Critical Release Notice

Publication number: 297-8301-550
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The content of this customer NTP supports the SN06 (DMS) software release.

Bookmarks used in this NTP highlight the changes between the XPM10 baseline and the current release. The bookmarks provided are color-coded to identify release-specific content changes. NTP volumes that do not contain bookmarks indicate that the XPM10 baseline remains unchanged and is valid for the current release.

Bookmark Color Legend

Black: Applies to new or modified content for XPM10 that is valid through the current release.

Red: Applies to new or modified content for SN04 (DMS) that is valid through the current release.

Blue: Applies to new or modified content for SN05 (DMS) that is valid through the current release.

Green: Applies to new or modified content for SN06 (DMS) that is valid through the current release.

Attention!
Adobe Acrobat Reader™ 5.0 is required to view bookmarks in color.

Publication History

March 2004

Standard release 07.02 for software release SN06 (DMS).

Appendix A "SMS unequipped lines troubleshooting" added, due to CR Q00425196-01.

Change of phone number from 1-800-684-2273 to 1-877-662-5669, Option 4 + 1.

297-8301-550

DMS-100 Family

Subscriber Carrier Module – 100S Remote
Maintenance Manual

XPM10   Standard 07.01   August 1998

NORTEL

NORTHERN TELECOM

DMS-100 Family

Subscriber Carrier Module – 100S Remote

Maintenance Manual

Publication number: 297-8301-550
Product release: XPM10
Document release: Standard 07.01
Date: August 1998

Contents

About this document

When to use this document

This Subscriber Carrier Module-100S Remote (SMS-R) maintenance reference manual provides: overview and hardware information for understanding the SMS-R product and operation; recovery procedure for returning to service an SMS-R from a completely out-of-service condition; alarm clearing procedures for clearing an SMS-R alarm condition at the MAP; card replacement procedures for removing and replacing hardware modules in the SMS-R as part of maintenance, verification, or acceptance procedures; trouble locating and clearing information for locating and clearing problems beyond the scope of other maintenance procedures. The information in this maintenance manual is intended for operating company personnel engaged in SMS-R maintenance.

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.

This document is written for all DMS-100 Family offices. More than one version of this document may exist. To determine whether you have the latest version of this document and how documentation for your product is organized, check the release information in *Product Documentation Directory*, 297-8991-001.

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References in this document

The following documents are referred to in this document:

- *Alarm Clearing Procedures*
- *Card Replacement Procedures*
- *Input/Output System Reference Manual*, 297-1001-129
- *PMDEBUG User Guide, Technical Assistance Manua*l, TAM-1001-004
- *Recovery Procedures*
- *Translations Guide*

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

> **WARNING**
> **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.
```

Maintenance overview

The subscriber carrier system that this document describes consists of the Subscriber Module SLC-96 Remote (SMS-R) and a minimum of one Remote Concentrator SLC-96 (RCS) modules. This document contains a description and information on procedures for the SMS-R, RCS, DS-1 links, and subscriber lines. This document includes a troubleshooting chart and procedures.

The SMS-R provides an interface between digital loop carrier systems that comply with TR-008 and the DMS-100 Remote Switching Center (RSC) or the RSC-SONET (RSC-S). The hardware and function of the SMS-R is very similar to the Subscriber Carrier Module-100S (SMS). This document uses remote concentrator SLC-96, or RCS, and SLC–96 to refer to digital loop carrier system equipment that complies with TR-008.

This section contains the following subsections:

- Operating description—overview of the SMS-R, RCS, and DS-1 links and highlights functions and software processes

  Note: The information in this section assumes that all components and software processes function correctly.

- Fault conditions—identifies problems that can occur in components, links that connect components, and software that controls voice and message flow

- Automatic maintenance—identifies system actions that identify a fault and correct the fault automatically. The correction occurs without manual correction. The following actions are automatic maintenance actions:

  — audit

  — switch of activity (SWACT)

  — protection switching from a DS-1 link

  — routine exercise (REX) testing

  — automatic subscriber lines testing

- Escalation to manual maintenance

  — describes manual protection switching that occurs when the SMS cannot switch a protection link in service. The SMS cannot switch a protection link when the SMS detects a fault on a primary link.

SMS-R functional description

The SMS-R is a redundant peripheral module with two identical units. The units are active and standby. Both units can support call processing and system control. One unit is active when the other unit is on standby. The units operate in hot standby configuration. The standby unit takes over when a fault in the active unit occurs. This unit maintains full control of the links until detection or correction of the fault occurs. The SMS-R performs the following tasks:

- interfaces to DS30A and DS-1 links

- connects P-side and C-side channels

  — remote cluster controller (RCC) to SMS-R to RCS messaging

  — special service hairpin connections

  — maintenance test connections, like a metal bypass to test subscriber loops

- connects calls that originate from the RCS

- reports call originations to central control (CC)

- connects and sets ringing control for calls that terminate on the RCS

- supplies tones to the RCS-subscriber

  — dial tone to request dialed digits

  — busy tone to indicate that the called party is already busy

  — reorder tone to indicate that the system cannot establish the connection.

  — ringback tone to indicate to the calling party that the line of the called party rings

- records connections to/from the RCS-subscriber

- records dial pulse digits

- detects when the flash feature is in use

- forwards messages (RCS to RCC and RCC to RCS)

- receives and issues coin service control messages that include:

  — coin first pay stations

  — dial tone first pay stations

  — semi-post pay stations

- loss padding

- switch of activity

- downloads provisioning data

- audits hardware and internal records

- executes internal diagnostics. Diagnostics are discussed in the section Trouble isolation and correction

- protection switching

SMS-R configuration

The SMS-R is like the SMS. The SMS is based on line group controller (LGC) architecture. The insertion of the following three different SMS cards converts the LGC to an SMS:

- ring/pad card, NT6X80

- A/B-DDL card, NT6X86

- DS-1 interface card, NT6X85

For RCC call processing features, the SMS-R functions like a line concentrating module (LCM) of the RCC call processing functions. The following figure shows the configuration of the SMS-R.

SMS–R configuration
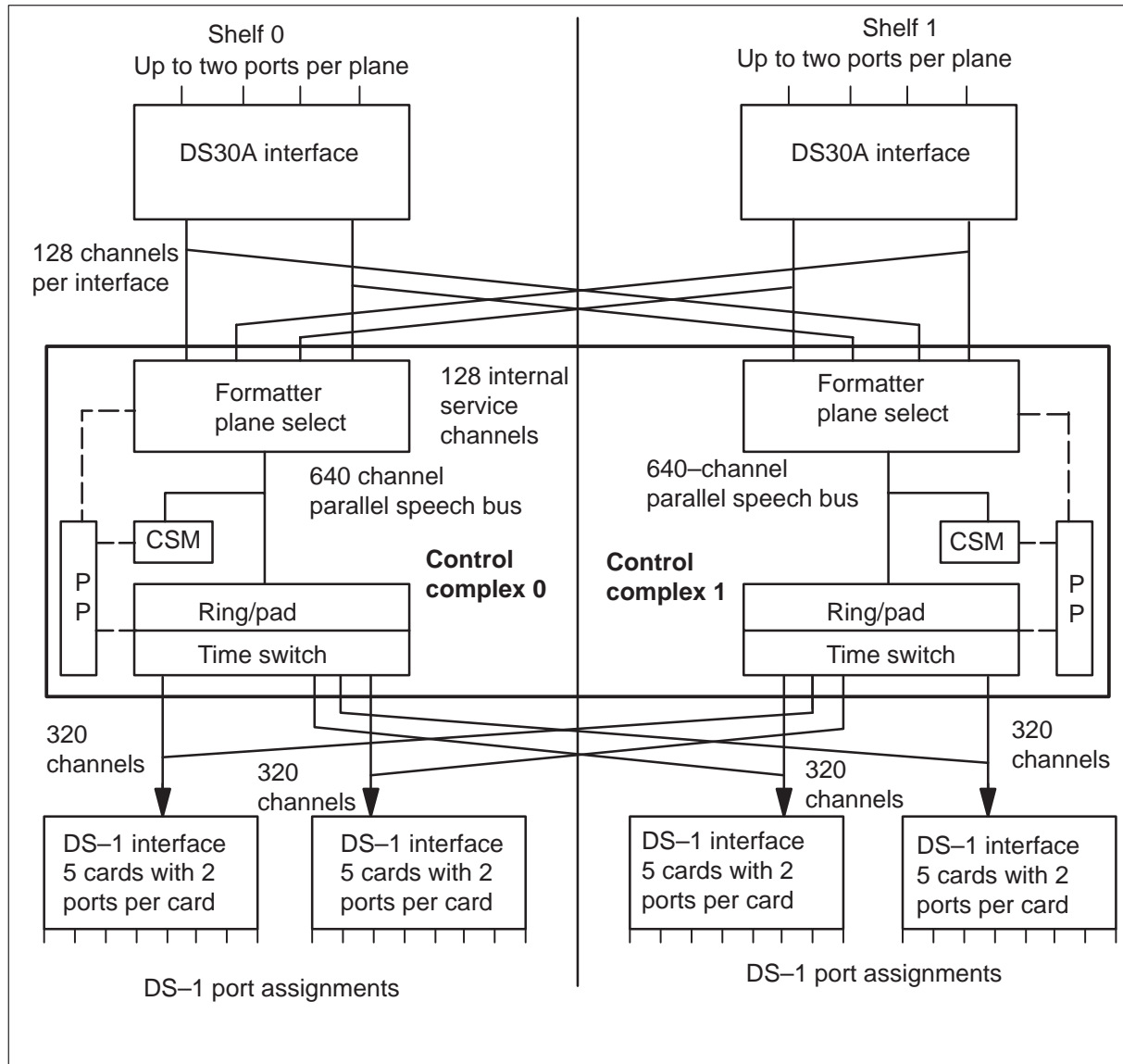
Refer to the preceding figure when you read the following paragraphs. The paragraphs describe the following three procedures:

- SMS-R connection to the RCC through the DS30A links

- the SMS-R connection to the RCS through DS-1 links

- the function of the cards in each unit of the SMS-R

The network connects to the SMS-R through the RSC with a maximum of four DS30A links. These links connect in the SMS-R to two DS30A interface cards (NT8X18). One card is in shelf 0 and one card is in shelf 1. Each card can supply one or two DS30A ports. Each card can provide a maximum of four ports on a fully equipped SMS-R. The ports are dedicated to the RSC through the remote cluster controller (RCC) unit 0 and through unit 1. Port assignments are distributed in the two DS30A cards. Links 0 and 2 are assigned to unit 0, and links 1 and 3 are assigned to unit 1. When the SMS-R is equipped with three links, links 0 and 2 are assigned to unit 0. Link 1 becomes the third link and is assigned to unit 1.

Each DS30A card synchronizes incoming information with the SMS-R. Each card provides 128 (4×32) channels for each plane to the formatter cards in units 0 and 1. The card provides a duplicated path through the currently active control complex.

The speech bus formatter card (NT6X41AA) multiplexes the incoming speech on a 640-channel bus. The formatter card handles 512 speech channels for each network plane. The formatter card adds 512 speech channels to 128 internal service channels. The formatter converts all channels to a 640-channel (512 plus 128) bus to the SMS–R control complex.

The channel supervision message (CSM) is a 40-bit message that contains 24 synchronization bits, eight integrity bits, and eight data bits. The complete message transfers over 40 frames. The integrity bits must match between the peripheral module (PM) that sends the CSM and the PM that receives the CSM. The central control [CC] tells the receiving PM the integrity value to expect. The integrity check makes sure a correct path between PMs is available. The eight-bit, data byte relays data on call setup, maintenance, and other PM data.

The time switch card (NT6X44) receives pulse coded modulation (PCM). The card switches the PCM to the correct P-side ports and channels under the unified processor (UP) directives. The time switch adds A- and B-signal bits, and tones and system control messages. The switch sends the message and tone card (NT6X69) to the correct channels on the DS-1 lines.

The pad/ring card (NT6X80) attenuates speech that goes from the SMS-R to the RCS with 0 to 7 dB loss. This attenuation loss reduces echo and other noise.

The A/B derived data link (DDL) message card (NT6X86) inserts A-, B-, and DDL-bits in the PCM data stream. The DDL message card extracts A-, B-, and DDL-bits from the PCM data stream.

The DS-1 interface cards (NT6X85) convert parallel PCM speech to serial format, and transmit the speech to the RCS.

The XPM peripheral loader (XPL) allows the reduction of XPM simplex time. XPM software loads can transfer to the XPM. The system can store the software loads in an XPM unit when the unit is in service. Storage of loads in an XPM allows a new loadfile to replace a current loadfile. During the replacement of a loadfile, the last image is available for recovery actions. The local storage mechanism is the NT7X05 circuit pack. The system instructs an XPM unit to load from the NT7X05 card. The XPM unit must load on a manually-busy (ManB) XPM unit to transfer software. The transfer occurs with the enhanced LOADPM command. The transfer uses the following parameters:

>LOADPM [PM] LOCAL IMAGE
        [INACTIVE]
        [UNIT]

To load the local loadfile, use the following parameters

WARNING
Possible service interruption
The LOCAL LOADFILE option of the LOADPM command has a parameter of [<file> string}]. If this file_name parameter is used, the loadfile named in the parameter is used. This parameter is not patched. Use this parameter only when you require the NOPATCH option of the loadfile.

>LOADPM [PM] LOCAL LOADFILE
        [INACTIVE]
        [UNIT]

Note: Only non–ISDN peripherals support the IMAGE parameter.

The XPL makes peripheral loading improvements with image technology. A high level in the CM monitors changes to restart survivable objects in the XPM. This action provides image control. The restart survivable objects are static data and code, in the form of patches. The XPL dumps an image, makes a copy of NTMX77 RAM in an in-service, active, or inactive XPM unit, and copies the image to the NT7X05. If a reload of the XPM must occur, the system restores the image to the UP RAM.

Note: The option to dump an image of an embedded processor is not available. You must use the LOADPM command and the CC CMR parameters to load the CMR processor from the CM.

You can dump images to the NT7X05 card when the XPM is InSV. Use the enhanced PM MAP level command with the following parameters:

>LOADPM [PM] CC XPMSTOR [file_name]
**   [ACTIVE]**
**   [INACTIVE]**

Note: The file_name must be the name of the file in field LOAD of the LTCINV inventory table.

When you first install the NT7X05 card, the loadfile is invalid. You must load the loadfile with the XPMSTOR parameter. The enhanced QUERYPM command with the new FILES option allows operating company personnel to view the status of files on the NT7X05. The following example shows the map response to this command.

>QUERYPM FILES

Example of a MAP response:

```
Unit 0:
   NT7X05 load File: ** Mismatch **
   NT7X05 Image File:   ECR05AW

Unit 1:
   NT7X05 load File: ** Mismatch **
   NT7X05 Image File:   ECR05AW
```

When the NT7X05 card is loaded, the CM checks the datafill of the NT7X05. If NT7X05 is present, the recovery software loader (RSL) transfers the name of the required load file. The RSL decides if the image or loadfile must be loaded from the CM to the unified processor (UP). The RSL checks for the loadfile name on the NT7X05. If the load name test passes, the RSL restores the image or load as instructed to the UP. The image/loadfile integrity is verified as part of the restore/loading process when the restored file is good. This action avoids delays during the load. The enhanced QUERYPM command allows, operating company personnel to view the status of files on the NT7X05. The following example shows the MAP response to the command:

>**QUERYPM FILES**

Example of a MAP response:

