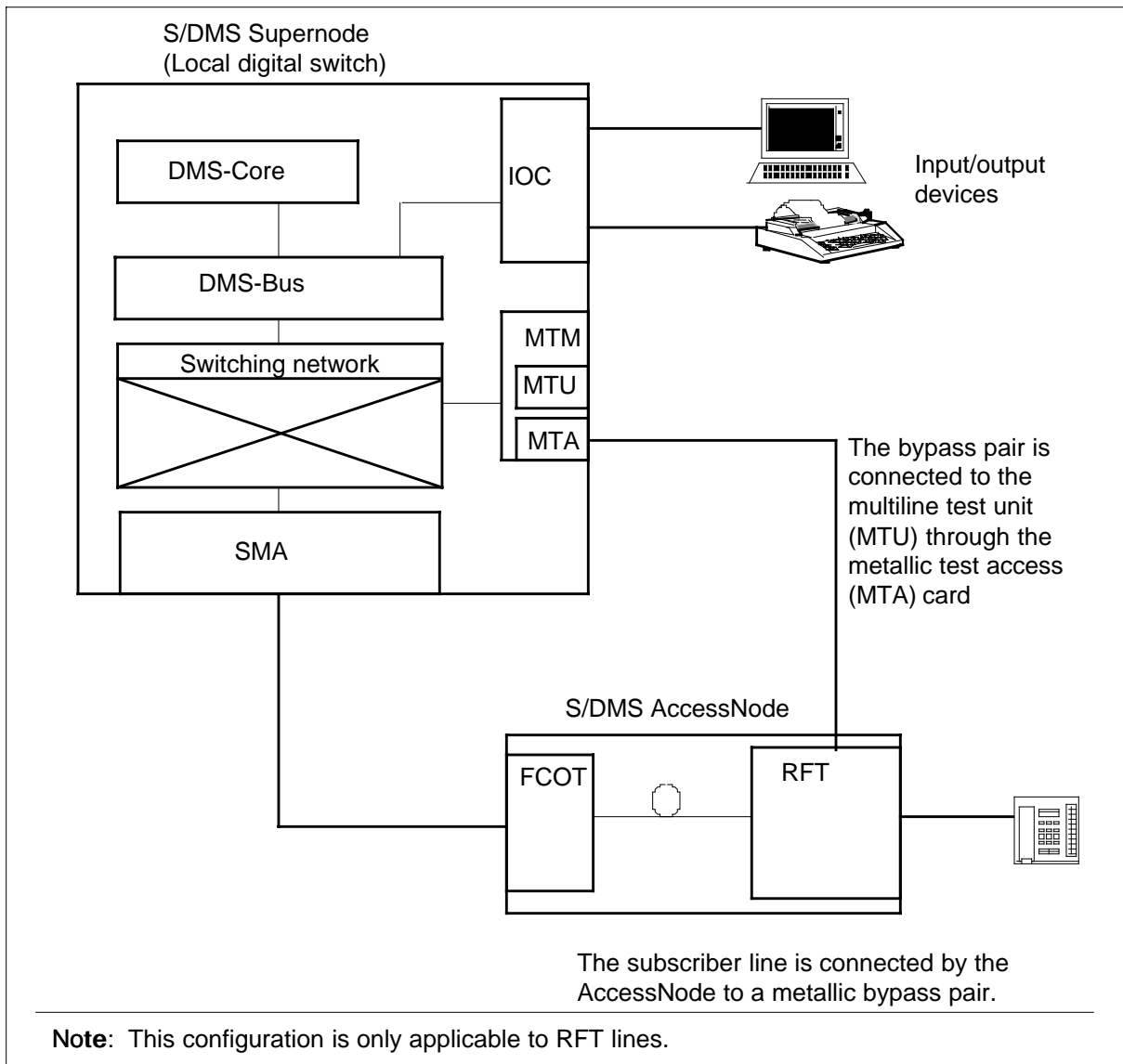
- LMB (line module busy)—An SSM channel unit is LMB when its RCU is out of service, when the SSM is out of service, or when an alarm is raised against the channel unit.
- MB (manual busy)—A channel unit is MB when it has been removed from service with the BSY command.
- INB (installation busy)—This is the normal in-service state for an SSM channel unit that is datafilled in table LNINV.

SSM testing is reported in LINE100 and LINE101 logs.

Testing RDT subscriber lines

Many subscriber line tests make various measurements on the subscriber line itself; the line card is bypassed. The commands that run these tests are LNTST (and the LIT, VDC, VAC, and CAP commands that perform a subset of the LNTST command), DIAGNOSE, and the station ringer test (ground check). In the SMA configuration, these tests can be performed by using a metallic bypass. Figure 8-18 shows the metallic bypass configuration.

Figure 8-18 Testing the RDT subscriber line using a metallic bypass



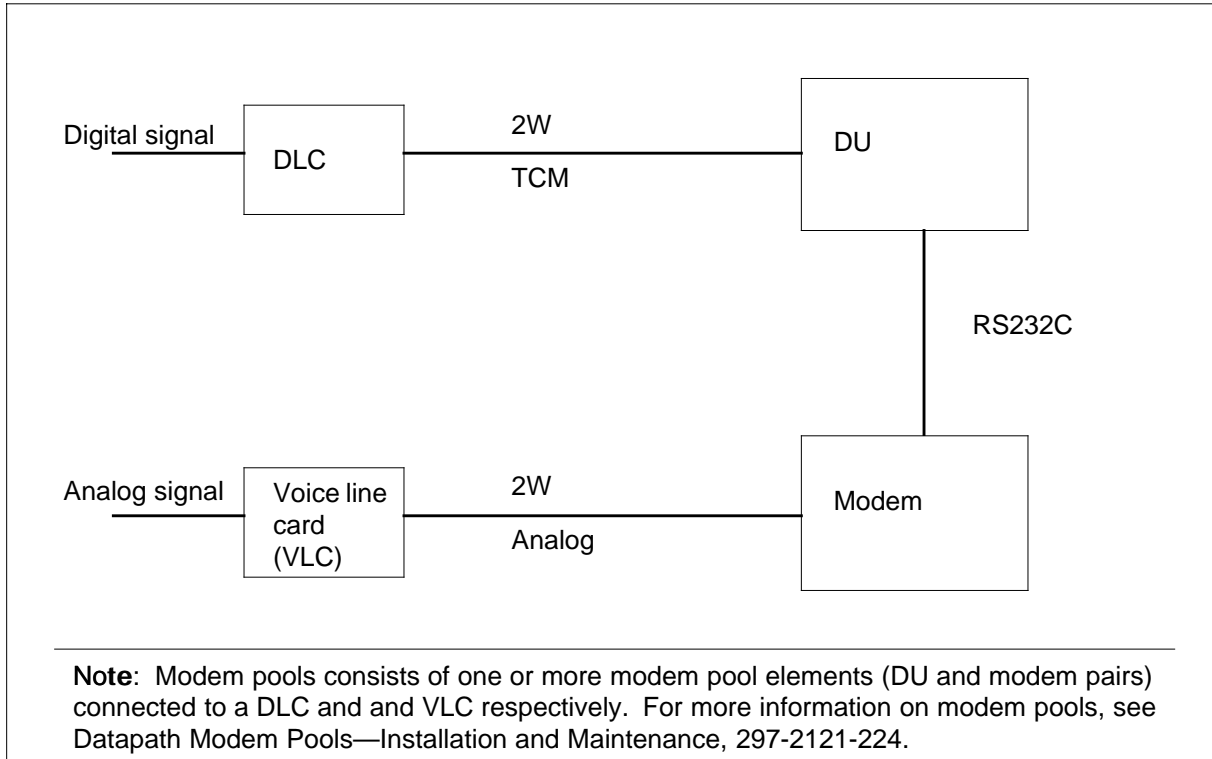
Datapath testing

Datapath, provided with software package NTX250, permits connection of data service to subscriber equipment that is located within approximately 5.7 km (16 696 ft) from the serving DMS-100 switch. The following components make up the datapath testing configuration:

- data units (DU) transmit and receive data
- modem pool (MP) provides an interface between digital and analog facilities used for data transmission (see Figure 8-19) if necessary.
- loop facility is a connecting path from a DU to a DLC

trunk facility is a connecting path between DLC, and MP if necessary, when DLC are in different switches

Figure 8-19 Modem pool



DIALAN service is an equipment configuration providing simultaneous voice and data communications over a single line using two integrated voice and data modules (IVDMs), one at the central office (CO) and one at the customer premises (CPE). The range limits for loops equipped for this service are determined by the capabilities of the specific IVDM units selected. The IVDM units are commercially available. (See *Datapath DIALAN Service-Installation and Maintenance*, 297-2121-227, for more information.)

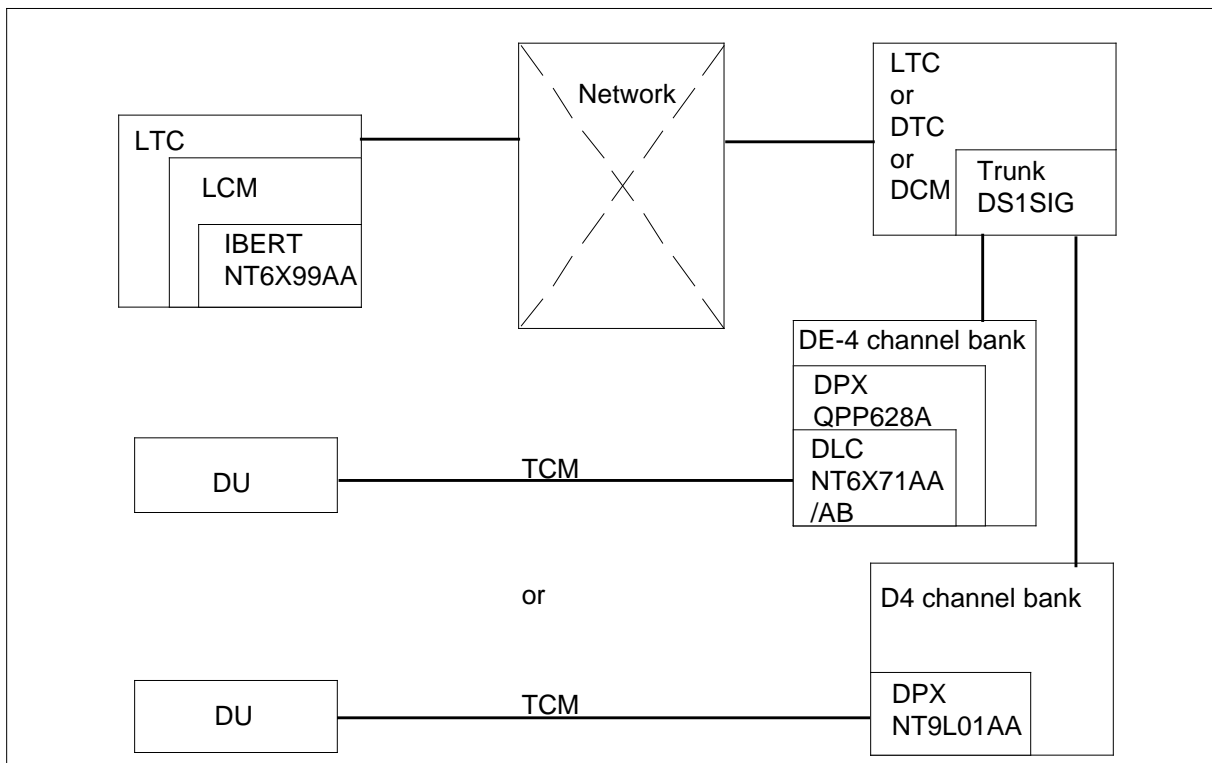
For more detailed information about DATAPATH maintenance see *Datapath Modem Pools - Installation and Maintenance*, 297-2121-224; *Datapath 3270 Network Switched Access Installation and Maintenance*, 297-2121-225, and *Data Unit - Installation and Maintenance*, 297-2121-226.

Software package NTX256, Datapath Loop Extension, extends the datapath range beyond 5.7 km (16 696 ft) from the serving office. The loop extension hardware replaces the DU and consists of equipment as shown in Figure 8-23, "Datapath loop extension facilities" on page 8-61, in accordance with the application that is required.

Software package NTX259, Datapath Extension (DPX), provides maintenance access to a datapath serving switch using one channel of a DE-4E or D4 channel bank, referred to as a DS-0 facility. There is no separate package for call processing.

In a DE-4E channel bank, one DS-0 facility consists of a QPP628A DPX card and a NT6X71AA/AB data line card (DLC). In a D4 channel bank, one DS-0 facility consists of a NT9L01AA DPX card. Both configurations are shown in Figure 8-20 .

Figure 8-20 Datapath extension facilities



Because the DPX datapath configuration connects to the DMS-100 switch over DS-1 facilities rather than through time compression multiplexing (TCM), DPX does not support all datapath features. The following maintenance functions are not supported:

- station ringer test and silent switchman test
- removing the DU from service when the DS-1 trunk at the serving switch is removed from service
- metallic test access to the TCM link between the DLC and the DU
- bipolar violation reporting

Maintenance action on DPX lines from the DPX to the DU is conducted from the LTP when an NT6X99AA integrated bit error rate tester (IBERT) card is provided. Maintenance action on the DS-1 facilities from the trunk in the host switch to the DPX card in the DE-4E or D4 channel bank is conducted from the TTP.

Datapath components are maintained by accessing the LTPDATA level to connect test equipment and facilities to them. When the connections are completed the components can be tested using MAP commands in the same manner that other lines are tested.

Interoffice maintenance

Monitoring A central maintenance center (CMC) can monitor a DU to DU call between remote switches by connecting monitor equipment through a DP or multi-frequency (MF) digital trunk. The procedure in Table 8-10, which is illustrated in Figure 8-21, "Inter-office DU maintenance" on page 8-57, is used to connect the equipment.

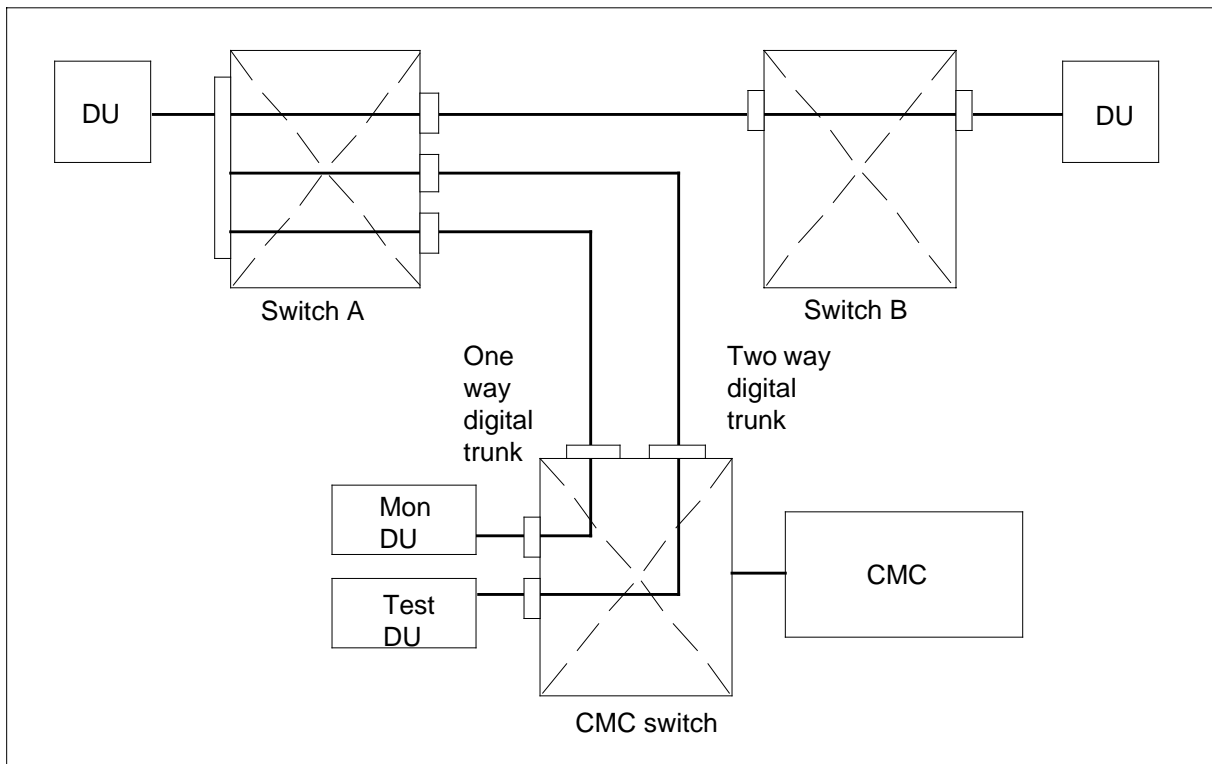
Table 8-10 Interoffice DU maintenance connection procedure (Sheet 1 of 2)

Step	Description
1	Enter the SELECT command. Access the switch that contains the DLC which is associated with a DU on the datapath that is to be monitored.
2	Log on to the switch.
3	Access the LTPDATA level.
4	Post the DU that is to be monitored.
5	Enter the EQUIP command and parameters in the following format to prepare a monitor trunk for connection to the CMC: <pre>>EQUIP MTR TX C clli dn</pre> or <pre>>EQUIP MTR RX C clli dn</pre>
	<p>Note: The variable <i>clli</i> is the CLLI of the digital trunk group to the CMC switch, and the variable <i>dn</i> is the directory number of the monitor DU located at the CMC switch.</p>
6	Establish a monitor connection by entering the command string CONNECT MTR (do not log off when proceeding to step 7).
7	Access the LTPDATA level of the MAP at the CMC switch using a separate terminal than was used in steps 1 to 6.

Table 8-10 Interoffice DU maintenance connection procedure (Sheet 2 of 2)

Step	Description
8	Post the monitoring DU.
9	Enter the command string CONNECT CALL to put the DU into the data mode, thereby establishing the monitor connection over the digital trunk.
10	The monitor DU is answered manually by pressing the DN key, or automatically if it is set for auto-answer.

Figure 8-21 Inter-office DU maintenance



The command string CONNECT CALL in step 9 is required to force the connection in spite of the failure to execute a handshake protocol with the posted DU. The protocol cannot be successfully executed with the monitor DU because it had been executed previously between the functioning DU of the established datapath.

When the monitor DU is connected to the DU under test, a flashing CONNECT lamp indicates that the baud rate of the monitor DU is different from the baud rate of DU under test. The monitor baud rate should be changed to that of the DU under test by adjusting the baud rate selected until the connect lamp is steady.

Testing A test DU at a CMC location can be connected to a DU at another switch through a two way DP or digital trunk by using the procedure in Table 8-11.

Table 8-11 Test DU connection procedure

Step	Description
1	Access the switch that contains the DLC that is associated with a DU on the datapath that is to be tested, and log on to the switch.
2	Access the LTPDATA level.
3	Post the DU that is to be tested.
4	Enter the EQUIP command and the appropriate parameters in the following format to prepare a test trunk for connection to the CMC: <pre>>EQUIP TEST C clli dn</pre> <p>Note: The variable clli is the CLLI of the digital trunk group to the CMC switch, and the variable dn is the directory number of the test DU.</p>
5	Establish a test connection by entering the CONNECT command and the parameter TEST.
6	Access the LTPDATA level at the CMC switch.
7	Post the test DU.
8	The test DU is answered manually by pressing the DN key, or automatically if it is set for auto-answer.

Standard DU A standard DU (not a test DU) at a CMC location can be connected through a DP or MF digital trunk to a DU at another switch, using the procedure in Table 8-12.

Table 8-12 Standard DU connection procedure (Sheet 1 of 2)

Step	Description
1	Access and log on to the switch where the DLC is located for the DU under test.
2	Access the LTPDATA level
3	Post the DU to be tested.

Table 8-12 Standard DU connection procedure (Sheet 2 of 2)

Step	Description
4	<p>Enter the CONNECT command and the appropriate parameters in the following format:</p> <pre>CONNECT C clli dn</pre> <p>Note: The parameter <i>clli</i> is the CLLI of the digital trunk group and <i>dn</i> is the directory number of the standard DU in the switch that contains the CMC.</p>
5	The DU at the CMC location is answered manually by pressing its DN key, or automatically if it is set for auto-answer.

If a monitor is required on the established datapath using a standard DU or a test DU, the EQUIP and CONNECT commands can be used with appropriate parameters as discussed previously. The connected monitor uses an additional digital trunk.

To release any connections that were established to the posted line, the command string CONNECT RLS is entered at the LTPDATA level from the switch where the command equip was invoked. The command string EQUIP RLS is then entered at the same switch to release the digital trunks that were used.

Loopback Data signals of known characteristics are reflected to the point of origin so that the reflected bit stream can be compared with the transmitted bit stream. The comparison procedure is called the bit error rate test (BERT), described later in this chapter. Locations in the data path are selected to establish a loopback so that BERT can be conducted at various points. The process assists in the isolation of fault locations. Loopbacks can be activated at the following points on loops that do not exceed 5.7 km (16 696 ft):

- DLC
- RS232C interface of the DU
- 64 kB interface of the DU
- RS232C interface of a remote DU

Loop extension Switches that contain software package NTX256 loop extension maintenance can activate loopbacks at additional locations in the data path, dependent on the type of loop extension facility. Figure 8-22 and Figure 8-23 show the loopback capabilities that apply in each application, and indicate the parameters used with the LOOPBK command.

Figure 8-22 Datapath loopback locations

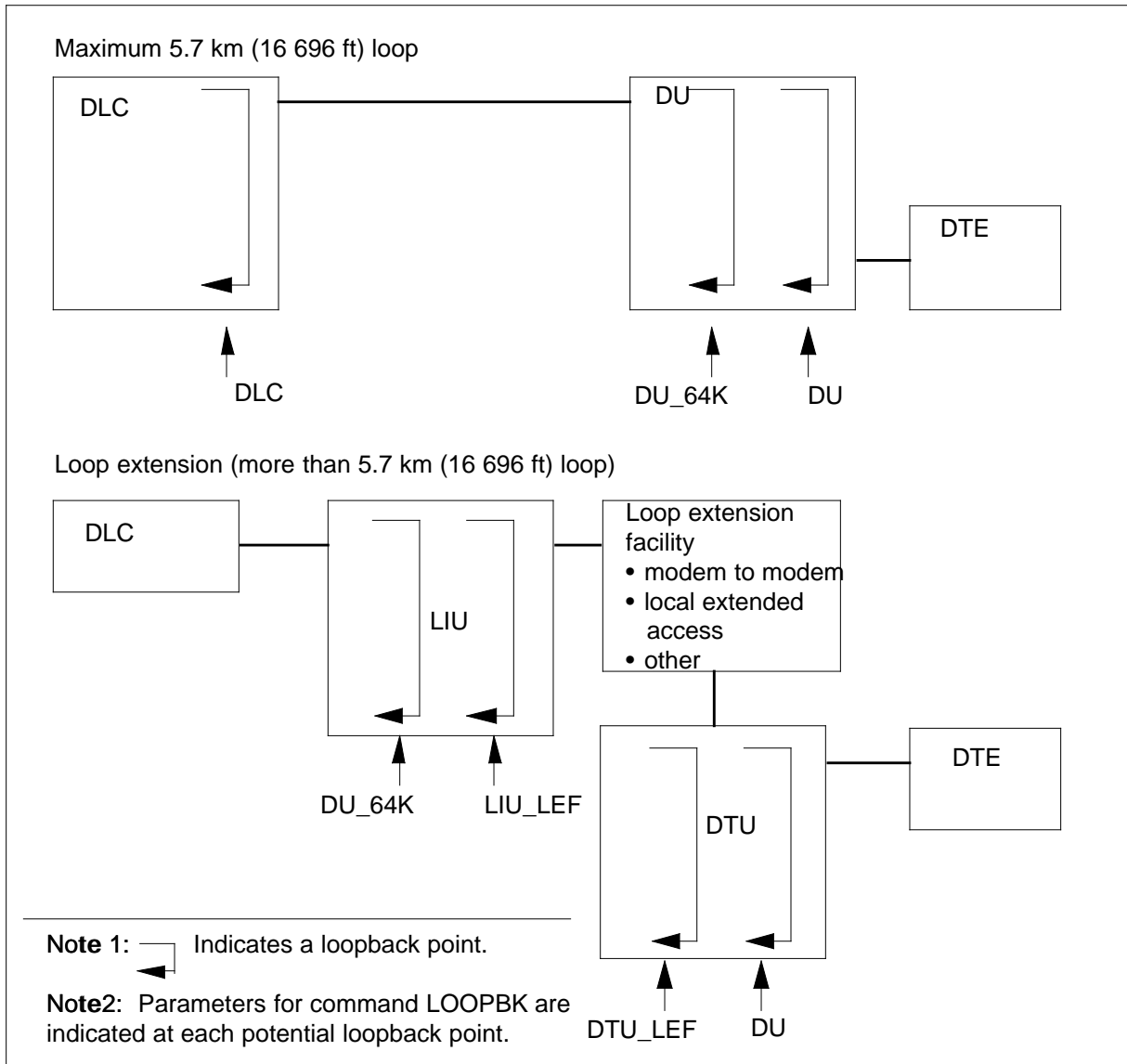
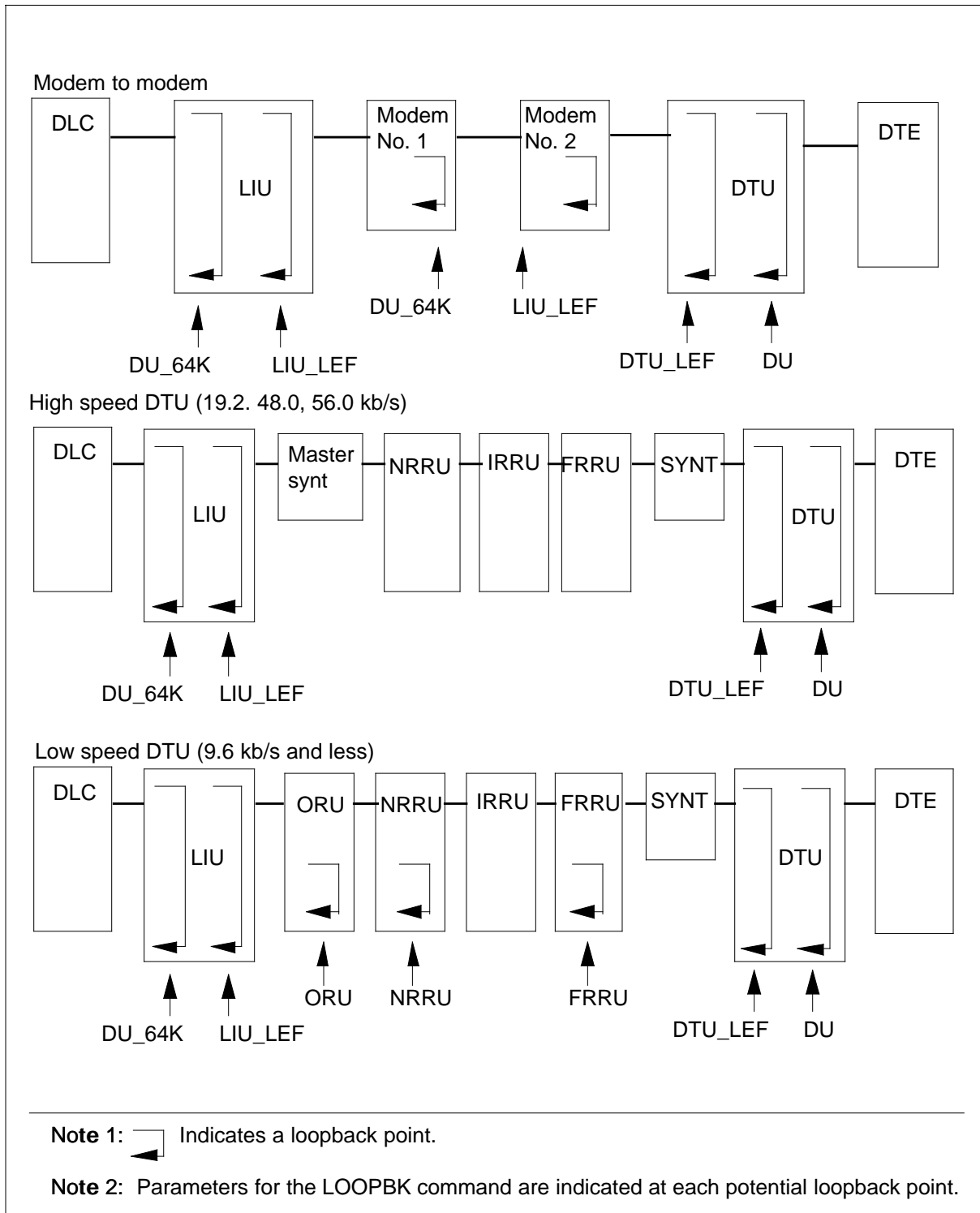


Figure 8-23 Datapath loop extension facilities



Datapath extension Switches that contain DPX software can activate loopbacks at the points shown in Figure 8-22 in the same way as for other circuits that are within 5.7 km (16 696 ft) of the datapath serving switch. The parameters shown are required with the LOOPBK command to activate the loopbacks.

DIALAN service Switches providing DIALAN service using the NT6X76AC asynchronous interface line card (AIRC) can activate additional loopbacks at the central office IVDM and at the customer premises IVDM. A local analog loopback at the central office IVDM, and a remote digital loopback at the customer premises equipment IVDM, are operated by setting the appropriate parameters with the LOOPBK command. (For additional information on DIALAN configurations and the loopback points, refer to *Datapath DIALAN Services - Installation and Maintenance*, 297-2121-227.)

Integrated bit error rate tester The integrated bit error rate tester (IBERT) is accessed at the LTPDATA level of the MAP. The IBERT is used to measure the transmission quality of a data loop. The IBERT circuit may be installed in an LCM or in an RLCM. A maximum of 64 IBERT circuits can operate in a DMS-100 switch.

IBERTS must be datafilled in table FMRESINV and FMRESUSE. If an IBERT is being used by a bit error rate performance test (BERP), it is possible to interrupt the BERP test and seize the IBERT for a BERT. In order to seize an IBERT from a BERP test, the IBERT has to be datafilled for use by both the BERP and LTP levels. (For details on BERP testing, see *Bit Error Rate Performance Testing*, 297-1001-533).

The BERT will not function when the DU under test is communicating with another DU. When this condition exists a bit error rate tester that is external to the MAP is required to measure transmission quality.

The IBERT process is always conducted through the network, whether the line under test is in the same LCD as the IBERT circuit or they are in a separate LCD. The IBERT can be used to test data lines that are connected to the DMS-100 switch and support the T-link protocol. Examples of data line types are

- DU
- AIM
- coax eliminator DU
- DU extended using the LIU method or the DTU method
- DPX

The IBERT circuit transmits either a 511 bit pattern or a 2047 bit pattern through the network to the two-wire data facility and equipment. Loopbacks that are activated by the LOOPBK command interrupt the pattern at the loopback point and return it to the IBERT circuit source. The transmitted pattern is compared with the returned pattern to determine the quantity of errors and synchronization slips; and to report the bit error ratio. A count is maintained of the following data:

- quantity of blocks received
- quantity of errors received
- quantity of sync losses
- quantity of error free seconds (an error free second is a period of 1 s during which the IBERT is in sync, and no transmission errors occur)
- total test time
- total time in sync

The six counters can be reset to record new data.

When BERT activity is conducted on DPX lines, the IBERT communicates with the DU through in-band signaling on the DS-0 channel.

The BERT can run at speeds of 64 kbit/s, 56 kbit/s, or can adapt to the speed of the line under test as follows:

- If the loopback is set at DU the BERT adapts to the speed of the data unit.
- If the loopback is set at DU_64K or DLC, the BERT runs at 56 kbit/s.
- If a loopback point is changed after a BERT is started, the initial rate of testing does not change.

Errors can be injected into the bit pattern that is sent to the IBERT to verify the detecting and reporting of errors. Alternatively, an external BERT may be connected to the DU under test to inject errors. It accepts the IBERT bit pattern and transmits the same CCITT standard bit pattern to the IBERT circuit.

When a BERT is started on a data line it continues to run until the command BERT and the parameter STOP are invoked. The BERT can be set to run for a maximum of 255 h by using the BERTTIME command. If no time is set, the test will run for 100 h; if the time is set to 0 min and 0 h the test will continue to run until it is stopped manually; or by a system restart. An audit is activated each 30 min to examine each running test and to stop it if the set duration has been reached or exceeded. When the BERT duration is set, all IBERT in the switch function for that period. Individual durations cannot be set by data line or by LCD. While the line under test is in the control position and under BERT action, the test results are continually updated. The tester may log out, and later log in, without interrupting the BERT process.

The IBERT will not function when a DU is communicating with another DU. The quality of transmission for this condition requires a BERT that is external to the DMS-100 system. Further, if a switch of activity (SWACT) occurs on the PM that contains the IBERT circuit, or on the PM that contains the line under test, the displayed result is frozen, and the synchronization status is INSYNC. See Figure 8-24 and Figure 8-25 for details of the bit error rate test sequences.

Figure 8-24 Bit error rate test sequence

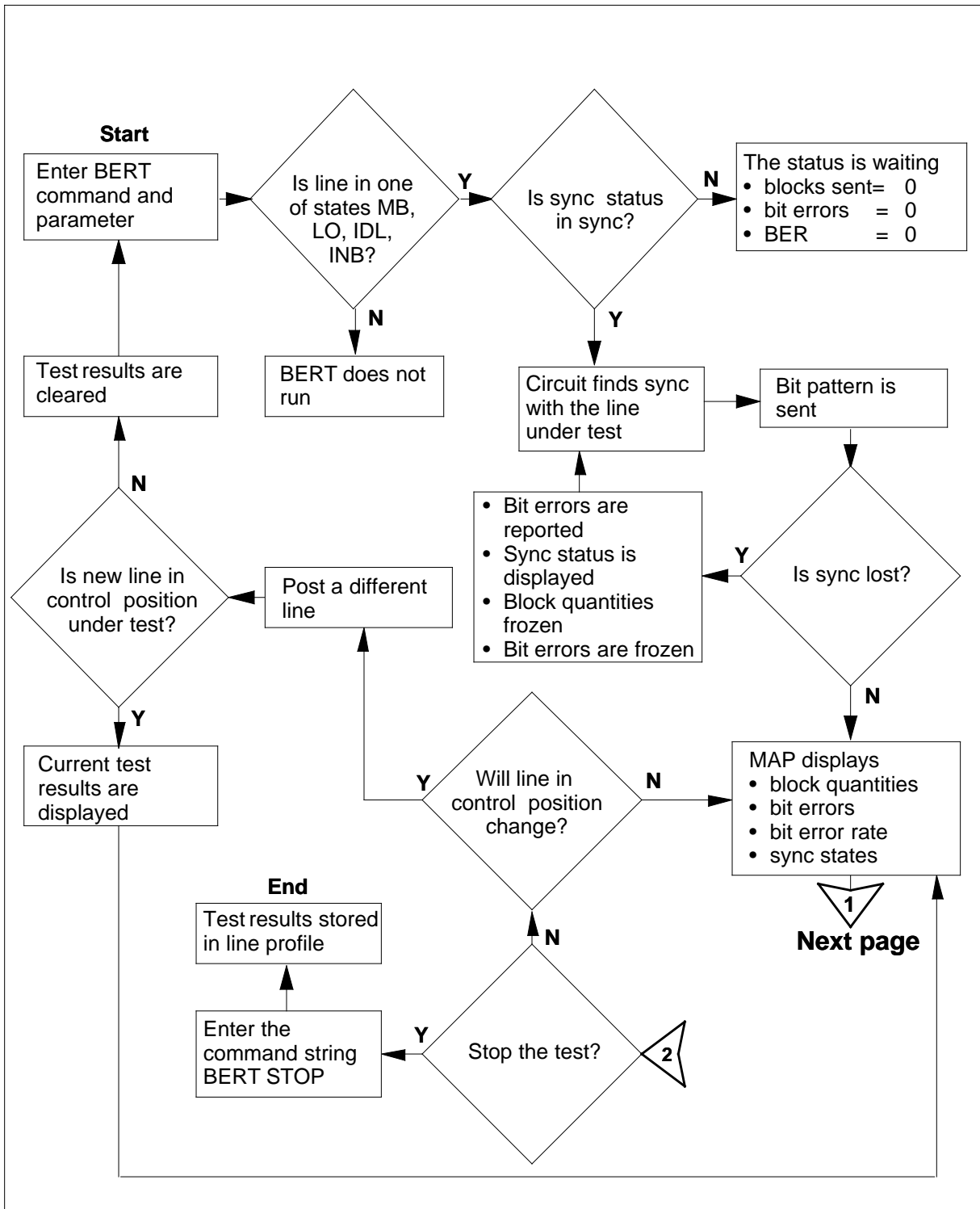
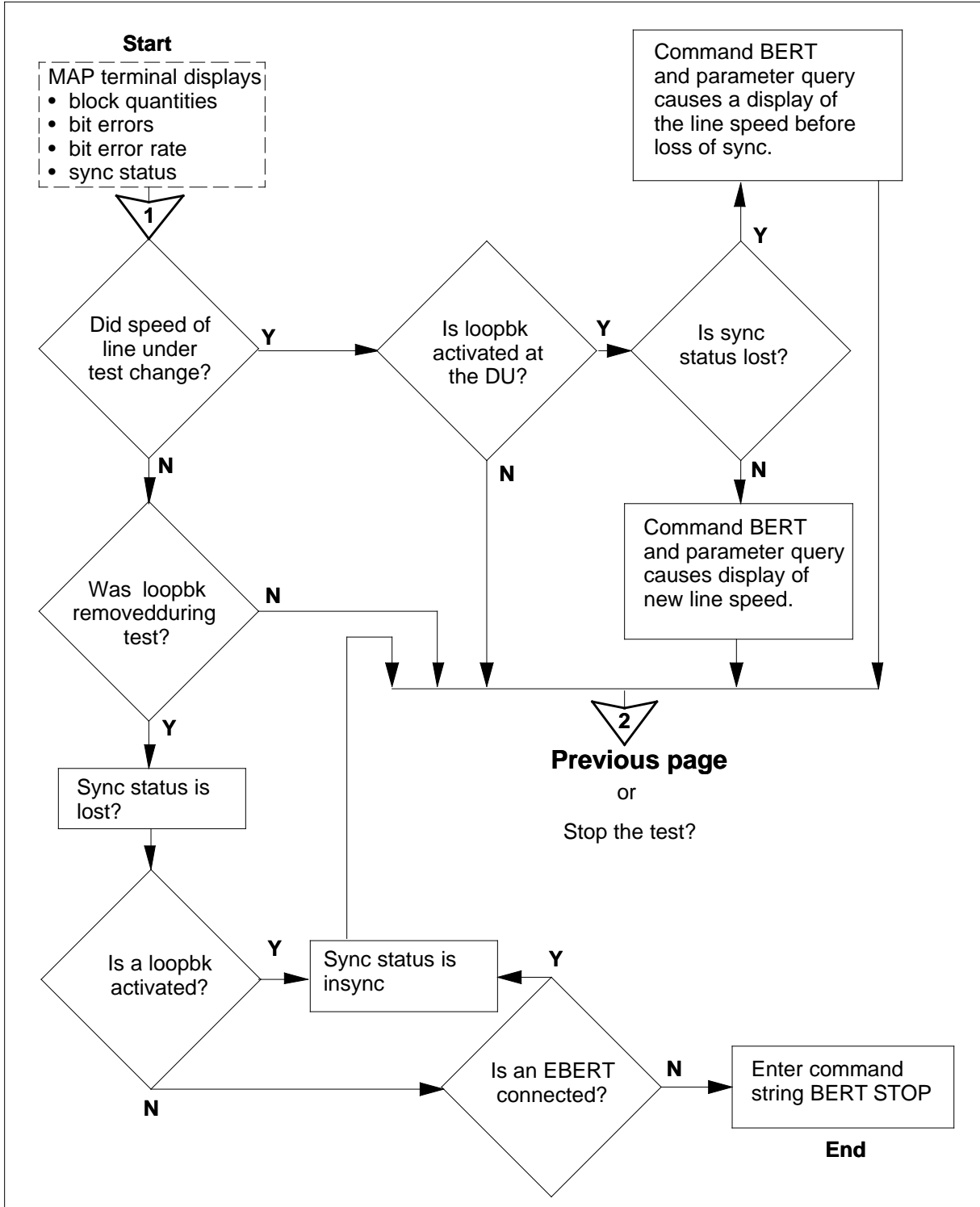


Figure 8-25 Bit error rate test inset



IBERT maintenance The IBERT circuit can be tested by posting it according to its LEN and using LTP level commands BSY, DIAG, CKTLOC, and RTS. The diagnostic tests the ability of the circuit to receive messages and to act on them; and causes a self test to be conducted on the circuit.

Modem pool maintenance A modem pool (MP) requires software package NTX251. A MP consists of a DLC (NT6X71AA line card), a DU, a modem, and a voice line card (VLC). The VLC can be one of the types of line cards identified in Table 8-13.

Table 8-13 VLC line card PECs

PEC	Type	LCD
NT2X17	A	LM
NT2X18	B	LM
NT6X17	A, world line card	LCM
NT6X18	B, world line card	LCM

The components of a modem pool are interconnected as shown in Figure 8-19, "Modem pool" on page 8-54.

An MP can be configured as outbound, where received digital data is retransmitted as analog data, or inbound, where received analog data is retransmitted as digital data.