```
Unit 0:
   NT7X05 load File: ECR05AW
   NT7X05 Image File:ECR05AW

Unit 1:
   NT7X05 load File: ECR05AW
   NT7X05 Image File:ECR05AW
```

SMS-R internal messaging

Message paths in the SMS-R appear in the figure that follows.

Start with BCS36 features AN0445 and AN0465. Replace the master processor (MP) card and the signaling processor (SP) card. Replace the related memory cards, with the unified processor (UP) card. This new configuration allows future service extension on the SMS–R. A modification must occur to the NT6X01 shelf to incorporate this feature upgrade on a current SMS–R. You must remove the four discrete cards, (2) 6X45s, (1) 6X46, and (1) 6X47. You must install a unified processor card (NTMX77). Refer to the replacement procedure in the Change Application Feature CAP1373 document. All messaging in the UP continues by the same method as in the dual processor (MP, SP) configuration.

The UP provides call processing functions. These functions include digit collection, channel assignment, and message processing. Real-time call processing functions allow the transfer of messages, control of the enhanced time switch, and supervision of channels. The UP provides dynamic random access memory (DRAM) and a direct memory access (DMA) from the EISP card. The UP has 8 megabytes of memory. The UP provides download firmware capability.

The UP card (NTMX77) links to other cards in the SMS-R through the A-bus. The UP polls each card, and uses direct memory access (DMA) to send or receive messages. The memory access protocol applies to a specified card.

The unified processor (Up) designs SMS-R messages sent to the CC. The UP directs the messages and sends the messages through the DS30A cards from the message and tone card. The system places the messages on channel 0 of DS30A links 0 and 2. The message and tone card extracts messages from the CC from the DS30A interface card. The UP scans the message and tone card, accesses the messages, and defines the messages.

The message and tone card exchange C-side messages with the DS30A card over a wired link. The messages sent to the network use DMSX protocol. The message and tone card allows message exchange between the active and inactive SMS-R units. These messages are sent over a wired link with intermodule communication (IMC) protocol as described in the section on Intermodule Communication.

The DS30A cards and the time switch exchange control messages over a wired link.

Control and status messages sent to and from the DS-1 cards use a message channel through the time switch. The time switch exchanges one message channel for each DS-1 link with each DS-1 card. A DS-1 card can handle two links. Two message channels are available for each card.

Message paths in SMS-R

DS30A interface 8X18   0   1

Wired link

Msg & tone 6X69

Wired link

To other unit

Speech bus formatter 6X41

PPL 7X05

CSM 6X42

Unified processor and memory card MX77

Wired link

A bus

Time switch 6X44

DS-1 interface 6X85   0   9

Message channel on speech bus
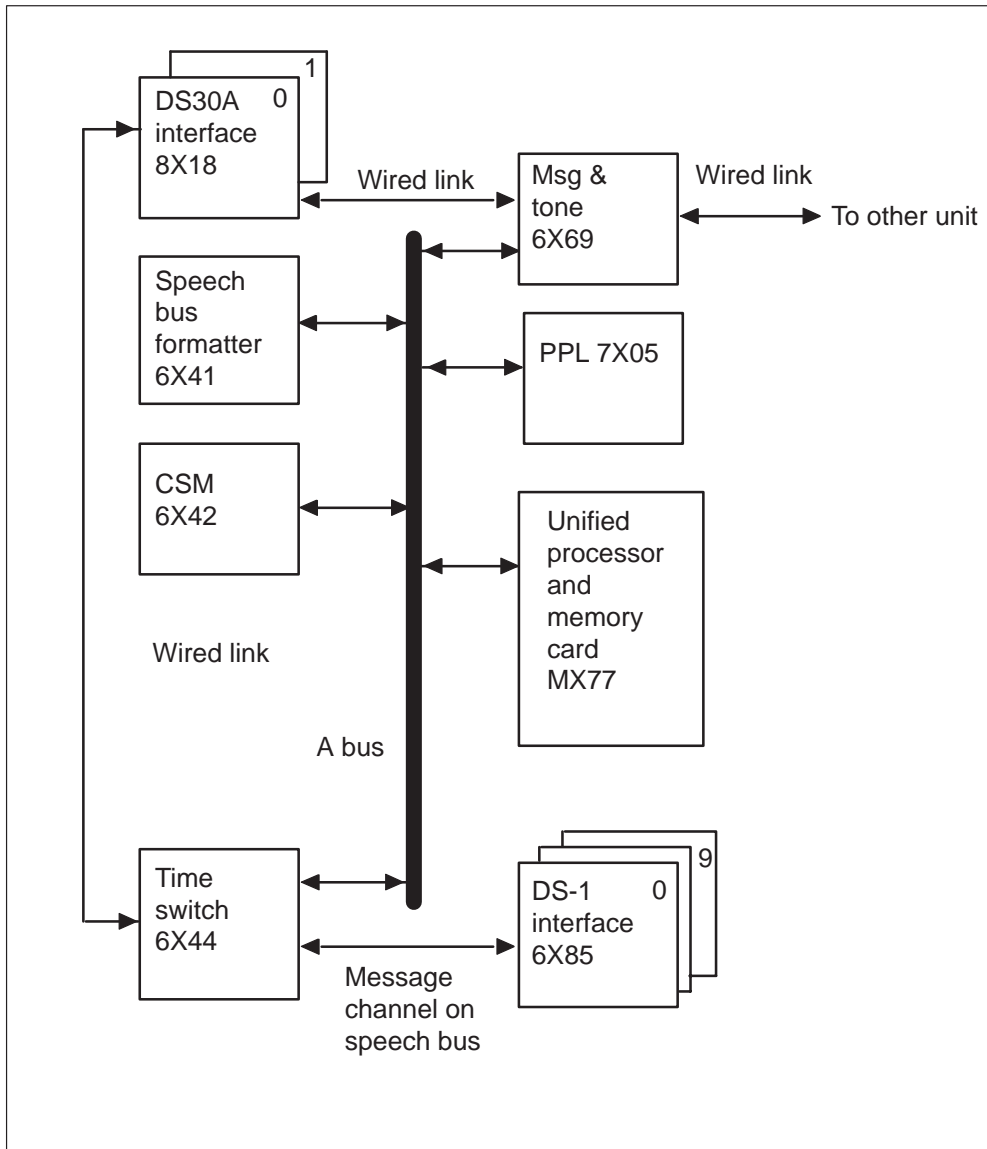
The following figure shows hardware process speech samples in the SMS-R.

The system receives speech from the network in the DS30A interface cards.

Data paths in SMS–R
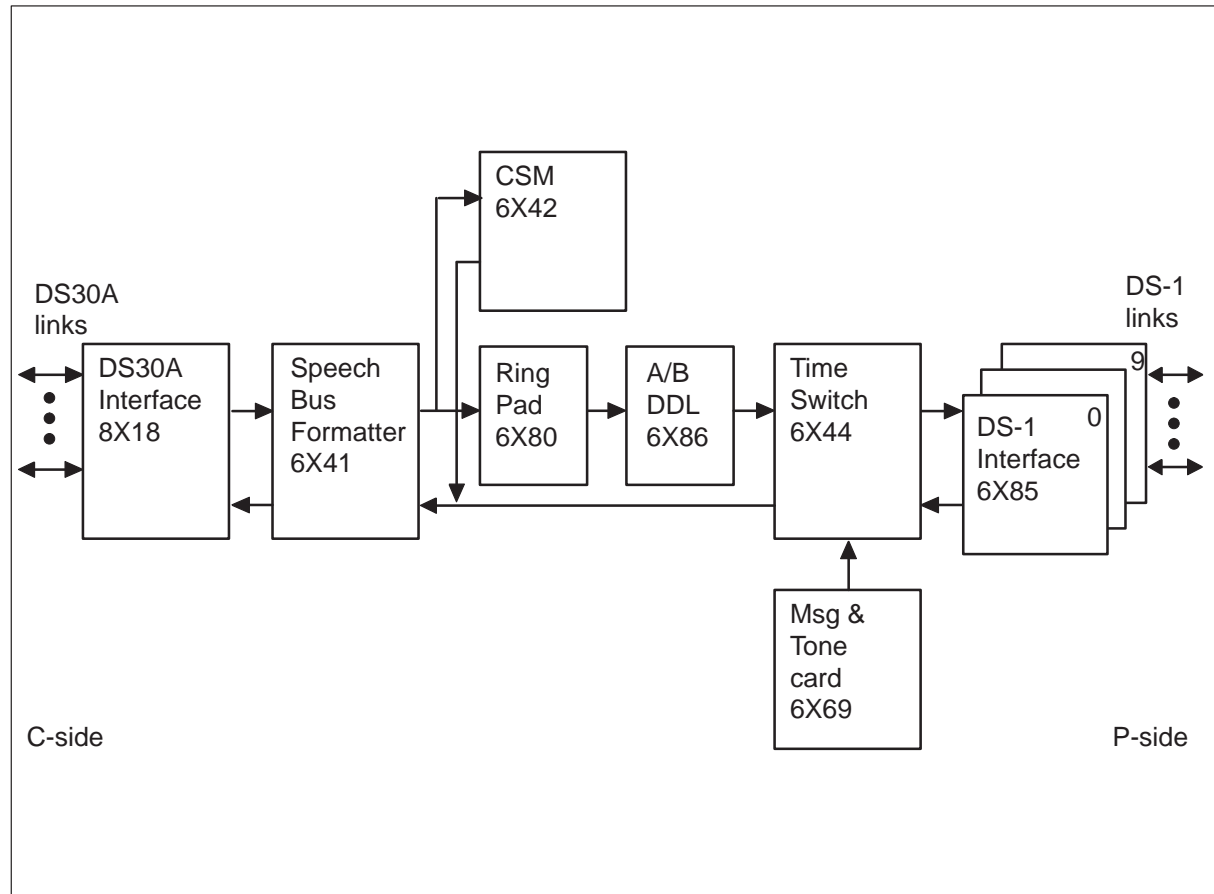
The system processes incoming speech from the PCS to the network like incoming speech from the network to the RCS. Incoming speech from the RCS to the network does not pass through the pad/ring. A DS–1 card receives the incoming speech first and sends the speech to the time switch. The time switch removes messages and signaling bits. Incoming speech connects through a switch to the correct C-side channel where the CSM card adds CSM and parity bits. The system sends incoming speech to the formatter card for demultiplexing. The DS30A card sends incoming speech to the RCC.

XPM intermodule communication

The IMC links in the XMS-based PM (XPM) exchange call processing and diagnostic messages. The IMC links transmit software loads and related data between the active and inactive units. The XPM uses the following IMC links:

- message protocol card (NT6X69)

- unified processor card (NTMX77)

The message protocol card is the primary IMC link in the XPM. The system uses the message protocol card for all types of IMC messaging between XPM units. The system uses the UP IMC for maintenance and diagnostics.

The message protocol card is an IMC link that connects each XPM unit. This IMC link exchanges the following:

- link status and connection information between the active unit and the inactive unit. This data allows the inactive unit to maintain calls if a switch of activity occurs.

- software loads and related data from the active unit to the inactive unit. This condition occurs when the C-side links on the inactive unit are down

- maintenance and diagnostic messages from the CC to the inactive unit when message links to the inactive unit do not function

- the results of diagnostic tests performed on the inactive unit and transmitted to the CC through the active unit

The UP IMC link is a universal asynchronous receiver/transmitter (UART) link that provides a connection for the UPs in both units. A UP IMC link performs the following:

- loads small diagnostic programs from the in-service active unit to the out-of-service inactive unit

- provides information that helps to diagnose faults in the mate unit when the message protocol card IMC link does not function

Information flows to/from the SMS-R

Information flows transfer between the SMS-R and the RCS (control messaging and speech/signaling). Information flows transfer between the CC (control messaging), and other peripheral modules that connect to the DMS network (speech/supervision messaging).

Control messaging between the SMS and the RCS

The derived data link (DDL) is the message protocol for message transfer from the SMS-R to the RCS. The DDL is the protocol for message transfer from the RCS to the SMS-R. The DDL is a 2.2 Kbit/second data path robbing frame signaling (Fs) bits forms. A Superframe consists of 12, 193-bit frames. A framing bit precedes the frame. These framing bits are either Ft or Fs bits. The SMS-R/RCS contains two Superframes that pass without changes. The four Superframes that follow are robbed of Fs bits. These bits are replaced with DDL bits. The DDL link contains 24 bits. The Fs bits are robbed at a card in the RCS or at the time switch card in the SMS-R. For additional information on DDL and the frame format used in the DS-1 link messaging, refer to *Translations Guide*.

DDL messaging

The 8085 microprocessor of the A/B-DDL message card sends DDL messages in the DS-1 PCM data stream to the time switch. The microprocessor extracts the DDL message from incoming PCM. Software in the UP, called the DDL facility, processes DDL messages.

The DDL message consists of 24 consecutive bits grouped as shown in the following table.

DDL message bits and field names

DDL bits	Field name
Bits 1 through 11	Concentrator field (C-field). When no C-field is available, the 8085 microprocessor sends an idle pattern on the DDL link. The RCS sends an idle pattern when no new C-field is present.
Bits 12 through 14	Spoiler bits (fixed pattern of 010). The system inserts spoiler bits at preassigned positions in the DDL to make sure the DDL never duplicates a signaling pattern.
Note: If the M-, A-, or S-fields do not change between messages, the 8085 microprocessor sends the previous field patterns. The RCS at the other end sends the same patterns. The 8085 microprocessor sends information to the UP only when a DDL field changes. The microprocessor does not transmit idle patterns.	
—continued—	

DDL message bits and field names (continued)

DDL bits	Field name
Bits 15 through 17	Maintenance field (M-field). The M-field on the A-link carries information for all shelves and controls card and customer loop testing.
Bits 18 and 19	Alarm data link field (A-field). The A-field on the A-link carries alarm and system control information for all shelves.
Bits 20 through 23	Protection line switch field (S-field). The S-field on the A-link controls the switching of the DS-1 protection link.
Bit 24	Spoiler bit field (fixed pattern of 1)

Note: If the M-, A-, or S-fields do not change between messages, the 8085 microprocessor sends the previous field patterns. The RCS at the other end sends the same patterns. The 8085 microprocessor sends information to the UP only when a DDL field changes. The microprocessor does not transmit idle patterns.

—**end**—

The RCS shelf groups AB and CD use the C-field only when the shelf groups operate in Mode II. This field carries information for shelves A, B, C, and D. This information includes control of assignment and deassignment of subscribers to DS-1 channels and hook changes.

Speech/signaling between the SMS-R and the RCS
The SMS-R and RCS use A and B-bit messaging to exchange speech and signaling information. The A and B-bits are either ones (1) or zeros (0). The assembly of the bits in patterns construct messages. These patterns are steady state 0 and 1, and modulated 0 and 1. These patterns signify different signaling states. The SMS-R sends the following signaling information to the RCS for each channel:

- start or stop ringing

- start or stop forward disconnect

- scan for on-hook and off-hook

- collect ANI/coin information

- collect channel maintenance information

The UP collects signaling information from the RCS that includes the following data:

- call origination
- call disconnect
- digit collection
- ANI/coin
- answer
- flash
- unequipped lines

The RCS sends only steady 1 and 0 messages to the SMS-R. The RCS does not send modulated 1 and 0 messages. The SMS-R can send modulated 1 and 0 messages to the RCS.

The system decodes A- and B-bit messages separately for all types of RCS line cards. A specified pattern for a single-party line card indicates this pattern is different from the same pattern for a coin card.

The UP contains software that makes sure the 8085 microprocessor operates correctly. This software is the A/B-bit facility. The UP scans incoming RCS signaling information for each channel. The UP scans for origination, answer, flash, disconnect, unequipped lines, and other subscriber telephone states. These states are as follows:

- origination – subscriber line goes off-hook from on-hook and stays off-hook for a minimum of 60 ms

- digit collection – subscriber line pulses 7.5 to 12 times each second, with a break of 58 to 64 percent. The digit-to-digit time-out is 300 ms.

- answer (to ringing) – subscriber line goes off-hook from on-hook and stays off-hook for at least 180 ms

- flash – subscriber line goes on–hook from off-hook, and stays on-hook for a minimum of 240 ms and a maximum of 1440 ms. The line returns to off-hook for a minimum of 200 ms

- disconnect – subscriber goes on-hook from off-hook and stays on-hook for a minimum of 1440 ms. The flash option is allowed. When the flash option is not allowed, disconnect occurs when a subscriber line goes on-hook from off-hook and stays on-hook for a minimum of 360 ms.

- unequipped lines – subscriber lines entered but unequipped are reported to the CM and are marked as line module busy (LMB). The CM generates a minor alarm. The PM subsystem generates a PM128 log report. This log report identifies the RCS shelf where the entry of the unequipped line circuit appears on the system.

Another part of the UP, the DIGC_ROUTINE, detects and collects digits. The DIGC_ROUTINE counts and reports the digits to the A/B-bit facility.

Control messaging between the SMS-R and the RCC

The SMS-R and RCC exchange control messages over dedicated control channels on the DS30A links. These channels are channel 0 on links 0 and 2. The control messages include the following information:

- messages to the RCC

    — change of subscriber status when a subscriber goes off-hook

    — dialed digits

    — maintenance information

- messages from the RCC

    — speech channel allocation for SMS-R-to-RCS or SMS-to-other peripheral connection

    — integrity values for supervision of SMS-R-to-other peripheral module connections

    — provisioning data for the SMS-R

    — maintenance operation

All in-service C-side links are active for processing of call traffic because of the architecture of the SMS-R. The SMS-R does not reassign channels when links change state. Any link that is in-service (InSv) and changes to a busy state can affect active telephone calls. When a link is busy and active calls are in progress, the link returns to service. The C-side node does not recognize the active calls on the busy link. The C-side node places all the channels on the link in an available status. After the return to service, the channels the active calls use are qualified for a new assignment. If a new call attempts to use one of the same channels as an active call, a cross connect occurs. The original call loses two-way talk path when a cross connect occurs.

Feature AF4308, SMS-R Enhanced C-side Maintenance, causes a message display at the MAP terminal. The message indicates how many active calls use the link when maintenance personnel attempt to busy a C-side link. Maintenance personnel can abort the manual busy operation. Maintenance personnel can continue and busy the channels and disconnect any active calls on the link. The policy of the local operating company determines the actions of maintenance personnel. Active calls disconnected on a link that is busy prevents the cross connect.

Speech/supervision messaging between the SMS-R and other peripheral modules

The SMS-R exchanges speech and channel supervision messages with other peripheral modules. The messages exchange over a speech channel connected through the network modules. The CC establishes these connections as part of call set-up procedures. The protocol that performs the exchange for speech samples transmits supervision bits across the channel. The SMS-R transmits and receives 40-bit channel supervision messages. The messages contain the integrity value allocated to the connection and other PM-to-PM control messages.

Call processing

The RCC controls call processes for telephone calls between subscribers. The RCC performs call control for Modes I, II, and III. The RCC:

- scans for changes in subscriber line status

- assigns a DS-1 channel to an off-hook subscriber (Mode II)

- sends dial tone to an off-hook subscriber who originated a call

- scans for and collecting digits

- rings a subscriber line

- sends an audible ringback tone to a calling subscriber

- trip ringing on a called subscriber when the subscriber goes off-hook

- disconnects the holding bridge on telephone keysets

Call-processing software modules

Call-processing and call-control features monitor and control the following activities through signals and messages sent to the RCS. These messages contain the A- and B-signaling bits and the DDL link.

The following software modules execute call-control operations for line circuits, subscriber loops, and telephone sets:

- Call-processing software in the RCC
    - terminal processing task (TPT)
- Call-processing software in the SMS-R unified processor (UP)
    - MP ringing task
    - DDL facility
    - A/B-bit facility
    - SMS-R maintenance

The following diagram shows the interface of the modules. A description for each module follows the diagram.

Call processing software modules

TPT software module   The TPT processes call-processing primitives or messages the CC sends to the RCC. The TPT sends messages to other call processing software in the SMS-R based on these messages.

The CC messages include the following:

- lists of active and equipped subscriber loops that connect to an RCS

- requests to service different subscriber loops on an RCS, like ringing, dial tone, and digit collection

- requests to execute channel and loop tests

- requests to generate a forward disconnect pattern on a channel to an RCS. The forward disconnect pattern forces a line card to drop the holding bridge on abandoned telephone calls. This line card has an associated key telephone set.

  Note: The system performs foward disconnect processing for single-circuit line cards with attached keysets. The forward disconnect signaling pattern sent to the line card causes the card to short the loop tip and ring together. This process causes key telephone sets to drop the holding bridge on abandoned calls.

- requests for automatic number identification (ANI) and coin functions

The TPT software in the RCC can receive CC primitive. When this condition occurs, the software sends messages to the following call-processing software areas in the SMS-R:

- DDL facility

  — assign a channel or terminate a channel assignment to a subscriber loop. The assign message (Mode II) can include a request for the PCM looping test.

- DDL facility

  — set channels associated with equipped and active loops to DS-1 channels. The DDL facility maintains an inventory of available DS-1 channels.

- A/B-bit facility

  — scan equipped, active subscriber loops for on-hook and off-hook

  — collect digits to send out ANI and coin requests to the RCS

  — scan responses to ANI and coin requests

  — send or cancel the forward disconnect signaling pattern on the correct channel to the specified subscriber loop

- MP ringing task

  — start or stop ringing on a subscriber loop

Note: Single-circuit cards in Mode II have fixed DS– channel assignments.

DDL facility software module   The DDL facility sends DDL messages to the RCS based on TPT messages the DDL receives from the RCC. Examples of DDL messages include assignment of DS-1 channels to subscriber loops and execution of the PCM looping test.

The DDL facility maintains an inventory of available DS-1 channels. As the DDL facility receives TPT messages, the DDL updates this inventory. These TPT messages request channel assignments and canceled assignments (Mode II). Subscriber lines that connect to a Mode I or Mode III RCS have fixed DS–1 channel assignments. The status of these channels is always open in the inventory. Other software areas, like the A/B-bit facility, use this inventory for available channels to perform functions associated with the channel.

A/B-bit facility software module   The A/B-bit facility performs the following operations associated with A- and B-bits:

- transmits signaling information to an RCS. The information requests the RCS to scan subscriber lines and perform ANI or coin operations. The information requests the RCS to ring subscriber lines or stop ringing on subscriber lines.

- receives A-bit signaling information from the RCS. The software checks the bit patterns for origination, answer, flash, disconnect, dial pulses for digit collection, and ANI or coin responses.

- transmits A and B bit information to the CM for unequipped lines at the remote terminal (RT), in Mode I operation. The RT transmits the line status information to the CM through an audit message that is not requested. The CM marks the line circuit as line module busy (LMB) and generates a minor alarm. The CM generates a PM128 log report.

- processes information related to the beginning or cancellation of the forward disconnect pattern on a channel

UP ringing task software module   The UP ringing task and A/B-bit facility work together. The UP and A/B–bit facility initiate or cancel ringing on a P-side channel in response to a TPT message from the RCC.

The UP ringing tasks receive a start or stop ringing message from the TPT. The UP ringing task sends messages to the A/B-bit facility. The A/B-bit facility sends the required A- and B-bits on the correct P-side channel to generate a ringing pattern. The A/B-DDL message card sends the signaling bits. The A/B-bit facility scans the P-side channel for signaling patterns that indicate that the subscriber answered the telephone. When the A/B-bit facility detects an answer, the facility sends the UP ringing task a confirmation message.

In Mode II, the C-field records the hook status for subscriber lines as an activity message from the RCS to the DDL facility.

SMS-R maintenance software module   The SMS-R maintenance software maintains the accuracy of the SMS-R/RCS. Operating company personnel can enter the busy (BSY), return to service (RTS), or test (TST) commands at the MAP terminal. When this event occurs, the CC sends associated messages to SMS-R maintenance software through the RCC. The SMS-R maintenance software processes these messages. The SMS-R maintenance processes CC messages that request that SMS-R P-side ports be opened or closed. If errors occur, SMS-R maintenance software informs the CC.

The SMS-R maintenance software performs the following tasks:

- sends RCS alarm information to the CC
- performs channel and loop tests
- allows operating company personnel protect switch protection lines
- updates data tables

The following sections describe the system setup required for call processing and the sequence of events that occur during call processing.

Call processing setup

 Call processing requires the following steps:

- The UP maintenance software loads static data tables.
- The UP maintenance software opens configured SMS-R P-side ports and closes the ports that remain. A CC request causes UP maintenance software actions.
- The UP maintenance software allows external signaling for all channels on opened P-side ports. This condition makes sure that the A/B-bit facility can transmit the required A- and B-bits on the channels.
- The DDL facility sets equipped, active channels to channels in the inventory in response to a TPT message.
- The TPT sends a message to the A/B-bit facility that requests the facility to scan equipped, active channels for off-hook.

Call processing sequence of events-originating end

The following sequence of events occurs during call processing at the originating end of a call:

1   The A/B-bit facility scans for A- and B-bit pattern changes that indicates the subscriber is off-hook. When the facility detects an off-hook, the A/B-bit facility sends a message to TPT software.

In Mode II, the DDL facility receives a message from the RCS through the C-field of the DDL message. This condition indicates a subscriber is off-hook.

2   In Modes I and III, DS-1 channel assignments are fixed for subscribers, and messaging is not required to assign a subscriber line to a channel.

In Mode II, the TPT decodes the message from the A/B-bit facility and sends a message to the DDL facility. The A/B–bit facility requests the DDL facility to assign a channel to the subscriber line. The TPT indicates if the DS–1 channel requires a PCM looping test. The DDL facility sends a channel-assignment message to the RCS through the A/B-DDL message card.

If the PCM looping test fails, the DDL facility reports the failure to SMS-R maintenance. The system disables transmission through the DS-1 channel.

3   When channel assignment occurs, the TPT connects dial tone to the subscriber loop after channel assignment. The system sends a dial tone over the DS-1 channel assigned to the subscriber line.

4   The TPT sends a message to the A/B-bit facility to request the facility to scan for digits.

5   If the subscriber dials digits, the A/B-bit facility digit collection routine collects the digits and sends the digits to the TPT. The digits are sent to the CC from the TPT.

6   The TPT connects audible ringing tone to the subscriber loop. The TPT sends a message to the A/B-bit facility to scan the subscriber loop for on-hook.

Call processing sequence of events-terminating end
The following sequence of events occurs during call processing at the terminating end of a call:

1   The RCC TPT sends a message to the UP ringing task to start ringing the called subscriber loop.

2   The UP ringing task schedules ringing and sends a message to the A/B-bit facility to scan for an answer. The A/B-bit facility directs the A/B-DDL message card to send ringing patterns to the RCS.

3   When the A/B-bit facility detects an answer, the facility sends a confirmation message to the UP ringing task.

4   The UP ringing task directs the A/B-bit facility to stop ringing on the subscriber loop. The UP task sends the RCC TPT a message that indicates a subscriber answer.

5   The RCC TPT sends a message to the A/B-bit facility. The message requests the facility to scan for on-hook on the called subscriber line.

6   The A/B-bit facility scans the originating and the terminating subscriber loops. The A/B–bit facility sends the TPT in the RCC a message when one of the loops goes on-hook.

7   When a loop goes on-hook, the RCC TPT sends the DDL facility a message. The message cancels the assignment of the DS-1 channel from the associated subscriber loop.

ANI and coin functions

The ANI and coin functions support coin features and ANI for the SMS-R/RCS. The ANI and coin functions are grouped as one feature because the software and hardware used for application are the same.

Coin features that apply to dial tone first (CDF) and coin first (CCF) lines, consist of the following capabilities:

- scan for off-hook
- check for coin presence during call origination
- check for coin presence during local call overtime
- return coins
- coins

The ANI determines if a two-party line is active from the tip or ring of the line. This action obtains billing responsibility for the call.

The system transmits A- and B-bit signaling patterns between the SMS-R and the RCS. These signaling patterns implement the ANI coin features. The system transmits the following signals from the SMS-R to the RCS:

- negative loop mode
- channel test
- positive loop mode
- ground start
- R ringing
- positive coin check
- positive coin control
- negative coin control
- negative coin check

The system transmits the following signals from the RCS to the SMS-R in response to SMS-R signals:

- on-hook

- off-hook

- coin ground

- unequipped

These signaling states are associated with exact A- and B-bit patterns. The Bell Communications Research document *Digital Interface Between the SLC-96 Digital Loop Carrier System and a Local Digital Switch*, TR–TSY-000008 describe these steps. The RCS receives a specified pattern on a DS-1 channel. The RCS causes the line card associated with the channel to place a voltage on the tip-ring pair. This voltage is negative or positive. These voltages cause operations, like ringing, coin return, or coin collect to occur.

Both CDF and CCF lines use the SCD233 coin card. This card has one line circuit. A maximum of 12 SCD233 coin cards are present on an RCS shelf that operates in Modes I or III. A maximum of 48 cards are present on the four shelves of a fully equipped RCS operating in Modes I or III.

Coin cards in Mode II are placed in one of the four right slots of an RCS shelf. When the coin card is plugged in, the system assigns a permanent DS-1 channel to the coin card.

Dial tone first loop

A dial tone first (CDF) loop starts in a negative loop mode. The negative loop mode has 48 V on the ring side and the tip side grounded. When the subscriber lifts the telephone handset, switchhook contacts and coin equipment relays establish a current path from ring to tip.

The RCS detects a change in current from the CDF loop that indicates an off hook. The RCS sends a pattern of A- and B-bits to the 8085 microprocessor in the A/B-DDL message card. This change in current indicates to the microprocessor that the subscriber is off-hook.

The SMS-R A/B-bit facility detects this origination through the 8085 microprocessor and sends a message to the TPT. The TPT informs the CC of the origination. The CC directs the TPT to connect dial tone to the subscriber.

The subscriber deposits the correct amount for a local call. The subscriber dials the directory number at the same time. Failure to deposit the correct amount results in a recording. The recording instructs the subscriber to initiate the call again and deposit the correct amount. Two cycles of this

announcement play. If the subscriber does not deposit the required amount at the end of two announcements, the call disconnects.

The digital recorded announcement machine (DRAM) is the source of the announcement. The DRAM is a maintenance trunk module (MTM) that contains digital recorded announcement (DRA) cards. DRA cards store audio messages for call processing. The switch uses the DRA cards to send recorded voice messages to subscribers. When the RCC enters emergency stand-alone (ESA), DRA does not provide recorded announcements.

The DMS-100 switch checks for coins through a negative coin check on the SCD233 coin card. The 8085 microprocessor sends an A- and B-bit pattern to the RCS. The bit pattern requests the RCS to check for coins. If a coin is present, contacts in the coin telephone set close and the RCS detects a ground signal. The RCS sends a signaling pattern of A- and B-bits to the 8085 microprocessor. This signaling pattern connects to a coin ground signal and indicates the subscriber deposited a coin. The A/B-bit facility scans the coin ground pattern and sends a message to the TPT that indicates that a coin ground pattern was received. The TPT informs the CC.

The subscriber receives a recording as described in this section if the RCS does not detect a coin ground pattern.

Coin first line
A coin first (CCF) line begins in ground start mode. The CCF line has a –48 V on the ring side of the loop and the tip side open.

The RCS detects origination when the subscriber lifts the handset only if the subscriber deposited the correct amount of money.

After the subscriber makes the correct deposit, switchhook contacts and coin set relays establish a current path from ring to ground. The RCS detects the ground current. The RTS sends a signaling pattern to the 8085 microprocessor. This signal indicates the ground current is present.

The A/B-bit facility detects the origination and sends a message to the TPT. The TPT informs the CC of the origination. The CC directs the TPT to connect dial tone to the subscriber line.

Local coin overtime
At the end of the first time period for a call, an announcement instructs the calling subscriber to add an additional deposit. The announcement indicates the deposit is necessary to continue the call. The SMS-R sends the RCS a positive coin check pattern to check for the correct amount. If a deposit does not occur, the call disconnects. An announcement for an additional deposit occurs at the end of each overtime period.

Coin collect and coin return

To collect coins, the CC sends a coin-collect message to the TPT. The TPT decodes this message. The TPT directs the A/B-bit facility to send an outgoing A- and B-bit signaling pattern to the RCS. This pattern requests the RCS to have the coin set collect the deposited coins. The 8085 microprocessor sends the signaling pattern to the RCS. The RCS applies a positive coin-collect voltage to the tip of the coin loop with the ring open. This voltage on the tip causes the coin telephone to deposit the coins into the hopper.

If the DMS-100 switch detects an on-hook before call connection occurs, the CC sends the TPT a message. The message instructs the TPT to return the coin. The TPT decodes this message. The TPT directs the A/B-bit facility to send an outgoing A- and B-bit signaling pattern. The RCS receives the pattern with the request that the coin set return the coin.

The 8085 microprocessor sends the signaling pattern to the RCS. The RCS applies a negative voltage to the tip side of the loop with the ring side open. This voltage on the tip side of the loop returns the coin to the subscriber.

ANI

To request ANI, the CC sends a message to the TPT. After the TPT decodes this message, the TPT directs the A/B-bit facility to perform ANI on the correct loop. The 8085 microprocessor sends an ANI request to the RCS.

The RCS detects a tip-party ground pattern if the tip party is off-hook. If this condition does not occur, the RCS detects an on-hook pattern that indicates the ring party is off-hook.

ANI and coin function limits

The following limits apply to ANI and coin functions:

- Coin cards can occupy only the four right slots of an RCS shelf in Mode II. In Modes I or III, coin cards can occupy any slot, but one DS-1 channel must not be in use.

- The SMS-R/RCS subsystem does not support semi-postpay lines.

Custom Local Access Services (CLASS)

Revisions are made in the proprietary DSCWID feature to comply with Bellcore TR-416. Bellcore TR416 describes the requirements for DSCWID and specifies how this feature interfaces with:

- an ADSI set—A screen ADSI CPE that can display options.

- an SCWID set—A non-ADSI CPE that can deliver caller identification (CID) data.

- an 2500 set—A non-ADSI CPE that is that can signal Dual Tone Multi-Frequency (DTMF). The 2500 set cannot perform off-hook delivery of CID data.

Tones the CC sends alert the DSCWID subscriber of a pending call. These tones alert the CPE of pending caller data. A line with the DSCWID option can have a call established. A second call can attempt to terminate to the same line. When this condition occurs, the CC displays one of two types of alerting signals. The two signals are a Subscriber Alerting Signal (SAS) and an SAS that precedes a CPE Alerting Signal (CAS). The SAS is the tone that the subscriber recognizes as the call waiting tone (CWT). The CAS alerts the CPE of incoming data if the subscriber line has the Caller Identification (CID) feature.

The DSCWID CPE generates an acknowledgement (ACK) tone in response to alerting tones. The ACK tone indicates that the DSCWID CPE can receive DSCWID data. The UTR card in the SMS-R collects the ACK tone. If the CPE is ADSI compatible, the system sends a DTMF A ACK signal in response to the CAS. If the CPE is a SCWID CPE, the CPE sends a DTMF D ACK signal in response to the CAS. When the transmission of alert tones completes, the subscriber can control the condition of the incoming call. The subscriber uses CPE softkeys to respond if the CPE is ADSI. The subscriber uses hard-coded keys if the CPE is a SCWID or a 2500 set. The system treats the CPE as a 2500 set if the CPE does not respond with the acknowledgment tone. The following figures show examples of responses from the three set types.

Example of a DSCWID call on an ADSI set

CC		SMS-R		CPE
	Data →			
	SAS →────────────────→			
	CAS →────────────────→			
			← ACK (DTMF A)	
			← Data	
			← Flash	
← DTMF digit			← DTMF digit	Softkey hit
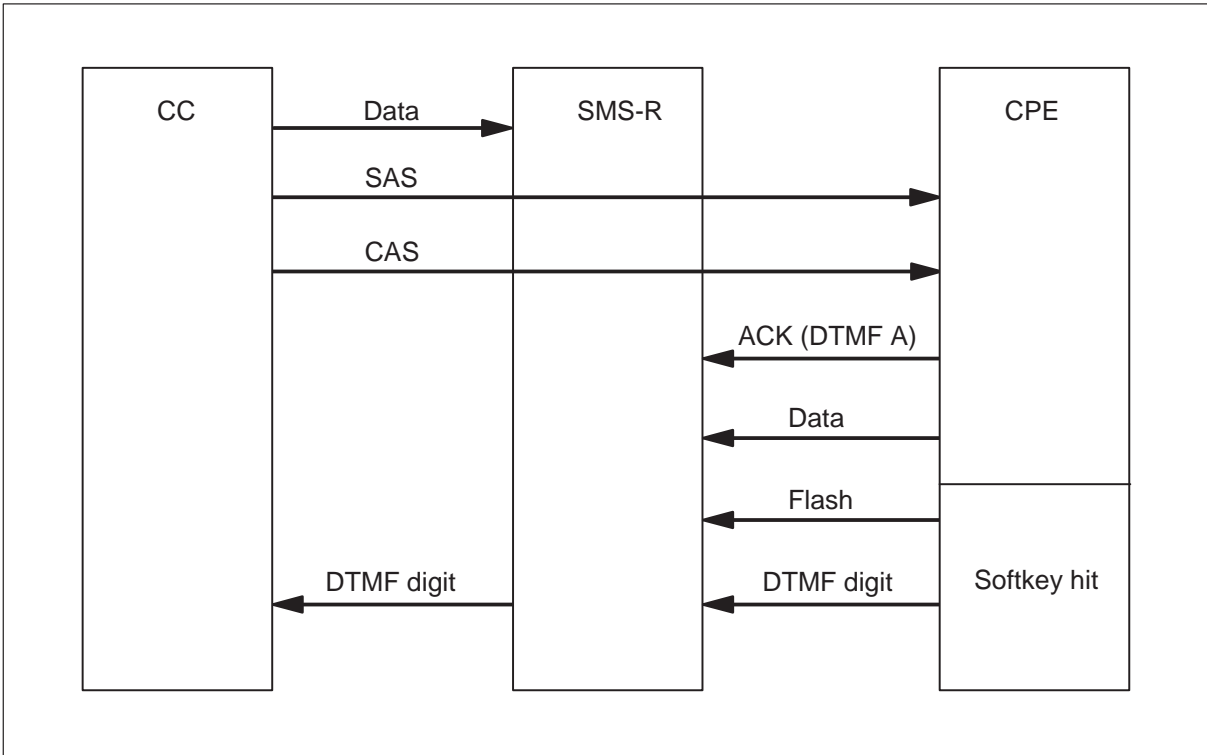
Example of a DSCWID call on a SCWID set

CC		SMS-R		CPE
	Data →			
	SAS →────────────────→			
	CAS →────────────────→			
			← ACK (DTMF D)	
			Data →	
			← Flash	
← DTMF digit			← DTMF digit	Select option
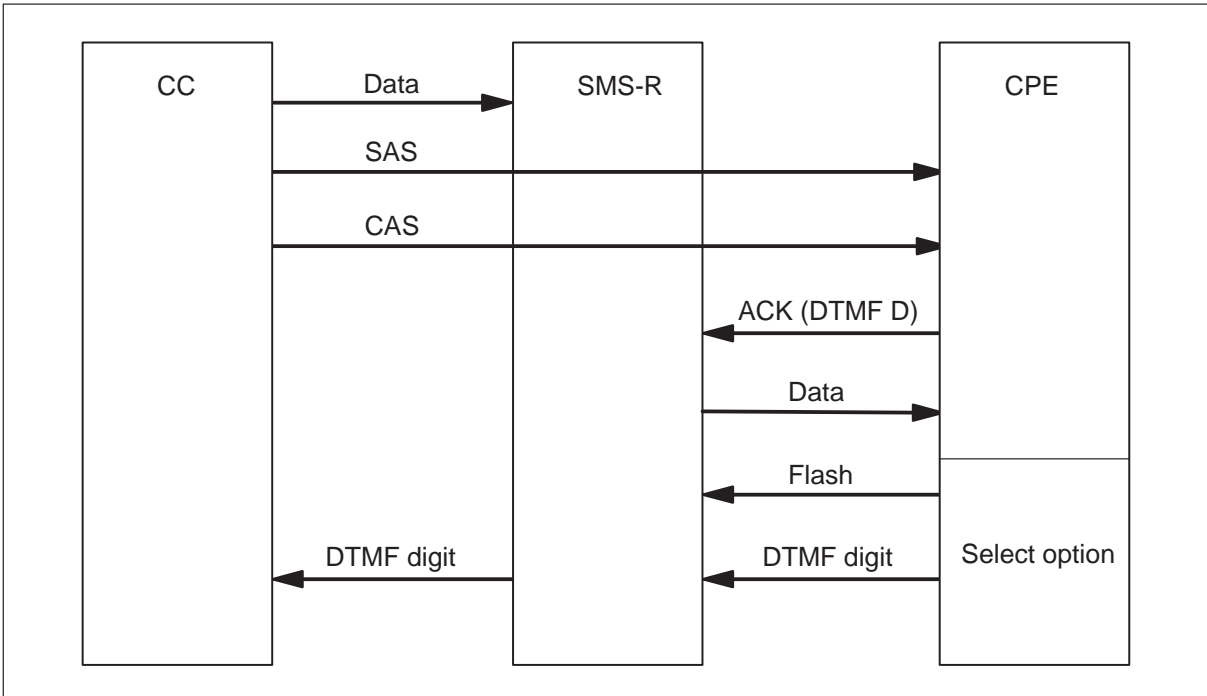
Example of a DSCWID call on a 2500 set
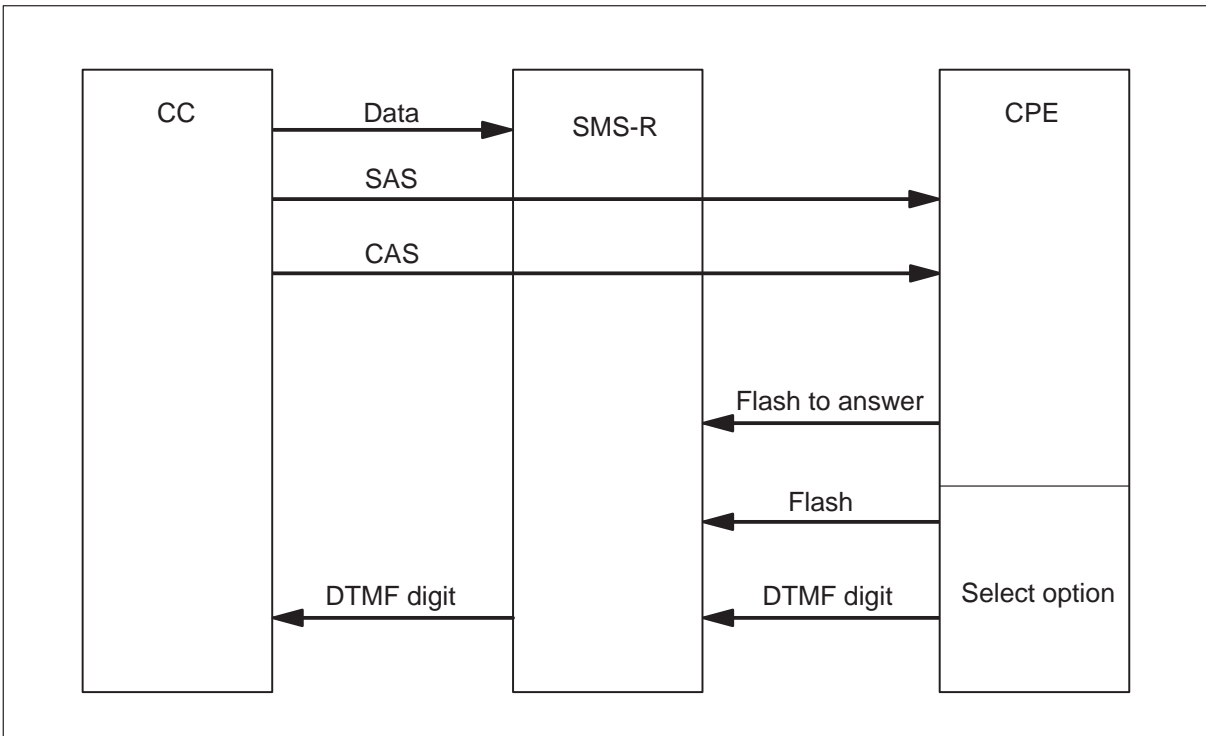
The CC sends alert signals to the CPE. This condition occurs even when one UTR channel is not available. If UTR channels are not available, the CC does not send data to the CPE. For the proprietary DSCWID, the system ignores a flash when the SMS-R cannot attach to a UTR. If the system detects a flash and cannot attach a UTR, the switch must provide options for Bellcore compliance. The SMS-R sends a flash to the CC if the SMS-R cannot attach a UTR in 400 ms. If the CC does not acknowledge the first notification of a call in 10 ms, the SMS-R sends a second alerting signal. If required channels are not available, display data cannot transfer to the CPE. If this condition occurs, the system stores and resends the data if the alerting signals continue.

The SMS-R starts a T-tone timer when the SMS-R receives a flash signal from the ADSI compatible CPE of the user. The ADSI compatible CPE sends the signal to the SMS-R. The Ttone timer measures the maximum time allowed between the flash sent and the DTMF digit on an ADSI set. The timeout is 600ms. The speech path is muted during timeout. The T-tone timer starts for the first option selection during a DSCWID call for any CPE type. All other ADSI DSCWID option selections start the T-tone timer.

All DSCWID option selections that follow on a SCWID or 2500 set use a current timer (T-flash). After a subscriber answers a call with SCWID and

2500 sets, the system uses the T-flash timer. The T flash timer provides the customer with time to select an option after a flash. This timer was introduced because subscribers did not have time to flash and dial a DTMF digit in 600 ms.

The operating company can set the T-flash timer from 1 to 8. The default time is 1.5. The SMS-R starts the T-flash timer if the NONADSI field in table DSCWDTYP is set to Y. The SMS-R receives a flash signal from customers SCWID or 2500 set during the held or conference call state. The SMS-R must keep track of the DSCWID call state and the type of CPE. Use of the the timer depends on these requirements. If the SMS-R cannot attach a UTR before 400 ms, the system applies the RETURN option.

The CC attempts to stay synchronized with the CPE at all times. This close supervision prevents some conditions where the CPE thinks the CPE performed a function. The switch does not process the option based on the call state. DSCWID call waiting condition options are:

- Answer the new call and put the current call on hold

- Disconnect the current call and answer the new call

- Forward the new call

- Connect the new call to a busy announcement

- Put the new call on hold after connection to a hold announcement

- Conference the new call with the current call.

Stable two-party call state

New incoming call detected alerting applied

Waiting call state

FWD	BUSY	DROP	ANSWER	HOLD	CONF	

Flash +
DTMF 9

Flash +
DTMF 8

Flash +
DTMF 7

*Flash +
DTMF 1

Flash +
DTMF 6

Flash +
DTMF 3

DEFAULT
timeout

Held call state

RETURN	DROP	CONF

*Flash +
DTMF 1

Flash +
DTMF 7

Flash +
DTMF 3

ANNC
default
treatment

FWD
default
treatment

RING
default
treatment

Conference call state

DROPFIRST	DROPLAST

Flash +
DTMF 5

*Flash +
DTMF 4

Note 1: An * indicates that a flash can perform the same function as the transmission of the DTMF code for that digit.

Note 2: If a non-ADSI set is configured for hard-coded keys to perform DSCWID dispositions, or the subscriber can provide a DTMF-digit in 600 ms, dispositions can be   availabl e if NONADSI = Y in table DSCWDTYP for the specified DSCWID type.

P-side channel management

SMS-R P-side channel management supports channel allocation in the SMS-R/RCS. P-side channel allocation is the process that allocates a P-side port off the RCC and allocates a P-side channel off the SMS-R.

Terminal ID in the RCS corresponds to an RCS and a line circuit in a line card of the RCS. The RCS has a maximum of 96 line circuits. The RCC associates an RCS terminal ID with an SMS-R P-side port and DS-1 channel. This condition establishes a communication link between the RCS line circuit and the SMS-R

The P-side ports and DS-1 channels connect a specified line circuit to the SMS-R when SMS-R shelf groups operate in Modes I or III. The DMS-100 switch allocates the ports and channels internally.

In Mode II, the switch allocates channels continuously. The RCC sends a trunk assign message. The RCC sends the message over the C-field of the DDL that associates a DS-1 channel with a line circuit.

Operator verification

Operator verification is the process that uses the operator bridge tip and ring of a subscriber line. Operator verification can monitor the conversation in progress to determine if a line is busy.

The operator bridges the tip and ring of the subscriber loop with a metal test pair to grant monitor access. The operator can replace the two-way connection with a three-way conference call.

The RCS cannot bridge tip and ring through the metal test pair when both parties are in a call. This limit causes operators to use a three-port network conference circuit to provide this bridge. The operator must use the RCC time switch connection for operator verification on interswitched or intraswitched calls. The RCC time switch connection must be closed and reconnected through the network to the conference circuit.

Conference circuits are for three-way calls. A new network connection occurs when an SMS-R line has three-way calling and makes an intraswitched call. This connection occurs when operator verification occurs. Refer to the following figure for the operator verification configuration used for network-switched SMS-R calls.

Operator verification equipment configuration
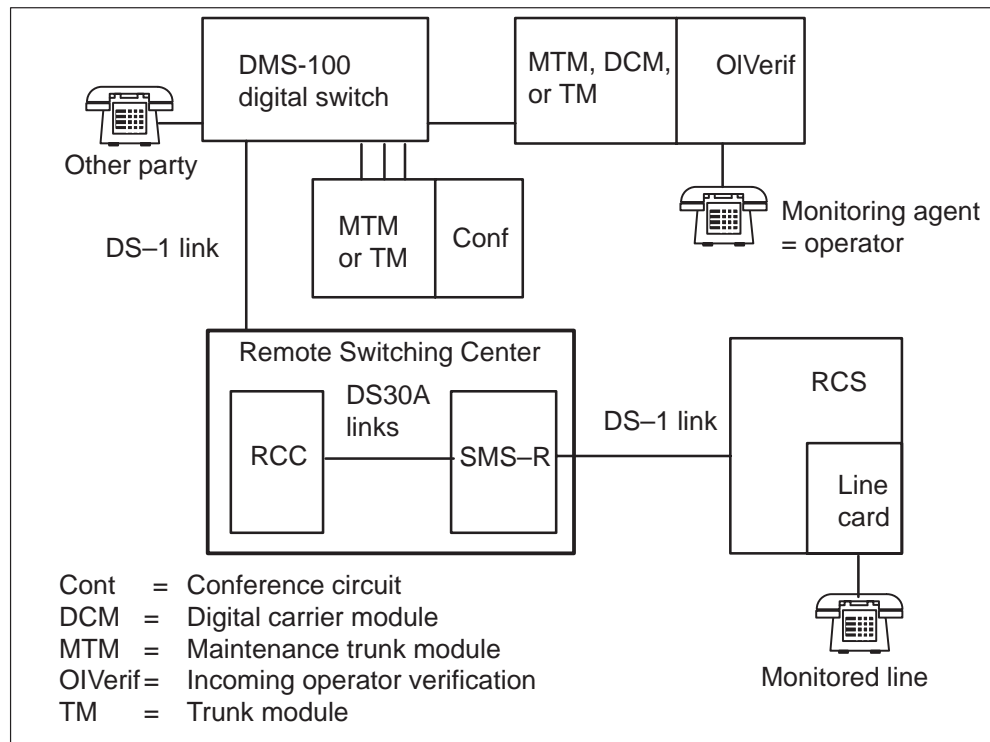
Operator verification on RCS lines uses three-port conference cards. Operator verification fails under the following conditions:

- the custom-calling feature activates. Call forwarding, speed calling, and call waiting are examples of this feature.

- the system routes the call through trunks of trunk group OP

- the RCC is in emergency stand-alone (ESA) mode

When operator verification fails, operating company personnel receive one of the following responses:

- busy tone (60 IPM) indicates that normal access is available. The line access is not available because the line has an activated custom calling feature. The line can be connected to another operator.

- the reorder tone (120 IPM) indicates that normal access is not available

When operator verification succeeds, the operator hears a quiet line, a conversation, or an announcement on the line. The following table describes line conditions and system actions.

Line conditions for operator verification

Line condition	Characteristics	DMS response
Idle line	Normal access available (voice and voice/data)	Normal connection – no ringing, no tone
	Normal access not available (voice and voice/data)	Reorder tone (120 IPM)
	Data-only line	Verification denied – busy tone (60 IPM)
Busy line	Line is traffic busy (voice and voice/data, simple line)	Access connection made – conversation, quiet line, reorder, busy tone, announcement, or some other indication that the line is traffic busy
		Note: Data signals are not reliable after verification because of conference port use. Line option, NO DOUBLE CONNECTION (NDC), does not allow testing and verification if the line is busy.
	Line up to permanent announcement or receiver off-hook (ROH) tone	Permanent signal tone
	Line up to tone or announcement that is not permanent	Same as traffic busy simple line
	Line is rung	Operator receives busy tone (60 IPM)
	Line in hunting with an idle line in the group	Normal access connection made – no ringing, no tone
	Line in hunting when all the lines in the group are busy	Same as traffic busy simple line
	Data-only line	Verification denied – busy tone (60 IPM)
	Line activated with custom calling feature	Operator receives busy tone (60 IPM)
Line module busy (LMB)	Line is entered and unequipped or remote terminal (RT) is out-of-service	System generates minor alarm and PM128 log report
LMB	RCS or SMS is SysB	System generates minor alarm and PM128 log reports
LMB	SMS P-side link is SysB	System generates minor alarm and PM128 log report
—continued—		

Line conditions for operator verification (continued)

Line condition	Characteristics	DMS response
Line verification in progress	Line becomes idle during verification	No-test-access connection dropped, normal access connection retained
	Line goes off-hook during verification	Normal access connection retained, customer does not receive dial tone
	Attempt to activate custom calling feature	System ignores transient state when system verifies line
Line with cutoff on disconnect option	Line has the cutoff on disconnect (COD) option	Operator obtains a verification connection. If the party that is not verified goes on-hook, the call goes down and operating company personnel receive busy tone (60 IPM).
—end—		

DMSX messaging

DS30A links between the SMS-R and the RCC use DMSX protocol. The DMSX protocol is an interterminal process. The process involves handshaking messages where two terminals in message transfer inform each other of the present message condition. Refer to the following figure for a general form of handshaking protocol, which comprises DMSX protocol.

DMSX handshaking protocol

Link control messages (request to send, send)

Message header: DMSX

Message data

Checksum or cyclic redundancy check

Message

Link control messages (acknowledgment)
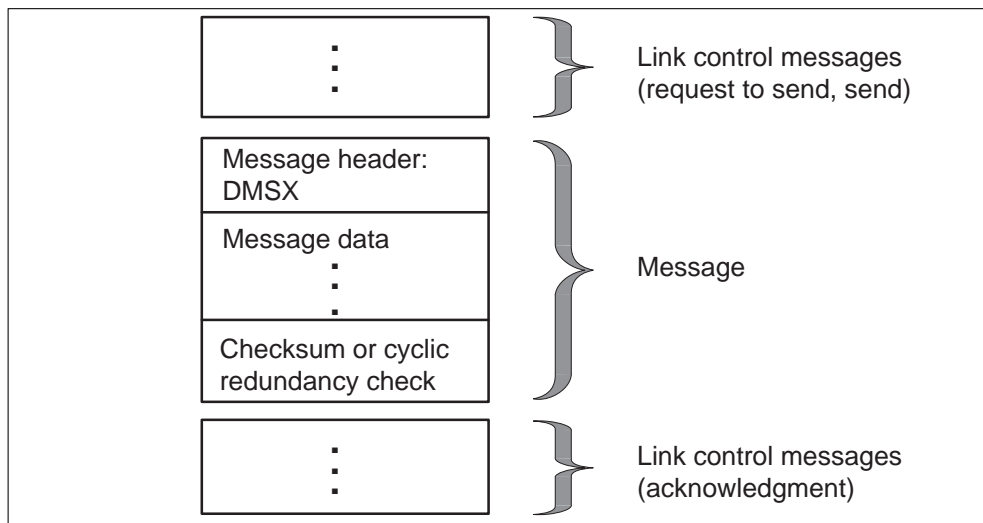
The DMSX is a half-duplex protocol used for messaging on the DS30A links between the RCC and the SMS-R. The DMSX protocol includes a cyclic redundancy check (CRC) code for error detection.

Message time-out and message checksum or CRC calculation performs message error detection. In the event of protocol, checksum, or CRC failure on an outgoing message, the sending node attempts the send sequence again. On an incoming message failure, the sending node reroutes the message over an alternate C-side link. Hardware redundancies provide a minimum of one alternative path to and from a node. The following figure describes the correct format for DMSX messages.

DMSX message format
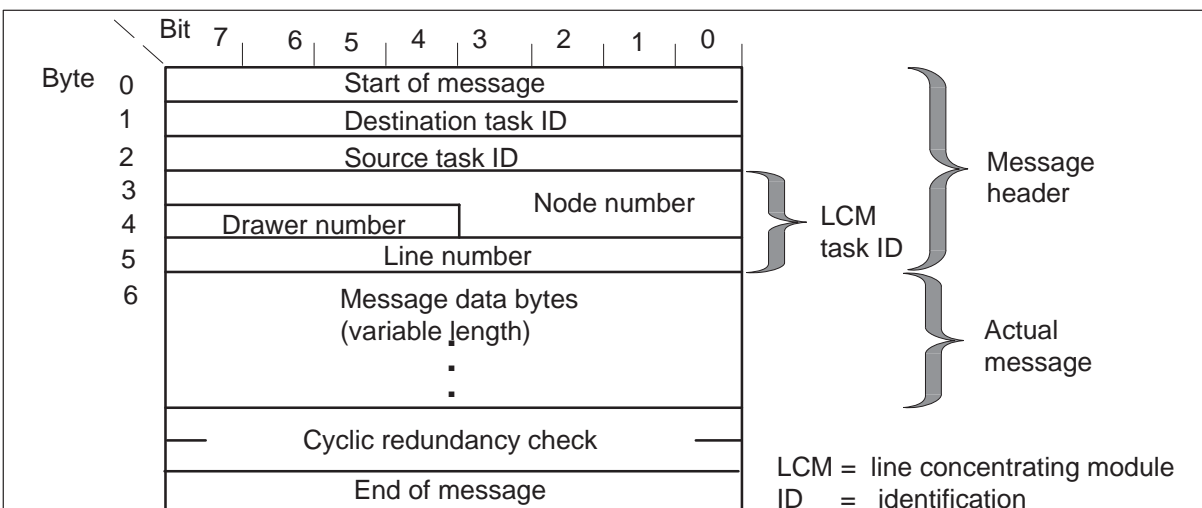
The system transmits the message over a link, with link control messages that precede and follow the message. Messaging occurs between programs that run in the SMS-R and programs that run in the RCC. Many processing tasks send messages over the DS30A links to communicate internally.

The first six bytes contain the DMSX message header as follows:

- first byte specifies the start of the message
- second byte specifies the destination task ID of the message. This ID is for an outgoing message to identify the process that receives the message.
- third byte specifies the source task ID. This ID is for an incoming message to identify the process that sent the message.
- fourth, fifth, and sixth bytes specify the task ID number.

The number of bytes in the message or data can change. The CRC that occupies two bytes, detects transmission errors. The end of message occupies one byte.

Intraswitching

Intraswitching bypasses the network to allow the RCC to complete calls to the RCC. Only calls to lines or trunks accessible by the RCC are successful. The RCC intraswitches calls that originate or terminate to RCS subscriber lines. The system supports calls from RCS lines to other RCS, LCM, or RLCM subscriber lines or trunks the same RCC can access. The system supports calls from these agents to RCS lines that the same RCC can access.

Calls for a dual RCC (DRCC) can originate or terminate to SMS-R lines, lines LCMs or RLCMs serve, or digital trunks. When these calls originate or terminate on these lines or trunks, the same RCC must serve these lines or trunks.

Interswitching

Interswitching refers to switching between RCCs in a dual RCC. Interswitched calls are calls that originate from lines one RCC serves and terminate to lines another RCC serves. Calls are interswitched between the RCCs through interlinks. The LCMs, RLCMs, or SMS-Rs can serve the lines. Interswitching occurs in both ESA and normal modes of operation.

Warm SWACT

A Warm SWACT allows the inactive unit of the SMS-R to maintain established calls. This event occurs when the unit takes control of the SMS-R. The system does not maintain calls in a transient state over a Warm SWACT. Transient call states include dialing or ringing. When the calls originate again, the calls receive dial tone immediately. This event does not occur for Mode II dual circuits where the subscriber must go on-hook first to reoriginate a call.

Warm SWACT requires that both units of the SMS-R be in-service. Continuous data updates and bulk data updates contain information on SMS-R/RSC. The updates occur when information transfers from the active to the inactive unit of the SMS-R during a Warm SWACT.

The following limits apply to Warm SWACT:

- The system sends messages between mates with the IMC-link. The IMC-link between the two SMS-R units and limited UP real time has bandwidth limits. These limits cause synchronization of call data between the mates when call processing is not in progress. Under heavy traffic, call data in the inactive unit is not always up to date. The system can drop some established calls when a SWACT occurs.

- A call maintained over an activity switch loses hook-flash capability to initiate features for the remainder of the call. The system recognizes the hook-flash as an on-hook.