When an MP is posted by its CLLI at the LTPDATA level in which the MP is located, the CLLI and the state of the MP are displayed. The state of the MP is the highest priority state of its component DLC or VLC. The valid MP states are as follows, beginning with the highest priority:

- INB
- MB
- CUT
- LMB
- LO
- DEL
- CPB
- CPD
- IDL
- PLO

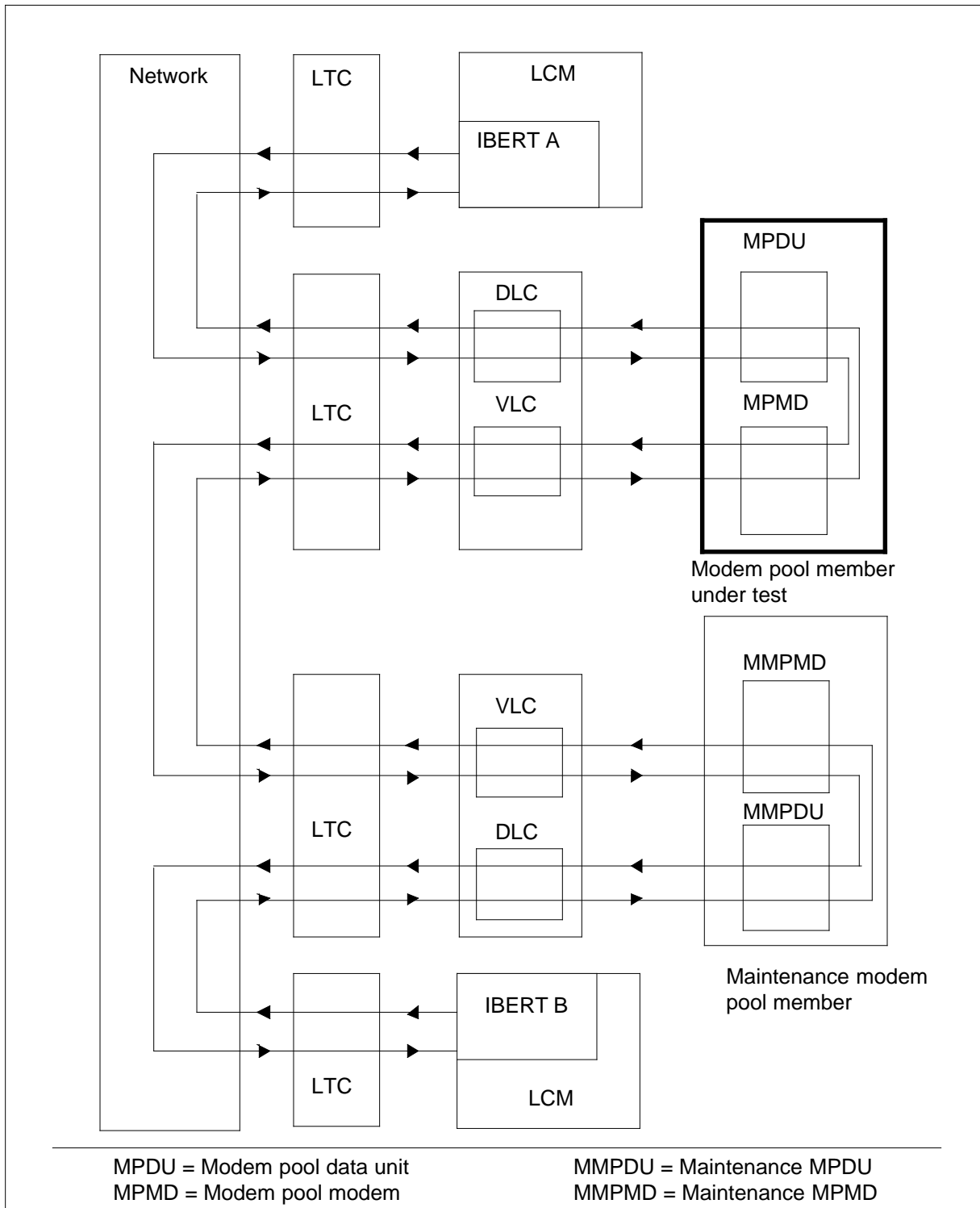
The LEN of DLC and VLC components of the MP, and their states, can be displayed in the lower position of the screen by entering the CKTLOC command for the posted MP.

When the DIAG command is entered on the posted MP, diagnostic tests are first run on the DLC and the DU, and then on the VLC. No diagnostic is available for the modem. Failure of either the DLC or VLC diagnostic is interpreted as an MP failure.

When the BSY command or the RTS command is entered on the posted MP, maintenance action is taken first on the DLC and then on the VLC. Any resulting failures are interpreted as MP failures.

A modem pool member can be tested by using the command BERT, in conjunction with a maintenance modem pool (MMP) member and two IBERTs. An MMP is a MP that has been proven to work properly, and is assigned solely to maintenance functions. The testing circuit is configured as shown in Figure 8-26.

Figure 8-26 Modem pool BERT configuration



The initial test requires transmitting a known bit pattern (511 or 2047 bits) from end to end in full duplex mode, without any loopbacks activated, when the MP is in one of the following states:

- INB
- MB
- LO
- IDL

If any of the conditions in Table 8-14 are encountered, loopbacks are set sequentially at the RS232 interface with the MPDU, at the 64 kb interface with the DU, and at the 64 kb interface with the DLC, to localize the fault.

Table 8-14 Loopback fault conditions

Status IBERT A	Status IBERT B	Probable cause
INSYNC	WAITING or LOST	Faulty transmit path from IBERT A through the MP member.
WAITING or LOST	INSYNC	Faulty receive path from IBERT A through the MP element.
WAITING or LOST	WAITING or LOST	Faulty transmit and receive paths from IBERT A. Faulty RS232 connection between the MPDU and modem pool modem.

A maximum of 32 simultaneous BERTs can be conducted. Additional test procedures can be devised by testers in the operating company to meet specific requirements.

The results of the tests are displayed at the MAP terminal, where:

- the largest quantity of blocks that were sent by either IBERT is displayed
- the largest quantity of bit errors that occurred in either direction is displayed
- the bit error ratio (BER) that is displayed is based on the blocks and bit errors that are displayed
- the sync status of the IBERT with the worst status is displayed, where the best status is *INSYNC* and the worst status is *LOST*

The displays are refreshed approximately every 5 s. When the test is completed, or it is stopped by command, by system restart, or by overrun of the established test duration; the results are stored in the profile of the MPDU.

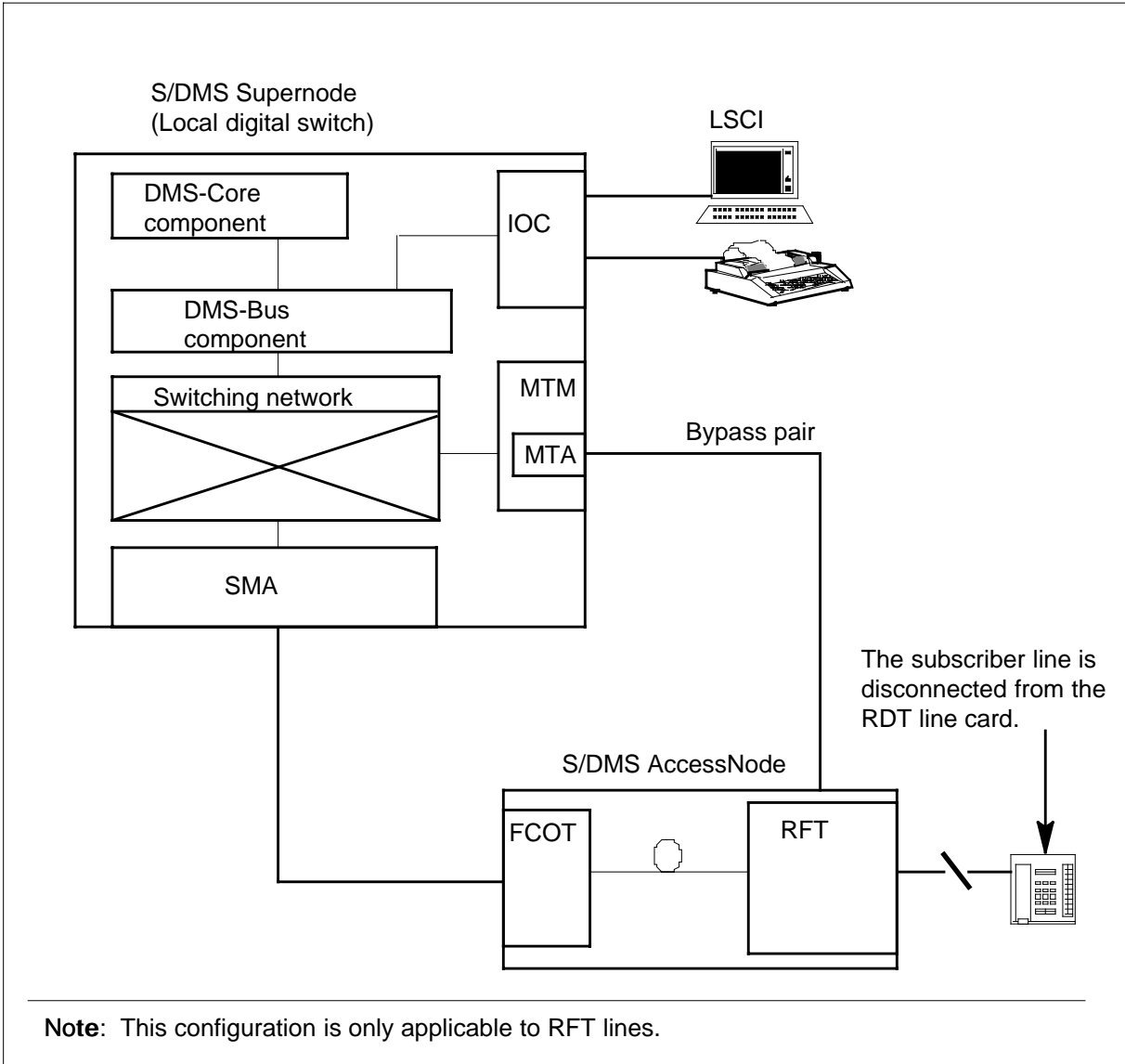
DIALAN service maintenance DIALAN service requires the use of the NT6X76AC AILC and two commercially available integrated voice and data modules (IVDM), one at the central office and one at the customer premises. For the service and maintenance features of this configuration, see *Datapath DIALAN Service - Installation and Maintenance*, 297-2121-227.

With the AILC configured for DIALAN service, the existence of a loopback at either IVDM is verified by running a BERT on the line. Since the IBERT attempts to find sync when run on a line, the sync status display for the BERT command indicates *INSYNC* if a loopback exists.

Testing the RDT line card ringing voltage

When the TSTRING command is entered at the LTPMAN level, the line card applies and measures ringing voltage. In the SMA configuration, the test access card (TAC) detects the ringing voltage, and then displays the results at the local switch craft interface (LSCI). Refer to Figure 8-27.

Figure 8-27 RDT line card ringing test configuration



Attendant console testing

The steps for testing an attendant console are as follows:

Procedure 8-7

- 1 Obtain subscriber permission to conduct test.
- 2 From the IBNCON level, make the console accessible to the tester and inaccessible to the subscriber.
- 3 Put the console in the testing mode.
- 4 Conduct the maintenance action.

- 5 Return the console to customer access when maintenance action is complete.

Details of the attendant console test procedure are provided in Table 8-15 and in Figure 8-28, "Attendant console maintenance action diagram" on page 8-75. Additional information concerning states is provided in Section , "States" on page 8-12.

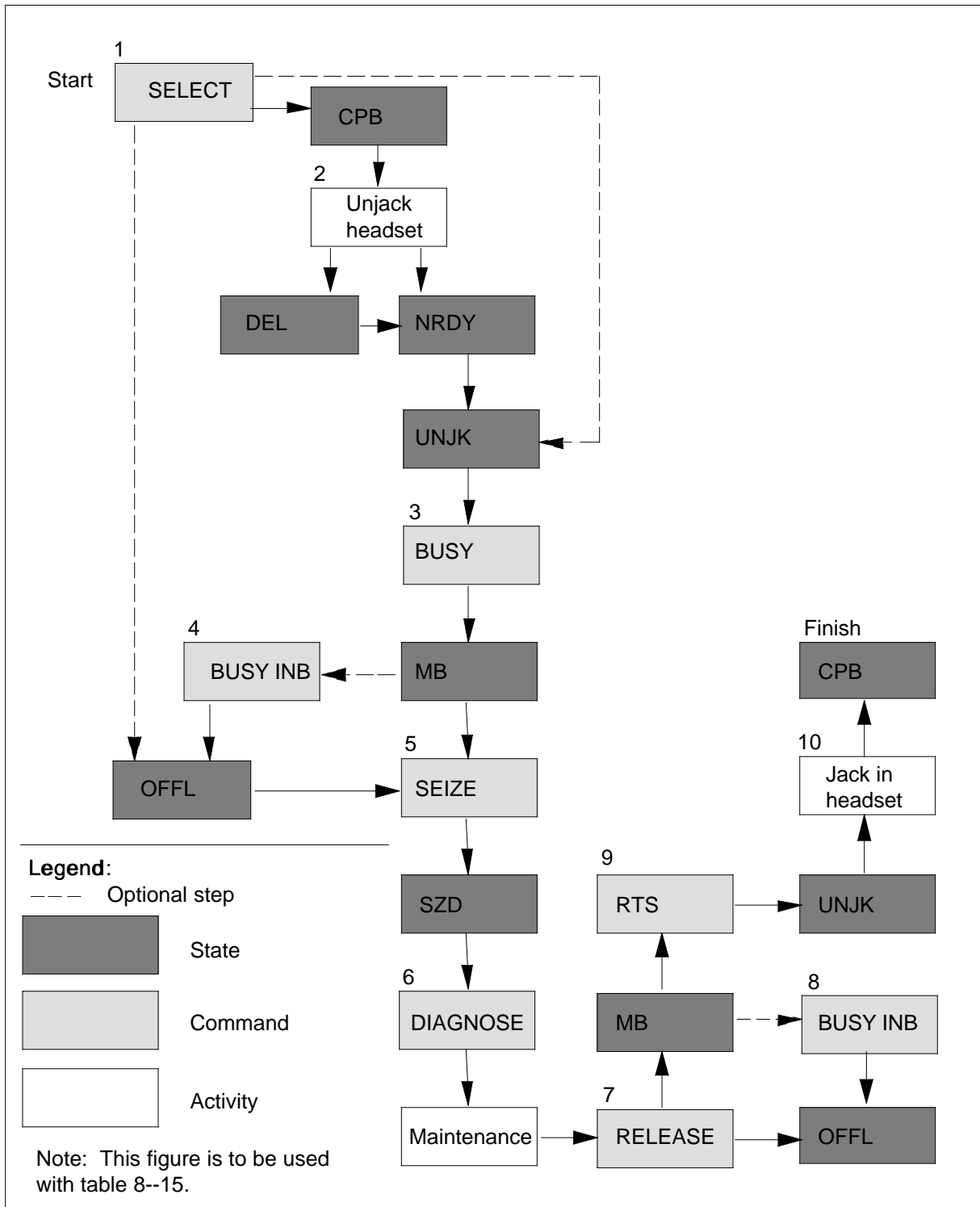
Table 8-15 Attendant console testing (Sheet 1 of 2)

Step	Action	Observation
1	Enter the SELECT command.	<p>The selected console is displayed in the console control position in the lower half of the CI output area.</p> <p>If the console is not in use by an attendant, its state is unjacked (UNJK). (Go to step 3.)</p> <p>If the console is not available to the subscriber, its state is offline (OFFL). (Go to step 5.)</p> <p>If the console is in use by the subscriber, its state is CPB. (Go to step 2.)</p>
2	Unjack the console headset (See Note 1.)	<p>If the console is not processing a call, the state of the console changes from CPB to not ready (NRDY).</p> <p>If the console is processing a call the console state is changed from CPB to DEL. When the call in progress is released, the console state changes from DEL to NRDY.</p> <p>60 s after the console headset is unjacked or a call in progress is released, the state changes from NRDY to UNJK.</p>
3	Enter the BUSY command.	The state of the console changes from UNJK to MB, removing it from subscriber accessibility.
4	Enter the command string BUSY INB to deter maintenance action on the console.	The state of the console changes from MB to OFFL.
<p>Note 1: Unjacking is required only if the console that is being tested is currently in use by the subscriber.</p> <p>Note 2: If the console that is being tested is not currently accessible to the subscriber, its current state is OFFL before changing to SZD.</p> <p>Note 3: A console is released to the state from which it was seized.</p> <p>Note 4: This procedure is to be used in conjunction with figure 8-28.</p>		

Table 8-15 Attendant console testing (Sheet 2 of 2)

Step	Action	Observation
5	Enter the SEIZE command to prepare the console for maintenance action.	The state of the console changes from MB to seized (SZD), or from OFFL to SZD. (See Note 2.)
6	Enter the DIAGNOSE command.	Test results are displayed beneath the display of the selected console.
7	Enter the RELEASE command.	The state of the console changes from SZD to MB or OFFL. (See note 3.)
8	Enter the command string BUSY INB to defer returning the console to subscriber accessibility.	The state of the console changes form MB to OFFL.
9	Enters the RTS command. (See Note 2.)	The state of the console changes from MB to UNJK.
10	The subscriber jacks a headset or handset into the console.	The state of the console changes from UNJK to CPB.
<p>Note 1: Unjacking is required only if the console that is being tested is currently in use by the subscriber.</p> <p>Note 2: If the console that is being tested is not currently accessible to the subscriber, its current state is OFFL before changing to SZD.</p> <p>Note 3: A console is released to the state from which it was seized.</p> <p>Note 4: This procedure is to be used in conjunction with figure 8-28.</p>		

Figure 8-28 Attendant console maintenance action diagram



Subscriber loop tests descriptions

Subscriber loop test

The subscriber loop test (SLT) is conducted if any of the diagnostic subtests fail that are listed beginning in Table 8-32, "Operated isolation relay specifications-NT6X94" on page 8-147, to determine if the failure is because of a fault on the loop. For ground start lines, the subscriber loop test is always conducted as part of the diagnostic sub-tests.

If the Negate Partial Ground Start Diagnostics (NPGD) is set in options for table LENLINE and IBNLINES, then the diagnostic module will only execute the tests selected. It will be selected on a per line basis. The NPGD option will run under the ALT or LTP level of the MAP on the command DIAG. NPGD will only be allowed on lines that are identified as gnd=Y in table LNINV. New limits for the SLT test are given in Table 8-19, "M5n09 MBS station ringer test" on page 8-90. Setting the NLT option is not necessary. The following is the sequence of tasks that are used in the test:

1. The test access relay in the line circuit is operated.
2. The cutoff relay in the line circuit is operated.
3. The MTU measures resistance, capacitance and dc voltage from tip (A) to ground and from ring (B) to ground, as well as resistance and capacitance from tip (A) to ring (B).

Note: The capacitance test does not apply to Meridian business sets, M5n09 sets, or M5n12 sets.

4. The DMS-100 switch compares the measured values with established limits. A *Pass* is reported when values are within limits and a *Fail* is reported when values are outside limits. The threshold values are listed in Table 8-16 and Table 8-18.

Table 8-16 Subscriber loop test for POTS line

Threshold values						
	Tip to ring		Tip to ground		Ring to ground	
Parameter	Min	Max	Min	Max	Min	Max
Volts dc	-10	+10	-60	+60	-60	+60
Volts ac	0	10	0	120	0	120
RES (kΩ)	800	INF	800	INF	800	INF
CAP (μF)	0	4	0	4	0	4

Table 8-17 Subscriber loop test for POTS line

Threshold values						
Parameter	Tip to ring		Tip to ground		Ring to ground	
	Min	Max	Min	Max	Min	Max
Volts dc	-10	+10	-60	+60	-60	+60
Volts ac	0	10	0	120	0	120
RES (kΩ)	18	INF	7	INF	7	INF
CAP (μF)	0	4	0	4	0	4

Line insulation test

The line insulation test consists of the electromotive force (EMF) test that measures any ac or dc voltages on the line; the resistance test that measures leakage between the line conductors and from each conductor to ground; and the capacitance test that measures capacitance between the conductors and between each conductor and ground. The following is the sequence of tasks is used:

1. The TA relay and cutoff relay in the line circuit under test are operated.
2. The MTU is connected to the line card under test.
3. The MTU measures the following resistances:
 - tip to ground
 - ring to ground
 - tip to ring

Note: The tip to ring resistance reading for MBS sets should be from 100 kΩ through 180 kΩ when the measurement is made with the MTU. For those offices using the LTU, the tip to ring resistance measurement will be approximately 999 kΩ

The MTU measures any voltages that may be present as follows:

- tip to ground
- ring to ground

and the MTU measures the following capacitances:

- tip to ground

- ring to ground
- tip to ring

Any or all of these measurements may be specified.

Note: The capacitance test does not apply to Meridian business sets, M5n09 sets, or M5n12 sets.

4. The DMS-100 switch compares the measured results with the limits defined by the operating company or with the default limits of the system (see Table 8-16, "Subscriber loop test for POTS line" on page 8-76). A *pass* is reported when values are within limits and a *fail* is reported when values are outside limits.

ABS on-hook balance network test

The automatic balance selection (ABS) on-hook balance network test is run when new line circuits are being placed in service, and only occasionally thereafter. It is used to determine whether a loop type is loaded or non-loaded, and to display the result on the MAP display. The loop type is displayed before and after testing. The test also changes the balance network in the line circuit that is connected to the loop being tested, and updates table line inventory (LNINV) of this line circuit if required, unless the changes have been inhibited, as discussed in Section , "ABS balance network testing" on page 8-124. The following is the sequence of tasks that are used:

1. Establish a path through the digital network between the TTU and the line circuit under test.
2. Temporarily configure the line circuit for testing, with a loaded balance network and a 0 dB pad.
3. The return loss is measured at each of 1000, 1500, 2000, 2500, 3000, and 3200 Hz frequencies.
4. The DMS-100 switch displays the loop type, as determined from return loss test results in task 3.
5. The pad setting for the line circuit is restored to the pre-test value.
6. The balance network is restored to its pre-test value, if the manual network override (MNO) value is *Y* in table LNINV for this line circuit. If the value of MNO is *N*, the balance network is set to correspond to the loop type determined by this test.

The balance network value (BNV) in table LNINV is updated by the DMS-100 switch for this line circuit if the value after the test differs from the value before the test.

ABS off-hook balance network test

The ABS off-hook balance network test determines whether a loop is the loaded type or the non-loaded type and displays the result on the MAP monitor. This test also changes the balance network and loss pad in the line circuit that is connected to the loop under test, and updates the data table LNINV for this line circuit if it is required. The following is the sequence of tasks that are used in this test:

1. Establish a path through the digital network between the TTU and the line circuit under test.
2. Temporarily configure the line circuit for testing, with a loaded balance network and 0 dB pad.
3. The return loss is measured at a frequency of 3200 Hz.
4. The line circuit is reconfigured using a non-loaded balance network and 0 dB pad.
5. Task 3 is repeated.
6. The loop type is displayed as determined from return loss measurements.
7. The balance network and loss pad in the line circuit are set for optimum echo return loss.
8. The BNV and the loss pad setting (LOSS) in table LNINV for intra-office calls, are updated by the DMS-100 switch for this line circuit to agree with the line card setting in task 7; the value for MNO is set to *Y*.

Loss test

The loss test measures the insertion loss of a tone signal that is sent from the subscriber end of the loop to the line circuit in the DMS-100 office. This test is normally limited to PBX subscriber applications. The following is the sequence of tasks used in this test:

1. The TTU is connected to the line circuit via the digital network.
2. The TP relay in the NT2X18 type or NT6X18 type line circuits is operated.
3. Tone is sent from the subscriber end of the loop at a known frequency and level.
4. The level of tone received at the TTU is measured and the result is displayed in dBm, at the LTP.
5. The level of tone that is sent is compared with the level that is received and the LTP operator calculates the loss in dB.

Coin test

The coin test checks the operation of the coin collect and coin return mechanism of the coin station that is connected to the line in the control position. The following is the sequence of tasks in this test:

1. The TA relay and the TP relay in the line circuit are operated to establish a talk or monitor connection between the communication module and the line circuit.
2. The command COIN is entered with the parameter CC to check the coin collect mechanism.
3. The command COIN is entered with the parameter CR to check the coin return mechanism.
4. The test result is displayed at the LTPLTA level.

ANI test and coin presence test

ANI test and coin presence test is conducted on RCS lines using the following sequence of tasks:

1. A termination is connected to the tip and ring of the line circuit at the RCS.
2. The CC requests the SMS to perform a coin presence test or an ANI test.
3. The result of the coin test is as follows:
 - a. A coin present is indicated when the connected termination is REFLECT/NTPG.
 - b. A coin not present is indicated by any other termination.

Note: The positive coin check signal (local overtime) is not tested in this diagnostic.

4. The result of the ANI test is as follows:
 - a. A tip party is indicated when the connected termination is REFLECT/NTPG.
 - b. A ring party is indicated by any other termination.

Digit test

The digit test checks the frequency and level of digits that are produced by a keyset and the make-break ratio and pulse rate that is produced by a rotary dial. The following is the sequence of tasks that are used in the test:

1. A talk connection is established between the communication module and the line circuit in the control position. This connects an MTU to the line circuit.
2. The RING command is entered to signal the station.

3. After the station is answered, enter the command DGTTST at the LTP menu level, then a digit sequence from Table 8-18 is sent from the station.
4. The test results are displayed in the CI output area of the MAP display.

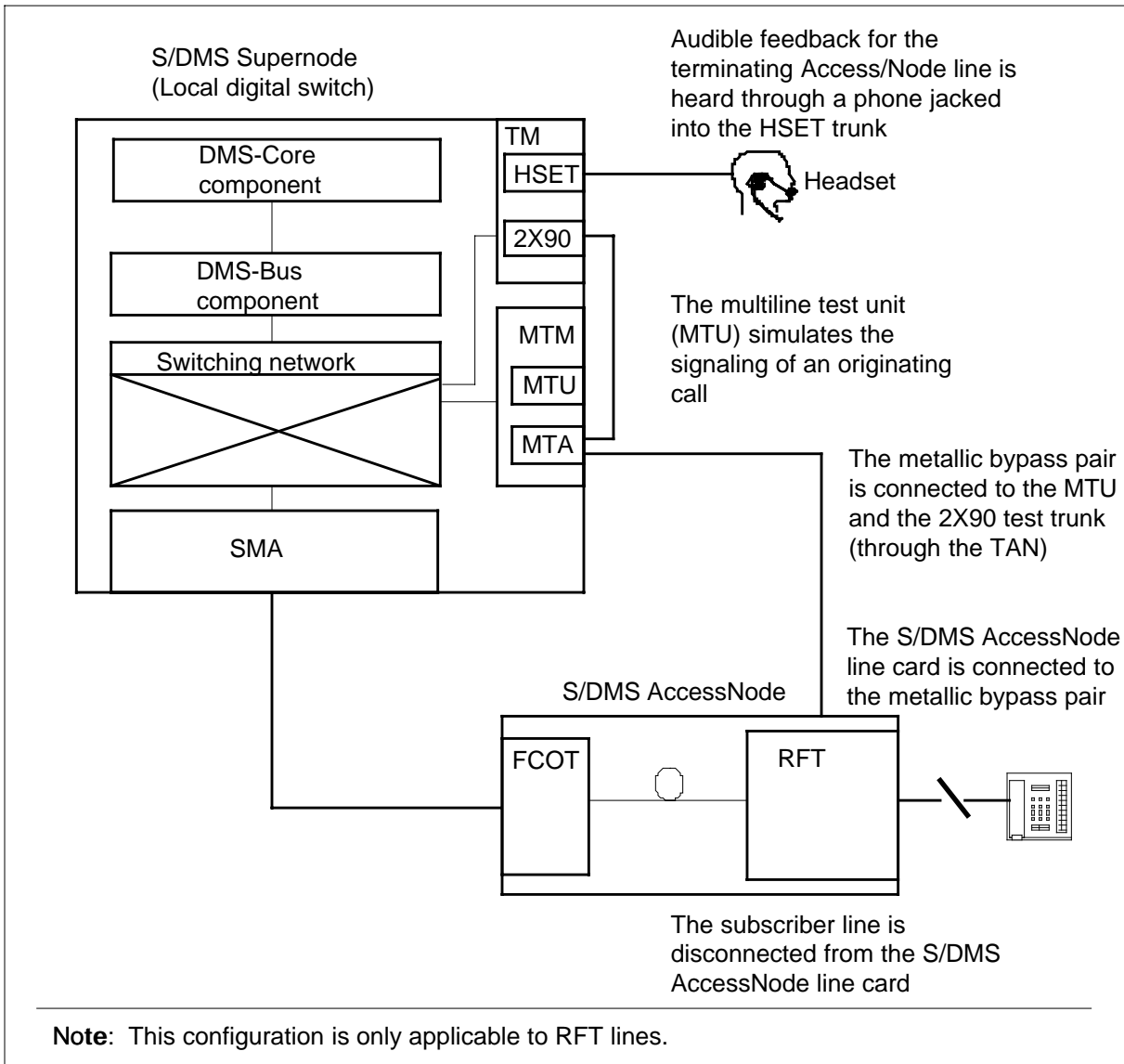
Originate test

The originate test checks the ability of a line circuit to obtain a dial tone, accept digits, and handle a call from the LTP operator to a selected destination. The following is the sequence of tasks that are used in this test:

1. A talk-monitor connection is established at the LTPLTA level by the tester from the LTP to the line circuit in the control position. This task also connects an MTU to the line circuit.
2. The tester enters the command ORIG without parameters. It causes the MTU to attach an off-hook termination to the loop side of the line circuit and sends dial tone to the tester.
3. The tester enters the command ORIG followed by digits to connect the line circuit to a selected station or service.
4. The MTU outputs the digits in dial pulse form.
5. The outputted digits are displayed.
6. The tester enters the ORIG command without parameters, causing the MTU to condition the line circuit as on-hook.

RDT lines originate testing The ORIG command simulates the signaling associated with an originating call (going off-hook and sending digits). In the SMA configuration, these tests can be performed by using a metallic bypass. Figure 8-29 shows the metallic bypass configuration.

Figure 8-29 RDT lines originate test configuration



Ring test

The ring test checks the operation of the ringers at the station that is connected to the line under test. The following is the sequence of tasks that are used in this test:

1. A talk connection is established to the line.
2. The RING command is entered without a parameter to ring the station that is associated with the directory number (DN) which is displayed in the control position.
3. The RING command is entered with the parameter of a station other than the one in the control position. The parameter value is from 0 through 5

and is obtained from the RINGCODE field in the LENLINES table (see Data Schema section of *Translations Guide*).

4. The station that is accessed with the parameter is called and the DN of the line in the control position continues to be the only DN that is displayed.

Subscriber premises tests

The silent switchman test and the station ringer test are usually conducted on subscriber premises by installation or repair personnel without involving central office personnel. The silent switchman test can also be used at intermediate locations by cable facility repair personnel to isolate faults.

Silent switchman test The silent switchman test (SSMAN) permits a subscriber loop to be conditioned for testing, from the associated station or from an intermediate test station, without involvement by personnel at the central office. The SSMAN test checks the subscriber loop for facility faults. The test circuit is accessed by dialing a service code or a seven digit number.

Note: The test is not applicable to DMS-1R RCT or to RCS subscriber carrier lines. An attempt to perform the test on a DMS-1R RCT or on a RCS line causes a reorder tone to be returned to the originating set.

The SSMAN is initiated from a station, typically by installation or repair personnel, by dialing a three or four digit service code. The code used is defined in data table HNPACONT, subtable HNPACODE, code types SCD3 or SCD4 (see Data Schema section of *Translations Guide*). A seven digit number can be used. It is defined in table DNROUTE (see Data Schema section of *Translations Guide*). The following is the sequence of tasks that are used in this test:

1. The accessing code is dialed by the tester from the subscriber's station or from an intermediate test location.
2. After 10 s a tone, interrupted 30 times per min, is sent to the calling station for a period of 10 s.
3. The cut-off relay in the line circuit operates for a defined period during which the station receives silence. When the station is a MBS, the LCD that is associated with the line used to originate the test, fades to off.
4. The line under test is placed in the CPB state.
5. The loop from the office battery and ground is disconnected.
6. The loop facility is checked for faults.

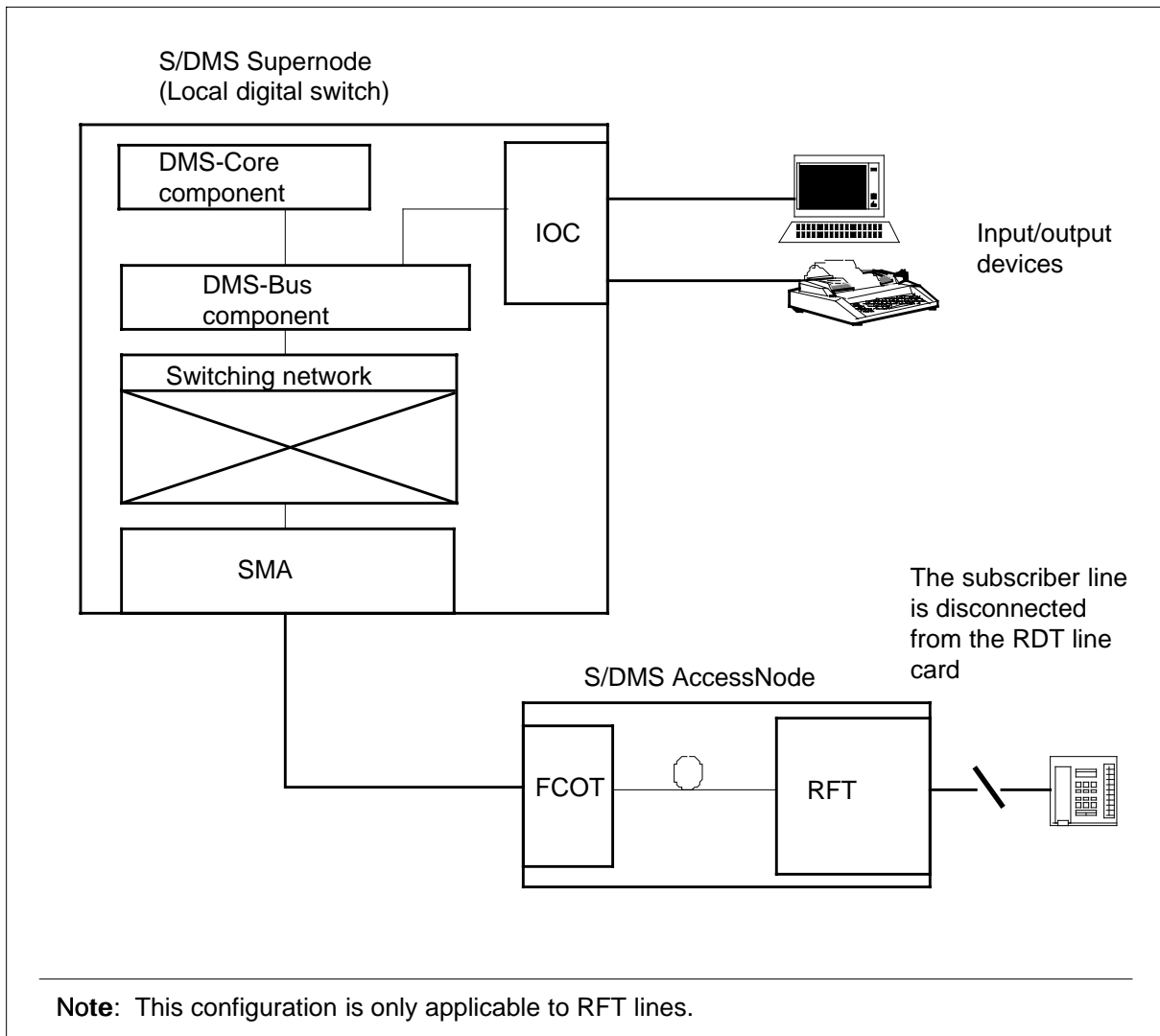
7. The completion of the test period discontinues the silence and is indicated differently for POTS, business set, and DU lines follows:
 - POTS lines send dial tone to the station
 - Business set lines change the condition of the lamp associated with the main line of the set from off to on, momentarily, and then goes off. It is recommended that the business set test be conducted with the handset on-hook.
 - DU lines change the condition of the data set power indicator lamp from flashing during the silent period, to the normal steady condition.
8. This test cannot be exited before the prescribed silent period has been completed.

Testers at intermediate locations observe test sets for the return of battery to indicate the end of the silent period.

Silent switchman test for RDT lines Using the silent switchman, outside plant personnel can check the subscriber loop for facility faults without the assistance of maintenance personnel at the CO. The subscriber line is isolated from the RDT so that facility faults can be identified using external test equipment.

The test circuit is accessed by dialing a service code or a seven-digit directory number (DN). When the dial-up service code is received, a confirmation tone is returned and the subscriber line is disconnected for a defined interval, allowing facility faults to be checked. Figure 8-30 shows the configuration.

Figure 8-30 Silent switchman test configuration for RDT lines



Station ringer test

The SRT test compares the digits that are received at the central office with known digits that are transmitted at the station, and checks the operation of the coin control mechanism at a coin station. The test circuit is accessed by dialing or keying a code at the station.

POTS station ringer test

The POTS station ringer test (SRT) is performed on the station equipment by installation or repair personnel. The following sequence of subtests should be performed:

1. Dial pulse (DP) digit collection (DP station) subtest collects the digits received and compares them with the digits dialed (see Table 8-19).
2. Digitone digit collection (DTMF station) subtest collects all digits during dial tone to verify that any initial digit would break dial tone on a normal call.
3. Coin return (coin station) subtest verifies that the coin control mechanism is operating.
4. Party identification and ground checks subtest verifies the operation of party lines.

Table 8-18 Digit sequences for station ringer test

Sequence	Digits used	Application (see note)
1	0	DP and DIGITONE station
2	1 2 3 4 5 6 7 8 9 0	DP and DIGITONE station
3	* #	DIGITONE station

Note: When a dial pulse station is used to initiate a station ringer test on a line with a universal tone receiver (UTR), all ten digits (1 through 9 plus 0) must be dialed during the dial test portion of the test (the same as with the DIGITONE station). The test will then proceed as normal.

Note: The SRT may be ended after either subtest 1 or 2 has been performed.

The SRT can be initiated by dialing one of the following number formats from the station:

1. A seven-digit number, where
 - a. a three-digit access code is followed by the last four digits in the DN of the station, or
 - b. a two-digit access code is followed by the last five digits in the DN of the station.

(See Data Schema section of *Translations Guide*, table HNPACONT, subtable HNPACODE, code type STRG).

2. A ten-digit number, where a three-digit access code is followed by the seven-digit DN of the station (see Data Schema section of *Translations Guide*; table CLLI, table OFRT, and table STDPRT).

Note: If format 2 is adopted, there is a delay of a few seconds after the initial three digits.

3. A 13-digit number, where a three-digit access code is followed by the NPA and the seven-digit DN of the station (see Data Schema section of *Translations Guide*; table CLLI, table OFRT, and table STDPRT).

A dial tone returned to the station signals that the SRT is ready for use; a reorder tone signals that the SRT is not ready for use. The SRT times out after 30 s if the test sequence is not acted on with the exception of the off-hook ground test. This phase of the test does not time out, the tester must go back on-hook with the set.

When the SRT is accessed, the current time, date, and the digits zero to nine are transmitted to the station equipment in the test message as specified by the TR-TSY-000030 *CLASS Feature: SPCS Customer Premises Equipment Data Interface*. This occurs on lines with the calling number delivery (CND) or CND subscription usage-sensitive pricing (SUSP) option.

After accessing the SRT, conduct the applicable tests according to Figure 8-31 and Figure 8-32.

Figure 8-31 POTS station ringer tests (steps a - c)

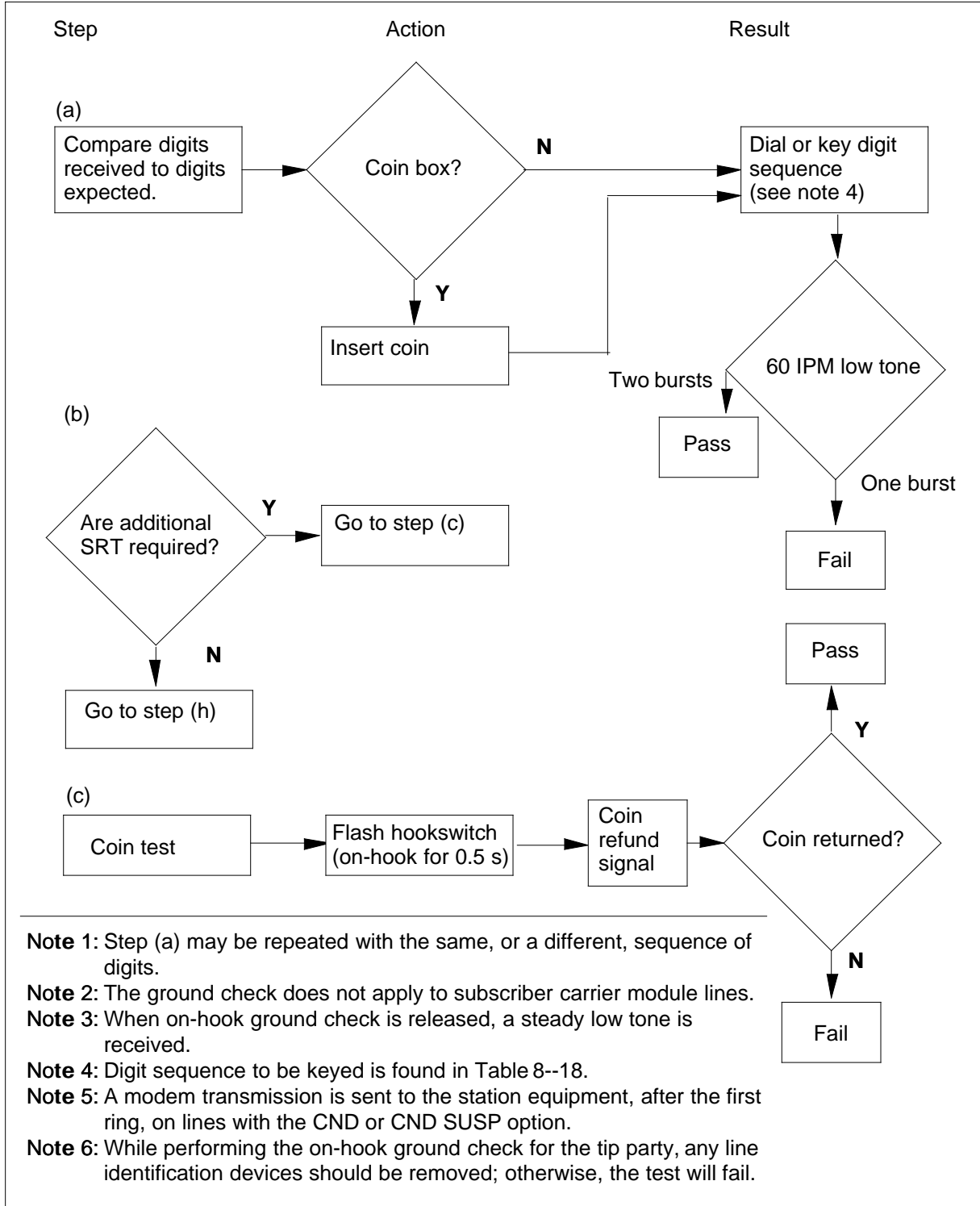
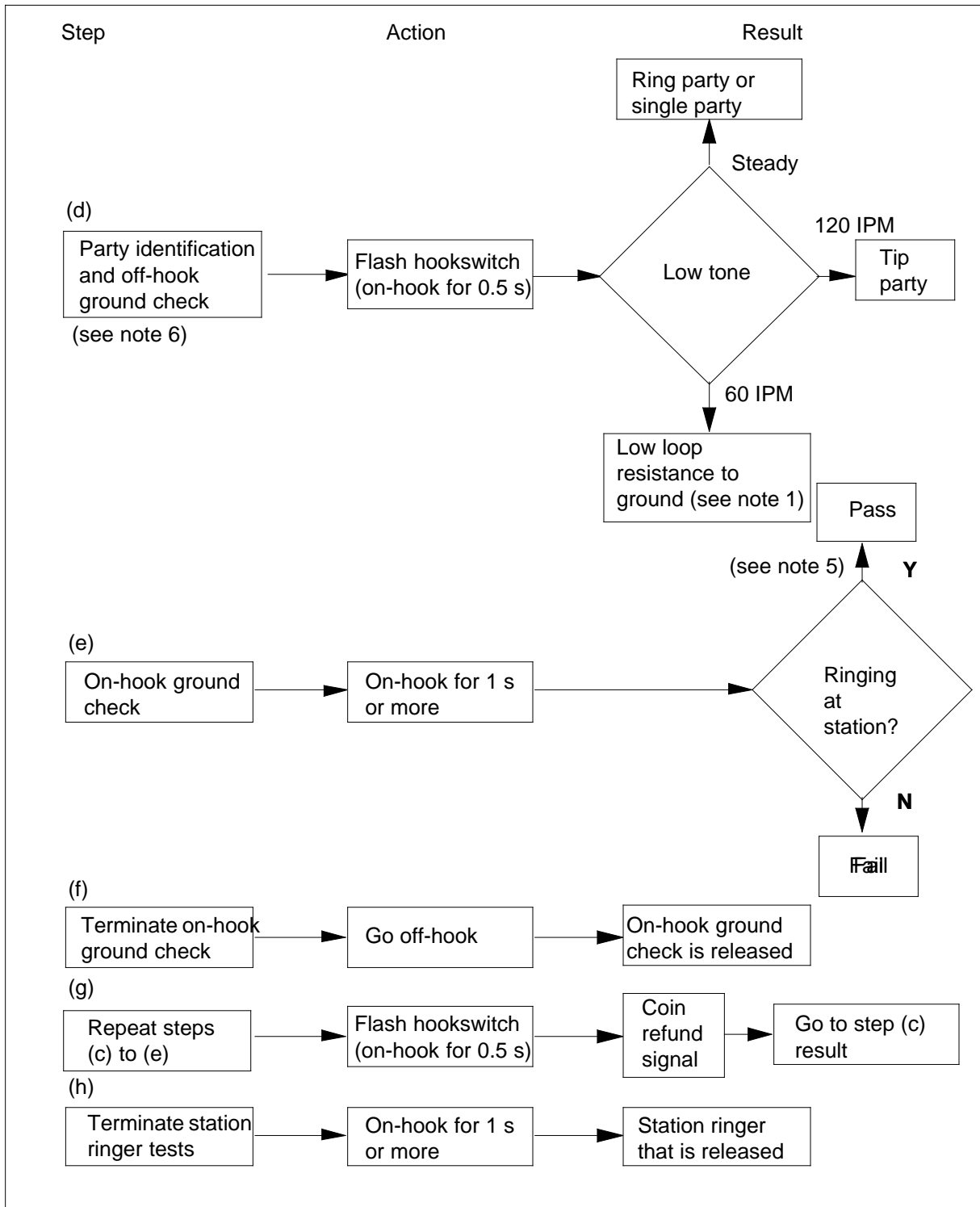


Figure 8-32 POTS station ringer tests (steps d - h)



Keypad station ringer test The keypad SRT tests the keypad hardware and performs a circuit test. The test is initiated by taking the following steps:

1. Place the handset on hook.
2. Verify that all liquid crystal displays (LCD) are off.
3. Press the loop key of the line for the set under test to obtain a dial tone.
4. Enter the SRT access code
5. If a reorder tone is heard, or if the call is intercepted, it indicates that the DN digits that were entered are different from the originating line DN. If either of these conditions occurs press the rls key, turning off all LCDs, and repeat steps 1 to 4 using the correct access code.
6. If the MBS is equipped with a display area, a flashing cursor is displayed in the leftmost position of the top row. When the first digit is keyed, the cursor moves to the position following the digit. Failure to display the flashing cursor initially in the leftmost position of the top row is the result of either a fault in the set or the set is not datafiled as a display set.
7. Perform the sequence of tests shown in Table 8-19.

Table 8-19 M5n09 MBS station ringer test (Sheet 1 of 4)

Step	Action	Response
1	Establish off-hook condition	All LCD flash
2	Establish on-hook condition	All LCD wink
3	Establish off-hook condition	All LCD are on
4	Establish on-hook condition	All LCD are off
5	Press dial pad key 1	LCD 1 is on
6	Press dial pad key 2	LCD 2 is on
7	Press dial pad key 3	LCD 3 is on
<p>Note 1: LCDs are numbered 1 to 8 from the bottom of the set to the top as shown in Figure 8-33 for the MBS, and in Figure 8-34 for the M5n09 set.</p> <p>Note 2: A wink response momentarily interrupts a LCD <i>ON</i> twice each second.</p> <p>Note 3: A flash response alternates an <i>ON</i> or <i>OFF</i> LCD display once each second.</p> <p>Note 4: After the HOLD key has been pressed for a total of four times the SRT is discontinued.</p> <p>Note 5: Only LCD 9 is on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p> <p>Note 6: LCD 6 to 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p> <p>Note 7: LCD 1, 2 and 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p>		

Table 8-19 M5n09 MBS station ringer test (Sheet 2 of 4)

Step	Action	Response
8	Press dial pad key 4	LCD 4 is on
9	Press dial pad key 5	LCD 5 is on
10	Press dial pad key 6	LCD 6 is on
11	Press dial pad key 7	LCD 7 is on
12	Press dial pad key 8	LCD 8 is on
13	Press dial pad key 9	LCD 1 and 8 are on
14	Press dial pad key 0	LCD 2 and 8 are on
15	Press dial pad key (* key)	All LCD are on
16	Press dial pad key (# key)	All LCD are off
17	Press feature key 1	LCD 1 is on
18	Press feature key 2	LCD 2 is on
19	Press feature key 3	LCD 3 is on
20	Press feature key 4	LCD 4 is on
21	Press feature key 5	LCD 5 is on
22	Press feature key 6	LCD 6 is on
23	Press feature key 7	LCD 7 is on
24	Press feature key 8	LCD 8 is on
25	Press feature key 9	LCD 1 and 8 are on
26	Press rls key	LCD 2 are 8 are on

Note 1: LCDs are numbered 1 to 8 from the bottom of the set to the top as shown in Figure 8-33 for the MBS, and in Figure 8-34 for the M5n09 set.

Note 2: A wink response momentarily interrupts a LCD *ON* twice each second.

Note 3: A flash response alternates an *ON* or *OFF* LCD display once each second.

Note 4: After the HOLD key has been pressed for a total of four times the SRT is discontinued.

Note 5: Only LCD 9 is on for a M5n09 MBS with 9 LCDs. See Figure 8-34.

Note 6: LCD 6 to 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.

Note 7: LCD 1, 2 and 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.

Table 8-19 M5n09 MBS station ringer test (Sheet 3 of 4)

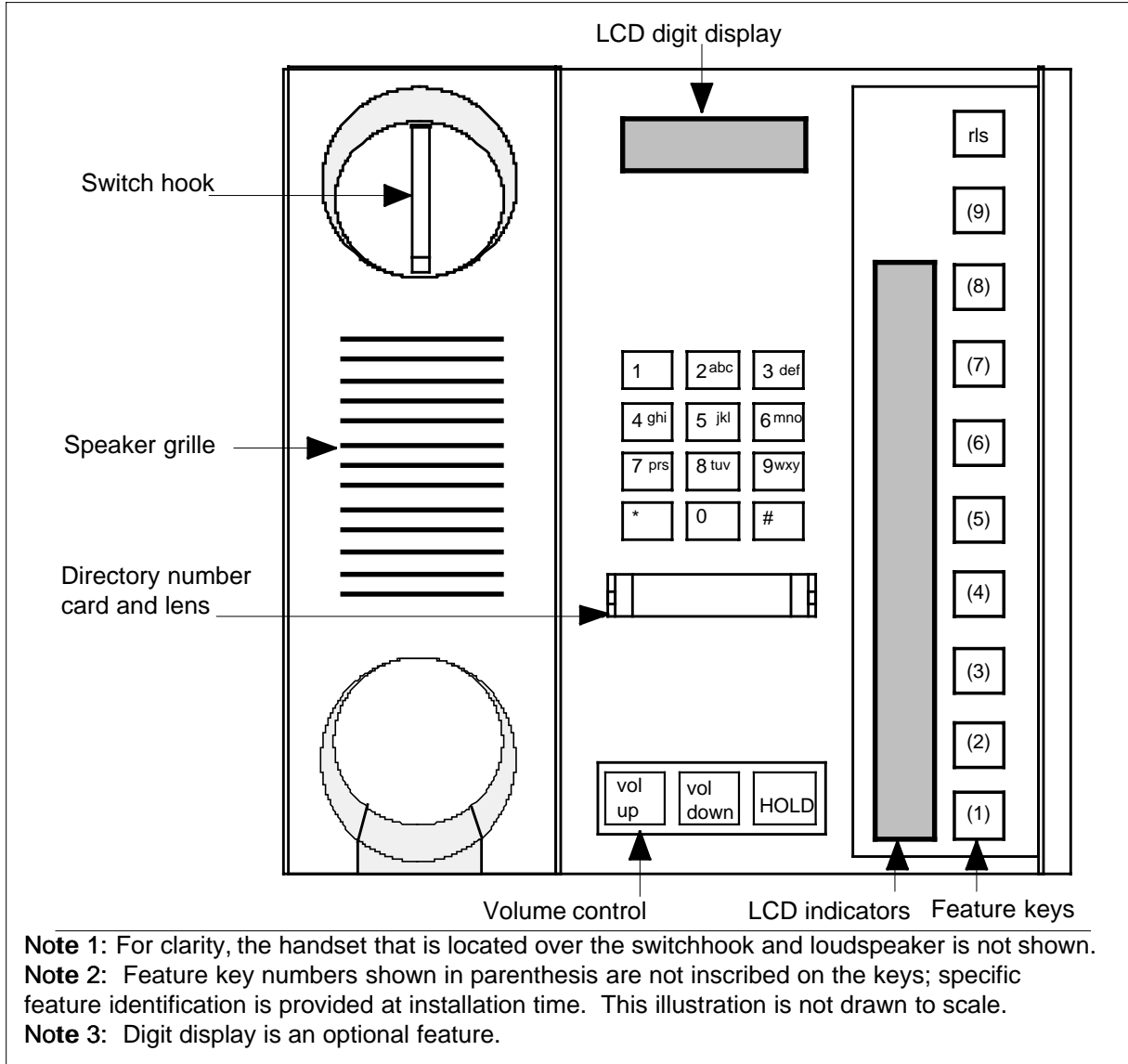
Step	Action	Response
27	Press HOLD key	Dial tone on the speaker LCD 1 to 5 are on
28	Press vol up key	Speaker dial tone volume increases
29	Press vol down key	Speaker dial tone volume decreases
30	Establish off-hook condition	Dial tone on the handset All LCD flash
31	Establish on-hook condition	Dial tone on the speaker All LCDs wink
32	Press HOLD key	Dial tone is discontinued 1 s of buzz LCD 6 to 8 are on (see Note 6)
33	Press HOLD key	Ringling from speaker All LCD are off
34	Press vol up key	Speaker ringing volume increases
35	Press vol down key	Speaker ringing volume decreases
<p>Note 1: LCDs are numbered 1 to 8 from the bottom of the set to the top as shown in Figure 8-33 for the MBS, and in Figure 8-34 for the M5n09 set.</p> <p>Note 2: A wink response momentarily interrupts a LCD <i>ON</i> twice each second.</p> <p>Note 3: A flash response alternates an <i>ON</i> or <i>OFF</i> LCD display once each second.</p> <p>Note 4: After the HOLD key has been pressed for a total of four times the SRT is discontinued.</p> <p>Note 5: Only LCD 9 is on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p> <p>Note 6: LCD 6 to 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p> <p>Note 7: LCD 1, 2 and 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p>		

Table 8-19 M5n09 MBS station ringer test (Sheet 4 of 4)

Step	Action	Response
36	Press HOLD key	<p>Ringing stops</p> <p>LCD 2,3, and 4 wink indicating that a circuit test running. No further keys should be pressed until the circuit test has finished since pressing these keys may affect the circuit test results. Any keys pressed while the circuit test is running are not acknowledged (lamps not changed).</p> <p>LCD 1 to 8 are on indicating that the circuit test has passed. Top line display indicates the number of messages received and the number of messages sent.</p> <p>LCD 1, 2, and 8 are on indicating that the circuit test has failed. See Note 7. Top line display indicates the number of messages received and the number of messages sent.</p> <p>LCD 1, 2, and 8 wink indicating that the circuit test is done, was not run, or has timed out respectively</p>
37	Press HOLD key	Exit from SRT
<p>Note 1: LCDs are numbered 1 to 8 from the bottom of the set to the top as shown in Figure 8-33 for the MBS, and in Figure 8-34 for the M5n09 set.</p> <p>Note 2: A wink response momentarily interrupts a LCD <i>ON</i> twice each second.</p> <p>Note 3: A flash response alternates an <i>ON</i> or <i>OFF</i> LCD display once each second.</p> <p>Note 4: After the HOLD key has been pressed for a total of four times the SRT is discontinued.</p> <p>Note 5: Only LCD 9 is on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p> <p>Note 6: LCD 6 to 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p> <p>Note 7: LCD 1, 2 and 9 are on for a M5n09 MBS with 9 LCDs. See Figure 8-34.</p>		

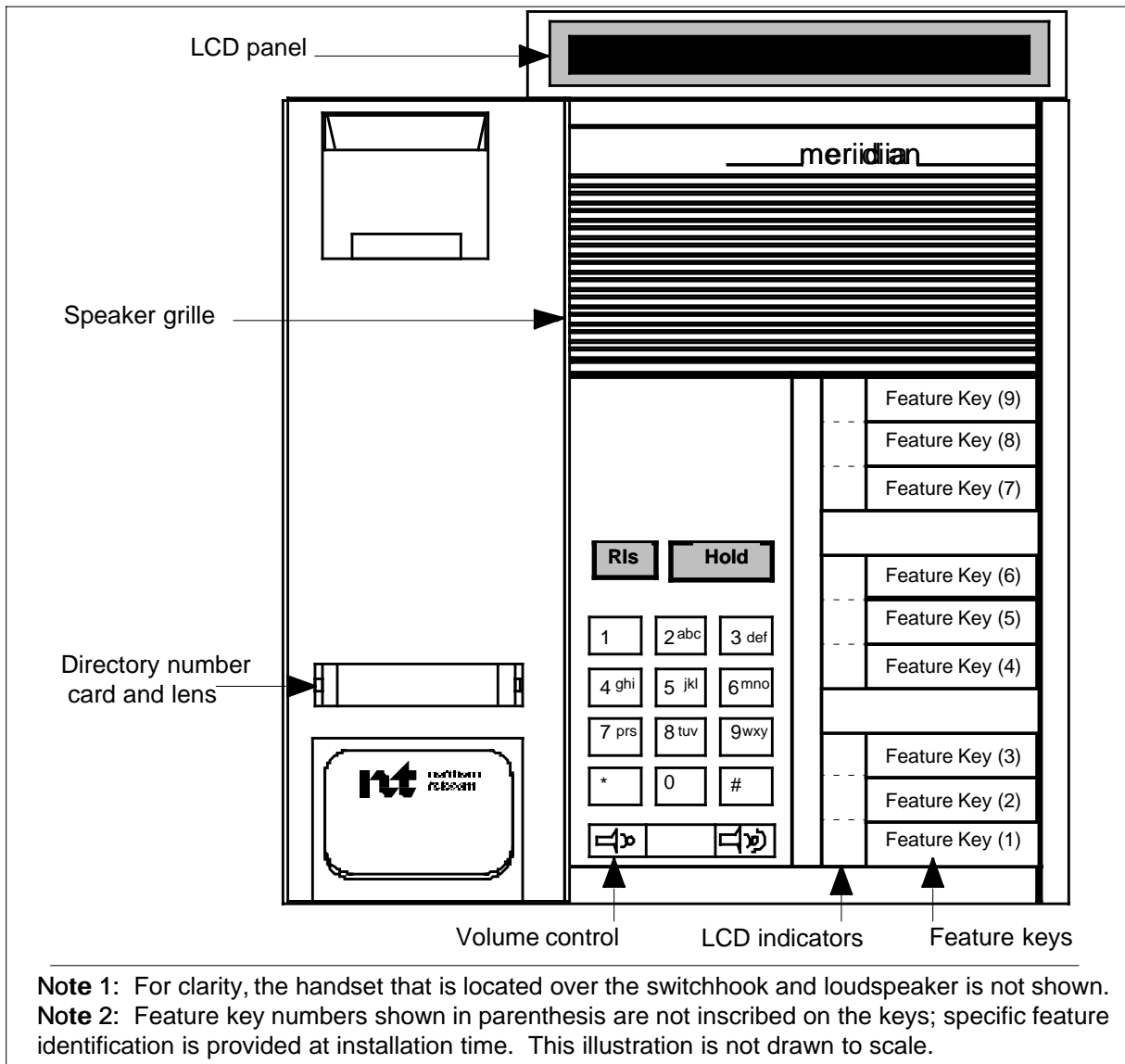
The following illustration shows the layout of the Meridian business set.

Figure 8-33 MBS layout



M5n09 Meridian business set station ringer test The M5n09 Meridian business set SRT tests the hardware of the business set using key sequences listed in Table 8-21. Key identification is shown in Figure 8-34. The test is initiated by performing steps 1 through 5 and step 7 listed for the MBS (see Section , "Keyset station ringer test" on page 8-90) and is subject to the same conditions listed for that set.

Figure 8-34 M5n09 Meridian business set layout



M5n12 Meridian business set station ringer test The M5n12 Meridian business set SRT tests the usage and hardware of the business sets using key sequences listed in Table 8-20. Key identification is shown in Figure 8-35. The test is initiated by taking steps 1 to 5 and step 7 listed for the MBS

(see "Keyset station ringer test" on page 8-90) and is subject to the same conditions listed for the set.

Table 8-20 M5n12MBS station ringer test (Sheet 1 of 3)

Step	Action	Response
1	Establish off-hook condition	All LCD flash
2	Establish on-hook condition	All LCD wink
3	Establish off-hook condition	All LCD are on
4	Establish on-hook condition	All LCD are off
5	Press dial pad key 1	LCD 1 is on
6	Press dial pad key 2	LCD 2 is on
7	Press dial pad key 3	LCD 3 is on
8	Press dial pad key 4	LCD 4 is on
9	Press dial pad key 5	LCD 5 is on
10	Press dial pad key 6	LCD 6 is on
11	Press dial pad key 7	LCD 7 is on
12	Press dial pad key 8	LCD 8 is on
13	Press dial pad key 9	LCD 1 and 8 are on
14	Press dial pad key 0	LCD 2 and 8 are on
15	Press dial pad key (* key)	All LCD are on
16	Press dial pad key (# key)	All LCD are off
17	Press feature key 1	LCD 1 is on
18	Press feature key 2	LCD 2 is on
19	Press feature key 3	LCD 3 is on
20	Press feature key 4	LCD 4 is on
21	Press feature key 5	LCD 5 is on
<p>Note 1: Key and lamp 11 of one version of M5n12 are inoperative; step 27 does not apply to it.</p> <p>Note 2: If step 27 does not apply, go to step 35.</p> <p>Note 3: For M112 set only.</p>		

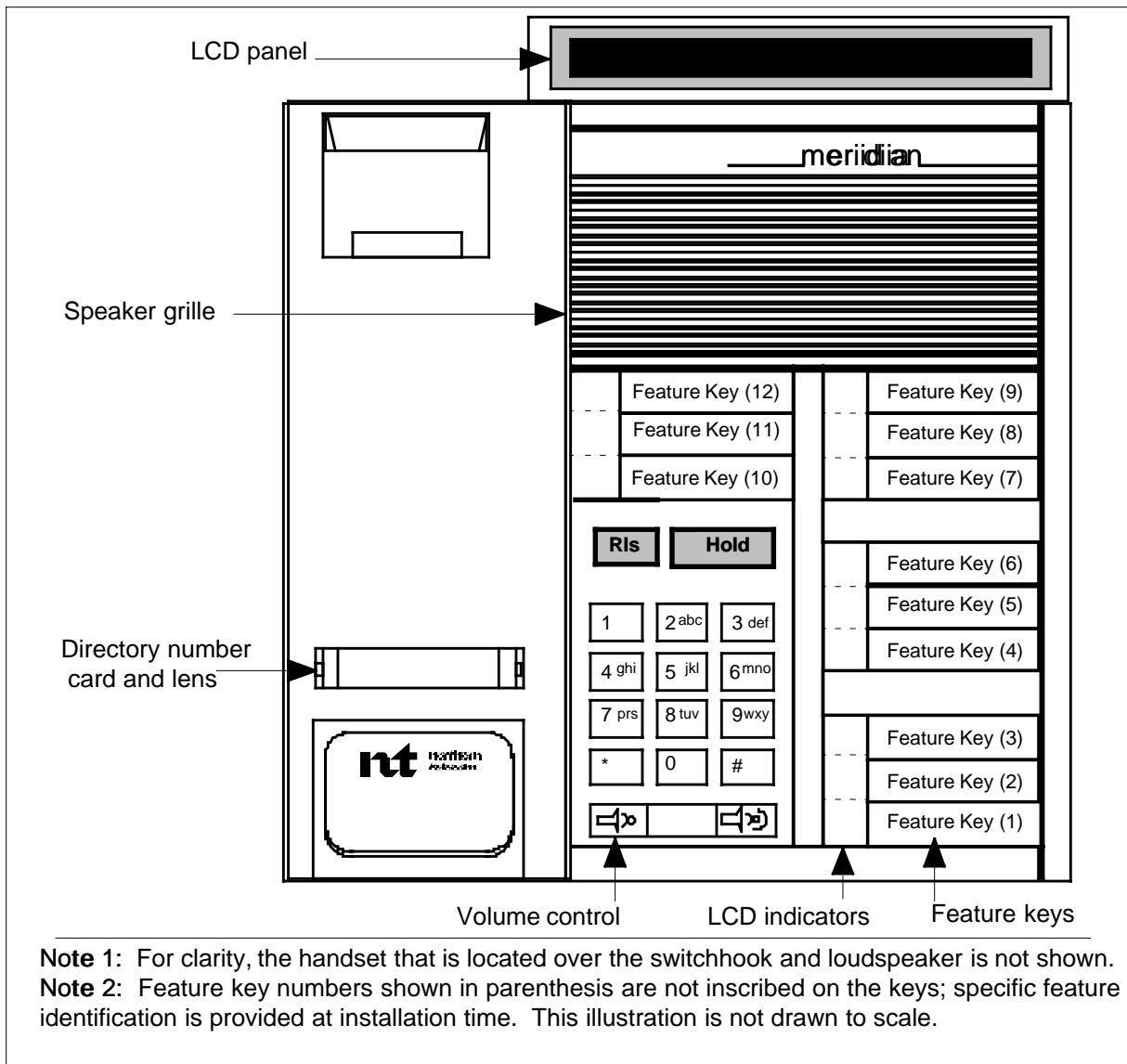
Table 8-20 M5n12MBS station ringer test (Sheet 2 of 3)

Step	Action	Response
22	Press feature key 6	LCD 6 is on
23	Press feature key 7	LCD 7 is on
24	Press feature key 8	LCD 8 is on
25	Press feature key 9	LCD 9 is on
26	Press feature key 10	LCD 10 is on
27	(see notes 1 and 2)	Press feature key 11 LCD 11 is on
28	Press feature key 12	LCD 12 is on
29	Press feature key 13	LCD 13 is on
30	Press feature key 14	LCD 14 is on
31	Press feature key 15	LCD 15 is on
32	Press feature key 16	LCD 16 is on
33	Press feature key 17	LCD 17 is on
34	Press feature key 18	LCD 18 is on
35	Press rls key	LCD 2 and 8 are on
36	Press HOLD key	LCD 1 to 5 are on Dial tone on speaker only
37 (see note 3)	Press HOLD key	LCD 1 to 9 are on Dial tone on speaker only
38	Establish off-hook condition	All LCD flash Dial tone on handset only
<p>Note 1: Key and lamp 11 of one version of M5n12 are inoperative; step 27 does not apply to it.</p> <p>Note 2: If step 27 does not apply, go to step 35.</p> <p>Note 3: For M112 set only.</p>		

Table 8-20 M5n12MBS station ringer test (Sheet 3 of 3)

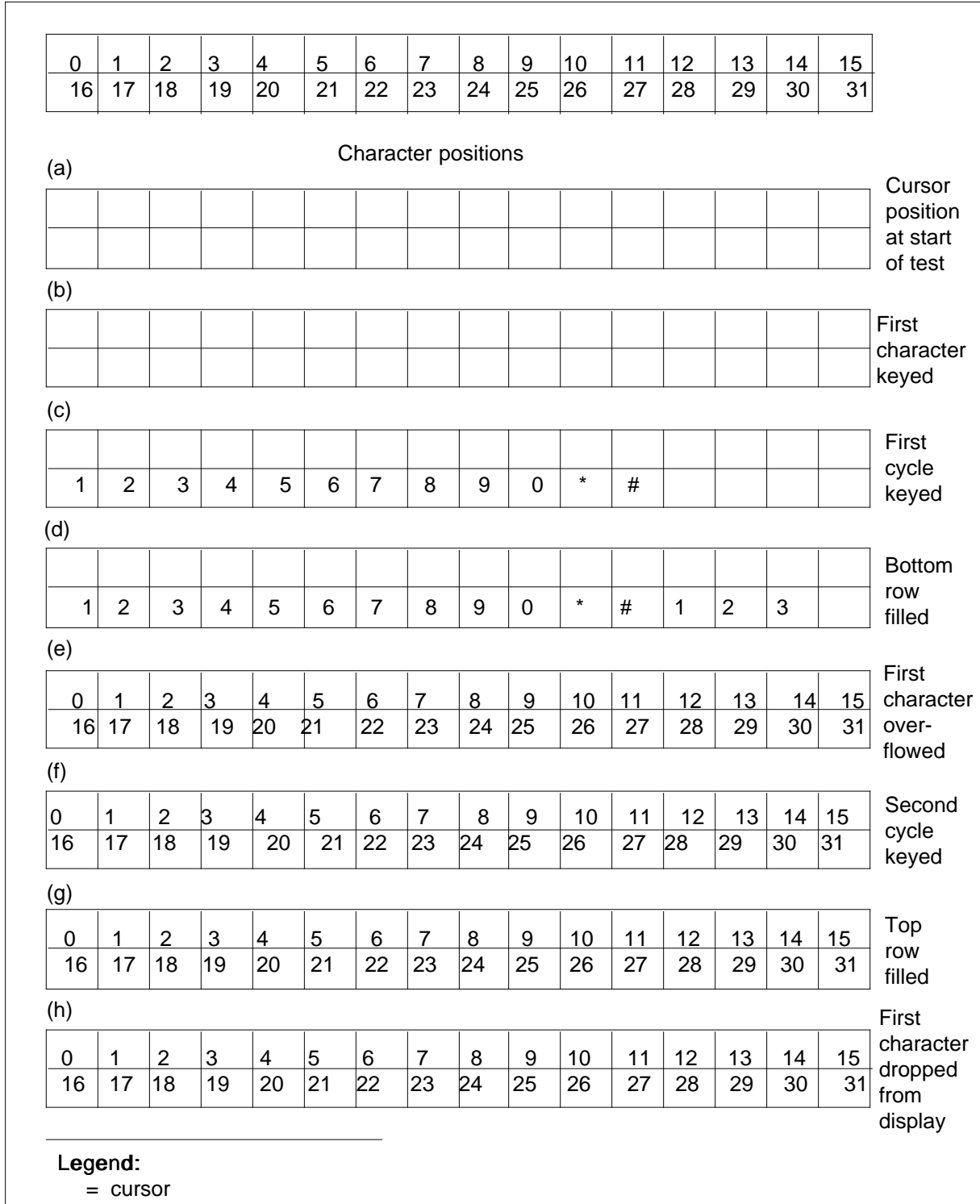
Step	Action	Response
39	Establish on-hook condition	All LCD wink Dial tone removed from handset Dial tone on speaker only LCD 12 is on
40	Press HOLD key	LCD 6 to 11 are on 2 s buzz tone on speaker Dial tone removed from speaker LCD 12 is off
41	Press HOLD key	LCD 10 to 18 are on 2 s buzz tone on speaker
42	Press HOLD key	All LCD are off Ringing tone on speaker
43	Press vol up key	Ringing tone volume increases
44	Press vol down key	Ringing tone volume decreases
45	Press HOLD key	Ringing stops LCD 2, 3, 4 wink indicating that a circuit test is running. No further keys should be pressed until the circuit test has finished since pressing these keys may affect the circuit test results. Any other keys pressed while the circuit test is running are not acknowledged (that is, lamps are not changed). LCD 1 to 8 are on, the circuit test has passed LCD 1, 2, and 8 are on, the circuit test has failed, failed LCD 1, 2, and 8 wink, indicating that the circuit test is done, not run, or has timed out
46	Press HOLD key	Exit from SRT
<p>Note 1: Key and lamp 11 of one version of M5n12 are inoperative; step 27 does not apply to it.</p> <p>Note 2: If step 27 does not apply, go to step 35.</p> <p>Note 3: For M112 set only.</p>		

Figure 8-35 M5n12 Meridian business set layout



An MBS equipped with a display area displays each character that is keyed using dial pad keys. The display area is configured in two rows of 16 positions each (see Figure 8-36). Each position can accommodate one keyed character. The display is tested by conducting two additional cycles of steps 5 to 16 in Table 8-19, "M5n09 MBS station ringer test" on page 8-90, immediately after the first cycle.

Figure 8-36 MBS SRT-digit display test



When the SRT is accessed, the cursor is located in position 0. The first digit that is keyed is displayed in position 16 and the cursor moves to position 17. As additional digits are keyed into positions 17 through 30, the cursor moves progressively through positions 17 through 30 and then remains in position 31 through additional keying. When position 30 is filled with a character, and an additional character is keyed, the additional character is located in position 30 and all current position characters are relocated downward one position. The character in position 16 is overflowed to position 15. As additional characters are keyed, positions 14 through 0 are filled. When position 0 is filled, additional keyed characters cause the character in position 0 to be dropped from display.

The add-on SRT is conducted using key sequences listed in Table 8-21. Key identification is shown in Figure 8-37. The test is conducted on each add-on module immediately after step 7 in Section , "Keyset station ringer test" on page 8-90 for the associated main set or extension set. Test responses that flash, wink or cause all LCD to be in the on condition affect only the main set, even if add-on modules are equipped.

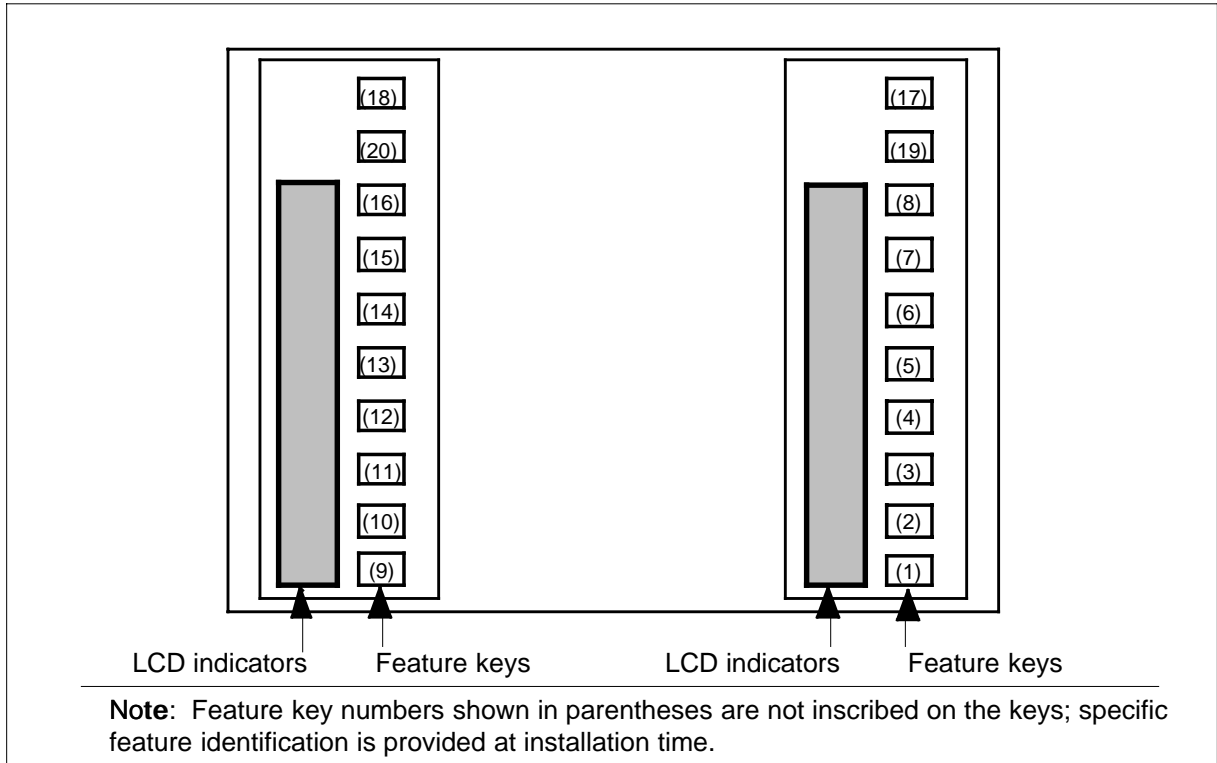
Table 8-21 Add-on and extension set station ringer set (Sheet 1 of 2)

Step	Action	Response
1	Press feature key 1	LCD 1 is on
2	Press feature key 2	LCD 2 is on
3	Press feature key 3	LCD 3 is on
4	Press feature key 4	LCD 4 is on
5	Press feature key 5	LCD 5 is on
6	Press feature key 6	LCD 6 is on
7	Press feature key 7	LCD 7 is on
8	Press feature key 8	LCD 8 is on
9	Press feature key 9	LCD 9 is on
10	Press feature key 10	LCD 10 is on
11	Press feature key 11	LCD 11 is on
12	Press feature key 12	LCD 12 is on
13	Press feature key 13	LCD 13 is on
14	Press feature key 14	LCD 14 is on

Table 8-21 Add-on and extension set station ringer set (Sheet 2 of 2)

Step	Action	Response
15	Press feature key 15	LCD 15 is on
16	Press feature key 16	LCD 16 is on
17	Press feature key 17	LCD 2 and 8 are on
18	Press feature key 18	LCD 10 and 16 are on
19	Press feature key 19	LCD 1 and 8 are on
20	Press feature key 20	LCD 9 and 16 are on

Figure 8-37 MBS add-on layout



The MBS SRT is subject to the following conditions:

- if any of the loop keys that are not in the test are in other than the idle state, a reorder tone is heard.
- the state of a feature does not change during the test, but the associated LCD is always off at the end of the test.

- other DN on the MBS cannot be used while SRT is in progress
- the MBS line is automatically returned to the IDL state 7 min after the start of the test.

Data set station ringer test The data set (also called a data unit) SRT tests the station hardware using key sequences listed in Table 8-22. Key identification is shown in Figure 8-38, "Data set layout" on page 8-106. The test is initiated by performing the following sequence of steps:

Procedure 8-8

- 1 Verify that all light emitting diodes (LED) for features are off.
- 2 Press the DN key to obtain a dial tone.
- 3 Key the two-digit access code established in the switch for the test, followed by the last five digits of the originating line DN, to turn ON all LEDs. If no further action is taken for 5 min, the connect lamp turns OFF.
- 4 If a reorder tone is heard, indicating that the last five digits that were keyed are different than those of the originating line DN, press the release key and repeat steps 1 through 3 using the correct last five digits.
- 5 Press the release key to turn off all feature LED and the CONNECT LED. The POWER, UNDERTEST and DTR LEDs remain on for the duration of the test.
- 6 If the LEDs are not turned off in step 5, indicating that the access code that was keyed is incorrect, repeat steps 1 through 5 using the correct access code.
- 7 Perform the tests listed in Table 8-22.
- 8 Press the release key to exit from SRT.

Table 8-22 Data set station ringer test (Sheet 1 of 3)

Step	Action	Response
Step	Action	Response
1	Press dial pad key 1	DN LED is on
2	Press dial pad key 2	Resource LED is on
3	Press dial pad key 3	Autodial LED is on
4	Press dial pad key 4	Speed call LED is on
5	Press dial pad key 5	Ring again LED is on
6	Press dial pad key 6	DN and resource LEDs are on
Note 1: A wink response momentarily interrupts a LED on display twice each second.		
Note 2: A flash response alternates a LED display on and off once each second.		

Table 8-22 Data set station ringer test (Sheet 2 of 3)

Step	Action	Response
7	Press dial pad key 7	DN and autodial LEDs are on
8	Press dial pad key 8	DN and ring again LEDs are on
9	Press dial pad key 9	DN and ring again LEDs wink
10	Press dial pad key 0	DN and ring again LEDs flash
11	Press dial pad key (* key)	All LEDs are on
12	Press dial pad key (# key)	All LEDs are off
13	Press feature key DN	DN LED is on
14	Press feature key resource	Resource LED is on
15	Press feature key autodial	Autodial LED is on
16	Press feature key speed call	Speed call LED is on
17	Press feature key ring again	Ring again LED is on
18	Press release key	Dial tone is heard DN, resource, autodial, speed call LEDs are on
19	Press volume up key	Dial tone volume increases
20	Press volume down key	Dial tone volume decreases
21	Press release key	1 s of buzz Ring again LED is on
22	Press release key	Ringing tone is heard
23	Press volume up key	Ringing tone volume increases
24	Press volume down key	Ringing tone volume decreases

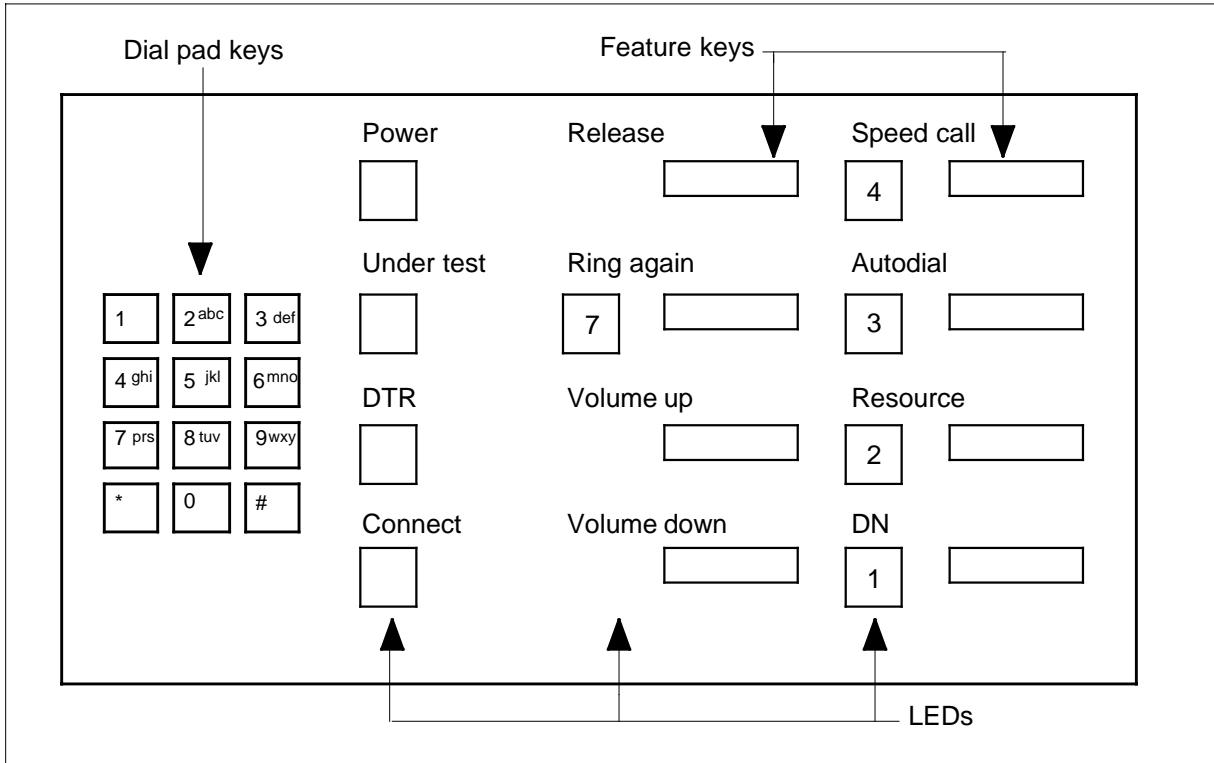
Note 1: A wink response momentarily interrupts a LED on display twice each second.

Note 2: A flash response alternates a LED display on and off once each second.