- When the RSC is in ESA, the system supports one Warm SWACT of the SMS-R. Any SWACTs that follow make the SMS-R lose call processing.

If a SWACT occurs when a subscriber line test is in progress, the test fails. The line test occurs when the RCS sets up a connection to the metal test pair. Operating company personnel can release the connection to the metal test pair, access the test network again, and attempt the test again.

Warm SWACT and the SWACT back feature

Feature AF5007 is the XPM Pre-SWACT/Post-SWACT Audit and improves the Warm SWACT operation. This feature denies the SWACT if the inactive unit cannot maintain activity or communication with the CC. This condition improves the operation. This feature allows the system to SWACT back to the originally active unit under these conditions. The software that drives this feature is the SWACT controller.

SWACT controller

The system routes all manual requests and selected system requests for Warm SWACTs to the SWACT controller in the CC. The SWACT controller polls PM diagnostic history data in the CC and XPM status data in the XPM. The XPM data is not the same as XPM static data. The SWACT controller denies the request for a Warm SWACT or allows a Warm SWACT to proceed.

If the SWACT controller denies a manual request for a SWACT, the system informs the user that the controller denied the request. The system informs the user that the user can override the SWACT controller. The user must enter the command string SWACT FORCE. If the user decides to override the SWACT controller, the system performs a Warm SWACT. The system does not consult diagnostic history or status data. The active unit of the XPM drops activity and becomes the inactive unit. This unit stays in service until the newly active unit can verify two-way communication with the CC. The system must maintain activity.

If two-way communication is available and the newly active unit can maintain activity, the system busies the inactive unit. The inactive unit returns to service. If communication fails or the newly-active unit cannot maintain activity, a SWACT back to the originally active unit occurs.   Refer to the following figure for an example of a SWACT back.

SWACT back example

1.
ISTb
Unit 0
InSv
Unit 1
☐ Active
☐ Inactive

2.
>SWACT

3.
SWACT controller
Data polling
PM diagnostic history
XPM status

4.
SWACT
refused
by SWACT
Controller

5.
>SWACT FORCE

6.
ISTb
Unit 0
InSv
Unit 1
☐ Active
☐ Inactive

7.
ISTb
Unit 0
InSv
Unit 1
☐ Active
☐ Inactive

1. Both units are in service; unit 0 is active.
2. The user attempts a Warm SWACT from unit 0 to unit 1.
3. The SWACT controller in the CC polls PM diagnostic history   data in the CC and XPM status data in the XPM.
4. Based on the polled data, the SWACT controller denies the   request of the user for a Warm SWACT.
5. The user decides to override the SWACT controller.
6. Unit 0 drops activity but remains in service while post-SWACT audits are run on unit 1.
7. Post-SWACT audits detect a problem in unit 1. This event causes a   SWACT back to unit 0.

During a SWACT back, the originally active unit attempts to regain activity. If the unit can regain activity, the system busies and returns to service the inactive unit. The active unit remains in service. The system preserves steady calls from the originally active unit over the SWACT back. The system drops all new calls that occur after the SWACT and before the SWACT back . If a SWACT back does not complete, the system busies and returns to service both units of the XPM.

Note 1: The system does not restart operational measurements and peg counts after a SWACT back.

Note 2:   The system does not support this feature during XPM or CC overload.

The following SWACT commands the user enters have the SWACT back capability:

- SWACT

- SWACT TEST

- SWACT NOW

- SWACT ALL

- SWACT FORCE

- TST REX NOW

- BSY UNIT unit_no

  where

  unit_no   is the number of the active unit
- BSY ACTIVE

Note: The SWACT back capability applies to a routine exercise (REX) test that the REX scheduler initiates. For additional information on how this feature interacts with REX testing, refer to Routine exercise test in this document.

PM diagnostic history data Feature AF5006, PM Diagnostic History, provides a data base of information on each XPM unit that subtends the DMS-100 switch. The SWACT controller uses this information to determine if an inactive unit can maintain activity if a Warm SWACT occurs. The information collected is reset when the unit correctly gains activity. For additional information about this feature, refer to XPM diagnostic history in section Trouble isolation and correction.

XPM status data   The SWACT controller polls data in the XPM to determine if the inactive unit can maintain activity. The XPM responds to the SWACT controller query. The XPM response indicates that the active unit can or cannot comply to drop activity based on the status data. For additional information on XPM status data, refer to Pre-gain audit in this document.

Functional description of the RCS

The RCS, or the SLC-96, is a digital loop carrier that serves a maximum of 96 subscribers. The RCS connects to the DMS-100 through the SMS-R.

Three to five DS-1 links connect the RCS to the SMS-R. These links include two to four active links and one protection link. All active DS-1

digital links support 24 time slots or channels. The RCS is organized in channel banks, or shelf groups. Channel banks separate in common equipment and channel units. Channel units are line cards.

The following common equipment is in the RCS:

- line interface unit – interfaces a shelf to a DS-1 line
- time assignment unit – acts as a carrier concentrator in Mode II
- multiplex unit – supports special services
- alarm control unit – processes alarm control information
- special service unit – processes special service functions
- channel test unit – tests channel units and subscriber loops
- data link unit – processes functions from the data link
- line switch unit – performs protection switching
- power unit – provides power to a shelf group
- transmit receive unit – performs encoding, decoding, channel timing, multiplexing, and framing for a DS-1 digroup

The RCS is configured with single-party, multiparty, coin, or special service lines. Single-party and multiparty channel units contain two dependent line circuits. Coin and special services channel units contain one line circuit.

Modes

Each shelf group operates in one of the following modes:

- Mode I

  Each subscriber has a dedicated DS-1 channel. The RCS supports a maximum of 96 subscriber lines. The lines connect to the SMS through a maximum of four primary DS-1 links.

- Mode II

  Two primary DS-1 links connect the RCS to the SMS-R. 48 subscribers compete for 24 time slots on a DS-1 link.

- Mode III

  The RCS operates through one DS-1 link on each shelf group. The RCS uses a multiplexer to multiplex channels from the two shelves on a shelf group to one DS-1 line.

Derived data link

The DDL allows messaging between the RCS and the SMS-R. To create DDL, the system adds data messages on to the framing bit of the PCM stream on DS-1 lines A and C. The DDL consists of the following units:

- C-field (slot assignment)

- M-field (maintenance messages)

- A-field (alarm messages)

- S-field (protection switch messages)

All fields are present on the A-link: you can use the C-field when shelf group AB operates in Mode II. The DDL is present on the C-link when shelf group CD operates in Mode II. The C-field is the only field on the C-link DDL. The DLU processes DDL messages.

The A- and B-bit on each DS-1 channel transmit signaling and supervision information. The A– and B–b+ allow the RCS to perform call processing on links B, C, and D. A failure results in a loss of link A and the associated DDL messaging between the SMS-R and RCS. To take advantage of the RCS capability, the user must define all links to the RCS as message links. The user must define all links as message links. The nature of the I/O system software causes this condition.

If the RCS remains in service with loss of the DDL link other problems can occur. These problems include the following:

- All PM maintenance on the RCS is disabled (maintenance messages to the RCS use the DDL link). The RCS state is not known from time of failure until the system returns the A-link to service.

- Audits that use the DDL link are shut off (for example, node audit and line diagnostics).

The system definition of the RCS provides only one message link (link A) for the RCS. Loss of service on this link causes the RCS to go out-of-service. The RCS can go out-of-service while call processing remains possible on links B, C, and D.

DS-1 link functional description

The DS-1 links connect the SMS-R to the RCS. The SMS-R provides a maximum of 20 DS-1 links to the SMS-R remotes. Each remote terminates from two to four primary DS-1 links from an SMS-R. The number of links that a remote terminates depends on the remote mode of the operation. In addition, each remote can have an optimal protection link. The protection link can provide continued communication between the SMS-R and the

RCS. The link provides communication if a primary DS-1 link fails or the switch operator places the link out-of-service.

- a primary DS-1 link fails
- the switch operator places a primary DS-1 link out of service

The DS-1 links connect to the SMS-R P-side through the DS-1 interface card (NT6X85) and terminate on a line interface unit in the RCS.

Each SMS-R shelf contains DS-1 interface cards. The number of cards depends on the number of RCSs being connected. Each DS-1 card connects to the control coupler of both shelves. Each shelf has a maximum of five DS–1 interface cards. Each card provides two DS-1 ports.

Port assignments for each shelf are as follows:
- shelf 0: ports 0, 1, 4, 5, 8, 9, 12, 13, 16, 17
- shelf 1: ports 2, 3, 6, 7, 10, 11, 14, 15, 18, 19

The active unit controls all the DS-1 ports (0-19).

A DS-1 link carries 24 channels. Each channel contains eight bits of PCM data. The sequence front includes a framing bit. This condition makes sure the SMS-R and the RCS recognize the start of each 24-channel sequence. The system sends 192 bits of information during each 24-channel sequence, plus a framing bit. These 193 bits of information are known as a channel frame. For more information on the design of the DS-1 link, refer to *Translations Guide*.

SMS-R fault conditions

Several types of faults can occur in SMS-R/R components. In the host office, C-side links from the SMS-R to the network can go down. Network links that have faults can cause a loss of messaging from the CC or a loss of subscriber service. A DS30A card with faults in the SMS-R also disrupts communication with the CC.

In the SMS-R, a circuit card that has faults can affect subscriber service. This condition includes the power converter card. The SMS-R equipment other than circuit cards can fail.

The SMS-R P-side links toward the subscriber transmit messages required to maintain subscriber service. A P-side link that has faults can damage subscriber service. In a P-side link, a channel must remain available for a call attempt to succeed. Signal or software problems can make a channel not available for a subscriber call.

The following section describes specific faults and includes the XPM parity fault and data mismatch.

XPM parity fault

The CC handles parity faults when possible. There are three types of parity faults:

- hard—requires manual intervention

- soft—cleared by the CC

- intermittent—cleared by the CC

A PM181 log notifies operating company personnel of the type of parity fault. Other logs tell operating company personnel what action the CC performs and if the CC clears the fault. These logs include PM128 and PM106. The QUERYPM FLT command also informs the user about the type of parity fault.

For information on how to handle parity audit failures, refer to Handling a parity error fault in section, Trouble isolation and correction.

Data updates

The following updates provide the inactive unit of the SMS-R with data to control maintenance and call processing:

- static data

- bulk

- dynamic

Static data

Static data holds SMS-R/RCS configuration information. The association between SMS-R P-side ports and RCS link numbers is an example of configuration information. The CC sends this information to both units of the SMS-R when the SMS-R returns to service. The CC also sends this information to an in-service SMS-R when data in table RCSINV or table LNINV changes.

Static data provides the parameter NODATASYNC after the return-to-service (RTS) command. The NODATASYNC parameter lets operating company personnel load the inactive unit with CC data without transferring data from the active unit. This parameter helps troubleshoot the SMS-R because of static data problems.

For more information, refer to "Handling data mismatch (using the NODATASYNC option)" in section "Trouble isolation and correction".

Bulk data update

When both SMS-R units are in-service, the inactive unit requests a transfer of dynamic data from the active unit. This data maintains established calls and continues call processing if a SWACT occurs. This transfer is a bulk data update.

If the inactive unit is out of service (OOS), the unit requests a bulk data update when the unit returns to service (RTS).

Bulk data includes RCS status, P-side and C-side port statuses (open/closed), and call processing data. An example is connection of a specific line circuit to a specific DS-1 channel.

A bulk data update transfers the information that follows from the active SMS-R unit to the unit that is not active:

- RCS status (in service/busy)
- FSR (Frequency Selective Ringing) codes
- subscriber states (idle/busy)

A bulk data update brings the inactive unit of the SMS-R up-to-date with the active unit.

Dynamic data update

A dynamic data update is an event driven data transfer. Updates occur on an ongoing basis as changing data in the active unit is updated in the inactive unit. The dynamic data updates include the following information:

- RCS status (in service/busy)
- FSR codes
- subscriber states
- channel reassignment (not supported for SMS-R)
- port statuses
- DS-1 link information

When bulk transfer of critical data completes, communication continues between the mates. The communication allows information to continue to flow from the active unit to the inactive unit (continuous data update). As data changes, the inactive unit updates. The update allows the unit to maintain capability to take over call processing (CP) from the unit mate if a SWACT occurs.

The table that follows lists critical dynamic data transferred to the inactive unit. The active unit sends this data in bulk to the unit mate. The data transmission occurs on a continuing basis as data in the active unit changes.

With this data, the inactive unit takes over call processing from the unit mate. The inactive unit retains a majority of established calls.

Critical dynamic data

Dynamic data	Condition for change
Call data	Call is established or disconnected
Terminal status	Terminal (line or trunk) placed in or taken out-of-service
Port status	P-side or C-side port change in state (open or close) requested
DS-1 maintenance	Maintenance or data synchronization reporting over DS-1 links enabled or disabled
P-side node status	P-side node (RCS) is busied or returned to service
Protection switching	Protection switching is enabled, disabled, switched, or unswitched
Nailed-up connection	P-side connection for special services established or taken down

RCS fault conditions

In the RCS, line cards can have faults and cause problems with subscriber service. Damage can occur to subscriber loops attached to these line cards.

Programmable power/miscellaneous alarm