Table 8-22 Data set station ringer test (Sheet 3 of 3)

Step	Action	Response
25	Press release key	<p>Ringing stops</p> <p>LCD 2, 3, and 4 wink indicating that a circuit test is running. No further keys should be pressed until the circuit test has finished since pressing these keys may affect the circuit test results. Any other keys that are pressed while the circuit test is running are not acknowledged (that is, the lamps are not changed).</p> <p>LED 1 to 7 are on, indicating the circuit test has passed</p> <p>LED 1, 2, and 7 are on, indicating the circuit test has failed</p> <p>LED 1, 2, and 7 wink, indicating the circuit test is done, was not run, or has timed out respectively</p>
26	Press release key	Exit from station ringer test
<p>Note 1: A wink response momentarily interrupts a LED on display twice each second.</p>		
<p>Note 2: A flash response alternates a LED display on and off once each second.</p>		

Figure 8-38 Data set layout

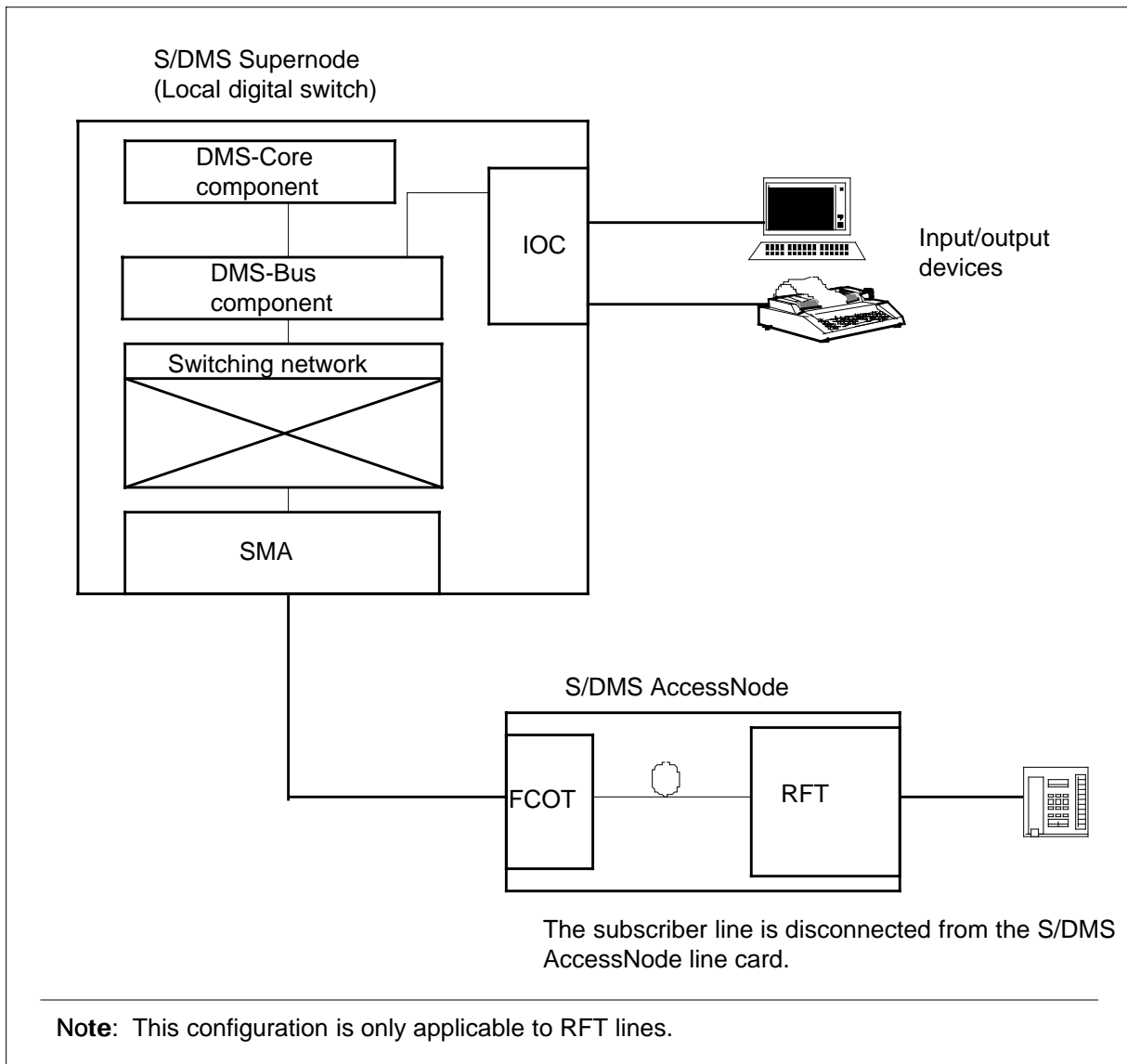


The data set SRT is subject to the following conditions:

- The state of a feature does not change during the test, but the associated LED is always OFF at the end of the test.
- The set is automatically returned to the idle state 12 min after the completion of step 3 of Section , "Data set station ringer test" on page 8-103.

Station ringer test on AccessNode line stations The station ringer test compares the digits that are received at the central office with known digits that are transmitted at the station, allowing verification of the subscriber's station equipment. Tests include dial pulse collection, dual-tone multifrequency collection, and MBS operations, such as the blinking lamp for visual response. Figure 8-39 shows the configuration.

Figure 8-39 Testing the station ringer on RDT lines



Dialable line circuit test actions

When a switch is equipped with software package NTX277, Dialable Line Circuit Identification, operating company personnel are able to:

- locate a cable pair for maintenance action by remotely connecting a tone to that pair
- place a short circuit across the tip and ring leads of a line

Dialable cable pair locator A tone generator is connected to any type of outgoing trunk or two-way trunk. The generator is external to the system and is supplied by the operating company. Figure 8-40 shows a sample

configuration of the dialable cable pair locator (DCL) connection. The tester accesses the tone by obtaining a dial tone from a randomly selected cable pair, and then dialing an access code plus the seven digit directory number of the line under test.

Figure 8-40 Dialable cable locator connection

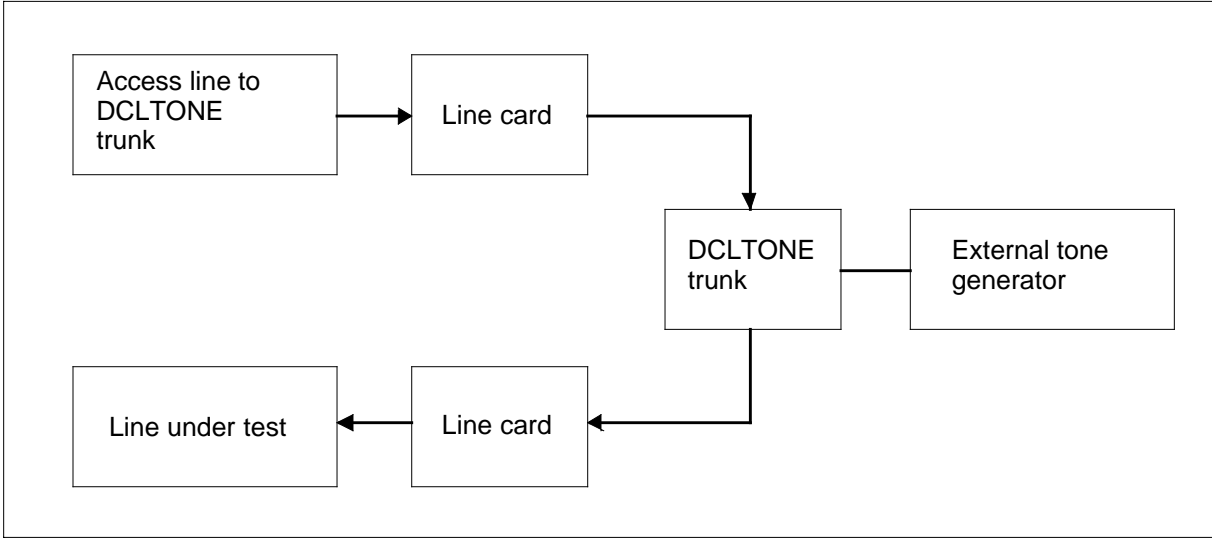
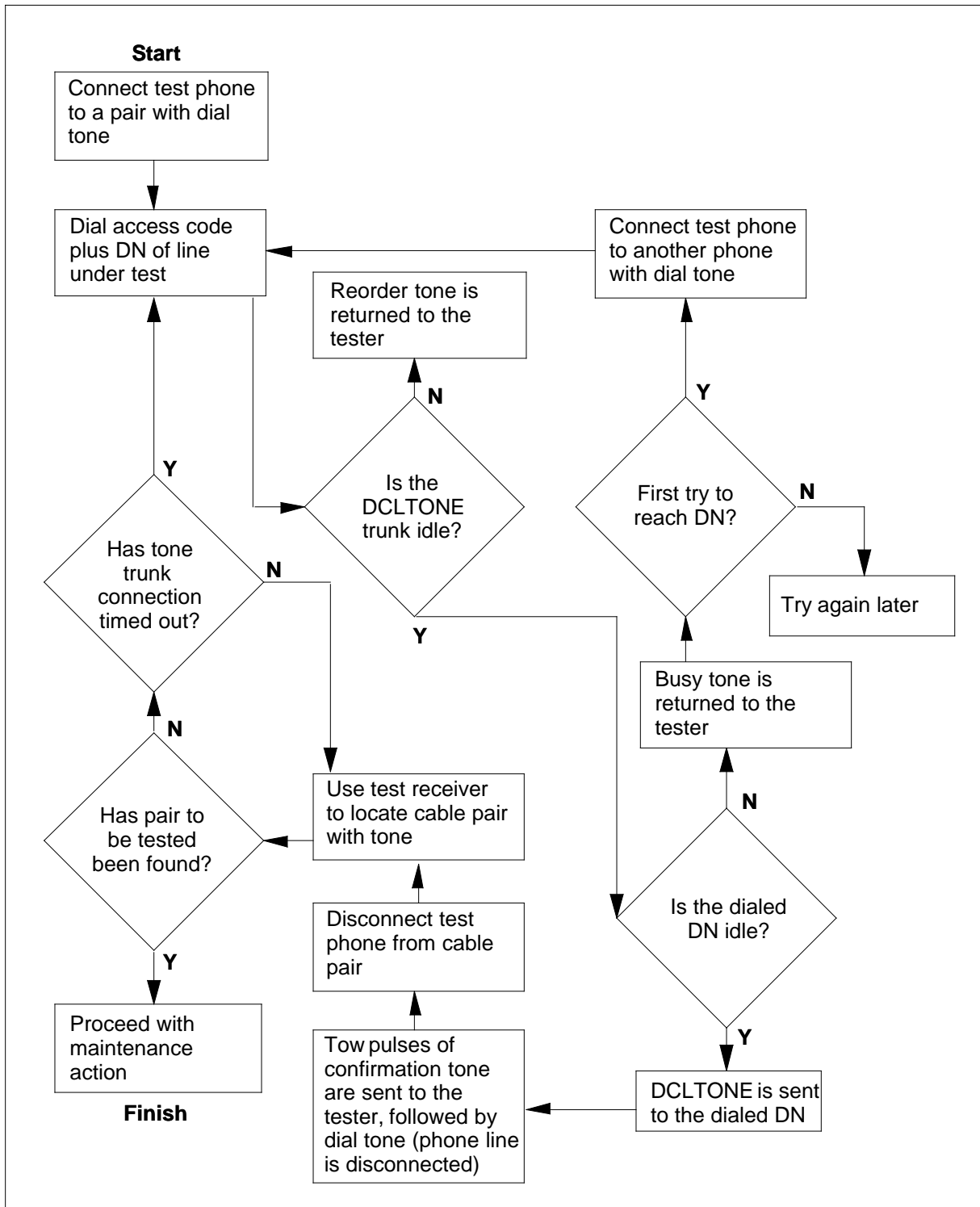


Figure 8-41 shows how the feature is used to locate a cable pair. It should be noted that a busy tone returned to the tester indicates either subscriber usage or that the tester has randomly selected the pair to be tested as the feature access pair; a second access attempt using a different cable pair will determine the cause of the busy condition.

Figure 8-41 Cable pair locating procedure



The operating company can establish the access code for the DCL feature by datafilling table STDPRT (see Data Schema section of *Translations Guide*). The specified code can be from three through seven digits in length. The DCL feature does not apply to a cable pair in a hunt group.

The duration of the generated tone on the specified cable pair is set at 180 s unless the operating company changes it by datafilling parameter CABLE_LOCATE_TIMEOUT in table OFCENG (see Data Schema section of *Translations Guide*). The maximum timeout period that can be set is 600 s.

Dialable short circuit A short circuit is placed across the tip and ring leads of a cable pair under test when a code is dialed to access the short circuit. The short circuit is connected to a horizontal in the MTA. The code may be accessed from the line under test or it may be accessed from another line. The short circuit persists on the line under test for a period of time as established by the operating company, or for the default period of 3 min. When the short circuit ends its established duration, the subscriber's line is returned to regular service. Figure 8-42 and 8-43 depict the short circuit process.

Figure 8-42 Dialing a short circuit on the originating line

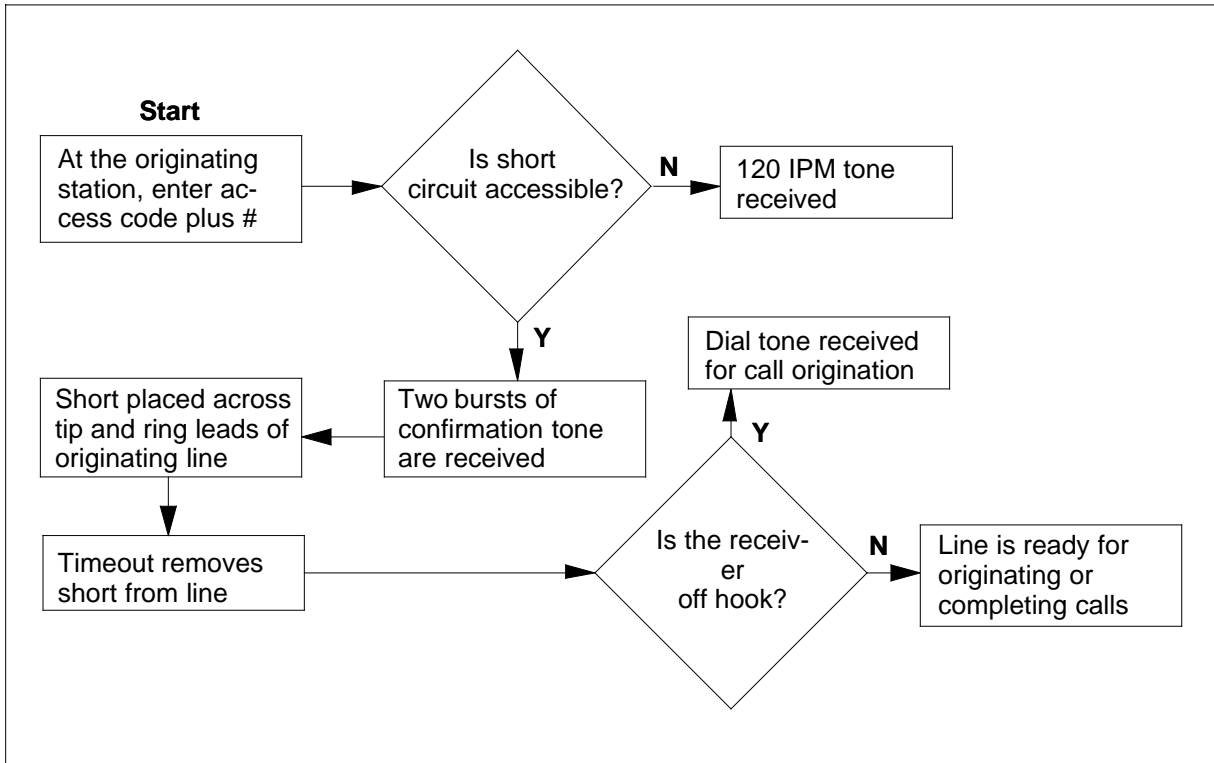
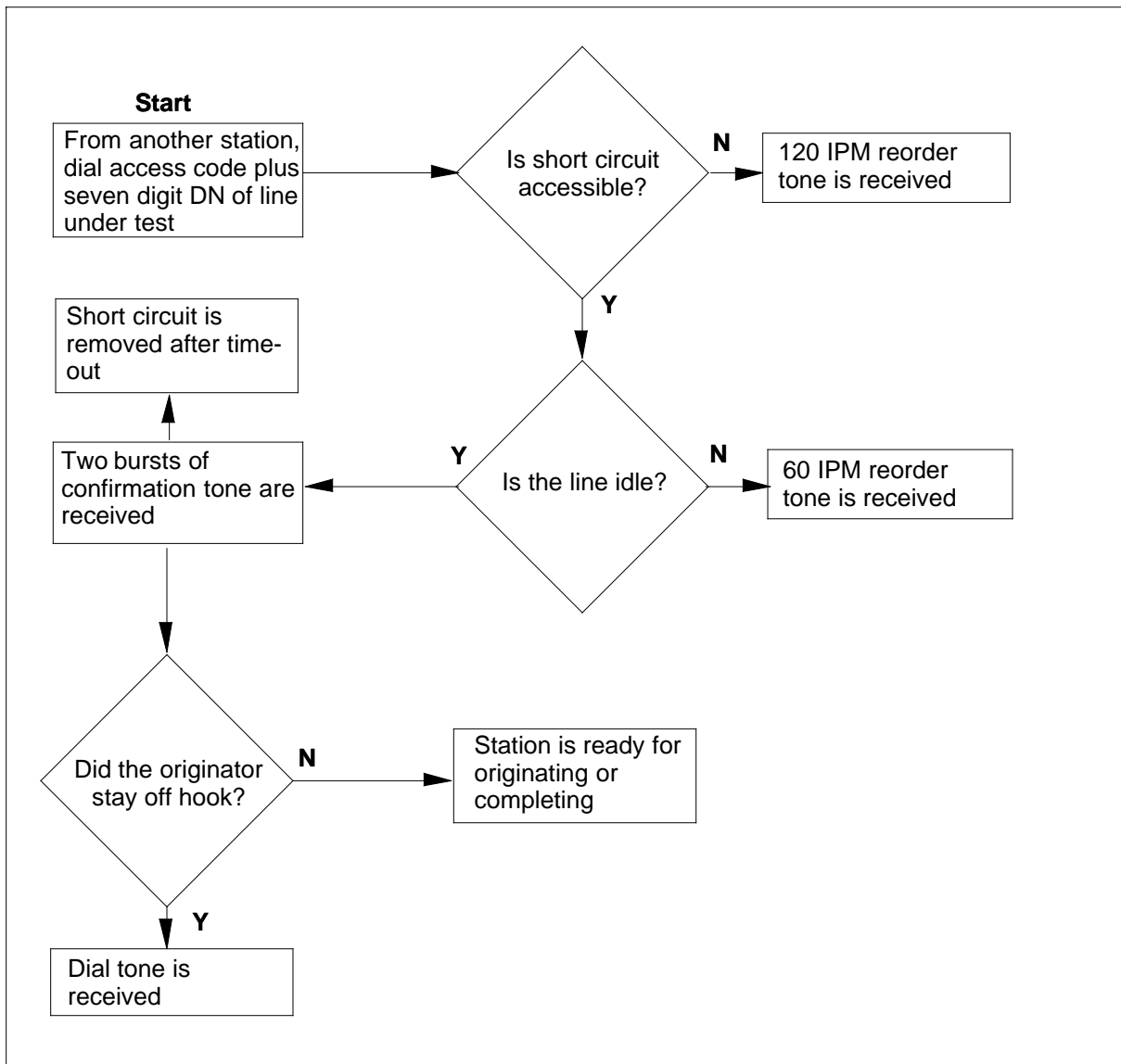


Figure 8-43 Dialable short circuit to a line under test



The following tables must be datafilled to condition the switch to provide the short circuit in accordance with operating company requirements:

- table MTATRK defines the short circuit hardware in software. A maximum of 64 horizontals may be defined this way in each office.
- table CLLI must have DSCKT added to route short circuit requests to a horizontal equipped with a short circuit.

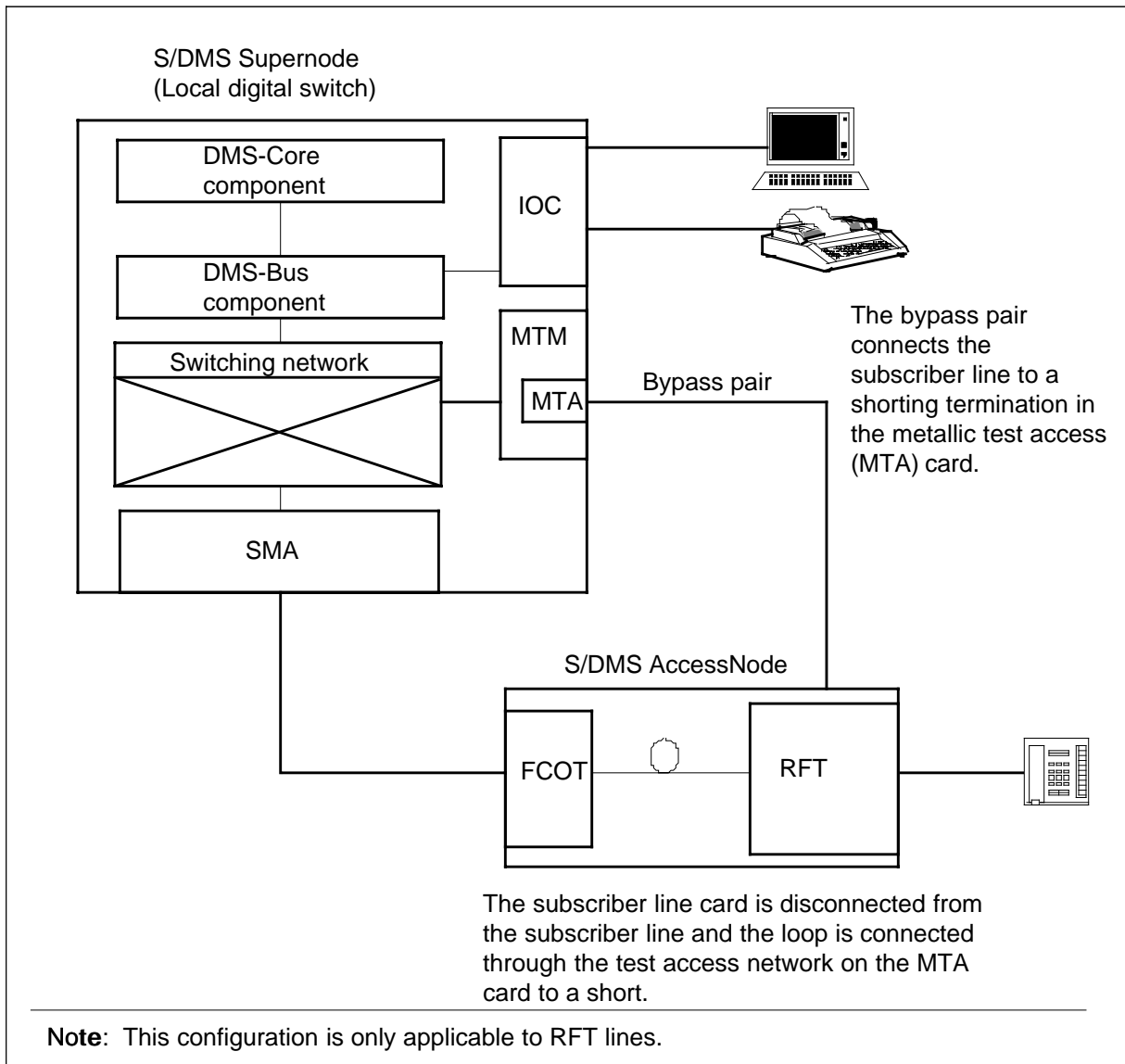
- table STDPRTCT may have from three to seven digits datafilled in subtable STDPRT to specify the access code to the short circuit.
- table OFCENG specifies the duration of the short circuit by replacing the default duration with the parameter name CABLE_SHORT_TIMEOUT, and selecting the required value from 0 through 600 s.

The following restrictions and limitations apply to the dialable short circuit feature:

- Three way calling may not be used with a line which has three-way calling in effect when the access code is dialed.
- If the line under test is a directory number huntgroup (DNH), the short circuit is applied to the DN that is accessed, and will not hunt through the group if the addressed DN is busy.
- If the line under test is a member of a multiline huntgroup (MLH), the short is applied to the line with the primary directory number.
- Lines on remote concentrating terminals cannot be conditioned with a dialable short circuit.
- Attendant consoles cannot originate a dialable short circuit.

Dialable short circuit test for RDT lines In this test, the tip and ring leads of the line under test are shorted together. At the subscriber premises, a dial-up service code is sent. The S/DMS responds with a confirmation tone and then applies the short circuit. In the SMA configuration, these tests can be performed by using a metallic bypass. Figure 8-44 shows the metallic bypass configuration.

Figure 8-44 Dialable short circuit test for RDT lines



Diagnostics

Short diagnostic

The following subtests, described later in this section, are included in the short diagnostic (SDIAG) for POTS subscriber lines (see Figure 8-7):

- transhybrid loss
- attenuation pads in the line card
- noise
- ringing and supervision

When the subscriber line is terminated in a DMS-1R RCT, the SDIAG is comprised of the following subtests:

- noise
- loop detector

The expected result of the noise test is the same for DMS-1R RCT as for lines that are terminated in DMS-100 Family peripherals. Expected results for the remaining three tests are unique for the DMS-1R RCT.

The DMS-1R RCT line card has a fixed 2dB pad and a fixed 900 Ω balance network, and therefore does not require the pads and balance network tests. The SDIAG for RCU lines, is sometimes referred to as the single-end test, and checks the operation of the line card. The tests that are included in SDIAG are shown in Figure 8-23, "Datapath loop extension facilities" on page 8-61. The diagnostic can be conducted from the MAP terminal, from a test desk, or from the RCU. When the SDIAG is conducted from the RCU, the maintenance card faceplate mode is set to *L*. The diagnostic is also run by the system when call processing faults generate a shower queue response. Table 8-24 provides the conditions that cause diagnostics to be activated. In all circumstances, RCU line diagnostics are authorized by the CC, and they can be aborted by the CC when higher priority activities are warranted.

Table 8-23 RCU line card diagnostic tests (Sheet 1 of 2)

Test	A	B	C
Voice frequency	S	S	S
Idle	S/E	S/E	S/E
Off-hook	S/E	E	E
Ring party		S	S
Tip party		S	S
Ring on ring side and ring trip	S	S	
Legend:			
E DIAG test applies			
S SDIAG test applies			
S/E S and E tests apply			
A Individual			
B Frequency selective ring (FSR)			
C Multiparty divided ring (MPDR) and 2 party			

Table 8-23 RCU line card diagnostic tests (Sheet 2 of 2)

Test	A	B	C
Ring on tip side and ring trip		S	E
Ring and ring trip	S/E	S/E	S/E
Echo return loss	E	E	E
Carrier channel loss	E	E	E
ANI ground detect and reproduce			E
Idle channel noise	E	E	E
Legend:			
E DIAG test applies			
S SDIAG test applies			
S/E S and E tests apply			
A Individual			
B Frequency selective ring (FSR)			
C Multiparty divided ring (MPDR) and 2 party			

Table 8-24 Conditions for RCU line diagnostics (Sheet 1 of 2)

Diagnostic	Activator	LTA card
S/E	DIAG	Y
S	DIAG	N
S	DIAG	Y
S	SDIAG	Y/N
S/E	SHWRQ	Y
<p>Note 1: The character S represents short diagnostic, and the character E represents extended diagnostic; S/E represents both short and extended diagnostics.</p> <p>Note 2: The activator DIAG and SDIAG are commands entered at an LTP.</p> <p>Note 3: The activator SHWRQ is the system initiated shower queue.</p> <p>Note 4: The activator EN T/D is an enhanced test desk.</p> <p>Note 5: The character Y indicates the condition applies, and the character N indicates the condition does not apply. The characters Y/N indicate that the condition may or may not apply.</p>		

Table 8-24 Conditions for RCU line diagnostics (Sheet 2 of 2)

Diagnostic	Activator	LTA card
S	SHWRQ	N
S	SHWRQ	Y
E	EN T/D	Y
S	EN T/D	Y

Note 1: The character S represents short diagnostic, and the character E represents extended diagnostic; S/E represents both short and extended diagnostics.

Note 2: The activator DIAG and SDIAG are commands entered at an LTP.

Note 3: The activator SHWRQ is the system initiated shower queue.

Note 4: The activator EN T/D is an enhanced test desk.

Note 5: The character Y indicates the condition applies, and the character N indicates the condition does not apply. The characters Y/N indicate that the condition may or may not apply.

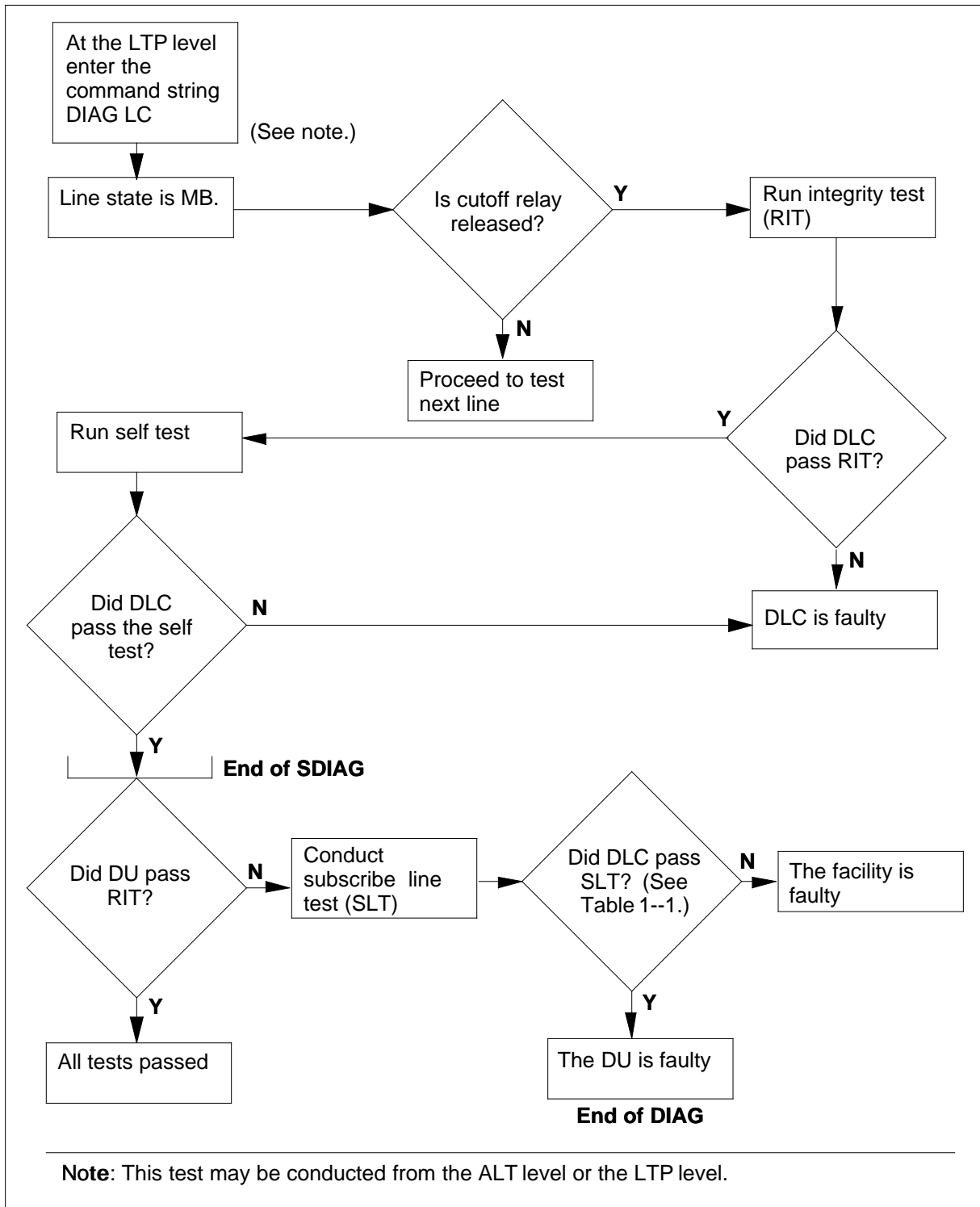
The SDIAG for MBS lines equipped with line card NT6X21 consists of the following subtests:

- transhybrid loss
- attenuation pads in the line card
- noise
- loop signaling at the keyset

The loop signaling test is unique to the MBS line card, while the remaining tests are the same as for POTS lines. The tests are described later in this section.

The SDIAG for data set lines equipped with an NT6X71AA/AB data line card (DLC) mounted in an LCM conducts a message loop test, referred to as an integrity test, and a self test on the line card. The message loop test causes the DLC to echo an LCM originated signaling byte back to the LCM where it is checked for errors. The sequence of tasks used in the test is included in figure 8-45. SDIAG does not apply to NT6X71AB cards that are mounted in a DE-4E DPX channel bank card.

Figure 8-45 Data line diagnostics



Data lines with short loops (maximum 1213 m (4000 ft) at 24 gauge) that are served by inside plant 4-wire loops can be equipped with an NT6X76AA or NT6X76AC AILC line card.

Data lines associated with Northern Telecom's DMS Integrated Local Area Network (DIALAN) service provide integrated voice-data access for DMS-100 subscribers. DIALAN service provides a means of simultaneously connecting a telephone and a personal computer (PC), or ASCII terminal, at a customer premises, to a DMS-100 central office using an existing two-wire facility. This configuration requires the NT6X76AC AILC.

DIALAN service also requires the use of two commercially available modules, the IVDM located at the subscriber premises (the CPE IVDM), and a compatible IVDM located at the central office (the CO IVDM). For additional information on DIALAN service, refer to *Datapath DIALAN Service - Installation and Maintenance*, 297-2121-227.

The short and extended diagnostics for the AILC are identical and are discussed in Section , "Extended diagnostic" on page 8-119. All tests are conducted at the ALT, LTP, and LTPMAN levels. The NOISE, LOSS, BAL, and JACK commands are not applicable to testing the AILC.

Figure 8-46 is a simplified schematic of the AILC and its relationship with the switch and the station equipment. The cutoff relay is operated when diagnostics are invoked, causing the two-wire transmit path and the two-wire receive path to be looped toward the switch.

Figure 8-46 Asynchronous interface line card

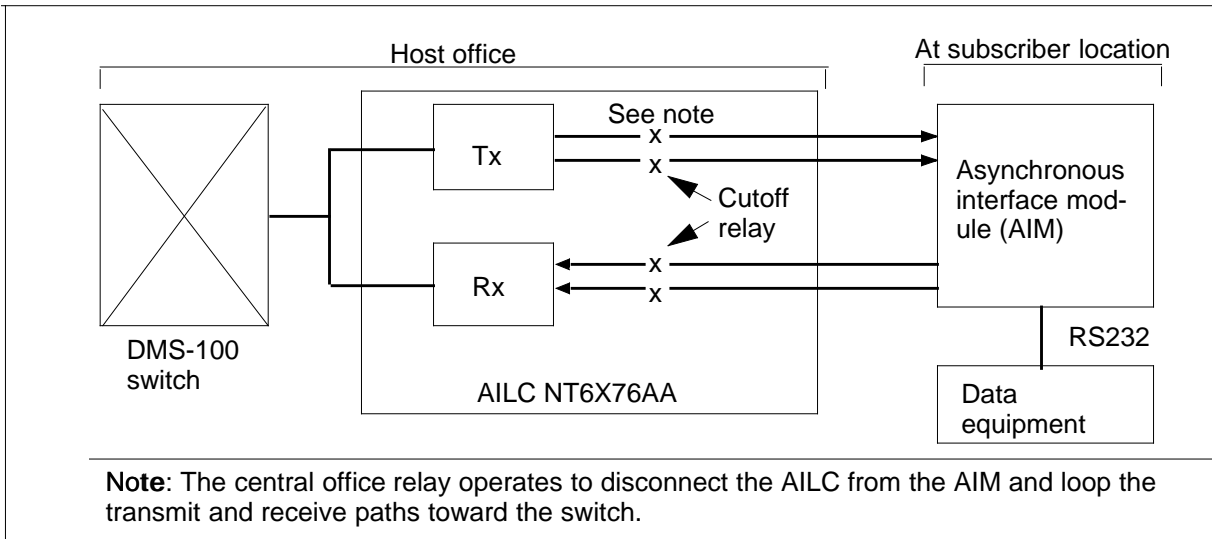


Table 8-25 Subscriber loop test for data line

Parameter	Threshold values					
	Tip to ring		Tip to ground		Ring to ground	
	Min	Max	Min	Max	Min	Max
Volts dc	-10	+10	-60	+60	-60	+60
Volts ac	0	10	0	120	0	120
RES (k Ω)	160	INF	N/A	N/A	800	INF
CAP (μF)	0	0.1	0	4	0	4

Extended diagnostic

The extended diagnostic test routine (DIAG) is more comprehensive than the SDIAG, and checks virtually all of the line circuit for correct operation (see Table 8-7, "Line card tests" on page 8-37). An MTU and a TTU are reserved for use by the test routine at the start of DIAG. The TTU is connected to the line under test through the network, while the MTU is connected through a vertical of the MTA.

Testing subscriber lines that use DMS-1 line cards in a remote concentrating terminal (DMS-1R RCT) requires a subscriber loop test digital (SLTD) circuit instead of an MTU.

The SLT-D is provided by installing a QPP423 circuit card in the DMS-1R RCT. The circuit performs the following functions:

- measures voltage, resistance, and capacitance parameters of a subscriber loop
- converts measurements into digital signals
- transmits digital measurements to the Subscriber Carrier Module-100 Rural (SMR) peripheral at the host switch.

The DIAG for RCU lines, sometimes referred to as the end-to-end test, checks the transmission and signaling performance of the type of RCU line in the control position of the MAP display. The transmission test results are compared with specific parameter limits. The signaling test checks the ability of the line card to respond properly to system messages; it also causes the LTA card to apply the proper termination for call processing functions off-hook, on-hook, ringing; and reports the results to the SMU. When the RCU is not equipped with an LTA card, the DIAG that is conducted is the same as the SDIAG.

The extended diagnostic for RCU lines requires a path to be established between a TTU in the host office, through a DS-1 channel from the SMU, to the line under test. The following tests are then conducted in the order shown:

- Off-hook—An absorb-PTPG termination is applied to the line by the LTA, simulating an off-hook condition. The condition is reported to the RCU by the SMU.
- Echo-return-loss—The absorb-PTPG termination enables the TTU to check the flux cancellation circuitry of the line card.
- On-hook—The LTA removes the absorb-PTPG termination. The RCU detects the on-hook condition and reports it to the SMU.
- Single-party ring—The SMU sends a ring signal to the RCU to apply a ring signal on the ring lead. This causes the RCU to connect a reflect termination to the line, simulating an off-hook condition. The condition is reported to the SMU by the RCU.
- Carrier channel loss—The TTU sends four different frequencies of signals to the line. The reflect termination causes the signals to be reflected to the TTU and compared with the original signals transmitted.
- Idle channel noise—This test is the same as that for RCS lines.
- Tip ringing for multiparty divided ring (MPDR) line—The RCU removes the reflect termination by instruction from the SMU. The SMU sends a ring signal to the RCU for the tip party. This causes a reflect-NTPG termination to be connected to the line by the RCU. The RCU sends a *tip party off-hook* message to the SMU. The carrier channel loss test is then repeated to ensure that the absorb-PTPG termination is intact.

TCM facility or the DU are faulty, the NEAR END FAIL LED flashes continuously.

When the test is conducted at the LTP, results are reported by the following messages:

- DPX PASSED
- DLC PASSED
- DU PASSED
- TEST COMPLETED

The short diagnostic for the AILC is identical to the extended diagnostic. It transmits a signal from the CC to the line card that is looped back through the contacts of the operated relay. The test verifies the following conditions:

- signaling path
- line card presence
- sanity of the line card microprocessor

When the CC does not receive the returned signal, the test fails.

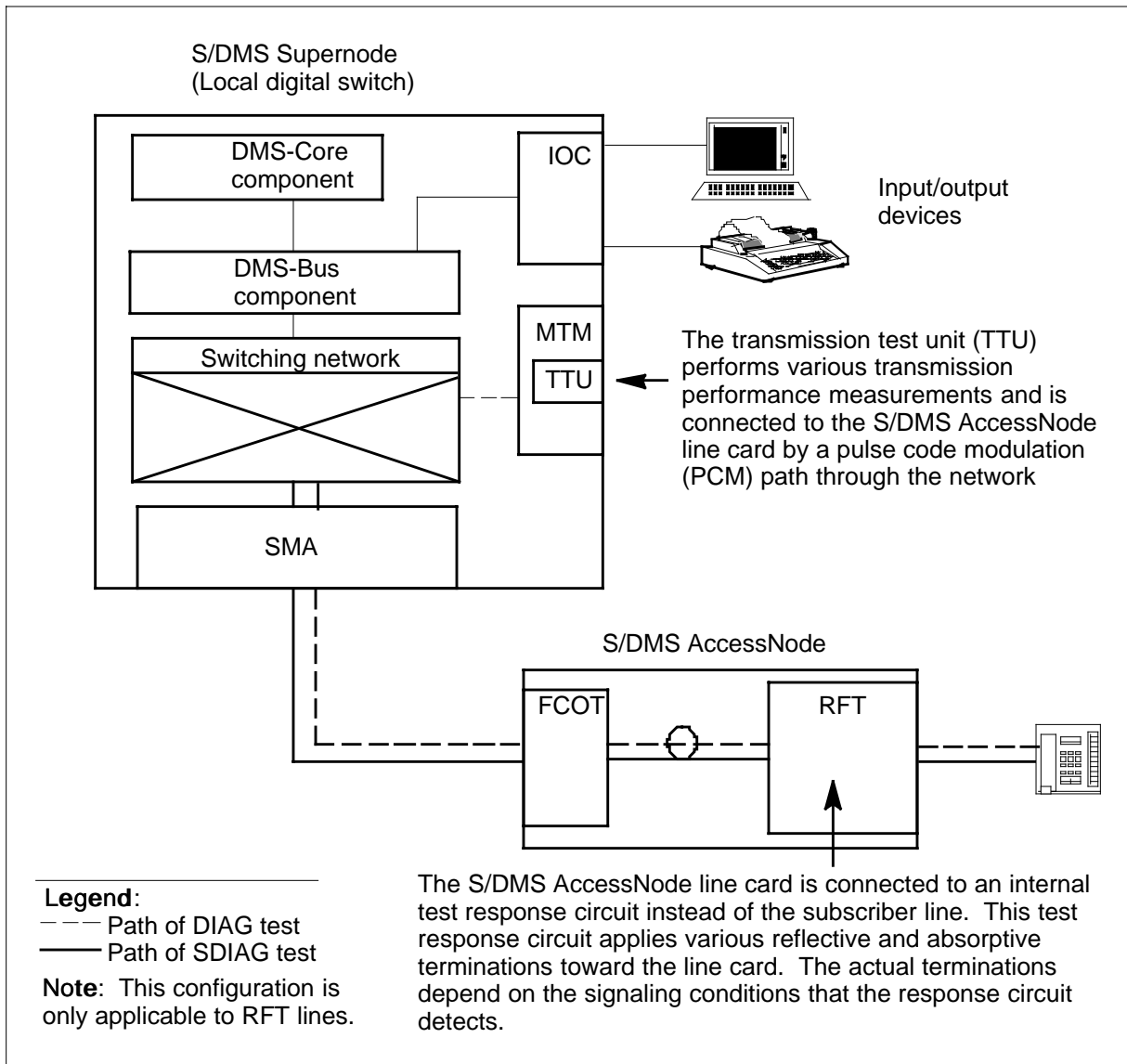
The extended diagnostic for DMS-1R RCT lines is the same as the short diagnostic, supplemented by the subscriber loop test if one of the diagnostic subtests fails. The subscriber loop test requires an SLTD instead of an MTU.

The SLTD is posted to the line under test at the LTP level using the POST command. When it is posted, the test access bus and the ring access bus are common for the shelf on which the line is located. As a result no line in the shelf can be tested when any other line in the shelf is being rung. If a line is rung when any line in the shelf is under test, the test is aborted.

Testing the RDT line card (DIAG, SDIAG)

Subscriber lines tests are intended to check either the line card itself or the terminal equipment loop. Figure 8-48 shows how to test only the line card.

Figure 8-48 Testing the RDT line card



Partial diagnostic

The DIAG is restricted at RLCM locations where an MTU is not available because the location is not equipped with an RMM. When the host of such an RLCM is equipped with feature package NTX146AA, a partial diagnostic test routine may be conducted. The routine is sometimes referred to as the *no MTU diagnostic*. It is used when the RLCM line in the control position is equipped with one of the following line cards:

- NT6X17AA—POTS type A
- NT6X19AA—message waiting

- NT6X21AA—MBS
- NT6X71AA—data unit

Metering tone card diagnostic

The diagnostic for the metering tone card NT6X95AA determines from the international LCM (ILCM) if the card is in the off-hook mode. If the card is in the on-hook mode, it is reported faulty by a LINE101 log.

Line insulation test

The line insulation test checks the subscriber loop to determine

- existence of a foreign potential
- magnitude of the foreign potential
- leakage resistance
- from conductors to ground
- between conductors
- leakage capacitance between conductors

Note: No LIT capacitance tests should be performed when a line card is associated with a Meridian business set (such as the NT6X21 type).

ABS balance network testing

Balance networks are provided on line cards to match the impedance of loaded and non-loaded subscriber loops, so that echo is maintained at or below a designed minimum. It may be necessary for the DMS-100 switch to introduce a 2dB pad in the voice path of intra-office calls so that the echo return loss is increased to achieve echo objectives.

The ABS on-hook balance network test, which is performed at the central office without an attendant at the station, is normally used to determine if a subscriber loop is loaded, and to optimize the balance network for nonloaded loops in accordance with objectives. The test is not run on data lines.

The ABS off-hook balance network test, requires an attendant at the station as well as the central office. It is normally used to optimize the balance network for loaded loops because the test is more accurate, and to determine pad values necessary for echo return loss requirements.

Any changes to the balance network configuration and pad value for a voice line circuit are updated in the line circuit inventory table (LNINV). (See data schema section of *Translations Guide*.) BNV or padgroup (PADGRP) value are not changed for MBS lines or data lines. The manual override bit (MNO) for each of these lines that are tested is set to Y (Yes) in the LNINV table to

prevent routine updating of line information from the on-hook balance network tests.

The LTPLTA level BALNET test consists of both the on-hook and the off-hook balance network subtests. The LTPMAN level BAL test consists of the ABS on-hook balance network subtest only.

The on-hook balance network test is used primarily to determine whether a subscriber loop is loaded or unloaded and to display the result at the MAP terminal. The loop type is displayed before the test and is changed after the test if results warrant it. When necessary, the test also changes the balance network in the line circuit that is connected to the loop being tested. It updates the table line circuit inventory (LNINV) of the tested line circuit if it is required, unless the changes have been inhibited.

Note: If the station under test has high ambient background noise, the on-hook balance network test might fail.

Keyset circuit test

The CKTTST command at the LTPMAN level can be run on DATA, AIM, IBERT, and MBS lines.

When the CKTTST test is run, the LCM transmits a specified number of test messages towards the subscriber terminal. The messages can be looped back at the line card or at the subscriber terminal. The received messages are compared with the transmitted messages. Since AIM and IBERT lines do not have terminals, the messages can be looped back only at the line card.

If the received messages do not match the transmitted messages, a failure is displayed at the LTPMAN level.

The office parameter CIRCUIT_TEST_NUMBER_MESSAGES in table OFCVAR is used to set the number of messages for the CKTTST test. This parameter has an initial setting of 10 messages, but has a range from 1 through 50 messages. The failure flag *L* (capital L) indicates a failure has occurred when a circuit test was run at the line card. The failure flag *l* (small l) indicates a failure has occurred when a circuit test was run at the terminal. If the loop signaling at the terminal test of the diagnostic fails, then the failure flag *l* is set regardless of the current failure status. If the loop signaling at the line card test of the diagnostic fails, then the failure flag *L* is set regardless of the current failure status.

Table 8-26 summarizes the test results for the CKTTST at the LTPMAN level. The results are as follows:

- The test passes, the circuit test was run at the line card.
- The test fails, the circuit test was run the at the line card, and at least one message is sent and received correctly.
- The test fails, the circuit test was run at the line card, and no messages are received correctly.
- The test passes, the circuit test was run at the terminal.
- The test fails, the circuit test was run at the terminal, and at least one message is sent and received correctly.
- The test fails, the circuit test was run at the terminal, and no messages are received correctly.

Table 8-26 LTPMAN circuit test failure flags

Current flag and meaning	CKTTST at terminal			CKTTST at line card		
	Pass	Fail Msg>0	Fail Msg=0	Pass	Fail Msg>0	Fail Msg=0
D—Long diagnostic failure	N	D	D	N	D	D
F—Facility fault	F	F	F	F	L	L
S—Short diagnostic	N	S	S	N	S	S
N—Needs long diagnostic	N	I	I	N	L	L
m—Set missing		I	m	m	L	L
M—Line card missing		I	M		L	L
Q—Shower queue	Q	Q	Q	Q	Q	Q
I—ICMO major		I	I		L	L
i—ICMO minor	i	i	i	i	i	i
I—Circuit test failed at terminal		I	I	I	L	L
L—Circuit test failed at line		L	L		L	L
U—Utility card	N/A	N/A	N/A	N/A	N/A	N/A
(blank)—no failure		I	I		L	L

N/A = Not applicable, circuit test not run on these lines.

Diagnostic test results

The lines maintenance subsystem maintains a record of the most recent diagnostic results for each line. This record is used to:

- classify a line as a failure
- cancel a failure classification when a fault is no longer detected
- update line records
- generate office alarms

When the following tests are performed on subscriber lines, a record of failures is maintained for the faulty line:

- all manual, automatic, or system diagnostics
- LIT voltage tests
- LIT resistance tests

Failure results of diagnostics that are conducted from the LTP level or its subtending levels are reported in the line record.

Threshold of line insulation resistance

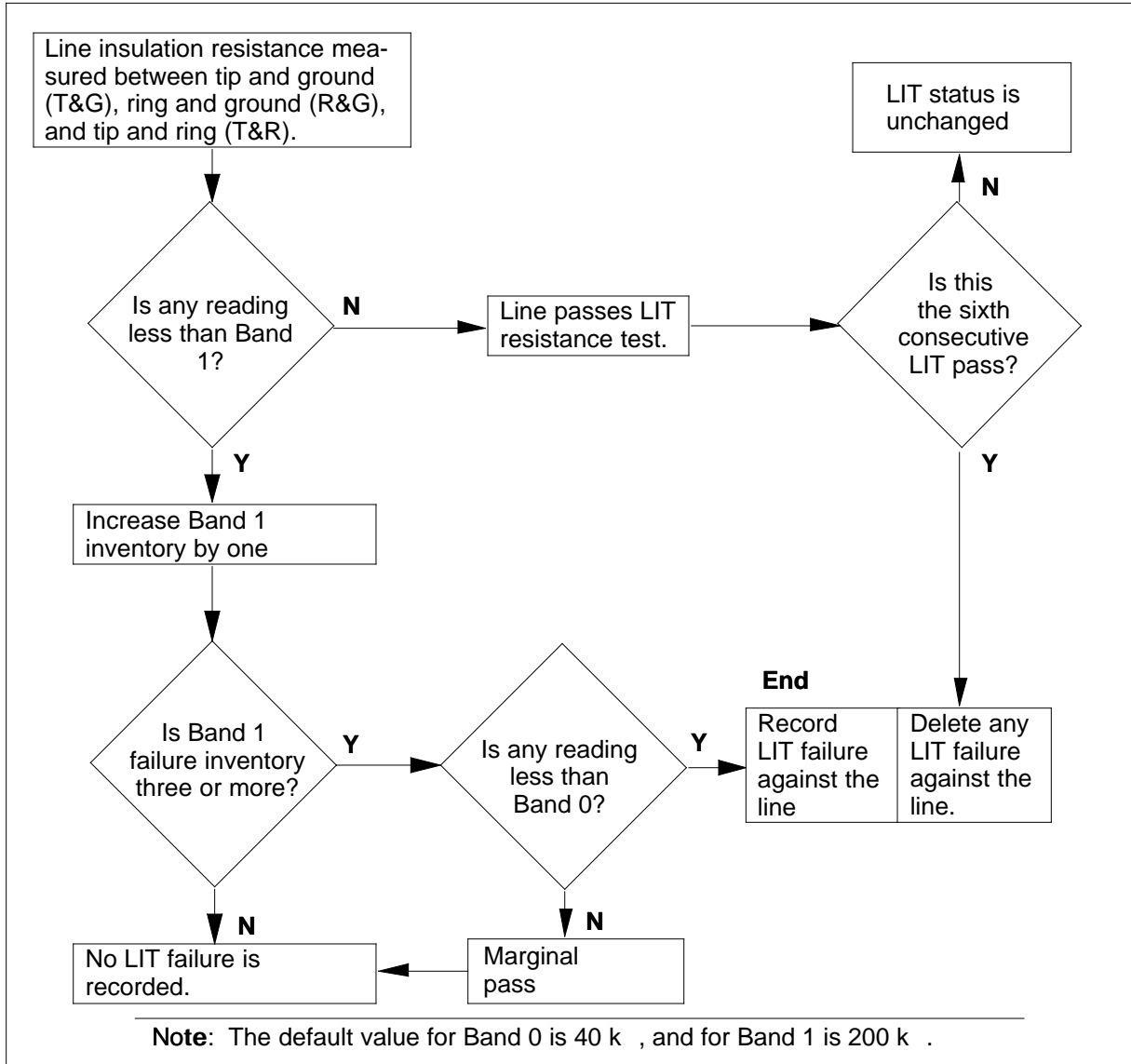
The operating company establishes test limits by defining threshold values for LIT resistance and voltage measurements. In the absence of operating company specified values, default values are used by the LNS subsystem to categorize test results as pass or fail.

The threshold of line insulation resistance for a voice line is established as Band 0 and Band 1 where:

- Band 0 is less in value than Band 1.
- A resistance failure is recorded against a voice line when both of the following conditions apply:
- a LIT measurement is less than the Band 0 value

- three previous LIT measurements were less than the Band 1 value
- The procedure for reporting LIT registered failures is shown in Figure 8-49

Figure 8-49 Line insulation test procedure for resistance



If a resistance failure is recorded against a voice line, that failure is maintained until the line measures less than the Band 1 threshold for six successive LIT measurements. During the first five LIT measurements, pass reports for the Band 1 threshold provides the line with a marginal pass. The sixth successive measurement less than Band 1 causes the LIT failure against the line to be deleted.

The status of the line in the course of conducting the measurements can be determined by including the parameters BAND 0 and BAND 1 with the command string POST LF LASTFAIL, where:

- BAND0 posts lines that failed the previous LIT Band 0 resistance measurements, resulting in a LIT failure
- BAND1 posts lines that failed the previous LIT Band 1 resistance measurement resulting in a marginal pass

The threshold of a tip to ring line insulation resistance measurement for a DU line is preset at 1800 Ω and is not alterable by the operating company. A resistance failure is recorded against a DU line when a LIT measurement is less than 1800 Ω . The failure is equivalent to a Band 0 failure for voice lines. The tip to ground and ring to ground thresholds are the same for DU lines as for voice lines.

Threshold of line voltage

The threshold of foreign ac or dc voltages on a subscriber loop is established by the operating company. Threshold values are assigned for measurements between the tip lead of the loop and ground, and between the ring lead of the loop and ground. A voltage failure is recorded against a line when a LIT measurement is greater than the established threshold.

Cancelling recorded failures

The LNS subsystem failure record against a line is cancelled after the fault has been corrected and the line is successfully retested. One or more of the following conditions cancels a recorded line failure:

- extended diagnostic test is performed and passed
- LIT EMF test is performed and all measurements are equal to or less than the thresholds in effect
- six successive LIT resistance measurements are equal to or greater than the Band 1 threshold for voice lines, or the DU line threshold

Posting test failures

Lines that fail a short diagnostic or an extended diagnostic may be posted according to the type of failure and the action required. The type of failure for a posted line is indicated by a letter character under the header F in the control position.

Table 8-27 identifies the failure characters that are used to indicate the type of failure and the action that is required:

Table 8-27 Failure indicators

Character	Failure	Action
(blank)	No failure	None
D	Long diagnostic	Replace card
F	Long diagnostic	Check facility
S	Short diagnostic	Run a long diagnostic
N	See note 1	Run a long diagnostic
m (See note)	Diagnostic (unplugged keyset)	Plug keyset in, run diagnostic
M (See note)	Diagnostic (unplugged LC)	Plug LC in, run diagnostic
Q	Call processing	Run short diagnostic
I (See note)	Major ICMO	See Figure 8-50
i (See note)	Minor ICMO	See Figure 8-50
U	Diagnostic	Replace card
c (See note)	Minor CP error threshold exceeded	See Figure 8-54
C (See note)	Major CP error threshold exceeded	See Figure 8-54
<p>Note: The line had previously failed a short diagnostic or a long diagnostic and recently passed a short diagnostic. It needs a long diagnostic to assure that the line fault has been fully corrected.</p> <p>The following characters displayed under the header F in the control position are equivalent to character strings in the system status display, and in the response to the command ALMSTAT, as indicated.</p>		
	Control Position	System Status/ALMSTAT
	m	MSET
	M	MCARD
	j	IMIN
	I	IMAJ
	c	CMIN
	C	CMAJ

Lines that fail a LIT voltage or resistance test are posted by using the command string POST LF with the variable VOLTFAIL or RESFAIL as appropriate.

Incoming message overloading lines A subscriber line is ICMO when a fault condition causes a rapid succession of changes between the on-hook mode and the off-hook mode. A high rate of ICMO, called major ICMO, makes the associated LCD vulnerable to failure. A lower rate of ICMO, called minor ICMO, wastes call processing time in the switch without threatening the survival of the LCD.

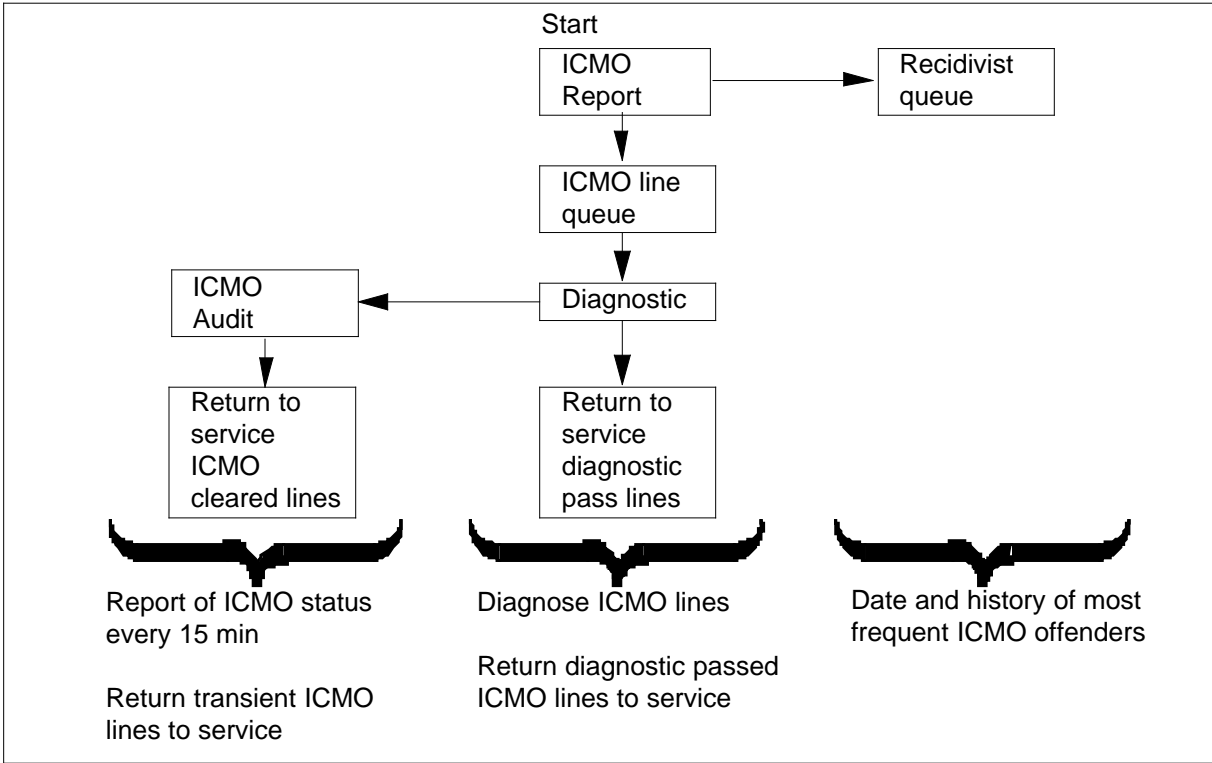
The ICMO rates for minor and major ICMO are established as part of switch design to maintain optimum call processing and LCD survival. The rates cannot be set or altered by the operating company.

Administration of ICMO lines (see Figure 8-50) provides for continuously monitoring the status of the lines to:

- remove the lines from service during the fault condition
- return the lines to service when the fault no longer exists
- diagnose faulty lines to obtain information for maintenance action
- establish records concerning most frequent offenders

An ICMO line generates a system fault report. When a line is reported ICMO, the handling procedure ensures the line is placed in the ICMO line queue, diagnosed, and returned to service when the fault is clear. The recidivist queue maintains a history of most frequent offenders. Information from diagnostics and history is used to determine the cause of faults.

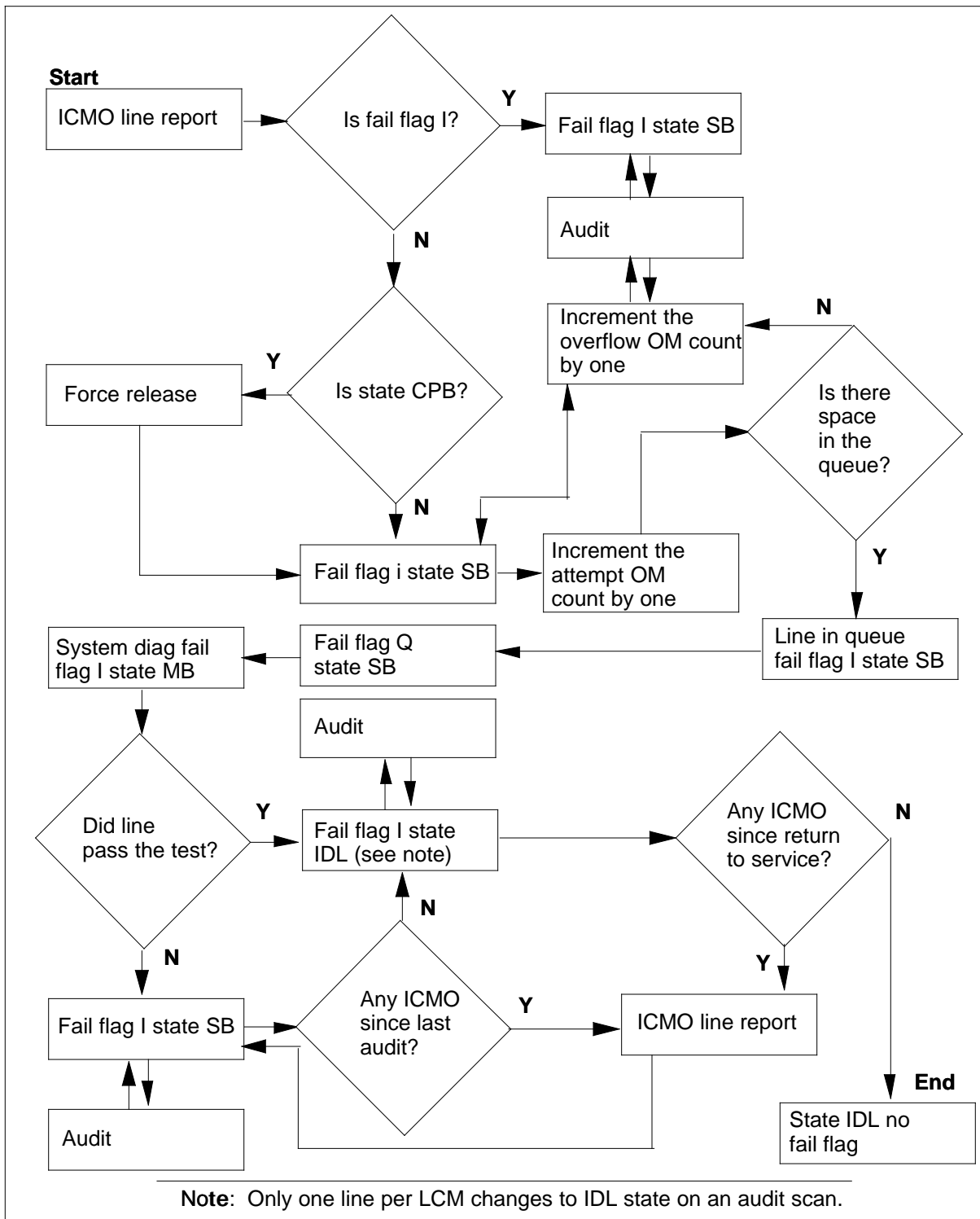
Figure 8-50 ICMO line administration



Handling of ICMO lines (see Figure 8-51) All reported lines to be placed in the ICMO line queue for diagnostic testing. The queue can accommodate a maximum of 128 ICMO lines. When the queue is full, additional attempts are marked for future access when space is available. ICMO lines are taken out of service while they are faulty and are returned to service when they pass the diagnostic. The procedure works in conjunction with the audit process to monitor faulty and fault-prone lines.

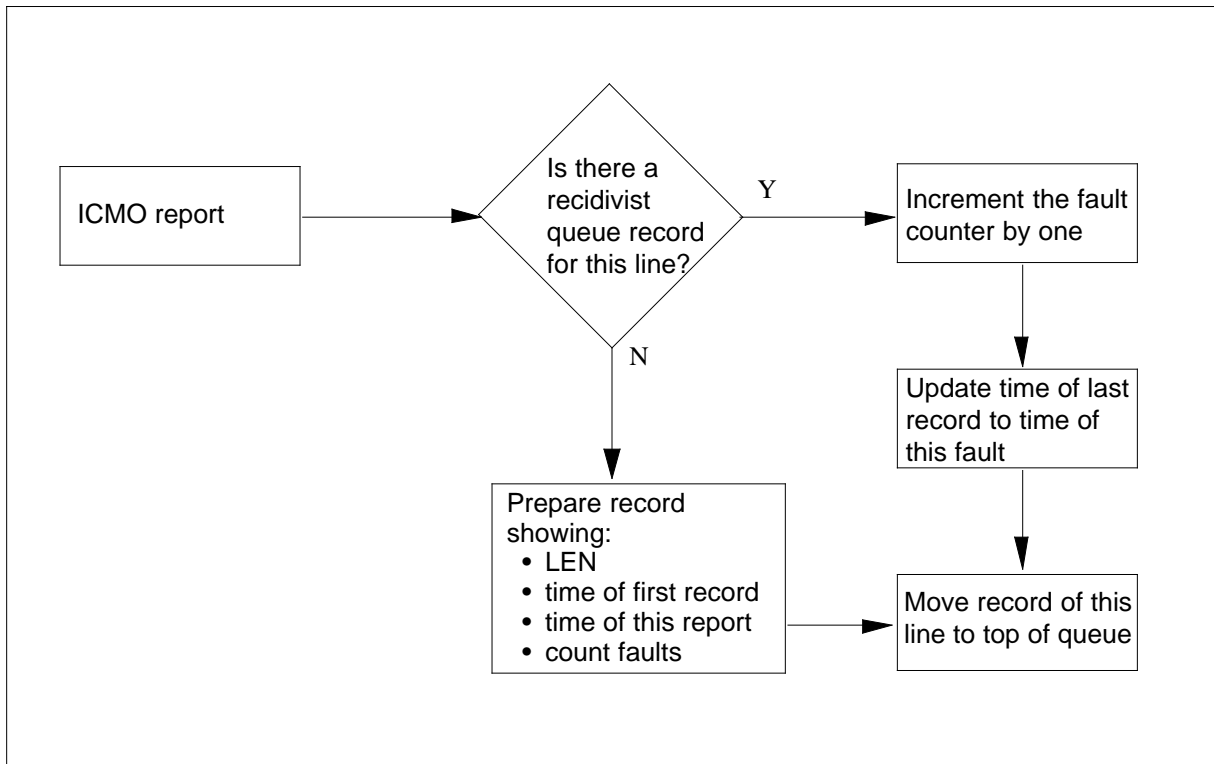
ICMO line audit (see Figure 8-52) The ICMO line audit scans all lines in the switch once each 15 minutes, identifying lines that demonstrate ICMO faults or a recent history of ICMO. It returns lines to service when faults are found to be transient, and monitors all states of ICMO lines regularly

Figure 8-51 ICMO line handling



Recidivist queue (see Figure 8-53) The Recidivist queue maintains a record of the worst 128 ICMO lines in the switch. Additional reports of an ICMO line cause the record to be augmented, and that line to be placed at the head of the queue. The last line in the queue is dropped from the queue if there is no room for the most recent occurrence.

Figure 8-53 Recidivist queue process



Call processing error threshold on lines

Unlike the messages from ICMO lines which occur as fast bursts, call processing (CP) errors appear at a slower, and continuous or regular, rate.

When messages from one particular line result in excessive call processing errors, a software error (SWER) log entry, and additional log entries are output that display the call condense block (CCB), call data block (CDB), and any other extension blocks involved in the call. The call process is terminated and the line is diagnosed. All of these actions waste call processing time, and, if there are an excessive number of call processing errors, switch performance degradation may result.

CP error thresholds and line handling procedures are provided to improve immunity to excessive CP errors.

The CP error rate threshold for a line is set by the operating company by setting office parameter CPERRORTHRESHOLD in table OFCENG.

A line is considered to have exceeded the threshold if any of the conditions in the following table are met:

Table 8-28

Error Count	Time (consecutive minutes)
X (see note)	1
1.5X	2
2.0X	3

Note: Where the value of X has a value ranging from 5 through 10 and is the value entered in table OFCENG for parameter CPERRORTHRESHOLD. The default value is 5.

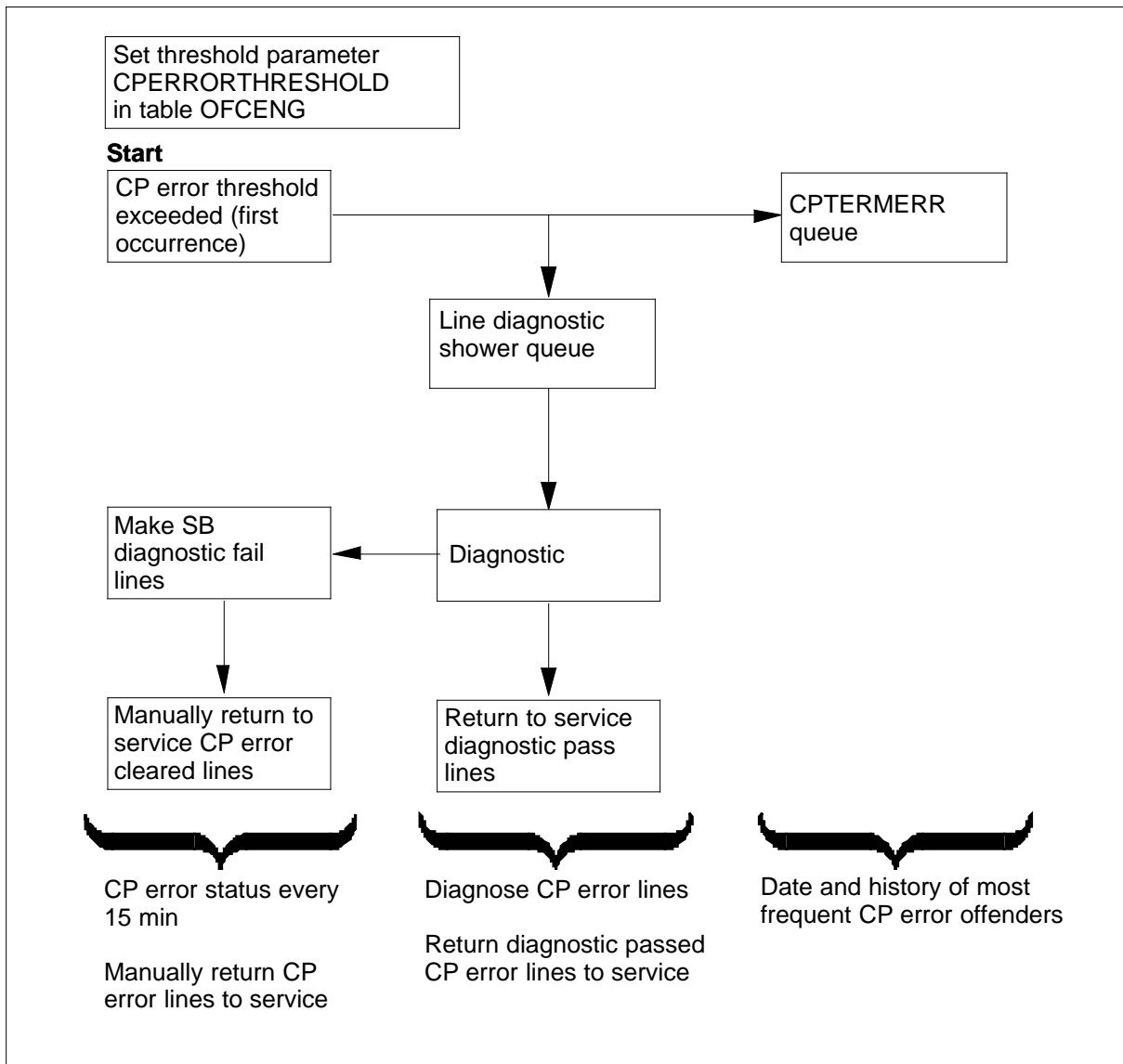
Administration of lines with excessive CP errors is shown in Figure 8-54. The system performs through the following actions:

- output a log message and remove the line from service for a system diagnostic, on the first occurrence of the line exceeding the error threshold
- return the line to service if the line passes the system diagnostic
- record the time of these events and activities in the CPTERMERR queue
- remove the line from service for further maintenance testing if the line fails the system diagnostic, or if the line exceeds the error threshold for a second time within 15 min of the first occurrence

Since the system takes no action to return the line to service, the line must be manually returned to service once the fault has been cleared.

Since GPP/PLD lines are virtual card lines, no diagnostic can be run on them. Once the GPP/PLD lines are returned to service, the fault is cleared.

Figure 8-54 CP error threshold—line administration



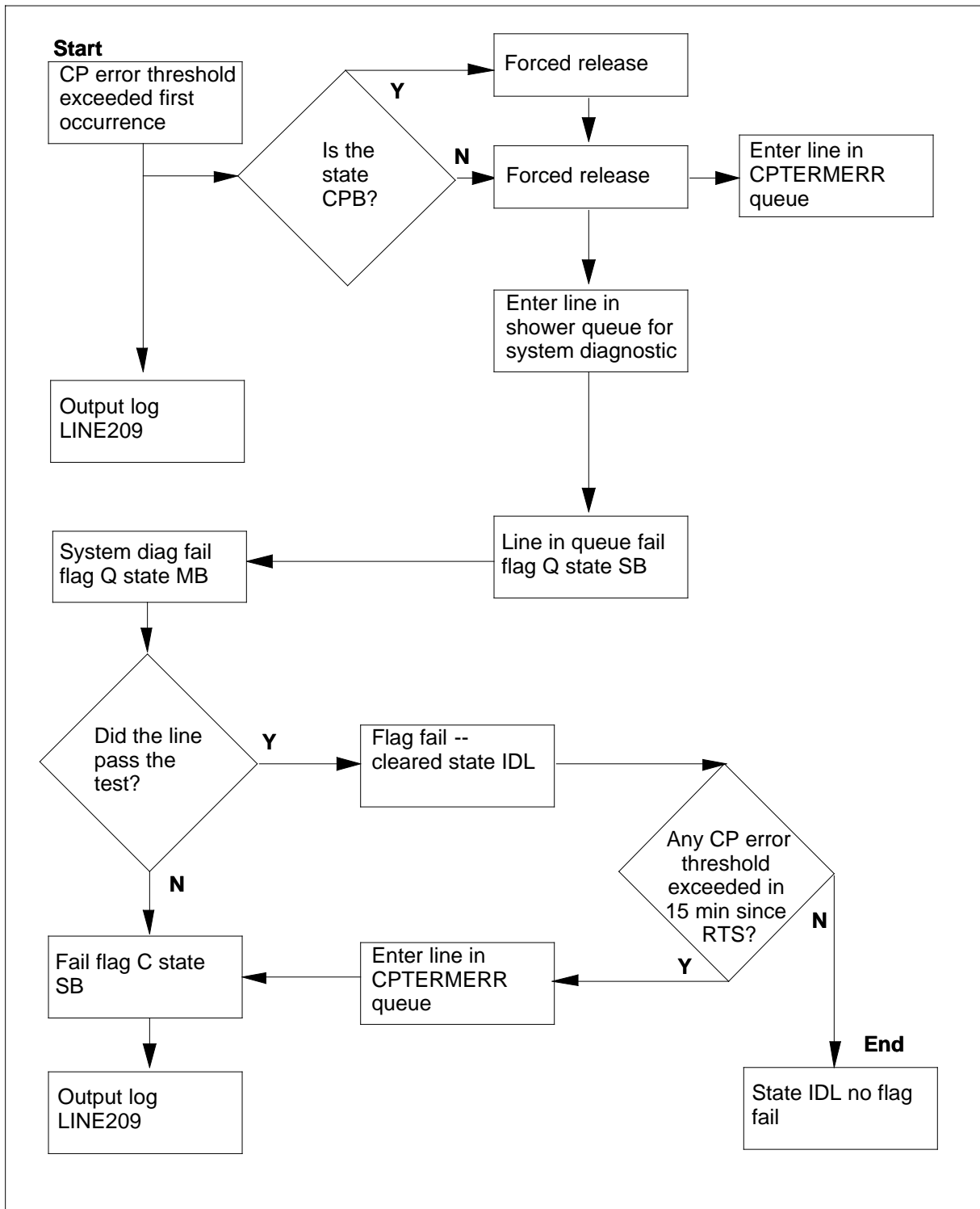
Handling of lines (See Figure 8-55, "CP error threshold—line handling" on page 8-139) The state of the line at each step in the process and the corresponding diagnostic fail flag that is set are indicated.

The CPTERMERR queue maintains a record of up to 32 lines reporting excessive CP errors. Each record contains the identifier for the line, the time that it was moved into the queue and the time that it was returned to service. The line entries in the CPTERMERR queue can be posted at the LTP level.

Note: The 32 entries in the CPTERMERR queue consist of both lines and trunks that have exceeded the error threshold. At any one time, a maximum

of 32 lines and trunks will be out of service because of CP errors. For handling excessive CP errors on trunks, refer to *Routine Maintenance Procedures*.

Figure 8-55 CP error threshold—line handling



Call processing logged failures

Switches that are equipped with software package NTX272, as discussed in Section , "Focused Line Maintenance" on page 1-34, can record data concerning call processing faults in buffers rather than record the data in log reports. The content of the buffers are made available to maintenance personnel by using the LTP to access the LNSTRBL level through the LNS subsystem. When this feature is provided, the logs in the following table are suppressed. They may be restored by setting table LOGCLASS to ignore the suppression (refer to data schema section of *Translations Guide*).

Table 8-29 FLM suppressed logs

Log	Log title
LINE102	Line lockout on
LINE103	Line lockout off
LINE104	Integrity lost
LINE105	Permanent signal
LINE106	DP reception
LINE108	Digitone reception
LINE109	Outgoing trunk
LINE110	Foreign EMF detected
LINE111	Foreign EMF removed
LINE204	Hit detected
	Bad keyset message
	DU sync lost
	CP IOMSG lost
	Bad CP IOMSG
	Ground loop fail
LINE209	CP error threshold exceeded
	Line diagnostic failed
	Line removed from service by system

Bipolar violations

Bipolar coding is used to transmit messages between data units. Bit errors that occur in the associated data loops during transmission of the messages are called bipolar violations (BpV). The quantity of BpV which is counted by the DLC over a 4.6 min period can be used as an early warning of a potential

degradation in the system. When the quantity of BpV in the digital loop of a posted line exceeds a threshold value, the bipolar violation overflow (BPVO) is reported to the central control (CC). The BpV threshold value is set by the operating company (see data schema section of *Translations Guide*) in the range 0 to 255.

Diagnostic subtests descriptions

Transhybrid loss

The transhybrid loss test is a measurement of loss between the line card and the network. The DMS-100 switch compares the measured loss with the expected loss for the line circuit under test. Measurements that are less than, or equal to, the established threshold are reported *Pass*. A TTU is required for this test. The TTU generates a specific tone which is reflected by the unbalanced transhybrid and measured at the TTU. Measurements that exceed the threshold values are reported *Fail*. See 8-30 and 8-31 for the loss limits for the standard and world line cards. The following sequence of tasks are used in the test:

1. The cut off relay is operated.
2. A path is established through the digital network between the TTU and the line circuit.
3. A 304 Hz tone is sent from the TTU to the line circuit.
4. The reflected tone signal is measured at the TTU.
5. Tasks 3 and 4 are repeated for the 704 Hz tone, for the 1504 Hz tone, and for the 3204 Hz tone.

Table 8-30 Transhybrid loss test limits for standard line card

304 Hz	704 Hz	1504 Hz	3204 Hz	Balanced network value datafilled in table LNINV
-4.0 dB	-4.0 dB	-4.8 dB	-6.9 dB	Min loaded
0.5 dB	0.0 dB	-0.8 dB	-1.9 dB	Max loaded
-2.0 dB	-2.0 dB	-2.0 dB	-3.0 dB	Min nonloaded
-3.5 dB	-3.0 dB	-3.0 dB	-3.0 dB	Max nonloaded

Table 8-31 Transhybrid loss test limits for world line card

304 Hz	704 Hz	1504 Hz	3204 Hz	Balanced network value datafilled in table LNINV
-7.5 dB	-7.5 dB	-7.5 dB	-7.5 dB	Min loaded
-1.0 dB	-1.0 dB	-1.0 dB	-1.0 dB	Max loaded
-3.0 dB	-3.0 dB	-2.5 dB	-2.0 dB	Min nonloaded
-3.0 dB	3.0 dB	-3.0 dB	4.0 dB	Max nonloaded

Channel loss for RCS lines

The channel loss test for RCS lines checks the RCS line channel for loss. The following is the sequence of tasks that are used in the test:

1. A REFLECT or a REFLECT/NTPG termination is connected across the tip and ring of the line circuit.
2. A path is established through the digital network between the TTU and the line circuit.
3. A 304 Hz tone is sent from the TTU to the line circuit.
4. The reflected tone signal is measured at the TTU.
5. Tasks 3 and 4 are repeated using the 704 Hz tone, the 1504 Hz tone, and the 3204 Hz tone, successively.

The tone signals that are sent to the line circuit are reflected to the TTU by the voice frequency (VF) transformer because of the impedance mismatch that is caused by the reflective termination between the tip and ring. The signal reflection is referred to as analog looparound.

Attenuation pad test

The attenuation pad test checks the 0, 1, 3, and 7 dB pads in the line circuit under test. The following is the sequence of tasks that are used in the test:

1. The attenuation pad in the line card under test is set for 0 dB loss.
2. The transhybrid loss test is performed and the results noted.
3. Task 2 is repeated for each of the 1dB, 3dB, and 7dB loss settings.
4. The DMS-100 switch compares the results that are obtained in tasks 2 and 3 with established limits.
5. Attenuation pads are restored to 0 dB value when the test is completed.

Talk battery test

The talk battery test checks the battery lead (B) and ground lead (A) circuit of the NT6X98AA line card. The following is the sequence of tasks that are used in the test:

1. The TA relay is operated.
2. The MTU measures the dc voltage between the A lead and ground to verify that the voltage lies between +4 V and -4 V.
3. The MTU measures the dc voltage between the B lead and ground to verify that the voltage lies between -42 V and -56 V.

Noise test

The noise test checks for the presence of noise in the line card under test. In the case of RCS lines, the test also checks for noise in the channel, and uses the reflective termination that was connected in the channel loss test. The following is the sequence of tasks that are used in the test:

1. Connect the TTU to the line circuit through the digital network.
2. Operate the TP relay in the NT2X18 type, NT6X18 type, or NT6X93 type line circuit.
3. Measure the C-message weighted noise with the TTU.
4. The DMS-100 switch compares the actual noise measurements of the line card under test with the expected measurements. Noise levels that are measured less than or equal to the established threshold are reported as *Pass*, while those that are measured in excess of the threshold value are reported as *Fail*.
5. The DMS-100 switch sends a 2000 Hz tone from the TTU to the line card at a level of -20 dB.

Note: For the World line card, the DMS-100 switch sends a 2800 Hz tone from the TTU to the line card at a level of -40 dB.

6. Measure the notch noise at the TTU.
7. Repeat task 4 to compare the actual notch noise measurement with the expected measurement.

Note: Tasks 1 through 3 are conducted by entering the NOISE command at the LTPMAN level; tasks 1 through 7 are conducted during diagnostics.

Loop signaling test at the line card

The loop signaling test at the line card checks the operation of the signaling chip on the MBS, DATA, AIM and IBERT line card. The test is performed

while the line card cut-off relay is operated to prevent test signals from reaching the set. The following is the sequence of tasks that are used in the test:

1. The DMS-100 switch sends a message to the signaling chip on the line card requesting it to enter the loop around mode.
2. The LCM transmits a number of messages to the line card where it is looped back to the LCM. The number of messages sent is specified in office parameter `CIRCUIT_TEST_NUMBER_MESSAGES` in table `OFCVAR`. The default is 10 messages.
3. The DMS-100 switch compared the transmitted signal with received signal.
4. Exit the loop around mode.
5. The diagnostic result display indicates *OK* or *Fail*.

Data line card self test

The data line card self test checks that the circuit components are functioning according to specifications. The following components are checked

- external RAM
- internal RAM
- linecard CPU
- ROM

Loop signaling test at a keyset

The loop signaling test at a keyset checks the ability of an MBS line card or data line card to exchange messages with its terminal. The following is the sequence of tasks used in the test:

1. A *close echo mode* message is sent to the keyset causing equalization current to be drawn and the input amplifiers to be set for the loop length.
2. An *open echo mode* message is sent to the keyset, establishing a loopback.
3. Test messages are sent to the keyset and returned to the line card (the number of test messages sent is specified in office parameter `CIRCUIT_TEST_NUMBER_MESSAGES` in table `OFCVAR`. The default is 10).
4. The transmitted message is compared with the received message at the line card.
5. A close echo mode message is sent to the keyset.

Add-on and extension test

The add-on and extension test checks for the presence of a MBS add-on or extension, and for its responding to a loopback test. The test will only run when

the loop signaling test at the keyset is passed. The sequence of tasks that are used in the test are as follows:

1. A message is looped at each of the eight possible MBS and add-on addresses.
2. The datafill for each address is checked to determine if a set or add-on is expected.
3. The transmitted message is compared with the received message.
4. If all addresses are datafilled and responding, or not datafilled and not responding, the test is passed.
5. A LINE101 log report is issued for a test failure. (Refer to Section , "Automatic line testing description" on page 1-43 and refer to chapter 3, "Lines related logs" on page -1 for a discussion of the LINE101 log.)