Operating company personnel can wire an alarm for an RCS fault. Operating company personnel can datafill the level of this alarm (minor or major) in table RCSINV. When the alarm occurs, the DMS-100 switch generates a PM128 log report. The report contains the alarm level and a text string that describes the alarm. This text string appears at the MAP terminal when the RCS on which the alarm occurs is posted and the command string QUERYPM FLT is entered. This text, like the alarm level, is entered in table RCSINV. The alarm text is according to the problem for which the *hard-wired* alarm is configured.

DS-1 link fault conditions

The DS-1 lines that connect the SMS-R/RCS can have several faults, including frame losses, slips, and bipolar violations. If a DS-1 protection link fails to switch a defective DS-1 line, the remote RCS loses contact with

the host office. This event can cause the loss of subscriber service. "Alarms" in section "Trouble isolation and correction" discusses DS-1 frame losses, slips, and bipolar violation alarms.

The RCC does not handle DS-1 failures, because RCC does not recognize SMS-R/RCS DS-1 link configurations. The system drops all active calls on damaged links. Most DS-1 link failures can be recovered when the cause of the failure is corrected. Terminals serviced by links that have faults cannot process calls.

SMS-R automatic maintenance

Automatic SMS–R maintenance consists of the audits and diagnostics that follow.

SMS-R basic audits

The following SMS-R basic audits check data in the SMS-R to make sure of hardware integrity and consistency:

- ring pad card (NT6X80)
- XPM parity
- unsolicited report handler
- call processing connection
- time switch connection
- P-side port and node
- IMC-link
- CMR card (conducted on the CMR card that resides in the RCC)

Ring/pad card audit

The ring/pad card drives FSR and provides signals used to attenuate calls. The ring/pad card audit checks indicators on this card. The indicators show that the system generates a correct 1 ms interrupt. The indicators also show if the PROM and RAM on the card do not contain faults.

If this diagnostic fails twice in a row, the system generates a PM181 log. The audit drives a warm SWACT of the SMS-R to switch to the shelf with a good ring/pad card. The log indicates if the memory part that fails is PROM or RAM.

Note: The 1 ms interrupt relates to link timing. This condition means that the ring/pad card is synchronized when writing PCM values to a DS-1 link.

XPM parity audit

This audit runs as a low priority background task in the UP. The audit walks through memory cards, and reads memory locations the system does not use. If the audit detects a damaged area, the audit reads the location again. If this procedure detects a fault, the audit tries to write a test pattern to the damaged memory location.

The CC acts on this audit to correct the memory fault. Refer to "Handling a parity error fault" in section "Trouble isolation and correction".

Unsolicited report handler audit

This audit generates a software error (PM180) message when the RCS sends the SMS-R an unsolicited or not defined message. For example, `Invalid time switch connection found` This example message indicates that a software digroup to DS-1 channel connection does not have a hardware connection that corresponds. The DMS-100 switch takes down the invalid timeswitch connection.

Timeswitch connection audit

This audit checks and corrects timeswitch connection differences between the SMS-R and RCS after every SMS-R warm SWACT. This operation is necessary because message transfer between active and not active SMS-R units has lower priority than other tasks. Message transfer contains call connection information and other data. After a SWACT, the present active SMS-R unit and original active SMS-R unit can contain different information.

After a warm SWACT, the SMS-R sends a message to the RCS. The SMS-R requests the RCS to report the time switch connections. The audit compares RCS connections to SMS-R connections. If the audit finds a difference between SMS-R and RCS connections, the system generates a software error message. The system idles the connections.

Call processing connection audit

This audit makes sure the SMS-R and RCS time switch connection records contain the same data. The audit takes down connections that associate with connection takedown and connection setup messages. The audit takes down these connections when the SMS-R sends the messages to the RCS and does not receive acknowledgement.

P-side port and node audit

This audit compares the SMS-R P-side port status and node (RCS) with the port and node status that the CC records. The audit attempts to correct mismatches. When the audit detects a mismatch in port, the audit generates a PM181 log with reason `Port Status Mismatch`. The operational measurement (OM) PM2ERR increases by one. When the audit discovers a

mismatch in node status, the audit generates a PM181 log with reason `Node Status Mismatch`. The operational measurement OM PM2ERR increases by one.

IMC-link audit
The SMS-R has two IMC-links. One link is between the NT6X69 cards and one link is between the NTM877 cards. The system audits the links to monitor the sanity of messages between the units. If the IMC audit fails and the audit detects the fault at the node level, the node becomes ISTb state. If the system detects the fault at the unit level, the system places the fault unit in the ISTb state.

When the system detects an IMC-link failure, the events that follow occur:

1   The system reports the fault to the CC.

2   The system closes the link and the SMS-R status changes to ISTb.

3   SMS-R processors do not use link.

4   The system prevents warm SWACTs.

Refer to Handling an IMC-link fault in section Trouble isolation and correction for corrective action. When the fault is corrected, the system audit opens the link again.

CMR card audit
An audit runs in-service diagnostics one time each 1 min on the CMR card in the RCC. If the audit detects an in-service fault, the system sets the RCC to in-service trouble (ISTb). The system generates a PM181 log. The log indicates that calling number delivery (CND) does not function. Operating company personnel can perform maintenance on the defective CMR card as required.

Pre-SWACT and post-SWACT audits
The SWACT audits allow the XPM to prevent a SWACT to a mate unit that cannot maintain activity. After a SWACT, if the new active unit cannot establish two-way communication with the CC, the system attempts a SWACT back. The system attempts a SWACT back to the original active unit. The XXP provides the following audits to improve SWACT reliability:

- pre-SWACT audits
    — pre-drop
    — pre-gain
- post-SWACT audits
    — post-gain

— post-drop

Each of these audits is present in each unit. A SWACT involves the drop of activity by one unit and of gain activity by the mate unit of a peripheral. Each audit performs a separate role in the different states of a SWACT. The subsections that follow describe the audits that control a SWACT in the XPM in more detail.

Pre-drop audit

The pre-drop audit accepts a request to drop activity and determines if the mate unit can accept activity. This audit runs only in the active XPM unit.

One of two possible sources can initiate a SWACT of the peripheral:

- the CC—in the form of a request to the active unit to drop activity

- the active XPM unit—causing an autonomous SWACT

To determine if the pre-drop audit must drop an activity, the pre-drop audit evaluates the requirements that follow:

- source of the request (CC or XPM)

- type of drop request

- known status and history of the currently active unit

- known status and history of the inactive mate unit

For a CC-initiated SWACT, the SWACT Controller queries the XPM. The pre-drop audit in the XPM responds to the query. The audit informs the CC if the active unit can comply with a drop request.

Pre-gain audit

The pre-gain audit monitors the XPM status data in the inactive unit. The audit sends this information to the pre-drop audit in the active unit. The pre-drop audit uses this information to determine if the active unit must drop activity. The audit examines the following XPM status data:

- Facility audits—the XPM records the result of the last run for each diagnostic in the facility audit for a given peripheral.

- Status information that the unit contains—including the following information about the inactive unit:

  — is in service and ready

  — has CC links OK

  — does not have corrupt static data

  — is in synchronization

— is not jammed as the inactive unit

Note: An inactive unit cannot reach all diagnostic paths. A manual SWACT with the FORCE option can be necessary. This process clears a failure from the pre-gain audit record.

The pre-gain audit continues to monitor and report unit status and condition information while the unit remains inactive. The pre-drop audit determines that the active unit can use the information provided by the pre-gain audit to drop activity. A warm SWACT occurs and the post-gain audit in the new active unit begins to run.

Post-gain audit

The post-gain audit runs in the new active unit. The audit verifies that the unit establishes two-way communication with the CC. If the unit establishes communication, the new active unit maintains activity. If the check fails, the unit forces a drop of activity to initiate a SWACT back to the originally active unit. The pre-drop audit does not refuse the SWACT and allows the SWACT to proceed. If the SWACT back fails, the system busies and returns the XPM node to service.

Post-drop audit

The post-drop audit runs in the current inactive unit. The current inactive unit remains not permanently in service but does not start. The post-drop audit cleans up the call processing data structures of calls that are not stable calls and non-synchronized stable calls. When a SWACT back is complete or not required the XPM informs the CC. The inactive unit is busied and returned to service.

Switch of activity

A switch of activity (SWACT) is the process in which the two units of the SMS-R switch activity. The active unit becomes the inactive unit. The inactive unit becomes the active unit and takes over call processing. A switch of activity occurs if the active unit of the SMS-R discovers a fault that cannot be recovered from. The CC also initiates SWACTs.

The types of SWACTs are as follows:

- cold – occurs when a switch of activity takes places and the system drops all calls. A cold SWACT occurs if warm SWACT is disabled at the MAP terminal.

- controlled warm – occurs when operating company personnel issue the SWACT command from the PM level of the MAP. This SWACT also occurs with scheduled diagnostics such as the routine exercise (REX).

The system maintains established calls and drops transient calls.

- Uncontrolled warm (as seen by the CC) – occurs when a hardware failure or a trap is present in the active unit. When a SWACT occurs, the CC and the SMS-R exchange a series of messages. The messages notify the CC and the SMS-R about the SWACT. The SWACT is complete when the CC receives a gain message from the current active unit.

Messaging improvements

If the CC does not receive a drop message, the original active unit is reset through the mate unit. This feature helps if the C-link to the original active unit is out-of-service (OOS).

The CC does not always receive the drop and gain messages from the SMS-R. Suspect noise on the C-side messaging links during a SWACT can prevent the drop and gain messages. To account for suspect noise, the XPM REX/SWACT Robustness feature allows the CC more opportunities to receive the messages. If the SMS-R does not receive an acknowledgement from the CC within 1 s, the SMS-R sends another gain message. The SMS-R repeats the process for 15 s to a maximum of 15 gain messages. If the CC does not receive a gain message within 20 s, the CC assumes the SWACT fails.

The SWACT descriptions use the terms that follow. In this example, the SMS-R is in service (INSV). Unit 0 is active. Unit 1 is inactive.

- Original active unit is the active unit before the SWACT (unit 0).

- Original inactive unit is the inactive unit before the SWACT (unit 1).

- New active unit is the active unit after the SWACT (unit 1).

- New inactive unit is the inactive unit after the SWACT (unit 0).

- Drop message is the message the original active unit (unit 0) sends to the CC telling the CC that the unit drops activity.

- Gain message is the message the new active unit (unit 1) sends to the CC to notify the CC that the unit gains activity.

Out-of-service diagnostic

The OOS diagnostic does not automatically start when the SWACT begins. This diagnostic is available through the SWACT command. The optional TEST parameter starts the diagnostic.

The routine exercise (REX) tests include the OOS diagnostics, because the REX sequence requires these tests. Also, REX tests are scheduled during low-traffic periods to limit the effect on call processing.

Activity drop reasons

The reasons for a SWACT are as follows:

- activity timeout – The SMS-R experiences an activity or sanity timeout.

- trap – The SMS-R is trapped.

- no CC-links – All DS30A links are lost or broken.

- request – A drop of activity requested through a SWACT or restart.

- duplicate fault – A critical operational fault of duplicated hardware occurs.

- jammed – The SMS-R unit cannot support call processing.

- DRCC sync – The mate is sane and the dual remote cluster controller (DRCC) is free-running. The SMS-R is about to SWACT and commence DRCC synchronization.

- ESA entry – Loss of all CC messaging occurs. If the original inactive unit does not send a drop message in a specified time period, the RCC enters emergency stand-alone.

- static data corruption – The static data audit found corrupt data in the SMS-R unit.

- pre-SWACT audit failure – The unit cannot gain activity.

The PM181 log includes the most up-to-date reason for an activity drop during SWACT.

If the RCC is in ESA, the system supports one SWACT of the SMS-R. The other SMS-R unit becomes the active unit if both SMS-R units are in-service when the RCC enters ESA. The other unit becomes active if a fault in one of the SMS-R units causes the active unit to drop activity.

The new inactive unit is jammed inactive. The unit does not return to an active state until the RCC hits ESA. The unit does not return to an active state until the CC returns the SMS-R to service. The CC returns the SMS-R to service after system busying the SMS-R.

Emergency stand alone

Emergency stand-alone (ESA) provides the host (CC) maintenance to perform cold exit of ESA for RCCs with subtending SMS-Rs and RCSs. When the RCC cannot communicate with the CC, the RCC enters ESA mode. The RCC enters ESA mode after a period an RSC office parameter specifies. The CC has no control in entering ESA on the RCC.

When the RCC is in ESA, the RCC appears to the CC in one of the following states:

- C-side busy (CBsy)

- system busy (SysB)

- manually busy (ManB)

The SMS-Rs and RCSs that subtend the RCC appear CBsy. The CC system maintenance handles the SMS-Rs and RCSs like all CBsy nodes off a CBsy, SysB, or ManB node.

When communication to the RCC begins again, the CC directs the RCC to exit ESA. When the RCC acknowledges ESA-exit, the RCC sends operational measurements (OM) to the CC operational measurements (OM) and the reason for entering ESA. The CC returns the RCC and the nodes that subtend the RCC to service.

The SMS-R does not receive notification that the RCC is in ESA. When the CC removes the RCC from ESA and returns the RCC to service, the SMS-R C-side node becomes busy. The SMS-R does not receive notification that the ESA exit occurs on the RCC. The same is true for the RCS. The figure that follows provides the sequence of RCC, SMS-R, and RCS node states that display at the MAP terminal. The sequence displays when an RCC goes into ESA because of a link failure on the C-side of the RCCs.

Note: If the RCC enters ESA, CLASS CND, the ESA does not affect stable calls. The ESA clears unstable calls. All parties can originate and terminate while in ESA and after ESA exit.

ESA entry and exit shown at the MAP display