Flux cancellation test

The flux cancellation test checks the flux cancellation circuitry on the POTS line card or the MBS line card. The circuitry is comprised of the flux balance winding of the VF transformers and circuitry in the line card supervision network. The MTU and TTU are still connected from the noise test. The following is the sequence of tasks that are used in the test:

1. A termination is placed between the tip (A) and ring (B) leads with the MTU. The termination is 900 Ω for North American line cards, and 600 Ω for international line cards.
2. The transhybrid loss test and analysis test is conducted.

Note: The flux cancellation test is not used for the World line card.

Echo return loss for RCS lines

Echo return loss for RCS lines is similar to the flux cancellation test. It measures loss using the Absorb termination or the Absorb/NTPG termination connected between the tip and ring of the line circuit.

Loop detector test

The loop detector test checks the ability of a POTS line circuit to recognize an off-hook condition on a loop start line. The following is the sequence of tasks that are used in the test:

1. The MTU is conditioned to provide sequentially
 - a. An off-hook termination for 2 s (the termination is 900 Ω for North American line cards, and 600 Ω for international line cards).
 - b. A digit one (open circuit for 60 ms)
 - c. Another off-hook termination for 2 s.
2. Supervision circuitry responses are noted by the DMS-100 switch for the correct indication of loop status changes.

Loop detector test for DMS-1R RCT lines The loop detector test for DMS-1R RCT lines uses a SLT-D to apply on-hook conditions to the line and to transmit results to the host SMR. The following is the sequence of tasks that are used in the test:

1. The combined ring/test relay in the line card is operated.
2. The test access relay in the shelf buffer card is operated.
3. The off-hook condition is applied to the line.
4. The off-hook test result is transmitted to the SMR.
5. The on-hook condition is applied to the line.
6. The on-hook test result is transmitted to the SMR.

Loop detector test for RCS lines The loop detector test for RCS lines checks the ability of the line circuit to detect off-hook and on-hook conditions. The sequence of tasks that are used in the test are as follows:

1. An absorb termination is connected to the line circuit.
2. The RCS scans the line for an off-hook condition.
3. The SMS sends an on-hook message to the RCS to disconnect the termination.
4. The line circuit detects the on-hook condition and an *abandon call* message is transmitted to the SMS.

Isolation relay test

The isolation relay test for international type B lines verifies that the line card connection to the subscriber's loop is discontinued when the relay is operated.

Note: The world line card does not use the isolation relay test.

The isolation relay is operated and the items in Table 8-32 are measured with an MTU.

Table 8-32 Operated isolation relay specifications-NT6X94

Item	Required
Tip to ring	14 k Ω to 18 kW range
Tip to ring	Open
Ring to ground	Open

Metering test

The metering test is applied to Type B international line cards to verify the presence and suitability of the signal that is provided by the metering tone card. Presence is demonstrated by an on-hook signal that is detected by the bus interface card of the ILCM.

Note: The world line card only measures the power of the signal, which must be less than 20 dB. In addition, the type B world line card does not require an NT6X95 tones card for metering because the tones function is included in the NT6X18BA.

The following sequence of tasks are conducted as part of the test:

1. Connect an MTU through the MTA, to the line under test
2. Operate the TA relay
3. Operate the isolation relay
4. Release the cutoff relay
5. Apply metering signal to the PCM side of the line card under test
6. Measure the frequency, amplitude, and duration of the metering signal
7. Compare the metering signal measurements with the expected values identified in Table 8-33.

Table 8-33 Metering tone specifications-NT6X95

Item	Required
Frequency	12 000 Hz +/-250 Hz
Amplitude	Greater than 1 V
Duration	150 ms +150 ms, -50 ms

The tasks are incorporated in the test as depicted in Figure 8-56. The tasks for the world line card are shown in Figure 8-57.

Figure 8-56 Metering test using NT6X94AA/AB international line card

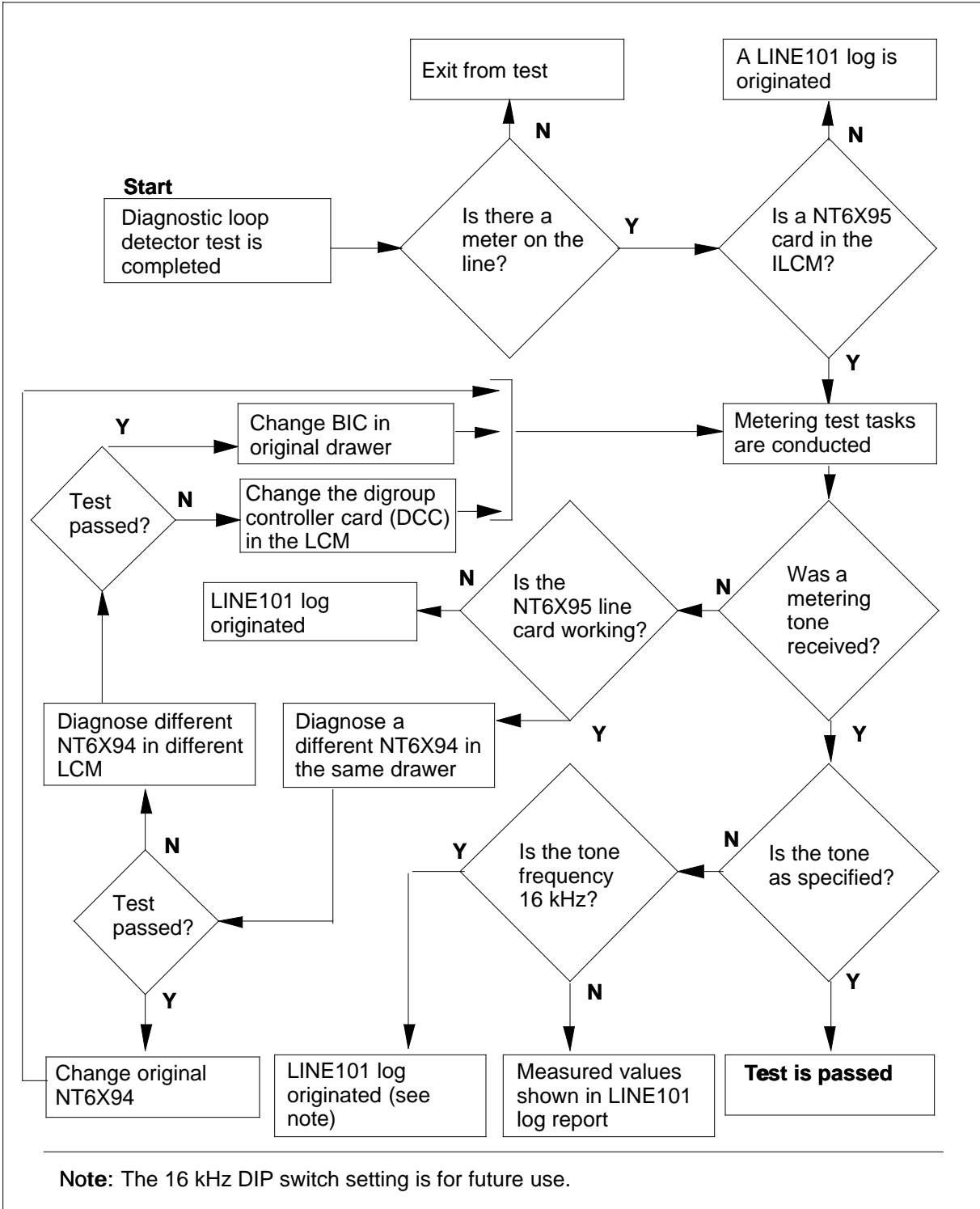
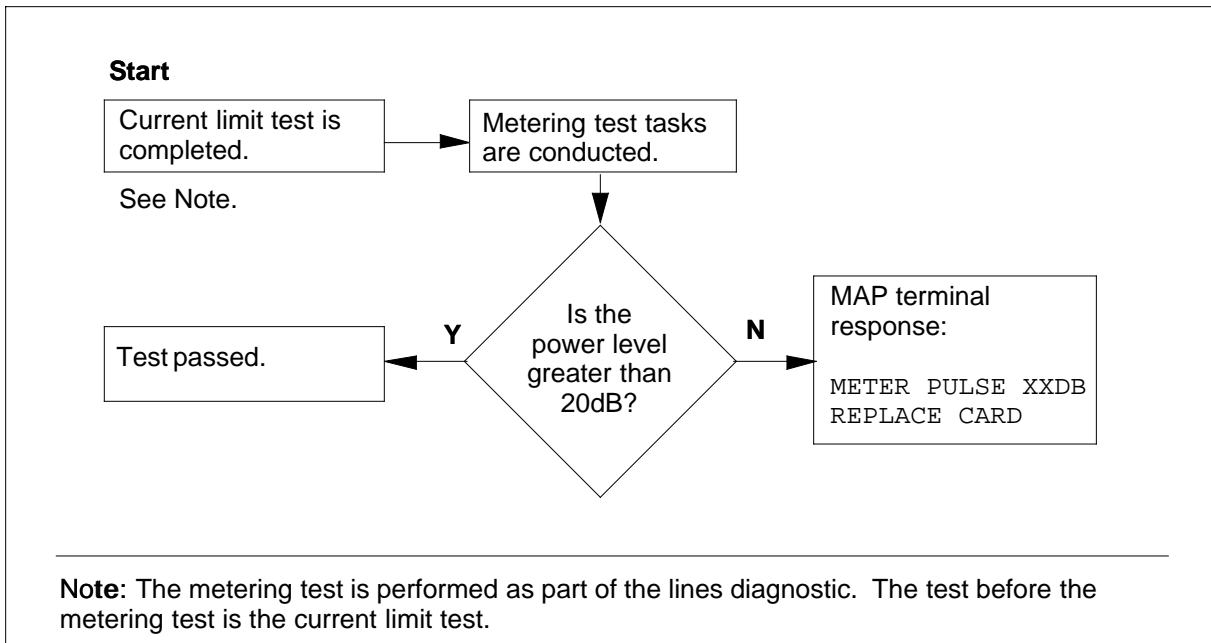


Figure 8-57 Metering test using NT6X18AB world line card



Two-party ANI test for DMS-1R RCT

The two-party ANI test for DMS-1R RCT lines is applied to a two-party line to identify the tip party. It is part of the extended diagnostic.

Equalization current detector test

The equalization current detector test is the MBS counterpart of the loop detector test for the POTS set. The test checks the ability of the line card to detect the presence of equalization current. The following is the sequence of tasks that are used in the test:

1. The line card is checked for the presence of equalization current after the flux cancellation test.
2. An *open echo mode* message is sent to the MBS from the line card to discontinue the equalization current.
3. The absence of equalization current is detected at the line card.

Buffer full flag test

The buffer full flag test is used to verify that a signaling message sent from a Business Set line card is received by the keyset. The following is the sequence of tasks that are used in the test:

1. A signaling message is sent from an MBS line card to the keyset, setting a flag HIGH in the line card buffer.
2. A positive acknowledgement (PACK) message is returned from the keyset resetting the buffer flag LOW.

Note: When the buffer flag remains *High* after the *Pack* message is received, it is an indication that the buffer full flag is stuck.

Battery feed resistors test

The battery feed resistors test checks that both battery feed resistor values are correct. It also checks that the -48 V battery and ground feeds are present at the loop side of the line circuit. The following is the sequence of tasks that are used in the test:

1. The tip (A) and ring (B) leads are terminated with a 47 Ω resistor.
2. The dc voltage between ring (B) and ground leads is measured using the MTU.
3. The DMS-100 switch compares the actual voltage measurements of the line card under test with the expected measurements. Actual measurements between specified low and high limits record a *Pass* report (greater than -34.2 V and less than -21V). Measurements outside these specified limits cause a *Fail* report to be displayed.

Reversal relay test

The reversal relay test checks that the RV relay both operates and releases. The following is the sequence of tasks that are used in the test:

1. The RV relay is operated in NT2X18AC, and the RV1 relay is operated in NT2X18AD or NT6X18AA.
2. The tip-to-ground and ring-to-ground dc voltages are measured with the MTU.
3. The RV or RV1 relay is released and the tip to ground and ring to ground voltages are measured again with the MTU.

The DMS-100 switch compares the actual voltage measurements of the line card under test with the expected measurements which are identified in the following table.

Table 8-34 Reversal relay voltage measurements

RV or RV1	Tip to ground	Ring to ground
Operated	-48 V	0 V
Released	0 V	-48 V

When expected voltages are measured, a *Pass* report is displayed. Other results cause a *Fail* report to be displayed.

+48 volt reversal relay test

The +48 volt reversal relay test checks that the NT2X18AD Digitone fraud prevention circuit functions properly. The following is the sequence of tasks that are used in the test:

1. The RV2 relay is operated.
2. The tip-to-ground and ring-to-ground dc voltages are measured with the MTU.
3. The RV2 relay is released.
4. The tip-to-ground and ring-to-ground dc voltages are measured with the MTU.

The DMS-100 switch compares the actual voltage measurements of the line card under test with the expected measurements which are identified in the following table.

Table 8-35 +48 V reversal relay voltage measurements

RV or RV1	Tip to ground	Ring to ground
Operated	+48 V	0 V
Released	0 V	-48 V

When measurements are as expected, a *Pass* report is displayed. Other results cause a *Fail* report to be displayed.

Ground-start relay test

The ground-start relay test checks that the ground start circuitry functions properly in the NT2X18AC, NT2X18AD, NT6X18AA, and NT6X18BA line cards. The following is the sequence of tasks that are used in the test:

1. The TP relay is released.
2. The tip and ring leads are terminated with a 47 Ω resistor.
3. The dc voltage between ring and ground is measured with the MTU.
4. The DMS-100 switch compares the actual voltage measurement of the line card under test with the expected measurement. A zero value causes a *Pass* report to be displayed, while any other value causes a *Fail* report to be displayed.

On the NT6X18AA, the ground-loop mode is controlled by a switch on the card. However, on the world line card (NT6X18BA), the ground start relay is controlled by software. When the ground start relay is released, it is ground start, and loop start when it is operated.

Ground start detector test

The ground start detector test checks the ability of the line circuit to recognize an off-hook condition on a ground-start loop. The following is the sequence of tasks that are used in the test:

1. A 18 k Ω off-hook termination is connected between the Ring and Ground leads using the MTU.
2. The DMS-100 switch checks for an off-hook signal and displays a *Pass* or *Fail* report.
3. A 950 Ω resistance is connected between the ring and ground leads using the MTU.
4. The DMS-100 switch checks for an on-hook signal and displays a *Pass* or *Fail* report.

Cutoff relay test

The cutoff relay test checks that the line circuitry functions properly. The following is the sequence of tasks that are used in the test:

1. The 18 k Ω and 950 Ω terminations are removed from the ground start detector test.
2. The cutoff relay is operated.
3. The dc voltage between ring (B) and ground leads is measured using the MTU.
4. The DMS-100 switch compares the actual voltage measurement of the line card under test with the expected measurement. A zero value actual

measurement causes a *Pass* report to be displayed, while any other value causes a *Fail* report to be displayed.

Ringling and supervision test

The ringling and supervision test checks that the ringling is sent to the tip and ring leads of the line circuit. A connected loop is not required to perform this test. The following is the sequence of tasks that are used in the test:

1. The cutoff relay is operated to prevent the ringling signal from being transmitted to the station.
2. The line card rings towards its loop.
3. The TTU measures the reflected ringling level.
4. The DMS-100 switch compares the reflected ringling measurement of the line under test with the expected measurement. A measurement equal to or greater than the established threshold value causes a *Pass* report to be displayed while a measurement less than the threshold value causes a *Fail* report to be displayed.

Ringling test for RCS lines

The ringling test for RCS lines verifies the ringling pattern produced by the channel unit. The following is the sequence of tasks that are used:

1. The termination is disconnected from the line circuit.
2. The CC requests the channel unit to perform the ringling function.
3. The RCS connects a termination to the tip and ring of the line circuit. The type of termination depends on the superimposed ringling voltage (refer to Section , "Testing SLC-96 subscriber carrier lines from a test desk" on page 8-21).
4. A channel loss test and ANI ground test are conducted to ensure that the proper termination was connected to the line circuit.

Test access relay test

The test access relay test checks that the test access relay on a line card releases. The following is the sequence of tasks that are used in the test:

1. The TA relay is released.
2. The dc voltage on the ring lead is measured with the MTU.
3. Absence of voltage on the ring lead confirms release of the TA relay and causes a *Pass* report. The presence of -48 V on the ring lead indicates an operated TA relay and causes a *Fail* report.

Ringling relay test

The ringling relay test checks the operation of the ringling relay in the line card. The following is the sequence of tasks that are used in the test:

1. The TA relay is operated.
2. The cutoff relay is operated.
3. The line circuit is connected with the MTU through the MTA and the ILCM test access bus.
4. The MTU measures the DC voltage between lead B and ground.

Missing card test

The missing card test verifies the ability of the world line card to read and write from the test register. The test consists of writing a 4-bit test pattern to the test register on the world line card and then reading the test pattern. The test will return as failed if the returned test pattern is not the expected pattern.

Current limit test for world line card

The current limit test for the world line card verifies the current limit for the circuitry. The following is the sequence of tasks that are used in the test:

1. The TA relay is operated.
2. The TA bus is connected with the MTU/LTU and the line card is terminated with a 47 Ω resistor.
3. The line card current limit is set to 40 mA.
4. The voltage at the tip is measured with respect to the ring across the 47 Ω resistor. The value should be less than 2.73 V. The measured voltage should be returned with a Pass/Fail statement.

Product specific test tools

Hardware

The following items of hardware are used for line testing and are discussed in this section:

- LTP
- multiline test unit in North American applications
- metallic test unit in International applications
- line test unit (LTU)
- transmission test unit
- transmission test trunk (TTT)
- four wire jack ended trunk
- external test equipment

- metallic test access
- wideband test access (WTA)
- input/output test trunk
- printer (optional)
- 101 communication test line
- communication module

Line test position

The LTP is a MAP terminal consisting of

- visual display unit (VDU)
- furniture
- communication module
- test jacks

The LTP is the user interface between the operating company personnel and the line maintenance subsystem (LNS). Requests for tests and other actions are input at the MAP keyboard, and responses are displayed on the MAP screen.

The LTP furniture consists of three interconnected modular units

- the centrally located corner unit for the MAP
- the storage unit on one side of the corner unit
- the counter unit on the other side of the corner unit

The standard communication module, a 20-button set with an optional headset, is used to

- access tie-lines
- access office telephone lines
- monitor and talk over lines under test

Alternatively, a basic telephone set may be used for LTP communication. However, it is limited to one of the communication functions, normally the monitor and talk function for lines under test.

There are two sets of eight jacks on the LTP to terminate external equipment. Additional information concerning their use is provided in a later paragraph.

A printer may be used in conjunction with an LTP to provide hard copy if required.

A portable LTP consists of the display unit and its associated keyboard, and can be used for temporary lines maintenance activities.

Multiline test unit

The multiline test unit consists of an NT2X10BA analog card and an NT2X11BA digital card mounted in either a maintenance trunk module (MTM) if the MTU is located at the host office, or mounted in a remote maintenance module (RMM) if it is located in an RLCM. Each physical MTU has two test head appearances, each MTU test head is equivalent to and provides the same functions as an LTU and can run concurrent and independent diagnostics on two separate lines. Each MTU appearance must be datafilled in table TRKMEM and table MTAHORIZ. Each MTU is connected to a selected line circuit through the MTA and the test access bus.

Metallic test unit

The metallic test unit (MTU) consists of an NT4X97AA digital controller card and an NT4X98BB analog card, mounted in an international MTM at the host office, or an international RMM for the remote office. Each physical MTU has two test head appearances that can run concurrent and independent diagnostics on two separate lines. Each MTU appearance must be datafilled in table TRKMEM and table MTAHORIZ (see data schema section of *Translations Guide*). Each MTU is connected to a selected line circuit through the MTA and the test access bus. The metallic test unit can perform all the functions of the multiline test unit, and can measure metering signals.

Line test unit

The line test unit consists of an NT2X10AC analog card and a NT2X11AD digital card mounted in a maintenance trunk module (MTM) if the MTU is located at the host office, in a remote maintenance module (RMM) if it is located in an RLCM, or in a remote service module (RSM) if it is located in an RLM. The LTU is connected to a selected line circuit under test through the metallic test access (MTA) and the test access bus.

Transmission test unit

The TTU consists of a NT2X56AB digital filter and a NT2X47AC control processor, both mounted in an MTM. The TTU is connected to a selected line circuit under test through the digital network.

Transmission test trunk

The TTT is a NT2X71AA card mounted in a 2-wire, or 4-wire, or 8-wire trunk module (TM). The TTT is connected to a selected line circuit under test through the digital network.

Jack-ended trunk

A jack ended trunk is part of an NT1X54AA circuit card, mounted in a MTM, which contains two four-wire jack-ended trunks that are connected to jacks on

the LTP. The jacks enable external test equipment to be connected to selected line circuits under test, through the trunk circuits and the digital network.

Jack-ended trunk connections for RDT lines Figure 8-58 shows a jack-ended connection to external test equipment for RDT line testing.

Figure 8-58 Jack-ended trunk connection between RDT lines and external test equipment

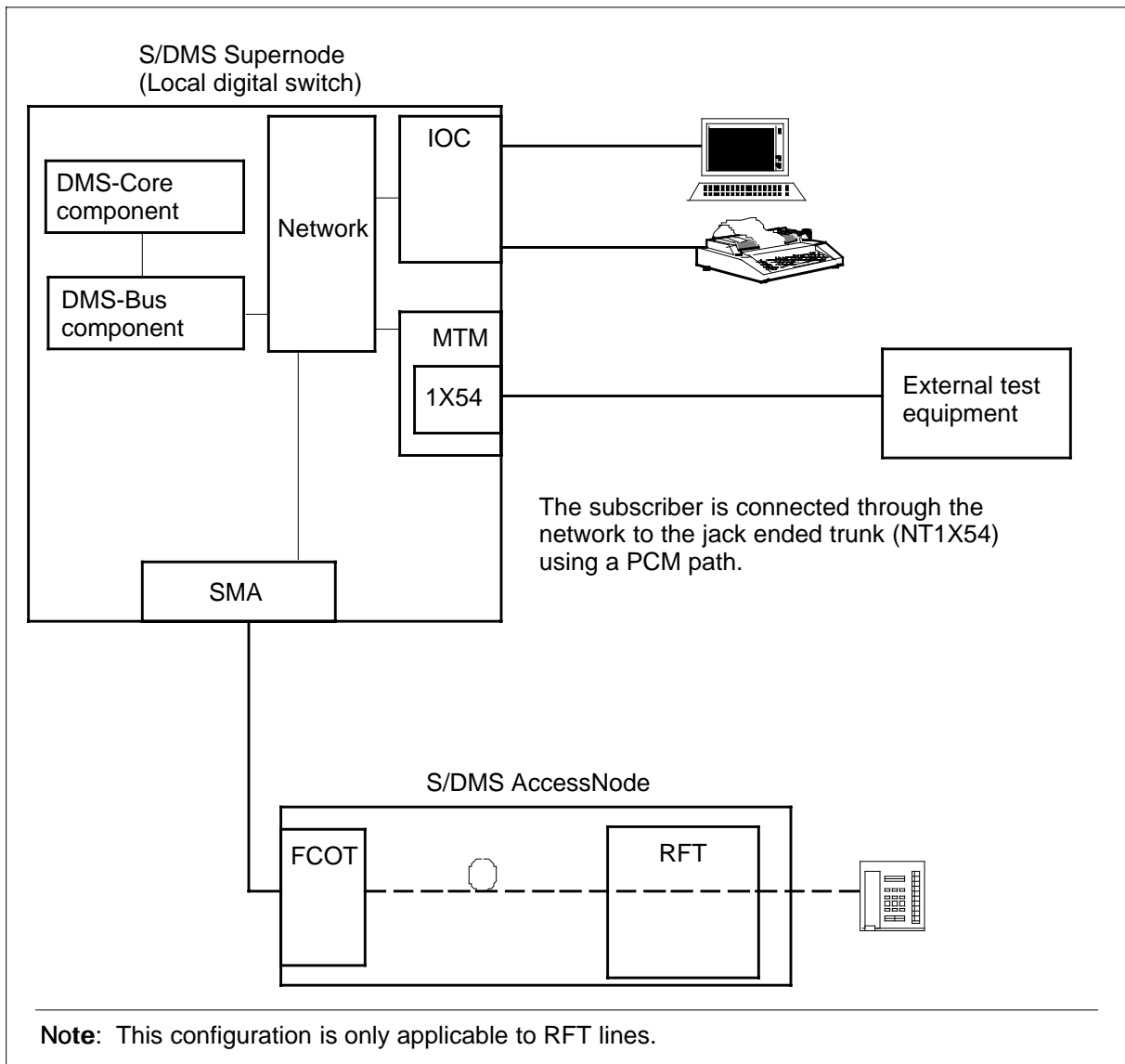
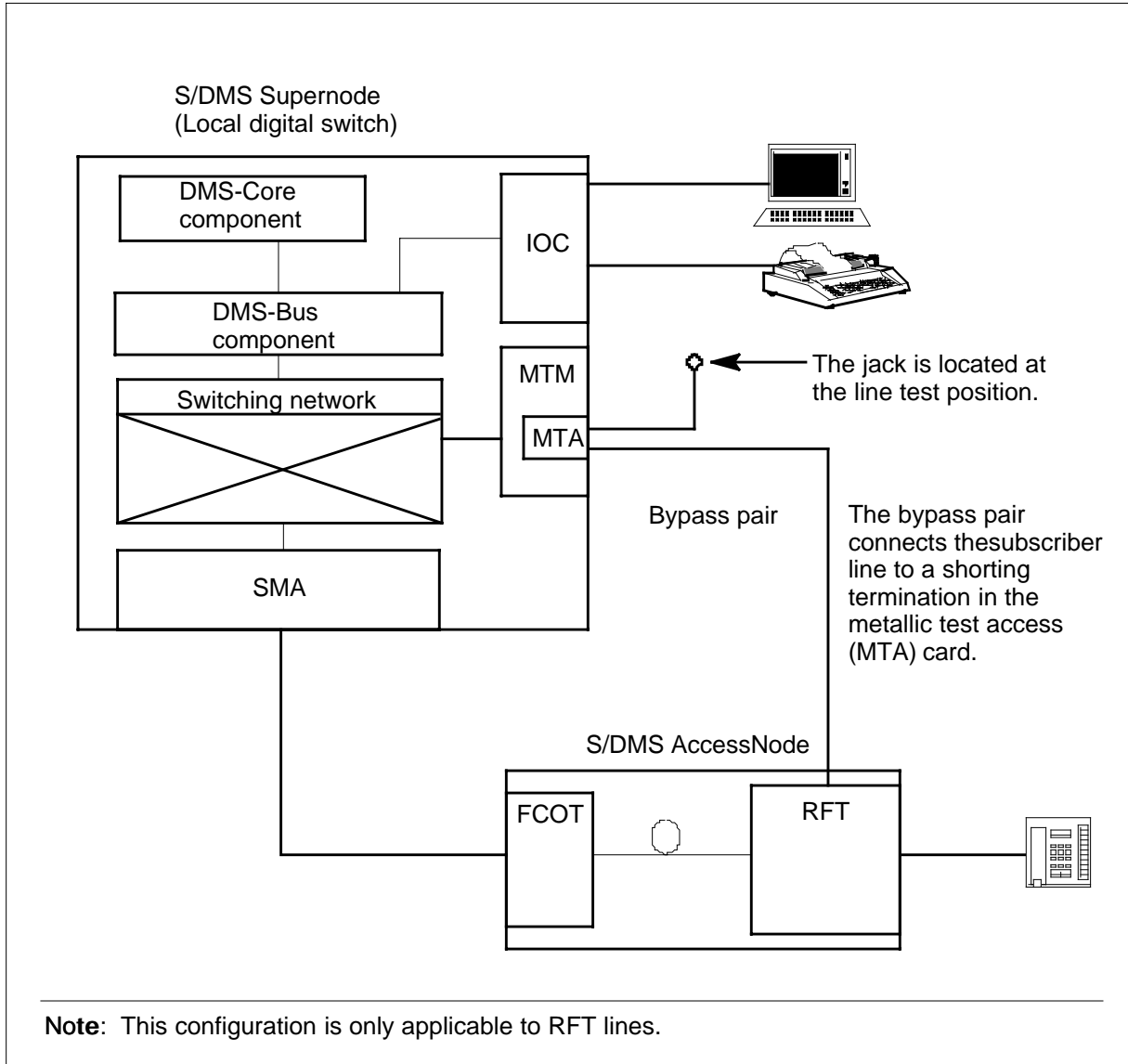


Figure 8-59 shows the configuration used when a craftsman enters the command string JACK METALLIC at the LTPMAN level for a jack-ended trunk to MTA configuration used for testing AccessNode lines.

Figure 8-59 Jack-ended trunk to MTA configuration for testing RDT lines

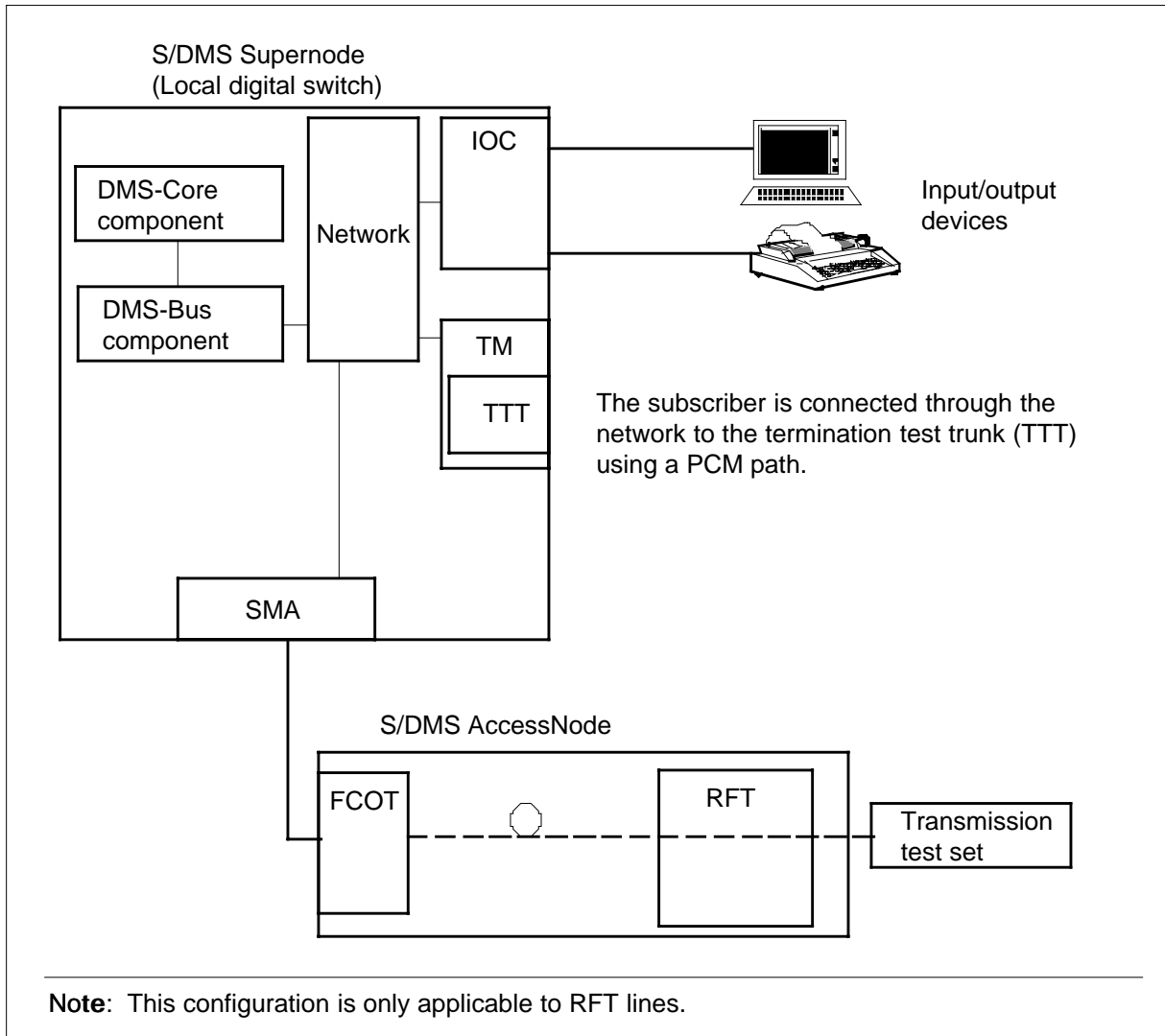


External test equipment

External test equipment includes any special test equipment that is not regularly used at the LTP and is connected to the line card through the test jacks. The return loss measuring set and the impulse noise measuring set are examples of external test equipment.

Using a transmission test set with RDT lines A transmission test set is used to send voice frequency signals through the network. At the MAP terminal, the user enters LOSS, NOISE, and TONEGEN commands to make measurements through the network. Figure 8-60 illustrates the test configuration used.

Figure 8-60 RDT line testing with a transmission test set



RDT line testing with RTEC Reliance Telecommunication Electronics, Inc. provides an MITS70 system that consists of the T-9/15 or T-9/SX central office unit, the T-916 remote test unit (RTU) selector, and the T-9/X remote test unit. Since this is a complicated configuration, the following section describes how the configuration works in more detail.

maintained only until the test is completed. This dial-up path contains the following links:

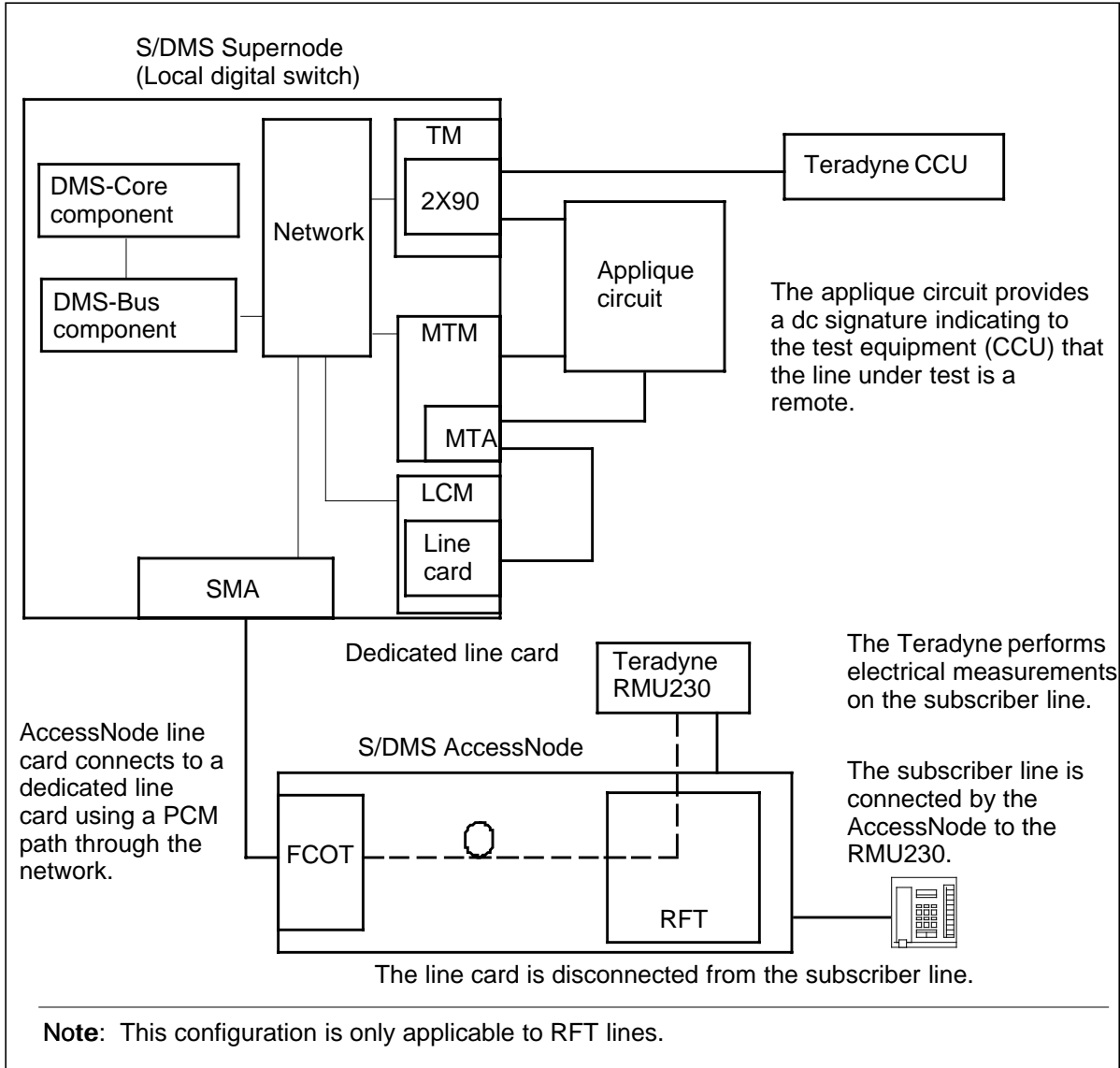
- from the T-9/X to a dedicated AccessNode line card
- from the dedicated line card to a dedicated line card in an LCM. When the T-9/X senses that this test access has occurred, it places a call to a dedicated line card that is in a host LCM.
- from the LCM line card to the T-916 RTU selector. The T-916 answers the call for the T-9/X and completes the connection to the T-9/15 or T-9/SX.

The T-9/SX and T-9/15 perform interactive tests (such as talk , ring, or monitor) that require a direct metallic path between the T-9/SX or T-9/15 and the subscriber line. This path is highlighted in Figure 8-61.

RDT line testing with Teradyne

Figure 8-62 shows the configuration used with the Teradyne testing system.

Figure 8-62 RDT line testing with Teradyne



Metallic test access

The MTA may be configured in either of two ways:

- An NT2X46AB minibar switch is mounted in a miscellaneous equipment frame and is used with an NT2X50AB driver card that is mounted in an MTM or RSM.
- The NT3X09AA and NT3X09BA type driver cards are each equipped with a network of relays that make up a matrix. The NT3X09AA card has eight horizontal connections for test equipment and four vertical connections for LCD. The NT3X09BA card has eight horizontal connections for test

equipment and eight vertical connections for LCD. The NT3X09AA or NT3X09BA card is mounted in an MTM in a host office, in an RMM at an RLCM, or in an RSM at an RLM. However, there are no RLM or RLCM in international applications.

The MTA provides a dc path between the line circuit and test equipment, such as an MTU or a #14 local test desk, through the test access bus.

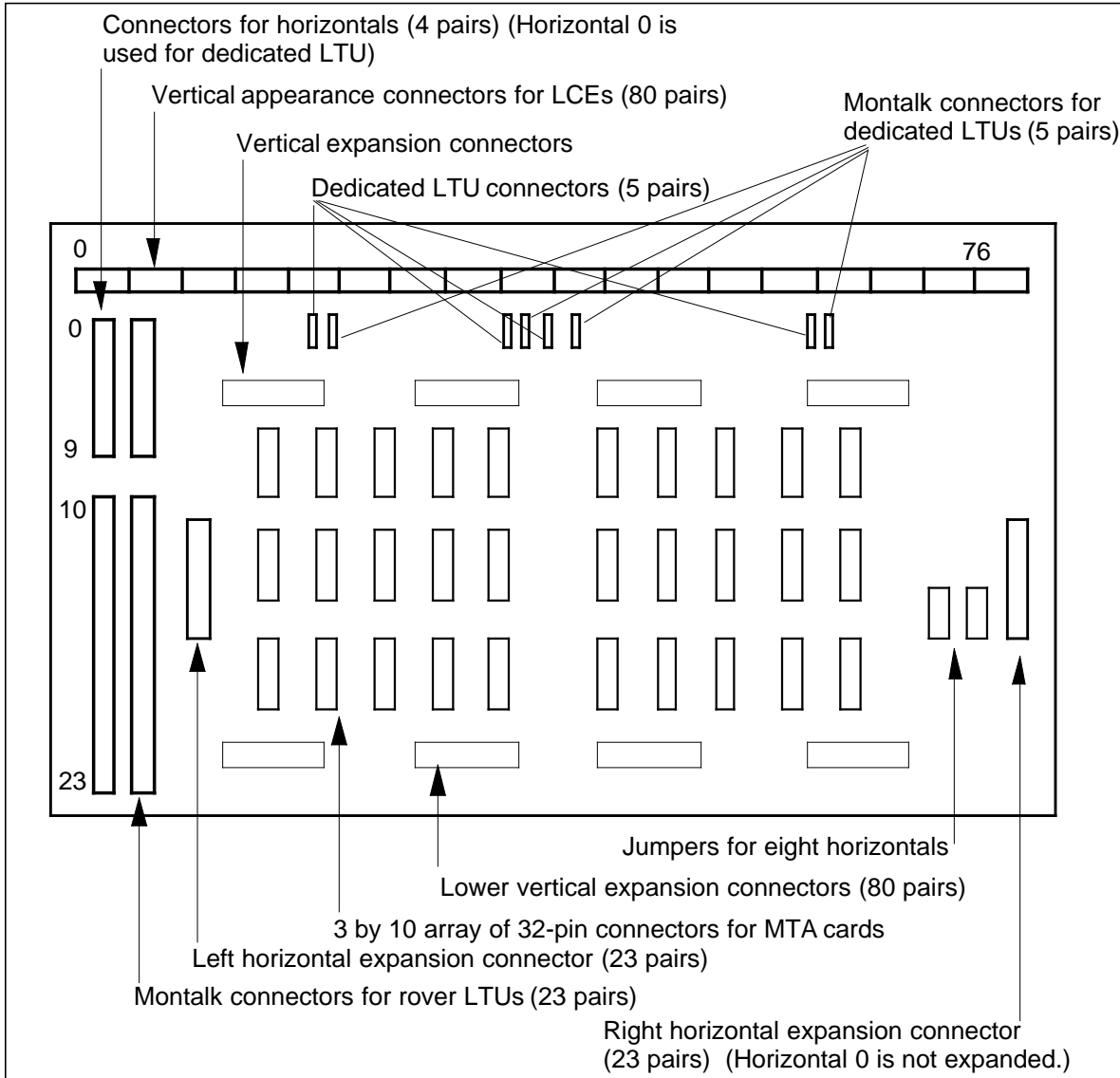
The MTA can be used to access subscriber loops, while bypassing the line card, and to connect a jack to the loop. Similarly, a tone can be transmitted on the subscriber loop while bypassing the line card.

Wideband test access panel

The wideband test access cross-connect panel consists of an NT7X76AA panel, or an NT7X76BA panel mounted on a miscellaneous equipment frame, and is used for testing of wideband services such as datapath and ISDN as well as existing voice frequency subscriber services. Both panels consist of an array of connectors that replace the MDF for cross-connecting the MTA cables, the test access cables to line equipment, the LTU/MTU (or other types of test equipment) cables, and the monitor cables (MONTALK).