```
 RCC          SMS-R         RCS

 InSv         InSv          InSv
  :            :             :     ◄─────── The C-side links of the RCC go
  :            :             :              down. RCC enters ESA.
 CBsy         CBsy          CBsy
  :            :             :     ◄─────── The I/O audit recognizes that the
  :            :             :              links to the RCC are down.
 SysB         CBsy          CBsy
  :            :             :     ◄─────── The C-side links of the RCC return.
  :            :             :              The CC tells the RCC to exit ESA.
  :            :             :              The CC returns the RCC to service.
 SysB         CBsy          CBsy
  :            :             :     ◄─────── The RCC returns to service.
  :            :             :              The CC returns the RCS to service.
 InSv         SysB          CBsy
  :            :             :     ◄─────── The SMS-R finishes return to service.
  :            :             :              The CC returns the RCS to service.
 InSv         InSv          CBsy
  :            :             :     ◄─────── RCSs return to service.
  :            :             :
  :            :             :     ─────────────────────────────────────
  ▼            ▼             ▼       **Note**:  This sequence assumes the user does
 InSv         InSv          InSv     not ManB the RCC while in ESA.
```

The SMS-R does not require more static data to perform ESA call processing. The SMS-R receives all necessary information to perform in ESA from normal static data downloads.

The limits that follow apply to ESA:

- All calls are taken down in the SMS-R on ESA cold entry,

- The SMS-R can cold SWACT once to bring the new active unit in service after entry into ESA. Faults that occur on the new active unit cause an activity drop. The activity drop causes a loss of all calls. Restoration of service does not occur until the RCC exits ESA.

- There is no DS-1 link recovery between SMS-R and RCSs. The system drops calls on the link that has faults.

- The RCC ESA does not provide line testing capability.

- The ESA does not allow recovery of RCS outages. ESA exit allows recovery of RCS outages.

- The RCS lines in ESA support plain old telephone service (POTS) call processing and Meridian Digital Centrex (MDC) extension dialing (if entered).

- The ESA supports dual RCC (DRCC) to the extent that SMS-Rs and RCSs can be present off one or both RCCs in dual configuration. ESA does not support interswitched calling that involves RCS lines.

Warm exit from ESA

The warm exit from ESA feature allows stable originating and terminating SMS-R calls to maintain. This feature allows calls intraswitched at the RCC or interswitched through the DRCC to maintain when the RRC exits ESA. This feature also reduces the time required to restore dial tone.

Warm exit from ESA provides CC communication with the RCC during ESA exit. This process provides an immediate RTS (IRTS) of the SMS-R. The instant RTS also integrates SMS-R P-side links and the RCS. With this feature, the SMS-R, the SMS-R D-side links, and the RCS do not require a full RTS after an exit. Warm exit from ESA makes sure that the SMS-R starts from a known state after an exit. Warm exit does not have subscribers in an unknown state.

Note: An instant RTS performs a subset of the normal RTS procedure to return a unit to service after ESA exit. When the CC initiates an instant RTS, the CC enters the CC data structures. The CC sets the RCC and nodes that subtend the RCC to InSv. The SMS-R and RCS are examples of nodes that subtend the RCC. Call processing requires that all nodes be InSv. The active unit of the SMS-R returns to service. The RTS begins on the inactive unit to maintain the integrity of the node.

All calls that the SMS-R serves continue after a warm exit except the calls that follow:

- calls on terminals that CC call processing does not support

- calls on manually busy terminals or calls that involve manually busy resources (links/nodes)

- calls that cannot obtain resources in the CC because of overload

Exceptions to warm exit from ESA   Some events that occur in ESA require action when the RSC exits ESA. These events affect the type of ESA exit (warm or cold). These events also affect if a node or link qualifies for an instant return to service (IRTS). If a node or link that associates with the RSC does not qualify for an IRTS, the system can drop calls. The SMS-R, SMS-R P-side link or RCS are examples of nodes or links that associate with the RSC.

The nodes and links that follow change to an out-of-service state while in ESA.

- SMS-R active unit – If the SMS-R active unit changes to an out-of-service state while in ESA, a SWACT is performed. If the SMS-R inactive unit is in service before the SWACT, the interactive unit becomes active. When a warm exit occurs, the CC receives notification of the activity change before initiating an IRTS on the SMS-R.

  If the SMS-R inactive unit is out of service before the SWACT, the SMS-R and the SMS–R P-side links or nodes do not qualify for an IRTS. When a warm exit occurs in this condition, the CC performs a full RTS on the SMS-R, the SMS-R P-side links and RCS.

- SMS-R P-side links – The SMS-R P-side links can change to out of service while in ESA. If the SMS-R P-side links that associate with an RCS have protection switching equipped, a protection switch occurs. When a warm exit occurs, out-of-service links do not receive an IRTS. The CARRIER maintenance level of the MAP terminal displays the changes to protection switching.

- RCS nodes – An RCS can go out of service while in ESA. If a warm exit occurs, the RCS does not qualify for an IRTS. The system attempts a full RTS.

These nodes and links are an exception to RSC warm exit from ESA.

The exceptions to CC warm exit from ESA follows. These include manual actions performed by operating company personnel. These actions occur while the RSC is in ESA, and affect an SMS-R warm exit:

- ManB/off-line SMS-R – Over a warm ESA exit from ESA, all calls that involve subscribers SMS–R serves are dropped.

- ManB SMS-R active unit – Over a warm ESA exit, a mismatch occurs between the CC and the SMS-R. A SWACT on the SMS-R during a warm exit corrects the mismatch. If a SWACT is not possible, the system drops all calls that involve SMS-R-served subscribers.

- ManB/off-line SMS-R P-side links – Over a warm ESA exit, the system takes down ManB/off-line P-side links in the SMS-R. Normal protection switching occurs if these links were in service while in ESA. Normal protection switching occurs if the links associate with an RCS with protection switching. The system can drop calls in this condition. This process is the same as ManB/off-line of an SMS-R P-side link that is not in ESA.

  Note: If the P-side links are in service when SMS-R enters ESA and taken off-line during ESA, the SMS-R performs a cold exit from ESA. The cold exit occurs because a change in the state of the P-side links causes static data mismatch.

- ManB/off-line RCS – Over an ESA warm exit, any ManB/off-line RCSs are taken out-of-service in the SMS-R. When this condition occurs, all calls that involve subscribers on the RCS are taken down.

- Table RCC Node Affected Static Data Changes – While in ESA static data changes that affect only the SMS-R node table cause a cold exit of the RSC. An addition or deletion of an SMS-R or RCS also causes a cold exit of the RSC from ESA.

- Table SMS-R Node Affected Static Data Changes– While in ESA, static data changes that affect only the SMS-Rs node table prevent an IRTS on the SMS-R. When a warm exit occurs, the system drops all calls that involve subscribers served by SMS-R. Changes that affect only the SMS-Rs node table are the addition, deletion, or a change to one of the following:

  — SMS-R P-side link information

  — cards in the card list of an SMS-R

- SMS-R nailed-up connections changes – While in ESA, changes to nailed-up connections prevent an IRTS on the SMS-R. When a warm exit occurs, the system drops all calls that involve subscribers served by SMS-R.

- SMS-R subscriber line data changes – While in ESA, changes to subscriber line data for a terminal that subtends from an SMS-R do not force the RSC to exit cold. When a warm exit from ESA occurs, the active units of the RCC and SMS-R can become ISTb. Static data mismatch errors cause the units to become ISTb.

  In a warm exit from ESA, a standard RTS runs on the inactive unit of the RCC and the SMS-R. A SWACT runs when the inactive sides of the RCC and SMS-R are in INSV to clear this flag. A standard RTS unit that was active (ISTb) updates static data. The active unit becomes InSv.

Routine exercise test

A REX test includes a series of tests performed on an SMS-R unit. The system scheduler can start REX tests or operating company personnel can start the test manually. The REX test combines the diagnostic and technical routines available on XPMs. The following four classes describe REX test results:

- not performed

- passed

- failed

- aborted by manual action—maintenance action with the FORCE parameter or with the ABTK command from another MAP terminal with the SMS-R posted.

All four classes generate a log or display a message at the MAP terminal. The maintenance record only stores data on REX tests that pass or fail. The system provides failure reasons only for REX tests.

The REX state machine (or controller) performs the following sequence of events:

1 Test the inactive unit (includes in-service tests only).

2 SysB the inactive unit.

3 RTS the inactive unit (includes out-of-service tests only).

4 Waits for superframe and data synchronization to occur.

5 Performs a pre-SWACT audit.

6 Performs a warm SWACT.

7 SysB the new inactive unit.

8 RTS the inactive unit.

9 Waits for superframe and data synchronization to occur.

10 Runs in service diagnostics (TST) on the new active unit.

11 Runs in service diagnostics (TST) on the inactive unit.

The following figure shows REX state machine (controller) actions.

REX state machine actions