The WTA panel provides the means for cross-connecting 30 NT3X09BA MTA cards, so that they form a 3 by 10 matrix. The NT7X76BA panel is similar to the NT7X76AA panel; however, it provides additional connectors for dedicated LTUs or MTUs. Figure 8-63 shows the layout of the NT7X76BA WTA panel.

Figure 8-63 NT7X76BA wideband test access panel layout



The WTA panel significantly reduces the overall cable length between test equipment and subscriber lines. The panel is used for testing with increased accuracy of all the existing subscriber services, and it may be used, under certain conditions, for testing of wideband subscriber services such as ISDN and Datapath. The WTA panel is also equipped with connectors for horizontal and/or vertical expansion to other WTA panels.

Input/output test trunk

The input/output (I/O) test trunk is a NT2X90AC card mounted in an 8-wire trunk module at a host office, in an RMM at an RLCM, or in an RSM at an

RLM. The I/O test trunk provides a DMS-100 switch interface with the following non-DMS local testing equipment:

- #14 local test desk
- #3 local test cabinet
- Centralized Automatic Loop Reporting System

The important test trunk enables the maintenance personnel who operate the non-DMS test equipment to access subscriber lines through the MTA.

Switches that contain software package NTX195, MLT interface, and I/O test trunk card NT2X90AD can conduct line tests from an MLT terminal on subscriber lines that are served from a subscriber carrier system such as the SLC-96. The tests are the same as those that use the NT2X90AC trunk card. An applique circuit is provided to extend test results to the MLT. Two applique circuits are provided in a NT3J00BB applique package; a maximum of ten applique packages can be mounted in an NT3J00BA applique shelf.

Each applique circuit contains four relays (K1 to K4) that are operated by points in the signal distributor (SD) card NT2X57AA, as displayed in the following table:

Table 8-36 Applique circuit relay SD points

Relay	SD point
K1	A7
K2	A6
K3	A5
K4	A4

Table 8-37 shows the signals sent to the testing system when the form relays are operated. Table LTDS (see data schema section of *Translations Guide*)

must be datafilled to establish the location of the SD card used to operate the applique circuit.

Table 8-37 MLT applique circuit operations

Relay	Tip	Signal Ring	HT	Description
K1 + K3	G	+75V	-	Bad
K1	G	-48V	1	Single party
K2 + K3	-48V	G	2	Multi-party
K2	+75V	G	3	Coin
K1 + K2	G	G	-	Not performed/not ready
Note 1: Relay K4 is not assigned.				
Note 2: Column HT indicates the quantity of high tone bursts that are transmitted.				

Printer

The printer is not considered to be part of the LTP. It may be located in either the same central office as the LTP or in a remote location. It is used to print a hard copy of:

- automatic line testing results
- a set of lines that are posted
- manual line testing records as required

101 communication test line

The communication test line uses a NT5X30AA card mounted in a TM. The test line provides the interface between the network module and the LTP, and is used at the communication module to originate voice contact with a subscriber. The test line is activated when the TALKLTA command is entered at the LTPLTA level. Additional information concerning this command is provided in chapter 6.

If the LTP is located elsewhere than the switch, an interconnecting analog test line facility may be equipped with a dial-long line circuit and voice amplification. If an interconnecting digital facility is used, the test line interfaces with a digital line card.

ALT test equipment

Factors that affect ALT testing

The frequency at which ALT can completely test an office depends on the following factors:

- availability of test equipment
- number of physical lines in the office
- time available to perform testing on lines

The number of streams used by a scheduled test depends on the following factors:

- availability of test equipment
- test equipment to be used
- type of LCD
- size of the LEN range

The equipment used to test LCDs

The LCDs affect the way streams are defined because not all LCDs use the same test equipment to do a test. For example, LCMs use an LTE and TTU for a DIAG test while digital line modules (DLM) use a TTT. If a test is defined, but the LCD does not support the test type, LCD test sets are not created.

Table 8-38 maps the different LCDs against the ALT tests and shows the test equipment that is used for the test.

Table 8-38 Equipment used to test LCDs for each ALT test (Sheet 1 of 2)

LCD type	BAL test equipment	DIAG test equipment	LIT test equipment	SDIAG test equipment	CKTTST	Max. test sets
LM	TTU	LTE TTU	LTE	TTU	-	2
RLM	TTU	LTE TTU	LTE	TTU	-	2
LCM	TTU	LTE TTU	LTE	TTU	Yes	2
Legend:						
- The test is not performed for this LCD type.						
Yes The test is performed, but no test equipment is required.						

Table 8-38 Equipment used to test LCDs for each ALT test (Sheet 2 of 2)

LCD type	BAL test equipment	DIAG test equipment	LIT test equipment	SDIAG test equipment	CKTTST	Max. test sets
RLCM	TTU	LTE TTU	LTE	TTU	Yes	2
RLCM no RMM	TTU	TTU	-	TTU	Yes	2
RCT no SLT	-	-	-	-	-	1
RCT SLTA	-	LTE TTU	LTE	TTU	-	1
RCT SLTD	-	SLTD TTU	SLTD	TTU	-	1
RCS	-	TTU Vert	LTE	RCU equipment	-	1
RCU	-	TTU	LTE	RCU equipment	-	1
RCU no Vert	-	TTU	-	RCU equipment	-	1
DLM	-	TTT	-	-	-	1
Legend:						
- The test is not performed for this LCD type.						
Yes The test is performed, but no test equipment is required.						

Test equipment availability

Some of the test equipment used for ALT is also used by other maintenance applications, either as a single or combined requirement:

- ATT (automatic trunk testing) uses trunk test equipment (TTE) to perform a trunk member test on a trunk group in the office. This uses a scheduled system to run tests automatically as well as manually. The ATT only allows a maximum of 15 ATT tests to run simultaneously. This limit sets the amount required of test equipment.
- TTP (trunk test position) uses TTEs on a MAP by MAP basis for manual tests. The amount of test equipment required for this application depends

on the number of operating company personnel expected to use the TTP level simultaneously.

- LTP (line test position) uses LTEs, TTEs and other external test equipment such as MONTALKs, HSETs, and metallic test access drivers for manual testing. Test equipment requirements are similar to the TTP requirements.
- Line shower queue is a single-line application that uses LTEs, TTEs and other external test equipment such as metallic test access drivers.
- Trunk shower queue/audit uses TTE equipment and involves a maximum of 17 trunk diagnostic requests.
- Other processes are call processing related and involve testing of suspected single circuits. Usually a sufficient spare or unused equipment is available for these. Some typical examples are
 - repeated call failure attempts using a receiver
 - repeated call failure attempts on a trunk member
 - incoming trunk testline tests
 - dialable tones
 - common channel system signalling terminal modem interface card diagnostic (CCIS6 and CCITT6 only)

ALT test equipment recommendations

The more equipment available for automatic line testing, the more frequently lines will be tested.

The following provisioning calculations require a *line weighting factor*. The value used can be any value, but 5120 is recommended (5120 lines equals eight LMs/LCMs) for tests involving LTEs, and 2560 is recommended for TTE-only tests. A line-weighting factor is used to determine how much test equipment is required for ALT testing.

LTE provisioning LCDs are grouped by their site name within an office and with verticals on the metallic test access (MTA) matrix. This relationship governs the LTE requirements of an office.

LTEs are provisioned two ways (table MTAHORIZ)

1. Not for ALT use (rover LTE). The LTE is datafilled to support all verticals for a site for manual and other line-testing processes. The rover LTE should not be made available for ALT use.
2. For ALT use. The LTE is datafilled in table MTAHORIZ to support some or all the verticals for a site (see *Customer Data Schema*, 297-1001-451). The prime function of the LTE is to be used for ALT. When not in use by ALT, the LTE can be used by manual testing.

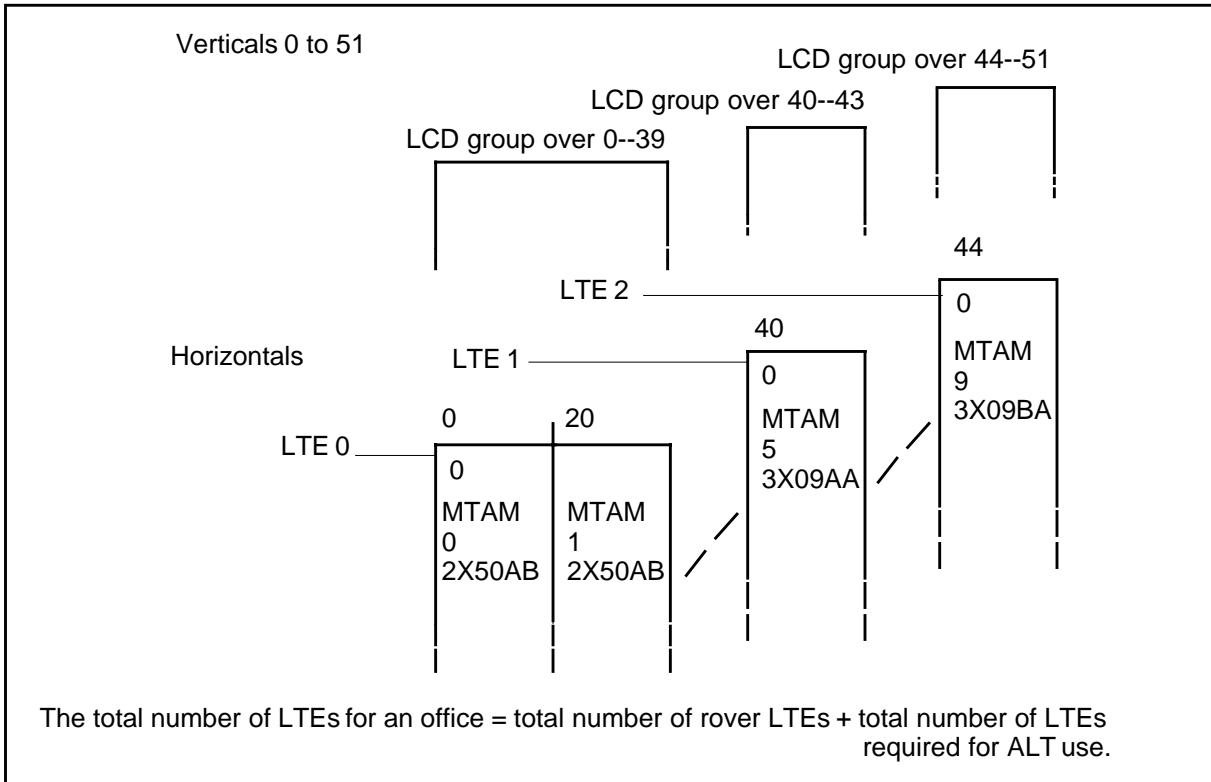
In some cases more than one site can share the same test equipment if the sites are located in the same building. For example, site REM1 and site REM2 could both be in the same building.

For the purpose of calculation, LCDs which use the same line test equipment should be grouped together and known as an LCD group.

Note: Where a single LCD is required to have its own LTE, it should be considered an LCD group. For example, an OPM RLCM requires an LTE for outside plant module (OPM) battery maintenance.

Figure 8-64 shows the relationship of verticals and LCD groups to line test equipment.

Figure 8-64 Relationship of verticals and LCDs to LTE



Two LTEs in each LCD group should be provisioned for simultaneous use of LTP and shower queue while ALT is running. Where the number of lines for an LCD group exceeds 20 000 lines, extra rover LTEs should be considered.

Note: It is recommended that at *least* one LTE in each LCD group be provisioned as a rover and not be available to ALT. The provisioning of a rover to a single LCD site such as an OPM is not practical.

Total no. of LTEs required for ALT use = the sum of all LTEs required for ALL LCD groups

The number of LTEs required for an LCD group is calculated as follows:

1. Calculate the number of lines for the LCD group.
 - For each vertical in the LCD group calculate the maximum number of lines for each LCD on the vertical (table MTAVERT).
 - Sum the maximum number of lines for each LCD on the vertical. This equals the maximum number of lines on the vertical.
 - Adjust the number of lines on the vertical to be not greater than the *line weighting factor*.
 - Use the smaller of either the *maximum number of lines on the vertical* or the *line weighting factor*.
 - Add to *the number of lines for LCD group*
2. Calculate the LTEs required for the LCD group.

$\frac{\text{Number of lines for LCD group}}{\text{group line weighting factor}} + 1 = \text{number of LTEs required for LCD}$

RCTs, RCUs and RCSs use only one vertical.

Sample LTE calculation The example in Table 8-39 involves different LCD types. (Values have been calculated and placed in the table).

This section shows the application of the stream calculation as it is applied to the LCD group shown in Table 8-39.

1. Calculate the number of lines for LCD group as shown in Table 8-39.

Table 8-39 Sample LTE calculations

Vertical	Number and type of LCD	Max # lines on vertical	Adjustment to # lines on vertical
a	LCM 0 0 0-9	320	320
b	LCM 0 0 10-19	320	320
c	LCM 0 1 0-9	320	320
d	LCM 0 1 10-19	320	320
e	RCU 1 0	608	608
f	RCS 1 0-6	672	672
g	RCU 2 0-8	5472	5120
h	RCT 5 0-9 RCT 6 0-5	4096	4096
i	RCS 3 0-1	192	192
j	RCS 4 0	96	96
Total number of lines over the ten verticals			12064

2. LTEs required for LCD group is then calculated as follows:

$$\frac{12064}{5120} + 1 = 3 \text{ LTEs required for LCD group}$$

Three LTEs should be provided for the example shown in Table 8-40. This results in three streams being calculated because the LTEs support the LCDs. This is shown in Table 8-41, "Test equipment available" on page 8-174.

Table 8-40 LCD group broken down into LCD test set (Sheet 1 of 3)

Vertical	LCD test set #	LCD	Max # LENS
a	0	LCM 0 0 drawers 0-9	320
b	1	LCM 0 0 drawers 10-19	320
c	2	LCM 0 1 drawers 0-9	320

Table 8-40 LCD group broken down into LCD test set (Sheet 2 of 3)

Vertical	LCD test set #	LCD	Max # LENS
d	3	LCM 0 1 drawers 10-19	320
e	4	RCU 1 0	608
	5	RCS 1 0	96
	6	RCS 1 1	96
	7	RCS 1 2	96
f	8	RCS 1 3	96
	9	RCS 1 4	96
	10	RCS 1 5	96
	11	RCS 1 6	96
	12	RCU 2 0	608
	13	RCU 2 1	608
	14	RCU 2 2	608
g	15	RCU 2 3	608
	16	RCU 2 4	608
	17	RCU 2 5	608
	18	RCU 2 6	608
	35	RCT 6 4	256
	36	RCT 6 5	256
	19	RCU 2 7	608
	20	RCU 2 8	608
	21	RCT 5 0	256
	22	RCT 5 1	256
	23	RCT 5 2	256
	24	RCT 5 3	256
	25	RCT 5 4	256
	26	RCT 5 5	256

Table 8-40 LCD group broken down into LCD test set (Sheet 3 of 3)

Vertical	LCD test set #	LCD	Max # LENS
h	27	RCT 5 6	256
	28	RCT 5 7	256
	29	RCT 5 8	256
	30	RCT 5 9	256
	31	RCT 6 0	256
	32	RCT 6 1	256
	33	RCT 6 2	256
	34	RCT 6 3	256
i	37	RCS 3 0	96
	38	RCS 3 1	96
j	39	RCS 4 0	96

Table 8-41 Test equipment available

Test Stream #	Test Equipment
0	LTE a & TTU x
1	LTE b & TTU y
2	LTE c & TTU z

By combining the information from Table 8-39 and 8-40, the relationship between LCD test sets and test streams can be identified. This relationship is shown in Table 8-42.

Table 8-42 LCD test set and stream relationship (Sheet 1 of 3)

LCD test set #	LCD	Max # LENS	Test stream relationship 0 1 2
0	LCM 0 0 drawers 0-9	320	Y Y Y
1	LCM 0 0 drawers 10-19	320	Y Y Y
2	LCM 0 1 drawers 0-9	320	Y Y Y

Table 8-42 LCD test set and stream relationship (Sheet 2 of 3)

LCD test set #	LCD	Max # LENS	Test stream relationship
			0 1 2
3	LCM 0 1 drawers 10-19	320	Y Y Y
4	RCU 1 0	608	Y Y Y
5	RCS 1 0	96	Y Y Y
6	RCS 1 1	96	Y Y Y
7	RCS 1 2	96	Y Y Y
8	RCS 1 3	96	Y Y Y
9	RCS 1 4	96	Y Y Y
10	RCS 1 5	96	Y Y Y
11	RCS 1 6	96	Y Y Y
12	RCU 2 0	608	Y Y Y
13	RCU 2 1	608	Y Y Y
14	RCU 2 2	608	Y Y Y
15	RCU 2 3	608	Y Y Y
16	RCU 2 4	608	Y Y Y
17	RCU 2 5	608	Y Y Y
18	RCU 2 6	608	Y Y Y
19	RCU 2 7	608	Y Y Y
20	RCU 2 8	608	Y Y Y
21	RCT 5 0	256	Y Y Y
22	RCT 5 1	256	Y Y Y
23	RCT 5 2	256	Y Y Y
24	RCT 5 3	256	Y Y Y
25	RCT 5 4	256	Y Y Y
26	RCT 5 5	256	Y Y Y

Table 8-42 LCD test set and stream relationship (Sheet 3 of 3)

LCD test set #	LCD	Max # LENs	Test stream relationship
			0 1 2
27	RCT 5 6	256	Y Y Y
28	RCT 5 7	256	Y Y Y
29	RCT 5 8	256	Y Y Y
30	RCT 5 9	256	Y Y Y
31	RCT 6 0	256	Y Y Y
32	RCT 6 1	256	Y Y Y
33	RCT 6 2	256	Y Y Y
34	RCT 6 3	256	Y Y Y
35	RCT 6 4	256	Y Y Y
36	RCT 6 5	256	Y Y Y
37	RCS 3 0	96	Y Y Y
38	RCS 3 1	96	Y Y Y
39	RCS 4 0	96	Y Y Y

The LCD test sets are then grouped based on the MTA connectivity. The group test sets are shown in Table 8-43.

Table 8-43 Group test sets (Sheet 1 of 3)

Test set # Group	LCD	LCD	Max # LENs	Test stream relationship
				0 1 2
0	0	LCM 0 0 drawers 0-9	320	Y Y Y
1	1	LCM 0 0 drawers 10-19	320	Y Y Y
2	2	LCM 0 1 drawers 0-9	320	Y Y Y
3	3	LCM 0 1 drawers 10-19	320	Y Y Y
4	4	RCU 1 0	608	Y Y Y
5	5	RCS 1 0	672	Y Y Y

Table 8-43 Group test sets (Sheet 2 of 3)

Test set # Group	LCD	LCD	Max # LENs	Test stream relationship 0 1 2
6	6	RCS 1 1	672	Y Y Y
	7	RCS 1 2	672	Y Y Y
	8	RCS 1 3	672	Y Y Y
	9	RCS 1 4	672	Y Y Y
	10	RCS 1 5	672	Y Y Y
	11	RCS 1 6	672	Y Y Y
	12	RCU 2 0	5472	Y Y Y
	13	RCU 2 1	5472	Y Y Y
	14	RCU 2 2	5472	Y Y Y
	15	RCU 2 3	5472	Y Y Y
7	16	RCU 2 4	5472	Y Y Y
	17	RCU 2 5	5472	Y Y Y
	18	RCU 2 6	5472	Y Y Y
	19	RCU 2 7	5472	Y Y Y
	20	RCU 2 8	5472	Y Y Y
	21	RCT 5 0	4096	Y Y Y
	22	RCT 5 1	4096	Y Y Y
	23	RCT 5 2	4096	Y Y Y
	24	RCT 5 3	4096	Y Y Y
	25	RCT 5 4	4096	Y Y Y
	26	RCT 5 5	4096	Y Y Y
	27	RCT 5 6	4096	Y Y Y
	28	RCT 5 7	4096	Y Y Y
	29	RCT 5 8	4096	Y Y Y

Table 8-43 Group test sets (Sheet 3 of 3)

Test set # Group	LCD	LCD	Max # LENs	Test stream relationship
				0 1 2
	30	RCT 5 9	4096	Y Y Y
	31	RCT 6 0	4096	Y Y Y
	32	RCT 6 1	4096	Y Y Y
	33	RCT 6 2	4096	Y Y Y
	34	RCT 6 3	4096	Y Y Y
	35	RCT 6 4	4096	Y Y Y
	36	RCT 6 5	4096	Y Y Y
8	37	RCS 3 0	192	Y Y Y
	38	RCS 3 1	192	Y Y Y
9	39	RCS 4 0	96	Y Y Y

Once the group test sets are determined, assigning the group test sets to streams is done as follows:

- The group test set with the highest number of LENs to test is selected to be assigned. If there are two or more with the same number of LENs, the first one encountered is assigned.
- The group test set just selected is assigned to the test stream which:
 - supports the selected group test set
 - has the least number of LENs assigned

If two or more test streams satisfy the above two requirements, the group test set is assigned to the first test stream encountered.

- The number of LENSs to test in the stream is increased by the number of LENSs in the group test set.
- The process is repeated until all group test sets have been assigned as shown in Table 8-44.

Table 8-44 Group test set assignment

Stream #		Test group assignment									
		0	1	2	3	4	5	6	7	8	9
0	Group to test	6									
	# of LENSs	5472									
	Total # of LENSs	5472									
1	Group to test		7								
	# of LENSs		4096								
	Total # of LENSs		4096								
2	Group to test			0	1	2	3	4	5	8	9
	# of LENSs			320	320	320	320	608	672	192	96
	Total # of LENSs			320	640	960	1280	1888	2560	2752	2848

TTE Provisioning There are two types of trunk test equipment:

- TTU
- TTT

TTU calculations There is one TTU for each LTE in the office. Additional TTUs are required where the test type for LCDs does not use an LTE. The following calculation is for each ALT test type which uses only TTUs.

1. Calculate the maximum number of lines involved for each test type which uses TTUs (all LCD lines in the office which support the test type and use TTUs). This equals the *number of lines in the office for test type & LCD*.
2. The formula for calculating the number of TTUs for each ALT test type is as follows:

$$\frac{\text{Number lines in office for test type \& LCD}}{\text{line weighting factor}} + 1 = \text{number TTUs for test type}$$

3. Where test types are expected to run concurrently, TTUs for test types should be added. Otherwise, use the highest number of TTUs for the test type.

Note: Consideration should be given to the trunk usage of TTUs expected to be used concurrently with ALT. For example, ATT, trunk shower queue/audit and *Other Processes*. These are extra TTUs.

Sample TTU calculation Using the same LCD group as discussed in "LTE provisioning" earlier in this chapter, the calculations are made as shown in Table 8-45.

1. Calculate the maximum number of lines involved for each test type which uses TTUs.

Table 8-45 Example of TTU calculation

Number and type of LCD	# of lines	Test type uses TTUs only		
		BAL	DIAG	SDIAG
LCM 0 0 0-9	320	320	-	320
LCM 0 0 10-19	320	320	-	320
LCM 0 1 0-9	320	320	-	320
LCM 0 1 10-19	320	320	-	320
RCU 1 0	608	-	608	-
RCS 1 0-6	672	-	672	672
RCU 2 0-8	5472	-	5472	-
RCT 5 0-9	4096	-	-	4096
RCT 6 0-5				
RCS 3 0-1	192	-	192	192
RCS 4 0	96	-	96	96
Totals		1280	7040	6336

2. The results of the calculations are:

BAL	DIAG	SDIAG
$\frac{1280}{2560} + 1 = 1$	$\frac{7040}{2560} + 1 = 3$	$\frac{6336}{2560} + 1 = 3$

3. If the test types are to run concurrently then the sum of TTUs means seven TTUs are required. Otherwise, the highest is used and three TTUs are required.

TTT Calculations TTTs are required where the test type for LCDs does not use an LTE. The following calculation is for each ALT test type which uses only TTTs

1. Calculate the maximum number of lines involved for each test type which uses TTTs (all LCD lines in office which support the test type and use TTTs). This equals the *number of lines in the office for test type & LCD*.
2. The formula for calculating the number of TTTs for each ALT test type is as follows:

$\frac{\text{Number lines in office for test type \& LCD}}{\text{line weighting factor}} + 1 = \text{Number TTTs for test type}$
--

3. Where test types are expected to run concurrently, TTTs for test types should be added. Otherwise, use the highest number TTTs for test type.

Note: Consideration should be given to the trunk usage of TTTs expected to be used concurrently with ALT; for example, ATT, trunk shower queue/audit and other processes are extra TTTs.

ALT office parameters

Office parameters ALT_TTU_USAGE_PERCENTAGE and ALT_TTT in table OFCENG should reflect the number of TTUs and TTTs available when ALT starts scheduled tests.

For manual ALT test equipment has to be available at the time of the request. If other applications are using test equipment, manual tests will take longer to complete. If ALT manual testing conflicts with ALT scheduled tests, the OVRIDE command can be used to override a scheduled test for a given period.

When a scheduled ALT test is defined, the number of streams required is calculated based on the existing test equipment and LCDs. If new equipment is added which could be included in an existing scheduled ALT test, the existing tuple must be deleted and readded to include the new equipment. Otherwise, the initial stream calculation remains.

If equipment is removed from a switch, it is not removed from existing scheduled ALT test stream information. If the equipment is test equipment, a stream is unable to run and a scheduled ALT test would never be completed. Deleting and readding the scheduled ALT test tuple recalculates the streams without including the removed equipment. If the equipment removed is an LCD, the test stream determines that the LCD is no longer present and does not test it.

It is advised that the tuples in ALTSCHED which affect the LCD be deleted and readded so the LCD is excluded. This results in a more efficient scheduled ALT test.

Note: When the stream and LCD test set calculations are done, TTUs and TTTs in INB states are not included in the TTEs available.

Office parameter CIRCUIT_TEST_NUMBER_MESSAGES in table OFCVAR has a range of 1 through 50 messages. The parameter is initially set to 10 messages. This parameter is only available if the keyset options are available in the software load.

The CIRCUIT_TEST_NUMBER_MESSAGES parameter is also used as the default value if no value is specified for the number of messages to send for the CKTTST command at the LTPMAN level and the ALTCKTTST level.

ALT data schema

Table MTAHORIZ is modified for *L* selectors only. A new field is added for this selector which indicates the LTE can be used by ALT. The purpose of this is to allow LTE to be available for LTP work when ALT has the remaining test equipment.

LTEs are provisioned, then made available for use to ALT by setting the ALTUSE refinement of the *L* selection in table MTAHORIZ. If ALT is not actively using an LTE, the LTE is available to the other processes such as the LTP. For details about table MTAHORIZ, see data schema section of *Translations Guide*.

Automatic line testing restrictions

The number of ALT users is limited to 16.

Any posted scheduled TESTID disappears when the command QUIT or the command string BREAK_HX is used to exit from an ALT menu sublevel. The schedule TESTID can be posted again if it is stored in memory (table ALTSCHED).

When ALT scheduled tests are being defined and then placed into table ALTSCHED (either by table control or the ALT sublevels), the following are not checked:

- The clash between times and LEN ranges occurs when the same LENs are expected to run at the same time. This clash is identified when some streams cannot run and the LENs are the same as the LENs being tested.
- The contention for line test equipment occurs when the same line test equipment is required for two or more TESTIDs during the same time spans.

- The number of ALT test processes being exceeded at any given time.
- The amount of test equipment required.

When test equipment is diagnosed, any external equipment is not diagnosed (such as MTA drivers and subscriber loop tests digital [SLTD]) because of existing connections being interfered with or because the diagnostic is not being designed to be performed by ALT.

The stop and start times have a restriction which prevents you from entering a scheduled that exceeds 7 days.

Single provisioned LTE with remote LCDs cannot interrupt the vertical because the LTE cannot be seized before the MTA (metallic test access) crosspoint connection is determined.

When many scheduled tests are datafilled to run at the same time, any audit start up can request that ALL TESTIDs be started. This sends many messages to the ALT tester. The ALT tester can only receive a certain number of messages (approximately 200). Once the limit is met, no new requests are processed until the existing requests are processed.

9 Troubleshooting chart

The following alarm clearing chart provides operating company personnel with easy access to procedures for clearing lines subsystem alarms. For an explanation of critical, major, and minor alarms, refer to Table 1-3, "Call processing alarms" on page 1-30. Table 1-5, "Lines subsystem alarm status codes" on page 1-31 describes the alarm status codes that occur in the display banner at the top of the MAP display.

9-2 Troubleshooting chart

More complete alarm clearing and troubleshooting methods for lines are provided in *Trouble Locating and Clearing Procedures*.

Table 9-1 Lines alarm clearing (Sheet 1 of 3)

Alarm condition	Possible cause	Action
Critical	The number of alarms reaches or exceeds the critical class threshold.	<p>Perform the following steps:</p> <ol style="list-style-type: none">1. Access the LTP level and enter the ALMSTAT command. Read the number of failures under the Current column and note the type of failure.2. Post the line or set of lines which have been identified as faulty.3. Determine the PEC of the line card in the control position by entering the CKTLOC command.4. Busy the line.5. Test the line by entering the DIAGN command.6. If the test passes, return the line to service.7. If the test fails, determine if the fault is in the line card or in the loop.8. If the fault is in the loop, escalate to outside lines maintenance personnel.9. If the fault is in the line card, replace the card. Test the new card; when it passes, return it to service.10. Bring the next line in the posted set to the control position using the command string NEXT_P.11. Identify the PEC of the line card using the CKTLOC command.12. Repair the line using the relevant procedures found in the <i>Trouble Locating and Clearing Procedures</i>.

Table 9-1 Lines alarm clearing (Sheet 2 of 3)

Alarm condition	Possible cause	Action
Major	The number of alarms reaches or exceeds the major class threshold, but is less than the critical class threshold.	<p>Perform the following steps:</p> <ol style="list-style-type: none"> 1. Access the LTP level and enter the ALMSTAT command. Read the number of failures under the Current column and note the type of failure. 2. Post the line or set of lines which have been identified as faulty. 3. Determine the PEC of the line card in the control position by entering the CKTLOC command. 4. Busy the line. 5. Test the line by entering the DIAGN command. 6. If the test passes, return the line to service. 7. If the test fails, determine if the fault is in the line card or in the loop. 8. If the fault is in the loop, escalate to outside lines maintenance personnel. 9. If the fault is in the line card, replace the card. Test the new card; when it passes, return it to service. 10. Bring the next line in the posted set to the control position using the command string NEXT_P. 11. Identify the PEC of the line card using the CKTLOC command. 12. Repair the line using the relevant procedures found in the <i>Trouble Locating and Clearing Procedures</i>.

Table 9-1 Lines alarm clearing (Sheet 3 of 3)

Alarm condition	Possible cause	Action
Minor	The quantity of alarms reaches or exceeds the minor class threshold, but is less than the major class threshold.	<p>Perform the following steps:</p> <ol style="list-style-type: none"> 1. Access the LTP level and enter the ALMSTAT command. Read the number of failures under the Current column and note the type of failure. 2. Post the line or set of lines which have been identified as faulty. 3. Determine the PEC of the line card in the control position by entering the CKTLOC command. 4. Busy the line. 5. Test the line by entering the DIAGN command. 6. If the test passes, return the line to service. 7. If the test fails, determine if the fault is in the line card or in the loop. 8. If the fault is in the loop, escalate to outside lines maintenance personnel. 9. If the fault is in the line card, replace the card. Test the new card; when it passes, return it to service. 10. Bring the next line in the posted set to the control position using the command string NEXT_P. 11. Identify the PEC of the line card using the CKTLOC command. 12. Repair the line using the relevant procedures found in the <i>Trouble Locating and Clearing Procedures</i>.

10 Advanced troubleshooting procedures

There are no advanced trouble locating procedures associated with the lines subsystem.

Task list

Not applicable

Advanced trouble locating procedures

Not applicable

Powering up lines

Not applicable

Powering down lines

Not applicable

Common procedures

Not applicable

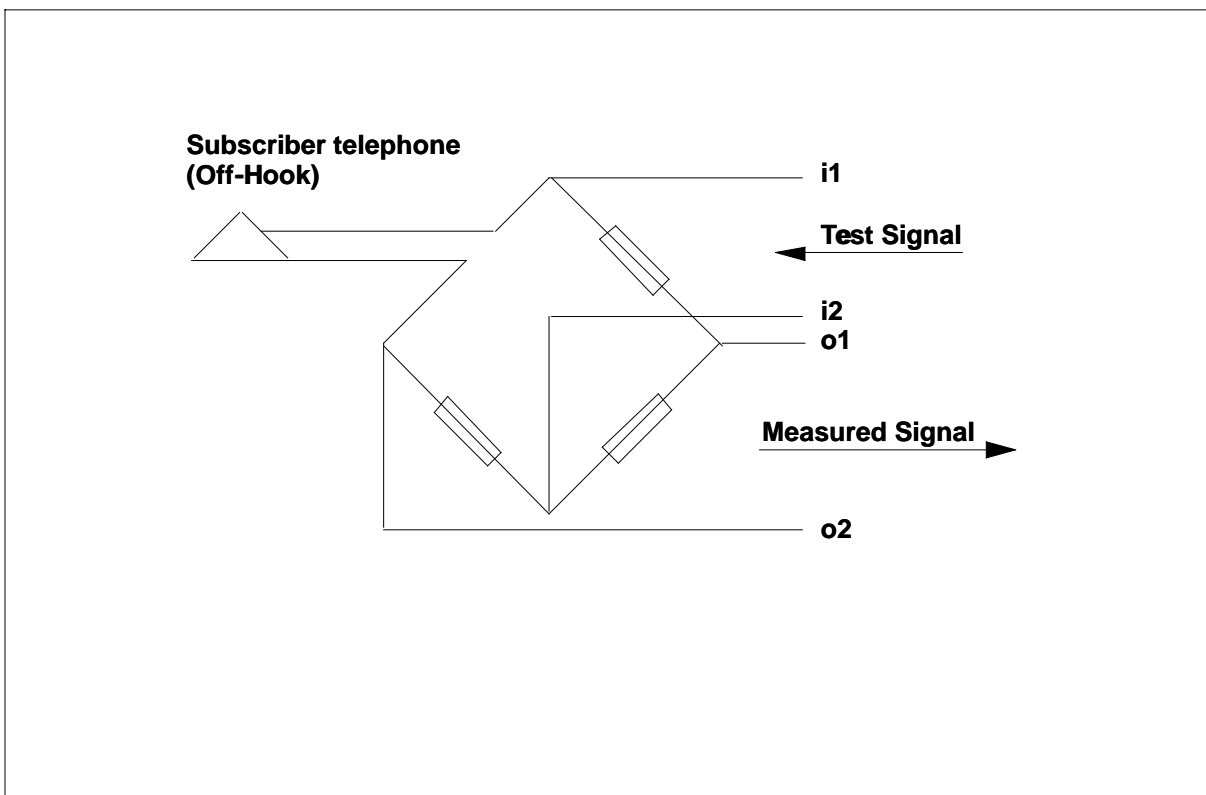
11 Off Hook balance test

This chapter provides a detailed description of an automatic line balancing feature, the Off Hook Balance Test (OHBT).

Description of the Off Hook balance test

The OHBT consists of the application of a test signal to a line hybrid circuit while the telephone set is off-hook and the subsequent measurement of the signal reflected outward from this circuit (as illustrated in Figure 11-1).

Figure 11-1 Balancing the hybrid circuit



The purpose of the OHBT is to balance the hybrid circuit as it is seen from the incoming path (i1-i2) and from the outgoing path (o1-o2) as much as possible

by utilizing a template in the line card. Selection of the optimal template is based upon a template selection algorithm which makes the selection based upon the energy of the signal reflected from the hybrid circuit.

The results of OHBT automatic line balancing are:

- improvement in voice transmission quality
- elimination of singing
- elimination of undesired echo effects

To achieve these results, the circuit must be balanced when the subscriber's equipment is off-hook. This condition makes it necessary to deal with interactions of the OHBT with call processing and other features which may be or become present. Some incompatibilities with entities involved in establishing a call may also interfere with the operation of the OHBT.

The OHBT feature is only supported on Line-to-Line, Line-to-Trunk and Trunk-to-Line calls. The test will run successfully only if both parties on a call are handled by either standard lines or standard trunks.

The OHBT can be carried out for the following circuit configurations:

- loaded
- non-loaded
- 900 ohm + 2.1 uF

The OHBT feature requires at least one Digital Test Unit (DTU) or Extended Digital Test Unit (EDTU) downloaded for OHBT. A maximum of twenty DTU/EDTU can be downloaded for OHBT in an office.

Operation of OHBT automatic line balancing

The OHBT feature is administered using table OHBTADMN for an entire office or table OHBTINV for individual lines.

Table OHBTADMN sets office-wide parameters for the OHBT and contains a list of Digital Test Unit (DTU) resources available for the OHBT.

Table OHBTINV contains the OHBT information for each individual line. Table OHBTINV is datafilled automatically when table LNINV is datafilled. Entries cannot be added to or deleted from table OHBTINV. As lines are added to or deleted from table LNINV, corresponding entries are added to or deleted from table OHBTINV.

Most changes to this table are made by using the CI command SCHDOHBT. The following OHBT CI commands are available:

Table 11-1

SCHDOHBT	Schedule Lines for OHBT Allows a series of lines within one peripheral module to be scheduled for the OHBT or for all supported lines within the office to be scheduled for the OHBT.
QOHBT	Query OHBT Information for Lines Provides detailed information on lines using the OHBT.
QDTU	Query Digital Test Units Provides information of DTUs datafilled (downloaded) for the OHBT as well as the mechanism forcing DTU maintenance to run.

When enabled, the OHBT feature is invoked after all the digits for the destination have been dialed but just before the connection between the calling and called parties is established. The OHBT is performed on either the originating line (referred to as OHBT on Origination) or the terminating line (referred to as OHBT on Termination).

The time interval during which the OHBT is performed can be:

- after digits dialed but before call answered (OHBT on Origination)
- when the call is answered (OHBT on Termination)
- during a silent time while the call is in progress (OHBT on Silence)

When Line A calls Line B, one of the activities as described in Table 11-2 will occur.

Table 11-2 OHBT configurations (Sheet 1 of 2)

Case	Line A	Line B	Feature Activity
1	OHBT on Origination	OHBT on Termination	OHBT runs on A
2	OHBT on Origination	OHBT on Termination	OHBT runs on A
3	OHBT on Origination	OHBT on Silence	OHBT runs on A
4	OHBT on Termination	OHBT on Origination	OHBT won't run
5	OHBT on Termination	OHBT on Termination	OHBT runs on B
6	OHBT on Termination	OHBT on Silence	OHBT runs on B

Table 11-2 OHBT configurations (Sheet 2 of 2)

Case	Line A	Line B	Feature Activity
7	OHBT on Silence	OHBT on Origination	OHBT won't run
8	OHBT on Silence	OHBT on Termination	OHBT runs on B
9	OHBT on Silence	OHBT on Silence	OHBT runs on B

Table 11-2 is valid for all intraoffice configurations. For interoffice configurations (those involving lines in separate offices), the OHBT may run on both lines in Cases 2, 3, 8, and 9 provided the far end office is a DMS-100 switch with the OHBT feature active. The remaining Cases are valid for both intraoffice and interoffice configurations.

The following sequence of processes occur during off hook balance testing:

1. Ensure all conditions for the call to be established are present.
2. Hold the connection.
3. Get and reset the equipment (DTUs or EDTUs).
4. Apply the OHBT.
5. Get the results.
6. Determine the recommended balance for the circuit.
7. Revert the call to call processing as it was at the beginning.

The basic indication that the OHBT is running is an audible scratchy test signal. Depending upon the type of OHBT schedule, it may be heard after digits are dialed (OHBT on Origination), after the terminating line answers (OHBT on Termination), or when a silent interval occurs during a preset time interval (usually 10 seconds) from the start of the call (OHBT on Silence).

Hearing the test sound over a headset is no indication that the OHBT has run successfully. It may be aborted or not finalized due to an interaction with another feature.

Interaction of OHBT with other features

Due to the manner, time interval and specific time the OHBT feature is invoked, remains in effect and operates, it may interfere with other features, including itself, or it may be affected by other features.

OHBT affecting other features

For intraoffice calls:

- OHBT takes priorities into account. OHBT leaves Feature Processing Environment (FPE) to a higher priority feature. OHBT is the lowest priority feature.
- If another feature is active at the time OHBT is to be invoked, OHBT is disabled on this call only. It will be attempted on the very next call.
- If a calling party is scheduled for OHBT on Origination and the called party is scheduled for OHBT on Termination on the same call, OHBT on Origination is given priority.
- If the calling party and the called party have the same line equipment number (LEN), OHBT will not be performed on either party.
- A call which would normally be intraswitched will be rerouted via Computing Core (CC) like an interswitched call.
- FLASH_MSG interference will cause OHBT to abort without passing the FLASH_MSG along for further processing. The FLASH_MSG must be reinitiated.

For interoffice calls:

- OHBT will not run on an EA_CALL (Equal Access Call).
- If the calling party is scheduled for OHBT on Origination and a call is made to a line with a Test Access Trunk (TAT) Trigger, OHBT is not invoked. This is because an Advance Intelligent Network (AIN) feature is active in FPE during the time OHBT is to be invoked.
- OHBT is aborted due to ISUP message interference during the OHBT process. OHBT returns the call to call processing and passes the abort message to it for further action.
- OHBT scheduled to run on Origination is disabled in order to allow the Calling Name Display (CNAMD) feature run in the same time interval and query information about the calling party. If OHBT were to be run during the same time it would prevent the CNAMD feature from running successfully. OHBT is enabled after the CNAMD call completes.
- OHBT scheduled to run on Origination is disabled on Other Common Carrier (OCC) calls due to an off-hook state not being detectable by OHBT. OHBT is enabled after the OCC call completes.

Other features affecting OHBT

For all calls:

- OHBT will be aborted due to high noise on the line.
- OHBT will not run during office image dumps and when reset processes run.
- OHBT will not run on calls going through analog trunks.
- OHBT will not run on calls going through Multi Line Hunt (MLH) groups.
- OHBT will not run on calls going through Distributed Line Hunt (DLH) groups.
- OHBT will not run on E911 calls with or without treatment.
- OHBT will not run on calls going through an operator.
- OHBT will not run on calls going through an Attendant Console.
- OHBT will not run on calls going through an announcement.
- OHBT will not run on calls carried on a Dual Tone Multi Frequency (DTMF) Sender or Receiver.
- OHBT will not run on calls carried on a Maintenance Trunk Module (MTM). MTM does not support some of the supervision required by OHBT.
- OHBT will not run on calls carried on a Trunk Module 8 (TM8) peripheral. TM8 not support some of the supervision required by OHBT.
- OHBT may not run successfully on calls through ISUP trunks due to high volume of ISUP messages.
- OHBT on Origination will not run on lines connected to a channel bank. Channel banks use tones while setting up a call and these tones conflict with the OHBT tones.
- OHBT on Termination will not run on calls terminating on a pool of lines (such as a modem pool).
- OHBT on Termination will no run if an answer_msg is not generated. When the terminating line is in the toll-free call group of the originator, since no billing is required, an answer_msg will not be sent to Computing Core (CC). OHBT on Termination relies on an answer_msg to be invoked and therefore it will not run in this case.
- OHBT on Termination will not run until after the minimum charge duration set in table OFCENG has past.
- OHBT is sensitive to foreign (unexpected) messages. If any non-OHBT message is received, OHBT returns the call to call processing and passes the unexpected message to it for further action.

OHBT and BERT testing

If OHBT and Bit Error Rate Testing (BERT) are both required within the same peripheral or the same office, the load names identified in the following fields of table OFCVAR must be as follows:

- field DTULDINFO:
 - for the DTU the entry must be default BERT LOAD name.
- field DTUOHBTLD:
 - for the DTU the entry must be default OHBT LOAD name.
- field EDTULDFILE:
 - for the EDTU the entry must be default LOAD name.
- field MTULDINFO:
 - for the MTU the entry must be default LOAD name

If the fields of table OFCVAR do not contain the correct load names, neither the OHBT nor the BERT will function properly.

List of terms

ABS

automatic balance selection

ac

alternating current

AccessNode

Northern Telecom's service delivery vehicle within FiberWorld. *See* access vehicle.

access vehicle

One or more network elements that multiplex information (such as speech) from subscriber lines and transport it to a switching system.

Circuit-switched connections are established in the switching system, not in the access vehicle. The DMS-1 Urban is an example of an access vehicle. The S/DMS AccessNode is the access vehicle used for both integrated (connected with the DMS-100 switch) and nonintegrated configurations.

alarm (ALM)

A visual, audible, or both visual and audible signal used to alert staff to a condition requiring attention.

ALM

alarm

ALT

automatic line testing

alternating current (ac)

A current that reverses at regularly recurring intervals and that has alternately positive and negative values. The average value of the current over a period of time is zero.

ANI

automatic number identification

applique circuit

The carrier test reporting circuit that supports a mechanized loop tester (MLT) or line test desk (LTD) on carrier system lines. The applique circuit provides dc signals used to report line card test results to the MLT or LTD.

ASCII

American Standard Code for Information Interchange

ATT

automatic trunk testing

attenuation pad test

A test performed in conjunction with the trans-hybrid loss test. The attenuation pads in the line circuit pack are set for up to 2 dB loss. The transhybrid loss test is performed and the DMS-100 switch compares measured loss values for the reflected tones at each attenuation pad setting with established limits.

AUL

Automatic Lines

automatic balance selection (ABS)

A feature of the DMS-100 Family switching system that determines the balance network required on subscriber lines to prevent degradation of service through noise, echo, and singing on the subscriber line resulting from improper loop impedance matching. The ABS feature is implemented by performing a test of the cable pair while the subscriber line is in the idle state.

Automatic Lines (AUL)

A directory-number feature that can be assigned to individual directory numbers (DN), including the primary DN, on a Meridian business set (MBS).

automatic line testing (ALT)

Testing of both line circuits and the attached loops. In most situations, ALT is run on a large group of lines during a low-traffic period. *See also* extended diagnostic test, line insulation test, on-hook balance network test, short diagnostic test.

automatic line testing (ALT) level

The level of line maintenance accessed from the lines maintenance subsystem (LNS) level of the MAP terminal.

automatic number identification (ANI)

A system whereby a calling number is identified automatically and transmitted to the automatic message accounting (AMA) office equipment for billing. *See also* operator number identification.

automatic trunk testing (ATT)

A combination of hardware and software that provides the capability of automatic testing for outgoing trunks and the outgoing portions of two-way trunks.

batch change supplement (BCS)

A DMS-100 Family software release.

bay

A physical structure of the DMS-100 switch that houses equipment such as shelves, frame supervisory panels, and cooling units. *See also* frame, shelf.

BCS

batch change supplement

BER

bit error rate

BERT

bit error rate test

BIC

bus interface card

bipolar violation (BpV)

An error in the transmission of bipolar signals when two successive marks have the same polarity.

bit error rate (BER)

The number of received bits that are in error, relative to a specific number of bits received, expressed as a number and a power of 10.

bit error rate test (BERT)

A test that is used to measure the transmission quality of a loop. The BERT transmits a known bit pattern over a line and compares the reflected signal against the initial pattern.

business set

A control device with addressable points, for example, directory number keys, feature keys, or display units. These sets can support multiple simultaneous calls, premium voice features, and low-speed data service.

bus interface card (BIC)

A hardware interface that connects two 32-channel digroups to a maximum of 64 line cards. This card is located in the drawer of the line concentrating module.

busy signal

An audible signal, a flashing signal, or both:

- transmitted at 60 impulses per minute, indicating that the called number is unavailable.
- transmitted at 120 impulses per minute, indicating that all voice paths are temporarily unavailable.

busy tone

The signal that a called line is busy, indicated by the sound of a low tone of 480 Hz and a high tone of 620 Hz, transmitted simultaneously, with 60 interruptions per minute.

call

In a DMS switch, any demand to set up a connection through the switch. Also used as a unit of telephone traffic. Also known as a cue.

call processing (CP)

The software that handles the processes involved in setting up connections through the DMS-100 Family network between calling and called parties.

call processing busy (CPB)

The state in which call processing is taking place and the equipment involved cannot be seized for maintenance.

call processing deload (CPD)

The state in which a line is in use by a subscriber and a maintenance request to busy the equipment is pending. The state changes following completion of the call.

call processing ID (CPID)

The two-word identifier used to identify a member of an agency. It consists of a CP selector and an agent identifier.

call processing (CP) selector

In DMS call processing, a utility that is used to select the appropriate starter procedure according to the agent involved in the call.

call treatment

The treatment a call receives, which may be based on the priority of the call, circuit availability, the class of service of a subscriber's line, or other factors determined by the automatic switching equipment.

CALRS

Centralized Automated Loop Reporting System

CC

central control

CCC

central control complex

CCIS6

Common Channel Interoffice Signaling No. 6

CCITT

From the French for International Telegraph and Telephone Consultative Committee (Comite Consultatif International Telegraphique et Telephonique). The CCITT is one of the four permanent groups within the International Telecommunication Union (ITU). The CCITT is responsible for studying technical, operating, and tariff questions. This organization also prepares recommendations relating to telegraphy and telephony.

CCITT No. 6 Signaling (N6)

A standardized out-of-band (common channel) signaling system that is suitable for terminal working (inside the same world zone) and transit working (between world zones). N6 normally uses a 2.4-kb/s transmission rate. *See also* Common Channel Interoffice Signaling No. 6.

central control (CC)

A part of the NT40 processor that consists of the data processing functions with the associated data store (DS) and program store (PS).

central control complex (CCC)

The part of the DMS-100 Family switch that contains all the central control (CC) functions including the central message controller (CMC), CPU, program store (PS), and data store (DS).

central office (CO)

A switching office (SO) arranged for terminating subscriber lines and provided with switching equipment and trunks for establishing connections to and from other SOs. Also known as local office. *See also* end office, office classification.

central processing unit (CPU)

The hardware unit of a computing system that contains the circuits that control and perform the execution of instructions.

Centralized Automated Loop Reporting System (CALRS)

A support system that provides full automation of the telephone company repair service bureau operating environment. CALRS permits remote testing independent of transmission media and geographic locations.

CI

command interpreter

CLLI

common language location identifier

coin test

A test performed at the line test position line test access (LTPLTA) MAP level to check the operation of the coin collect and coin return mechanism of a coin station connected to the line in the control position.

command interpreter (CI)

A component in the Support Operating System (SOS) that functions as the main interface between machine and user. Its principal roles include the following:

- reading lines entered by a terminal user
- breaking each line into recognizable units
- analyzing the units
- recognizing command-item numbers on the input lines
- activating these commands

Common Channel Interoffice Signaling No. 6 (CCIS6)

A common channel signaling (CCS) system using analog trunks for the North American market. CCIS6 uses fixed-length signaling messages.

common language location identifier (CLLI)

A standard identification method for trunk groups in the form:

aaaa bb xx yyyy

Where:

aaaa=City code

bb=Province or state code

xx=Trunk group identifier

yyyy=Trunk number

See also short common language location identifier.

CP

call processing

CPB

call processing busy

CPD

call processing deload

CPU

central processing unit

cutoff relay test

A test in which the cutoff relay opens the tip and ring leads. When the cutoff relay is operated and a current is sent through the circuit, the dc voltage measurement between ring and ground leads should be zero.

data call tester line test position (DCTLTP)

The data call tester line test position is a sublevel of LTP.

data terminal equipment (DTE)

Equipment consisting of digital end instruments that convert user information into data signals for transmission or reconvert the received data signals into user information.

DGT

Digitone

datafill

The entry of data into tables.

data line card (DLC)

The line card that connects a Datapath loop to a data unit. The DLC is part of a line subgroup (LSG) in a line concentrating module (LCM). *See also* Datapath, line card, voice line card.

Datapath

Northern Telecom's system for providing direct circuit-switched digital data transmission through a DMS switch over existing telephone networks. Datapath also provides connectivity to public and private networks. Datapath functions with industry-standard data terminal equipment (DTE) and applications, using T-link rate adaptation protocol for communication.

data set

In data communication, an electronic device that provides an interface between a data processing machine and a telephone or telegraph line. Also known as modem.

data schema

The format of data for a particular database table.

data unit (DU)

Equipment that is used as a data interface, allowing data terminal equipment (DTE) to access the DMS-100 switch network. A DU can be configured as a desktop unit or as a rack-mounted component of the switch.

DCC

digroup control card

dial tone

A continuous audible tone sent to a subscriber to signify readiness of the DMS switch to receive digits.

dial tone speed recording (DTSR)

A measurement of the DMS-100 switch's ability to return dial tone within a specified time period after an off-hook signal is sent. The time can be set by the operating company.

Digital Multiplex System (DMS)

A central office (CO) switching system in which all external signals are converted to digital data and stored in assigned time slots. Switching is performed by reassigning the original time slots.

digital trunk controller (DTC)

A peripheral module (PM) that connects DS30 links from the network with digital trunk circuits. *See also* Austrian digital trunk controller, international digital trunk controller.

digital trunk equipment (DTE) frame

A frame containing up to two dual-shelf digital trunk controllers (DTC). *See also* ISDN digital trunk equipment.

Digitone (DGT)

A service-related telephony feature that allows address information to be generated from a telephone set in the form of dual-tone multifrequency (DTMF) signals by manually pressing nonlocking buttons. Also known as dual-tone multifrequency dialing.

digit test

A test performed at the line test position (LTP) MAP level that checks the quality of digits produced by the Digitone keypad of the station connected to the line in the control position.

digroup control card (DCC)

A circuit comprising part of the line concentrating module (LCM) unit control complex. DCC provides eight DS30A ports for connection to the network in the host LCM or to the host interface equipment (HIE) shelf in the Remote Line Concentrating Module (RLCM).

direct current (dc)

A practically nonpulsating unidirectional current in which the changes in value are either zero or so small that they can be ignored.

directory number (DN)

The full complement of digits required to designate a subscriber's station within one numbering plan area (NPA)—usually a three-digit central office (CO) code followed by a four-digit station number.

directory number hunt (DNH)

A service that permits calls to a busy line to be rerouted. Lines in the hunt group are searched in order of their directory numbers (DN), beginning with the DN dialed. *See also* preferential hunt.

distribution frame (DF)

- A hardware device that, on one side, provides metallic terminations for cables carrying incoming and outgoing voice paths to the peripheral modules (PM) and, on the other side, provides terminations for outside cables.
- A structure with terminations for connecting permanent wiring in such a manner that interconnection can be achieved readily by means of cross-connecting wires.

DLC

data line card

DMS

Digital Multiplex System

DMS-1

A digital subscriber carrier system serving up to 256 lines.

DMS-100

A member of a family of digital multiplexed switching systems. The DMS-100 is a local switch. *See also* DMS-100 Family of switches.

DMS-100 Family switches

A family of digital multiplexed switching systems, which includes the following: DMS-100, DMS-100/200, DMS-100 switching cluster, DMS-100 switching network, DMS-200, DMS-250, and DMS-300.

DMS-1R RCT

A remote concentrator terminal (RCT) providing a service for up to 256 subscriber lines. Acting as a remote switch, it concentrates subscriber line signals onto 24 or 48 digital transmission channels.

DMS-Bus

The messaging control component of the DMS SuperNode processor. The DMS-Bus components are a pair of message switches (MS).

DMS-Core

The call management and system control portion of the DMS SuperNode processor. The DMS-Core portion consists of a computing module (CM) and a system load module (SLM).

DN

directory number

DNH

directory number hunt

drawer

A sliding container within a shelf in the DMS-100 cabinet. A drawer contains components, such as cards, to which easy access is required for maintenance and service requests.

DT

Digitone. Preferred abbreviation is DGT.

DTC

digital trunk controller

DTE

digital trunk equipment; data terminal equipment

DTMF

dual-tone multifrequency (signaling)

DU

data unit

dual-tone multifrequency dialing

See Digitone.

dual-tone multifrequency (DTMF) signaling

A signaling method employing set combinations of two specific voice-band frequencies. One of these voice-band frequencies is selected from a group of four low frequencies, and the other is selected from a group of three or four relatively high frequencies.

EBS

electronic business set

echo return loss

Echo return loss is the weighted averages of the return losses in the frequency band from 400 through 3400 Hz. *See* return loss.

electromagnetic interference (EMI)

The phenomenon resulting when electromagnetic energy causes an unacceptable or undesirable response, malfunction, degradation, or interruption of the intended operation of the electronic equipment, subsystem, or system.

electronic business set (EBS)

A telephone set that provides subscribers with push-button access to various business features. Also known as electronic telephone set. *See also* Meridian business set.

EMI

electromagnetic interference

enhanced line concentrating module with ISDN (LCME)

A dual-unit peripheral module (PM) that terminates ISDN 2B1Q (two binary one quaternary) U-type (single slot) lines, ISDN S/T-type lines, POTS lines, electronic business set (EBS) lines, and Datapath lines. The LCME also provides access to the ISDN B-, D-, and M-channels. The LCME supports 480 POTS or EBS lines or 240 Datapath lines.

ERL

echo return loss

extended diagnostic test

A diagnostic run at the line test position or automatic line testing (ALT) levels of the MAP terminal. The extended diagnostic test checks a line card for correct operation.

FCOT

fiber central office terminal

fiber central office terminal (FCOT)

A component of the S/DMS AccessNode that terminates connections from service nodes and fiber optic transmission facilities from remote fiber terminals (RFT). The primary function of the FCOT is to convey traffic arriving on the fiber optic transmission facilities to the appropriate service nodes and to direct traffic arriving from the service nodes to the proper fiber optic transmission facilities.

FiberWorld

The Northern Telecom vision of global communications infrastructure for the 21st century—any media, anytime, anywhere, and for anyone.

flux cancellation

The cancellation of electromagnetic lines of force through the use of equal but opposing electromagnetic lines of force.

flux cancellation test

A test that checks the flux cancellation circuitry on the POTS or electronic business set (EBS) line card.

force release (FRLS)

A technique used at the trunk test position (TTP) to force the release of a posted trunk circuit. After release, the circuit can be manually busied and tested.

foreign exchange (FX)

A service that allows a telephone or a private branch exchange (PBX) to be served by a distant central office (CO), rather than by the CO in the immediate geographical area.

foreign exchange with battery (FXB)

A line card used in special-service connections that connects either to a subscriber (foreign exchange with battery station end (FXBS)) or to a piece of digital telephone equipment such as a channel bank before reaching the subscriber (foreign exchange with battery office end (FXBO)).

four-party line

A common line arranged to serve four main stations. Identification of each party is not automatic, and ringing selectivity is dependent upon central office (CO) ringing arrangements in accordance with the multiparty ringing service.

frame

- One complete cycle of events in time-division multiplexing. The frame usually includes a sequence of time slots for the various channels and extra bits, which are used, for example, for control or framing.
- A unit of hardware in a DMS switch that usually contains one bay but can contain two or more functionally related bays.

FRLS

force release

FX

foreign exchange

FXB

foreign exchange with battery

ground start line

A line circuit arrangement in which a dial tone is sent in response to a ground signal on the ring conductor applied by the calling station or private branch exchange (PBX). This process differs from the more common loop start configuration in which seizure is accomplished by bridging the tip and ring conductors.

host office

A central office (CO) equipped to control peripheral modules (PM) at remote sites.

IBERT

integrated bit error rate test

IBN

Integrated Business Network. Preferred term is Meridian Digital Centrex.

ICMO

incoming message overload

ILCM

international line concentrating module

impulses per minute (IPM)

Interruption rate for call progress tones or supervisory lamps.

incoming message buffer (IMB)

Registers that store control and data messages between components of the central control complex (CCC), network module controllers (NMC), and peripheral modules (PM). Each IMB is associated with the receive path of a message link and stores the message while the I/O message protocol is performed.

incoming message overload (ICMO)

An overload caused by a line card or business set sending messages at a high rate toward the line group controller (LGC) or line trunk controller (LTC).

input/output controller (IOC)

An equipment shelf that provides an interface between up to 36 I/O devices and the central message controller (CMC). The IOC contains a peripheral processor (PP) that independently performs local tasks, thus relieving the load on the CPU. *See also* IOC shelf.

integrated bit error rate test (IBERT)

A test that a MAP operator runs using an IBERT card to test the transmission quality of a selected data line. The card resides in the line drawer of a line concentrating module (LCM) and generates the bit stream for an IBERT. An IBERT can be used to test most types of lines connected to the DMS switch if the lines support the T-link protocol.

Integrated Business Network (IBN)

See Meridian Digital Centrex.

integrated services digital network (ISDN)

A set of standards proposed by the CCITT to establish compatibility between the telephone network and various data terminals and devices. ISDN is a fully digital network, in general evolving from a telephone integrated digital network. It provides end-to-end connectivity to support a wide range of services, including circuit-switched voice, circuit-switched data, and packet-switched data over the same local facility.

international line concentrating module (ILCM)

A three-processor peripheral module (PM) that acts as an interface between the international line group controller (ILGC) or international line trunk controller (ILTC) and up to 256 subscriber lines. *See also* line concentrating module.

IOC

input/output controller

ISDN

integrated services digital network

keyset

See key telephone set.

key telephone set (KTS)

A multiline telephone set in which lines can be selected or placed on hold using push buttons. Features of the system include pickup and holding, intercommunications, visual and audible signals, cutoff, exclusion, and signaling. Also known as keyset. *See also* Key Telephone System.

LCC

line class code

LCD

line concentrating device; liquid crystal display

LCM

line concentrating module

LCME

enhanced line concentrating module with ISDN

LDS

local digital switch

LEN

line equipment number

LED

light-emitting diode

LGC

line group controller

LGE

line group equipment

light-emitting diode (LED)

A solid-state device which emits light when the appropriate voltage is applied to it. The LEDs are used in the DMS-100 switch components as front panel indicators, and they are usually off when equipment status is normal.

line card

One of the line circuit (LC) cards in a line drawer. *See also* data line card, voice line card.

line class code (LCC)

An alphanumeric code that identifies the class of service assigned to a line.

line concentrating device (LCD)

The generic term for all modules such as line module, line concentrating module (LCM), remote line module (RLM), and remote concentrator SLC-96 (RCS) that can accommodate a subscriber line card.

line concentrating module (LCM)

A peripheral module (PM) that connects the line trunk controller (LTC) or line group controller (LGC) and up to 640 subscriber lines using two to six DS30A links. *See also* international line concentrating module.

line drawer (LD)

A hardware device in the line module (LM) and line concentrating module (LCM) that contains line circuit (LC) cards. *See also* line circuit.

line equipment number (LEN)

A seven-digit functional reference that identifies line circuits (LC). The LEN provides physical location information on equipment such as site, frame number, unit number, line subgroup (shelf), and circuit pack.

line group controller (LGC)

A peripheral module (PM) that connects DS30 links from the network to line concentrating modules (LCM). *See also* international line group controller.

line group equipment (LGE) frame

A single-bay frame containing line group controller (LGC) modules.

line insulation test (LIT)

In automatic line testing (ALT), a test performed on an idle subscriber line to check for insulation defects. The test is based on measurements of resistance.

line module (LM)

A peripheral module (PM) that provides speech and signaling interfaces for up to 640 subscriber lines. The LM consists of line drawers, a line module controller (LMC), and a frame supervisory panel (FSP).

lines maintenance subsystem (LNS)

A DMS-100 Family subsystem for maintenance of subscriber loops.

line subgroup (LSG)

A group of up to 32 line cards in a drawer of the line concentrating module (LCM). Each drawer contains two LSGs.

line test

A test performed at the LTPLTA (line test position line test access) MAP level that measures dc voltage, ac voltage, resistance, and capacitance on subscriber loops.

line test access (LTA)

- Access to either a line card or the subscriber loop associated with the line card for testing.
- A card in the remote carrier urban (RCU) that provides line test access.

line test unit (LTU)

A pair of circuit cards located in a maintenance trunk module (MTM). The LTU connects to the line circuits by means of metallic connections and performs tests on both the line circuitry and the subscriber loop.

line trunk controller (LTC)

A peripheral module (PM) that is a combination of the line group controller (LGC) and the digital trunk controller (DTC) and provides all the services offered by both. It supports line concentrating module (LCM) and AB trunks. *See also* international line trunk controller.

line trunk equipment (LTE) frame

Frame containing up to two dual-shelf line trunk controllers (LTC).

link

- In a DMS switch, a connection between any two nodes.
- A four-wire group of conductors providing transmit and receive paths for the serial speech or message data between components of DMS-100 Family switches. Speech links connect peripheral modules (PM) to the network modules (NM). Message links connect NM controllers or input/output controllers (IOC) to the central message controller (CMC).

link interface unit (LIU)

A peripheral module (PM) that processes messages entering and leaving a link peripheral processor (LPP) through an individual signaling data link. *See also* CCS7 link interface unit.

liquid crystal display (LCD) lamp

An LCD located beside seven of eight feature keys on an Automatic Call Distribution (ACD) set. The display can show a black diamond indicator

(lamp) against each feature key. The indicator has four states: off, on, flashing (60 times per minute), and winking (120 times per minute).

LIT

line insulation test

LIU

link interface unit

LM

line module

LMC

line module controller

LME

line module equipment

LNS

lines maintenance subsystem

local digital switch (LDS)

Any Class 5 digital central office switching system, such as the DMS-100. Specifically, this refers to the software control system in place that provides the table control and maintenance functions required to support the SMA.

local switch craft interface (LSCI)

A standard DMS-100 MAP interface.

local test cabinet (LTC)

A piece of external test equipment from which a special access code can be dialed to gain metallic access to the subscriber loop.

local test desk (LTD)

A piece of external test equipment from which a special access code can be dialed to gain metallic access to the subscriber loop.

log report

A message sent from the DMS switch whenever a significant event has occurred in the switch or one of its peripherals. A log report includes state and activity reports as well as reports on hardware and software faults, test results, and other events or conditions likely to affect the performance of the switch. A log report can be generated in response to a system or manual action.

log system

The system used by DMS software to record the occurrence of all significant events (for example, equipment failure) and report the events to the operating company.

loop (LP)

- A local circuit between a central office (CO) and a subscriber telephone station. Also known as subscriber loop and local loop.
- A signaling method whereby on-hook/off-hook signals are transmitted by bridging the loop on a two-wire trunk or circuit. Signals are received by detecting the flow of loop current. In a trunk, LP signaling occurs in one direction at a time.

loopback

The reflection of data signals of known characteristics to their point of origin so that the reflected bit stream can be compared with the transmitted bit stream.

loop detector test

A test that checks the ability of a line circuit to detect an off-hook condition.

loss

A decrease in transmitted signal power.

LP

loop

LSCI

local switch craft interface

LSG

line subgroup

LTA

line test access

LTC

local test cabinet

LTD

local test desk

LTU

line test unit

M5209T

A Meridian business set M5209T ISDN telephone that can be used as a stand-alone telephone. Together with the personal computer terminal adapter (PCTA) and software, the M5209T unifies call handling and personal computer functions in a functionally integrated voice/data work station.

main distribution frame (MDF)

A frame containing terminal blocks where cables from outside plant and office equipment are terminated. Outside plant equipment is terminated on vertical columns of blocks and office equipment on horizontal rows. Cross-connection flexibility and organization is provided by jumper pairs between horizontal and vertical terminal blocks.

maintenance and administration position

See MAP.

maintenance level

See MTC.

maintenance modem pool (MMP)

A modem pool reserved for testing only. MMPs allow the operator to test the modem pool equipment from MAP terminals of the DMS-100 Family switch through integrated test equipment.

maintenance trunk module (MTM)

In a trunk module equipment (TME) frame, a peripheral module (PM) that is equipped with test and service circuit cards and contains special buses to accommodate test cards for maintenance. The MTM provides an interface between the DMS-100 Family digital network and digital or analog test and service circuits.

MAP

Maintenance and administration position. A group of components that provides a user interface between operating company personnel and the DMS-100 Family switches. The interface consists of a visual display unit (VDU) and keyboard, a voice communications module, test facilities, and special furniture.

MAPCI

MAP command interpreter

MDF

main distribution frame

mechanized loop tester (MLT)

A piece of external test equipment from which a special access code can be dialed to gain metallic access to the subscriber loop.

Meridian business set (MBS)

A telephone set that provides subscribers with push-button access to various business features. This set, used by the supervisor, has one more field display than the electronic business set (EBS). *See also* electronic business set.

Meridian Digital Centrex (MDC)

A special DMS business services package that uses the data-handling capabilities of DMS-100 Family offices to provide a centralized telephone exchange service. Formerly known as Integrated Business Network (IBN).

metallic test access (MTA)

A hardware device providing metallic connections between test access points (for example, in subscriber line circuits in a digital switching center) and various types of test equipment.

metallic test unit (MTU)

A circuit card that has all the capabilities of a line test unit (LTU) and can measure metering signals. An MTU is used in international applications. *See also* line test unit.

MLH

multiline hunt

MMP

maintenance modem pool

modem pool (MP)

A group of hardware devices that converts digital data signals to analog signals and analog signals to digital data signals. The MP converts these signals for transmission along cable pairs or carrier channels. An MP consists of a data line card (DLC), a data unit (DU), a modem, and a voice line card (VLC).

MTA

metallic test access

MTC (maintenance level)

A MAP level used to access several areas of the DMS-100 switch, such as central control (CC), peripheral modules (PM), the lines maintenance subsystem (LNS), and others.

MTM

maintenance trunk module

MTU

metallic test unit; multiline test unit

multiline test unit (MTU)

The MTU consists of an NT2X10 analog card and an NT2X11 digital card mounted in an MTM if the MTU is located in a host office or is located in an RMM if the MTU is located in an RLCM, or it is located in an RSM if it is located in an RLM. An MTU is used in North American applications. *See also* metallic test unit.

multiline hunt (MLH)

A service that routes calls to a busy line to other specified lines without assigning a directory number (DN) to each line.

nailed-up cross-connection

A special-services connection in which channels on a DS-1 link used for special-services cards are not switched through the DMS-100 network. Instead, they are looped around in the Subscriber Carrier Module-100S (SMS) or Subscriber Carrier Module-100 Urban (SMU) formatter card onto a second DS-1 link leading to a channel bank, DMS-100 switch, or other telephone equipment.

network module (NM)

The basic building block of the DMS-100 Family switches. The NM accepts incoming calls and uses connection instructions from the central control complex (CCC) to connect the incoming calls to the appropriate outgoing channels. Network module controllers control the activities in the NM.

NM

network module

noise

- Any natural disturbances or unwanted electrical signals introduced by circuit components that tend to degrade the performance of a communications channel.
- Any unwanted background signal on a circuit caused by system design limitations, improper alignment, or interference from an outside source.

noise test

A test that checks the level of noise in a line circuit pack.

no line insulation testing (NLT)

A service that causes a line to be skipped by the automatic line insulation test (ALIT).

Northern Telecom (NT)

A part of the tricorporate structure consisting of Bell-Northern Research, Bell Canada, and Northern Telecom.

no test trunk (NTT)

A circuit card, located in a trunk module (TM) or maintenance trunk module (MTM), through which external test equipment can be used to test subscriber lines.

NPGD

Negate Partial Ground start Diagnostics

NT

Northern Telecom

NTT

no test trunk

OM

operational measurements

off-hook

- The condition existing in telephone operations when the receiver or handset is removed from its hookswitch.
- One of two possible signaling states such as tone or no-tone, or ground connection or battery connection.
- The active state (closed loop) of a subscriber or private branch exchange (PBX) line loop.

one-party flat rate line (1FR)

A line for which a subscriber, for a fixed monthly charge, is allowed to complete an unlimited number of calls within the flat rate area.

on-hook

- The condition existing in telephone operation when the receiver or handset is resting on its hookswitch.
- One of two possible signaling states, such as tone or no-tone, or ground connection or battery connection.
- The idle state (open loop) of a subscriber or private branch exchange (PBX) line loop.

on-hook balance network test

A test used to determine whether a loop is the loaded type or the nonloaded type and to display the result on the MAP terminal.

operational measurements (OM)

The hardware and software resources of the DMS-100 Family switches that control the collection and display of measurements taken on an operating system. The OM subsystem organizes the measurement data and manages its transfer to displays and records. The OM data is used for maintenance, traffic, accounting, and provisioning decisions.

OPM

Outside Plant Module

out of service test

A test that checks the address control circuit pack of a remote concentrator terminal (RCT).

Outside Plant Module (OPM)

A stand-alone weatherproofed enclosure equipped to connect from two to six DS-1 links from a line group controller (LGC) at a host office and up to 640 locally connected subscriber lines. An OPM consists of one line concentrating module (LCM), a remote maintenance module (RMM), a host interface equipment (HIE) shelf, a power supply, environmental control equipment, and a cable cross-connection for up to 1280 pairs.

PAM

pulse amplitude modulation

PBX

private branch exchange

PEC

product engineering code

peripheral module (PM)

A generic term referring to all hardware modules in the DMS-100 Family switches that provide interfaces with external line, trunk, or service facilities. A PM contains peripheral processors (PP), which perform local routines, thus relieving the load on the CPU.

plain old telephone service (POTS)

The basic conventional telephone service. In the context of service screening, POTS is a pseudo-service that is derived from the combination of a bearer service of speech with no supplementary services.

PM

peripheral module

POTS

plain old telephone service

private branch exchange (PBX)

A private telephone exchange, either automatic or attendant operated, serving extensions in an organization and providing access to the public network.

product engineering code (PEC)

An eight-character unique identifier for each marketable hardware item manufactured by Northern Telecom.

pulse amplitude modulation (PAM)

A modulation system in which the magnitude and polarity of an analog waveform at a series of sample instants is represented by pulses of equivalent magnitude and polarity at the same relative instants of time.

RCS

remote concentrator SLC-96

RCT

remote concentrator terminal

RDT

remote digital terminal

receiver off-hook (ROH)

A condition meaning a telephone receiver is off-hook. Receiver off-hook often refers to the loud howling tone one hears when the receiver is off hook.

receiver off-hook tone

A fast busy tone initiated when a subscriber's telephone has been off hook for a specified period, and no digits have been dialed.

remote carrier urban (RCU)

A peripheral module (PM) that provides remote subscriber loop concentration for a DMS-1 urban carrier system. The RCU uses high-level message protocol to communicate over one or two message channels and, in configuration with a digital switch, supports up to 528 subscriber lines over a maximum of eight DS-1 links.

remote concentrator SLC-96 (RCS)

A peripheral module (PM) that provides remote subscriber loop concentration for an SLC-96 subscriber carrier system. The RCS supports up to 96 subscriber lines over two to four DS-1 links.

remote concentrator terminal (RCT)

In the DMS-1 switch, a peripheral module (PM) that provides remote subscriber loop concentration over two DS-1 links for a maximum of 256 subscriber lines.

remote digital terminal (RDT)

A generic term for an intelligent network element that provides an interface from subscriber access loops to digital transmission facilities.

remote fiber terminal (RFT)

A FiberWorld network element that is the Northern Telecom version of a remote digital terminal (RDT). The RFT terminates subscriber lines and multiplexes them onto a Synchronous Optical Network (SONET) facility.

Remote Line Concentrating Module (RLCM)

An equipment frame that provides an interface between two to six DS-1 links (from the line group controller (LGC) at the host office) and up to 640 subscriber lines (connected locally). An RLCM is equipped with one line concentrating module (LCM), a remote maintenance module (RMM), and a host interface equipment (HIE) shelf.

remote line controller (RLC)

The basic control unit in the remote line module (RLM). Its operation is similar to that of the line module controller (LMC).

remote line module (RLM)

A pair of remotely located line modules that provide an interface (over two to eight DS-1 links) between a digital carrier module (DCM) at the host office and up to 1280 subscriber lines.

remote maintenance module (RMM)

A peripheral module (PM) with a configuration similar to that of the maintenance trunk module (MTM). An RMM accommodates up to 12 service and test cards.

remote make busy (RMB)

A status signal received on a two-way trunk from the far-end trunk circuit indicating that the affected circuit is classed as made-busy to incoming traffic.

remote service module (RSM)

A peripheral module (PM) that operates in conjunction with and controls the metallic test access unit (MTAU) at a remote line module (RLM) site.

remote test unit (RTU)

A line test resource allocated at the remote fiber terminal (RFT) and that provides test head functions.

reversal relay test

A test that checks the reversal relay for correct operation and release in the appropriate line circuit packs.

return loss

Return loss in dB is defined mathematically in terms of the input impedance (Z_{in}) and the impedance of the reference network (Z_o) as shown in the following formula.

return to service (RTS)

An action that allows an out-of-service unit or piece of equipment to process calls.

RFT

remote fiber terminal

ringing and supervision test

A test to check if ringing is sent to the tip and ring leads of a subscriber loop.

ringing generator (RG)

A programmable generator that can produce a variety of ringing waveforms on receipt of a suitable drive signal.

ring test

A test performed on the LTPLTA (line test position line test access) MAP level that checks the operation of the station ringers connected to a line in the control position.

ring trip

Cancellation of ringing to a subscriber after the subscriber lifts the phone set receiver in response to ringing. The ringing signal is stopped to prevent the subscriber from hearing ringing.

RLCM

Remote Line Concentrating Module

RLM

remote line module

RMB

remote make busy

RMM

remote maintenance module

RTS

return to service

RTU

remote test unit

schema

The representation of data in a DMS switch as seen by the various users. It includes both tables and associated operations.

shelf

A container for drawers, cards, or both. *See also* bay, frame.

short diagnostic test

- A test performed on the ALT (automatic line testing) MAP level that checks the operation of the remote concentrator terminal (RCT) line circuit card and the pulse code modulation (PCM) path between the circuit card and the network.
- A test that checks lines for transhybrid loss, attenuation pads in the line card, noise, and problems in ringing and supervision.

shower queue

A system-originated diagnostic schedule.

signal distribution (SD)

A method of converting digital control messages addressed to a trunk or service circuit into supervisory signals compatible with the characteristics of the associated trunk or service facility.

signal distribution (SD) points

The writeable bits in the trunk logic circuit that usually correspond to relays in the hardware. Signal distribution points are used to control activities in the hardware.

singing return loss-high (SRL Hi)

Singing return loss-high is the weighted averages of the return losses in the 1800 through 4200 Hz frequency band.

singing return loss-low (SRL Lo)

Singing return loss-low is the weighted averages of the return losses in the 200 through 800 Hz frequency band.

SLC-96

A subscriber loop carrier that can provide service to 96 subscribers over two to four DS-1 links running from a remote terminal to a central office (CO).

SLT-D

subscriber loop test digital

SLT-E

subscriber loop test extended

SMA

Subscriber Carrier Module-100 Access

small remote unit (SRU)

A cabinetized, 240-line, DMS-100 remote capable of handling POTS and Centrex call types. The SRU merges the LCME subscriber ISDN access capability with the remote maintenance and host interface deployment capabilities of the Remote Line Concentrating Module (RLCM). It can be used for customer premises applications and can be provisioned with an internal ac power supply and battery backup. Up to six PCM-30 host links can be used. The SRU is currently applicable to the United Kingdom market only.

SMR

Subscriber Carrier Module-100 Rural

SMS

Software Management System; Subscriber Carrier Module-100S

SMU

Subscriber Carrier Module-100 Urban

special services module (SSM)

A miscellaneous bay connected to a remote carrier urban (RCU) that provides special services.

SRL Hi

singing return loss-high

SRL Lo

singing return loss-low

SRT

station ringer test

SRU

small remote unit

SSM

special services module

station ringer test (SRT)

A test performed on station equipment, usually a business or residential telephone station or a coin station, by personnel at that station without involving the switch operator at the central office (CO). The SRT checks digit collection, coin return, and on-hook and off-hook ground ringers. Available on POTS sets, Meridian business sets (MBS), and Automatic Call Distribution (ACD) sets.

Subscriber Carrier Module-100 Access (SMA)

The Subscriber Carrier Module-100 Access is the LTC-based DMS peripheral that provides common signaling channel/embedded operations channel (CSC/EOC) link management, DS-1 facility management, and the interface to the DMS-Core.

Subscriber Carrier Module-100 (SCM-100)

A family of four peripheral modules (PM) that connect three types of remote terminals with DMS-100 Family switches. The SCM-100 family consists of: Subscriber Carrier Module-100 Rural (SMR), Subscriber Carrier Module-100S (SMS), Subscriber Carrier Module-100S Remote (SMSR), and Subscriber Carrier Module-100 Urban (SMU).

Subscriber Carrier Module-100 Rural (SMR)

A subscriber carrier module that provides an interface between the remote concentrator terminal of a DMS-1 switch and the central office (CO) of a DMS-100 Family switch.

Subscriber Carrier Module-100S (SMS)

A subscriber carrier module that provides an interface between the remote concentrator SLC-96 of an SLC-96 system and the central office (CO) of a DMS-100 Family switch.

Subscriber Carrier Module-100 Urban (SMU)

A subscriber carrier module that provides an interface between the remote carrier urban (RCU) of a DMS-1 switch and the central office (CO) of a DMS-100 Family switch.

subscriber line

A transmission path connecting the subscriber's telephone to the local telephone company's central office (CO) equipment.

subscriber loop

See loop.

subscriber loop test

A test that determines if failure of an extended diagnostic subtest is due to a fault on the loop.

subscriber loop test digital (SLT-D)

Facilities that use a test head in the DMS-1R remote concentrator terminal (RCT) to which any subscriber loop can be connected. The digital test head is digital hardware (controlled by B words) that tests such parameters as resistance, capacitance, and line insulation.

subscriber loop test extended (SLT-E)

Facilities that use office equipment, such as a line test unit, to conduct subscriber loop tests. The test equipment is connected to a metallic test access (MTA) that, in turn, connects to subscriber lines, thus establishing a direct dc path between office equipment and subscriber loops.

SwAct

switch of activity

switching network

A digital-switching matrix that interconnects the peripheral modules (PM), using time-division multiplexing (TDM). The switching network components are microprocessor controlled, digital-switching network modules. The switching network has duplicate network planes for reliability and can be connected to either the central message controller (CMC) or the DMS-Bus and the PMs. The two generations of the switching network are the junctored network (JNET) and the enhanced network (ENET). The NT40 can use only the JNET, while the DMS SuperNode can use either the JNET or the ENET. *See also* Enhanced Network, Junctored Network.

switch of activity (SwAct)

In a DMS fault tolerant system, a switch that changes the states of two identical devices devoted to the same function. A SWACT makes an active device inactive and an inactive device active.

S/DMS AccessNode

A trademark of Northern Telecom for one of the FiberWorld products.

table

Two-dimensional entities in which data associated with hardware and software in the DMS-100 Family switches are stored.

TAN

test access network

terminal

- The point of origination or termination in a communications network.
- Any device capable of sending information, receiving information, or both over a communication channel.
- In a DMS switch, the smallest unit of address space within the input/output (I/O) system.

test access network (TAN)

A peripheral module (PM) that provides metallic connections between a trunk test position (TTP) or a test trunk and the access bus on a special type of trunk module (TM) used in the DMS-300 switch.

T-link

A full duplex byte-oriented adaptation protocol designed to transfer synchronous or asynchronous data over a digital circuit at digital trunk equipment (DTE) data rates of up to 64 kb/s.

TM

trunk module

TR-008

Bellcore Standard TR-TSY-000008: Digital Interface between digital loop carrier and a local digital switch.

transhybrid loss test

A test that measures loss between the line card and the network. For the line circuit being tested, expected loss is compared with measured loss. Measurements that are less than or equal to the established threshold are

reported as passed, and measurements that exceed the threshold values are reported as failed.

translation data

The DMS central control (CC) data needed for call processing.

transmission test trunk (TTT)

A DMS facility used by the trunk test position to provide circuitry for performing loss and noise measurements.

transmission test unit (TTU)

A digital signal processor used to perform transmission measurements on DMS lines and trunks.

trunk module (TM)

A peripheral module (PM), in a trunk module equipment (TME) frame, that provides speech and signaling interfaces between a DS30 network port and analog trunks.

trunk test center (TTC)

The location of the MAP terminal being used as a trunk test position (TTP).

trunk test position (TTP)

A MAP terminal specially equipped to perform trunk testing.

TTP

trunk test position

TTT

transmission test trunk

TTU

transmission test unit

two-party line

A common line arranged to serve two main stations. Automatic originating identification of each party and individual ringing capabilities may be provided. A two-party line can be used to provide telephone service to subscribers in residential and business locations. Service-related features may vary between parties sharing the line. Reverting calls between two-party subscribers sharing the same line are treated in accordance with reverting call service.

unit

One of two parts of an XMS-based peripheral module (XPM) or a line concentrating module. Each unit has independent processing capabilities.

The peripheral module (PM) has an active unit and an inactive unit. The active unit does all the processing while the inactive unit is on standby.

user interface

The series of commands and responses used by operating company personnel to communicate with the DMS-100 Family switches. It is achieved through the MAP terminal and other input/output devices (IOD). Formerly known as man-machine interface.

VDU

visual display unit

visual display unit (VDU)

An electronic output device that presents data to a terminal user in the form of a television picture. In a DMS switch, the VDU is one of the components of the MAP terminal and, along with a keyboard, provides the main user interface in the DMS-100 Family switches.

VLC

voice line card

voice line card (VLC)

A card equivalent to a line card. The term is used to contrast with data line card (DLC) when both cards are present in a hardware configuration. *See also* line card, data line card.

XMS

A workstation-based microcomputer with networking capabilities based on a Motorola 68000 microprocessor with system software written in Bell-Northern Research (BNR) Pascal.

XMS-based peripheral module (XPM)

The generic name for XMS peripheral modules (PM) that use the Motorola 68000 microprocessor. An XPM has two processors in a hot standby configuration: a master processor (MP) and a signaling processor (SP).

XPM

XMS-based peripheral module

DMS-100 Family

Lines

Maintenance Guide

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