```
Start
┌─────────────────────┐      ┌─────────────────────┐      ┌─────────────────────┐
│ Test the inactive   │─────▶│ SysB the inactive   │─────▶│ RTS the inactive    │
│ unit                │      │ unit                │      │ unit                │
│ (in-service tests   │      │                     │      │ (out-of-service     │
│ only)               │      │                     │      │ tests only)         │
└─────────────────────┘      └─────────────────────┘      └─────────────────────┘
                                                                     │
                                                                     ▼
                                                          ┌─────────────────────┐
                                                          │ Wait for superframe │
                                                          │ and data            │
                                                          │ synchronization to  │
                                                          │ occur               │
                                                          └─────────────────────┘
                                                                     │
                        (See note 1)                                 ▼
                                                          ┌─────────────────────┐
                                                          │ Initiate a          │
                                                          │ pre-SWACT audit to  │
                                                          │ determine if a      │
                                                          │ SWACT is necessary  │
                                                          └─────────────────────┘
                                                                     │
                        (See note 2)                                 ▼
                                                          ┌─────────────────────┐
                                                          │ Perform a Warm      │
                                                          │ SWACT               │
                                                          └─────────────────────┘
┌─────────────────────┐                                              │
│ The system          │                                              ▼
│ generates the PM600 │                                   ┌─────────────────────┐
│ log to identify the │                                   │ SysB the inactive   │
│ REX failure reason  │                                   │ unit                │
└─────────────────────┘                                   └─────────────────────┘
        (A)                                                          │
                                                                     ▼
                                                          ┌─────────────────────┐
                                                          │ RTS the inactive    │
                                                          │ unit                │
                                                          └─────────────────────┘
                                                                     │
                                                                     ▼
                                                          ┌─────────────────────┐
                                                          │ Wait for superframe │
                                                          │ and data            │
                                                          │ synchronization to  │
                                                          │ occur               │
                                                          └─────────────────────┘
                  SwA ct                                             │
                  passes                                             ▼
┌──────────────────┐   ┌──────────────────┐           ┌─────────────────────┐
│ SysB the         │◀──│ Perform a        │◀ ─ ─ ─ ─ ─│ Perform in-service  │
│ inactive unit    │   │ recovery Warm    │           │ diagnostics (TST)   │
│ after recovery   │   │ SWACT            │           │ on the new active   │
│ failure          │   │                  │           │ unit                │
└──────────────────┘   └──────────────────┘           └─────────────────────┘
                                                                     │
                                                                     ▼
                                                          ┌─────────────────────┐
                                                          │ Perform in-service  │
                                                          │ diagnostics (TST)   │
                                                          │ on the new inactive │
                                                          │ unit                │
                                                          └─────────────────────┘
                                                          Finish     │
                                                                     ▼
                                                                    (A)
```

Note 3: Pre-SWACT query failed   - - ▶ Indicates process failed
Note 4: SWACT back occurred   ─── ▶ Indicates process passed

If a REX test fails, the system generates a PM600 log. The PM600 log starts a major alarm for the SMS-R that fails the REX test. The major alarm appears at the MAP terminal under the PM banner at the top of the display.

If an INSV or OOS diagnostic test fails, the REX failure reason includes a mnemonic. The REX failure reason includes the mnemonic of the diagnostic that fails and the unit that fails (0 or 1).

The PM600 log details the start time of steps the REX test executes. The PM600 also details the unit the REX step affects and the failure reason.

The REX steps included in the log after the step that fail are recovery actions. The REX starts the recovered actions because of the failure. The log only includes the unit number if the REX action is unit specific and does not affect the node. Examples of unit specific REX actions include BSY unit, RTS unit, TST unit and synchronization. Examples of REX actions that affect the node are SWACT, BSY both units. The additional data of the log contains a card list and mnemonic of the failed diagnostic. The following table lists the mnemonics and a description of the diagnostic.

Diagnostic name and description

Diagnostic name (mnemonic)	Description of diagnostic
ABDIAG	A/B Bits
CSMDIAG	CSM Diag
CS SPCH	Network Links
DS1DIAG	P-Side DS-1
FORMATR	Local Formatter
MSGDIAG	6X69 Messaging Card
MSG IMC	IMC Link
PADRING	6X80 Pad/Ring
PARITY	Parity audit
PS LOOP	P-Side Loops
PS SPCH	P-Side Speech Links
SMS MSG	SMS A/B DDL Msg
SPCH DG	Speech Path
—continued—	

Diagnostic name and description (continued)

Diagnostic name (mnemonic)	Description of diagnostic
SYNC DG	Sync Diag
TONESDG	Tone Diag
TSDIAG	Time Switch Diag
UTRDIAG	UTR Card
—end—	

The QUERYPM command and command strings QUERYPM FLT and TST REX QUERY contain information about the last REX. System and manually initiated REXs store and display a new date/time and status (passed/failed) in the REX maintenance record. *Passed* means the REX completes without errors. *Failed* means the REX does not complete because of an error. This information is available through the command strings QUERY PM and TST REX QUERY. If the REX fails, perform a manual RTS, a manual REX, or an automated REX. These actions can return the SMS-R to service from ISTb.

The system stores a REX maintenance record for each SMS-R that contains the following information:

- the REX scheduler, if the SMS-R is in the system

- the date/time and result (passed/failed) of the last REX

- the failure reason, diagnostics failures, and a list of cards that have faults (if applicable), if the last REX fails

- the date/time of last REX that fails

- the date/time of first REX that passes after the last failure

The restrictions that follow apply to REX tests:

- The system REX (SREX) controller only runs REX on one XPM at a time if the office uses the NT-40 processor. SuperNode supports more than one REX test at a time. SuperNode supports a REX test on a maximum of ten XPMs with the same REX test class.

- For REX to run, the node must be in service or in service trouble because of a REX failure. The node can be in service trouble because P-side DS-1 links are out of service for REX to run.

- If a warm SWACT cannot run, REX terminates. REX does not perform a cold SWACT.

- After the REX completes, the XPM has a new active unit because of the SWACT.

- If a restart occurs while REX is in progress, the system does not generate the PM600 log. The system can not generate the log because the restart deallocates the temporary data store. The temporary data stores build the PM600 log.

- Manual REX does not have a SWACT controller override. See subsection SWACT controller in section Maintenance overview.

REX state machine interface to the pre-SWACT and post-SWACT audits

The REX state machine (or controller) permits the SWACT controller to refuse to attempt a SWACT. For information on the pre-SWACT and post-SWACT audits, see subsection Pre-SWACT and post-SWACT audits in section, Maintenance overview.

The REX controller performs the following functions:

- calls the SWACT controller during the pre-SWACT step before the beginning of the SWACT request. The SWACT controller determines if a SWACT can run based on the following:

  — the diagnostic history of the unit maintained in the diagnostic history database

  — the result of the last SWACT attempt to the inactive unit

  — the data the XPM returns in the pre-SWACT query message

An XPM can fail the SWACT step of REX and not display failures in the MAP display DiagHist level. This condition can occur if the reasons for the pre-SWACT failure do not include diagnostic failures.

- accounts for SWACT denial and failure reasons

- terminates a REX test if the SWACT controller does not allow a SWACT.

- terminates a REX test if a SWACT occurs. The active unit of the XPM does not change from the start of the test. The REX terminates without recovery actions because the pre-SWACT code starts a BSY/RTS of the inactive unit.

- displays the failure reason for a SWACT denial or failure performed during a manual REX at the MAP terminal as *REX failed*. Use the command string TST REX QUERY for the posted XPM to obtain the reason for the failure. The system also generates a PM600 log report that details the REX failure reason.

A REX test that does not complete sets the LCM unit ISTb or SysB with the reason REX failed. Audits on LCMs run every 10 min and run InSv tests. The ISTb flag remains with a REX failed reason. If the audit does not complete and detects more failure conditions, the audit adds to the ISTb list. If the LCM is SysB and a system RTS completes, the unit returns to ISTb with the REX failed reason. To remove the ISTb state, the LCM must complete a manual RTS or a manual or scheduled REX test. The node assessment graph log (NAG400) lists all nodes that are not in service (InSv). The system generates NAG400 one time each 1 h. The system also generates NAG400 in response to the NAG command.

SREX scheduler feature AF3771

Feature AF3771, System REX Controller: XPM Maintenance provides the SuperNode switch with an S/DMS System REX test (SREX) controller. The controller coordinates all the system REX tests under a common REX scheduler. The SREX controller can schedule SMS-R REX tests to run while other REX tests run. The SREX controller can REX the whole switch in less time. Feature AF3771 finds REX test failures early and to resolve the failures in less time. This feature helps reduce outages in the field.

The SREX controller allows operating company personnel to

- change the order of tests on the peripherals

- coordinate between manual and system initiated REX tests

- receive alarms for the SMS-R on which the REX does not run in a time limit set through table REXSCHED

The SREX scheduler permits you to enter the CI level command REXTEST and the parameters that follow:

- The SUSPEND parameter suspends REX testing for one maintenance window. A maintenance window is the period between the time the REX START and STOP time entered in table OFCVAR under parameter NODEREXCONTROL.

- The RESUME parameter resumes a REX test after the suspension of the REX test.

- The QUERY parameter returns the status of the REX test (active or suspended).

- The HELP parameter returns a brief description of the REX test.

Note: A maximum of ten XPM REX tests of each type can run at the same time.

The REX test order for feature AF3771 is as follows:

- critical nodes like CM and MS

- the number of days since the last system or manual REX test
- the order of internal PM (SMS-R) number

Table REXSCHED must contain data to establish the REX schedule for the SMS-R. This table contains the information the REX coordinator requires to schedule the tests according to specification of the operating company. Datafill in table REXSCHED can also disable the test. For more information on table REXSCHED, see the data schema section of the *Translation Guide*.

When more than seven days pass between REX tests of the SMS-R, the system generates log report IOAU112.

XPM bit error rate test

The XPM bit error rate test (XBERT) is a diagnostic tool that detects and measures PCM bit errors. High-speed data transmission in the SMS-R and the P-side nodes cause these errors. The XBERT also identifies circuit packs that cause data errors. The CC command at any level of the CC MAP terminal initiates XBERT. Enter the XBERT command, the peripheral type and number to test to access the XBERT main menu.

Note: The XBERT does not test the DS30A-link (NT8X18) between the RCC and the SMS-R. One MAP user at at time can use the XBERT command.

The XBERT supports the following tests. These tests check different hardware components in the speech/data paths:

- XPM internal speech path test (XPMINT)
- XPM P-side loop test (XPMPSL)
- XPM hard loop test (XPMHLP)

The Isolate test allows for automatic fault isolation. After a request for this function, XBERT automatically runs the correct subtests. These subtests detect and isolate a fault to a certain set of circuit packs. The sublist isolates one to three cards in a card list. The separate test results determine the number of cards in the card list.

The XBERT allows you to test several P-side ports in order without additional action.

For accurate fault detection tests, each of the above tests runs on an active in-service SMS-R unit. The XBERT is a fault detection and isolation tool.

Note: Do not use XBERT to provide accurate bit error ratio assessments. The XBERT test procedure does not use the CCITT standard test patterns. The XBERT uses XPM tone PCM to provide the 64K bit/second test bit stream.

Refer to XBERT diagnostics in section Trouble isolation and correction for more information. The XBERT diagnostic clarifies XBERT, XBERT test configuration and discusses the tests mentioned above.

Refer to section SMS-R related user interface commands for information on bit error rate performance (BERP) MAP level commands. Bit error rate performance tests are conducted on the SMS-R, C-side (D530A) and P-side (DS-1) links.

Digital phase lock loop clock failure

The enhanced field failure information feature identifies when loss of synchronization causes a system busy after a digital phase lock loop (DPLL) clock failure. First, the CC acknowledges reception of a synchronization lost message. If the SMS-R does not receive the acknowledgment, the SMS-R goes system busy. The next time the SMS-R returns to service, the system generates a sync_was_lost log. This feature also logs all large out–of–phrase readings to provide information on DPLL clock problems. For more information on the PM189 sync_was_lost log and the big_sync_hit log, see section, "SMS–R related logs".

DS-1 link automatic maintenance

DS–1 maintenance requires protection switching.

Protection switching

Protection switching is a DMS-100 backup feature. Protection switching makes sure that communcation between an SMS-R and an RCS continues if a DS-1 line that connects the two fails.

A protection line occupies one DS-1 P-side port of an SMS-R and connects a single RCS. Each RCS has from one to four primary lines and a maximum of one protection line. The modes of the RCS shelf groups determine the number of primary lines. Each protection line serves only the RCS to which the line connects. The following figure shows a typical protection line configuration.

Protection line configuration
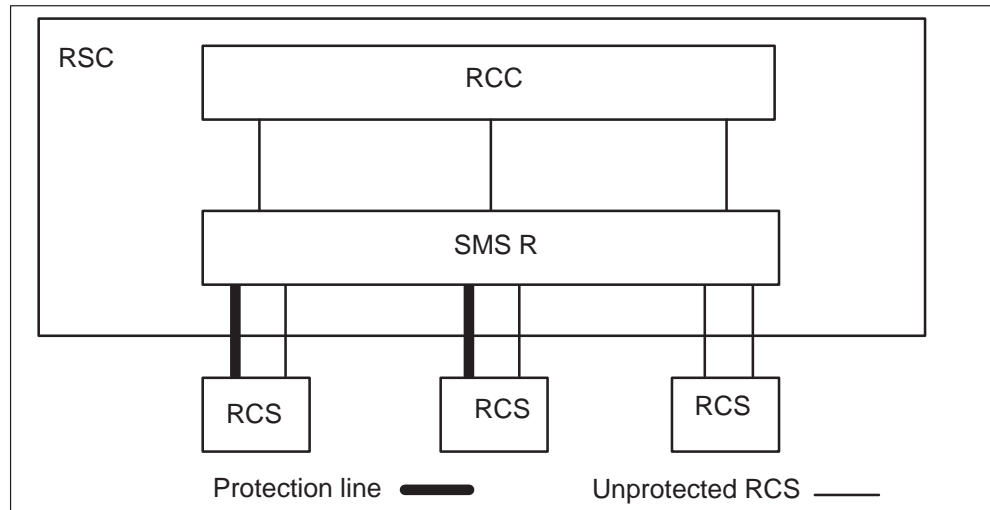
The RCS or SMS-R can start a protection switch automatically. Operating company personnel can use the PROTSW command at the CARRIER level to start the protection switch manually. Operating company personnel can start the protection switch when the FELP command runs. The FELP command allows a continuous loopback on all 24 DS-1 channels of a specified link.

When a protection switch starts, the system maintains calls in the talking state. For POTS and coin lines, the system also maintains calls in the ringing state. The protection line carries voice and signaling information. If the A-link is protection switched (or C-link in Mode II), the protection line also carries system control information.

In this section, a protection line is a *protection link*. A DS-1 line, with or without a protection link, is a *primary line*.

When the SMS-R enters service, protection switching automatically applies each primary line of an RCS equipped with a protection link. Also, addition of a protection link to an RCS, means all primary lines that connect to that RCS are made able for protection switching.

The ESA and non-ESA modes support protection switching. Protection switching works in ESA without CC intervention. If protection switching starts before ESA, protection switching continues in ESA. If protection switching starts while in ESA, protection switching continues after the exit from ESA. Entering or exiting from ESA does not affect protection switching.

Causes of automatic protection switching

An SMS-R or an RCS can start a protection switch after detection of a primary link failure. The module that detects the failure starts the protection switch.

The SMS-R starts a protection switch for the faults that follow:

- bipolar violations (BpV) that exceed the threshold entered in table CARRMTC

- loss of signal that continues for a time greater than the threshold entered in table CARRMTC

- removal of a DS-1 interface card

The RCS initiates a protection switch for the following failures:

- bipolar violations exceeding the threshold setting on the line interface unit (LIU) card

- loss of DS-1 framing

The SMS-R initiates a protection switch back to the normal line under the conditions that follow:

- bipolar violations on the line fall below the threshold in table CARRMTC

- frame synchronization restarts without slips for a threshold time as entered in table CARRMTC (when frame loss caused the protection switch)

- replacement of a DS-1 card that connects to the line (when removal of the DS-1 card causes the protection switch)

The DS-1 A-link carries system messaging between the SMS-R and the RCS. The A-link has priority over B, C, and D-links. A switch request for link A always succeeds. If the A-link fails and cannot be restored, the RCS remains in service if one other link operates correctly.

The system handles automatic protection switch requests for links other than the A-link in the order the requests arrive. Two or more switch requests can arrive at the same time. For example, a group of lines fails at the same time. If two or more switch requests for non-A-links arrive at the same time, an exception occurs. The protection link goes to the shelf that is first in alphabetical order (B before C, C before D). For links B, C, and D, if a fault is present and another fault occurs, protection switching switches lowest-lettered link. If the end that detects the fault has another fault on a link protection, switching does not occur. The end that detects the fault is SMS-R or RCS.

Three tables require data to support protection switching. These tables are CARRMTC, LTCRPINV, and RCSINV.

The data schema section of the *Translation Guide* describes how to enter data in these tables

Automatic protection switching (InSv, SysB, ManB, and PBsy primary lines)

The SMS-R supports automatic protection line switching for InSv, SysB, ManB, and PBsy primary DS-1 lines.

If a protection link is not InSv the protection switch cannot occur. A protection switch can not occur on a link with protection switching manually disabled. If a fault exists on the A-link, protection switching cannot occur for shelves B, C, or D. A protection switch to the A-shelf because of an A-link fault has priority over other shelves.

If a fault exists on the A-link, loss of DDL messaging occurs. Without DDL messaging, protection switch messages for shelves B, C, or D cannot be sent to the RCS or the SMS-R.

InSv and SysB primary DS-1 links

If the SMS-R detects a fault on a primary link, the SMS-R attempts to switch the protection link into service. This process replaces the damaged DS-1 link. If the RCS requests a protection switch, the SMS-R attempts to execute the protection switch. If the protection switch fails, an alarm condition occurs. Refer to protection switching Examples 1, 2, 3, 4, and 13 below.

The A-link has protection-switching priority. A protection switch request for the A-shelf causes the system to drop any other shelf that uses the protection link. Refer to Example 5.

Two or more faults can occur at the same end of a configured SMS–R/RCS. When faults occur at the same end, the system switches the protection link to the first shelf that requests the switch. This switch occurs if none of the faults are on the A-link. Refer to Example 6.

The SMS-R and the RCS can request a protection switch at the same time. If this event occurs, the protection link is switched for the lowest-lettered shelf. For example, shelf B is a lower letter than shelf C. Refer to Examples 7, 8, and 9.

If a protection link switches to defective RCS shelf hardware, the fault can cause the link to become SysB. The switch to the defective shelf causes the system to detect a fault on the protection link. The protection link does not

contain a fault. The protection link for the shelf remains switched. The primary link that serves the defective shelf becomes system busy. The system does not process calls for the shelf. Refer to Example 10.

If the protection link is switched and the SMS-R detects a problem with the link, the system releases the protection link. Protection and primary links become system busy. Refer to Examples 11 and 12.

Examples of protection switching for InSv and SysB primary links

The following protection switching scenarios apply to primary InSv and SysB DS-1 links:

Example 1 All DS-1 links are in service, including the protection link. Faults are not present on any link.

1   The RCS detects a fault on the C-link.

2   The C-shelf is protection switched.

Example 2 All DS-1 links are in service, including the protection link. Faults are not present on any links.

1   The SMS-R detects a fault on the C-link.

2   The C-shelf is protection switched.

Example 3 All DS-1 links are in service, including the protection link. Protection switching is disabled for the C-link. Faults are not present on any link.

1   The RCS detects a fault on the C-link.

2   A protection switch does not occur. The C-link is made system busy.

Example 4 All primary DS-1 links are in service. The protection link is out of service (SysB or ManB). Faults are not present on any link.

1   The SMS-R detects a fault on the C-link.

2   A protection switch does not occur. The C-link becomes system busy.

3   The RCS detects a fault on the A-link.

4   A protection switch does not occur. The A-link becomes system busy.

Note: If the RCS is in Mode II or III, the RCS becomes system busy because all DS-1 links are out-of-service.

Example 5 All DS-1 links are in service, including the protection link. Faults are not present on any link.

1   The SMS-R detects a fault on the C-link.

2   The C-shelf is protection switched.

3   The SMS-R detects a fault on the A-link.

4   The system drops the protection link from the C-shelf and switches the link to the A-shelf. The C-link becomes system busy.

Example 6 All DS-1 links are in service, including the protection link. Faults are not present on any link.

1   The SMS-R detects a fault on the C-link.

2   The C-shelf is protection switched.

3   The SMS-R detects a fault on the B-link.

4   The protection link remains switched on the C-shelf. The B-link becomes system busy.

Example 7 All DS-1 links are in service, including the protection link. Faults are not present on any link.

1   The RCS detects a fault on the C-link. At the same time, the SMS-R detects a fault on the B-link.

2   The B-shelf is protection switched. The C-link becomes system busy.

Example 8 All DS-1 links are in service, including the protection link. Faults are not present on any links.

1   The SMS-R detects a fault on the C-link.

2   The C-shelf is protection switched.

3   The RCS detects a fault on the B-shelf.

4   The B-shelf is protection switched and the C-link becomes system busy.

The RCS can send an IDLE code to the SMS-R. The RCS sends an IDLE code when the RCS detects a fault on a shelf that is protection switched. The RCS sends a switch request after the IDLE code. (In this example, the request is for the B-shelf.) When the SMS-R receives the IDLE code, the SMS-R releases the protection link. In example 8, the SMS-R detects the C-link fault after the SMS-R releases the protection line. The RCS requests a switch for the B-shelf at the same time the SMS-R detects the C-link fault again. The B-shelf has the lower letter and has priority over the C-shelf. The B-shelf is switched.

Example 9 All DS-1 links are in-service, including the protection link. Faults are not present on any link.

1   The RCS detects a fault on the C-link.

2   The C-shelf is protection switched.

3   The SMS-R detects a fault on the B-shelf.

4   The B-shelf is protection switched. The C-link becomes system busy.

Example 10 All DS-1 links are in-service, including the protection link. Faults are not present on any link.

1   The transmit receive unit card of the RCS C-shelf is removed.

2   The SMS-R detects a fault (frame loss) on the C-link. Removal of the transmit receive unit card causes frame loss on the RCS transmit side of the DS-1 link.

3   The protection link is switched for the C-link.

4   Because the transmit receive unit card is not present, the SMS-R detects a fault (frame loss) on the protection link.

5   The protection link becomes system busy.

6   The C-link becomes system busy.

7   The protection link does not have any faults. Protection link release does not occur. This example also applies for B- and D-shelf transmit receive units.

Example 11 All DS-1 links are in service, including the protection link. Faults are not present on any link.

1   The C-shelf link is broken.

2   The SMS-R and RCS detect frame loss on the C-link.

3   The protection link is switched for the C-link.

4   The protection link is broken.

5   The SMS-R detects a fault on the protection link.

6   The protection link becomes system busy.

7   The C-link becomes system busy.

8   The protection link is released from the C-link because a fault is present with the protection link facility.

Example 12 All DS-1 links are in service, including the protection link. Faults are not present on any link.

1   The A-shelf transmit receive unit card is removed.

2   The SMS-R detects a fault (frame loss) on the A-link and the protection link.

3   The protection link becomes system busy.

4   The A-link becomes system busy.

5   The protection link is not switched.

The SMS-R considers the protection link defective. The A-shelf transmit receive unit serves the A-link and protection link. The protection link is not switched to the A-shelf.

Note: The SMS-R can switch the protection link to the A-shelf for a short time. Datafill in table CARRMTC allows the SMS-R to switch the link. For the primary and protection links, datafill in LCGAST allows the SMS-R to switch the link. This condition occurs when the CARRMTC LCGAST (LCGA set filter time) for the protection link is greater than the LCGAST for the A-link.

Example 13 The A-, B-, and D-links are in service. The B-shelf is protection switched because of a fault on the B-link. The C-link is system-busy (SysB) because of a fault.

1   The fault on the B-link clears.

2   The protection link is released from the B-shelf and switched to the SysB C-link.

3   The C-link returns to service.

ManB and PBsy primary DS-1 links

Automatic protection switching for shelves B-, C-, or D- cannot occur if the DS-1 link that corresponds is ManB or PBsy. Automatic protection switching can occur for a ManB or PBsy A-link. Refer to Example 1 in this section.

If the RCS requests a protection switch for the A-shelf, the protection link is switched for the A-shelf. The link state does not affect the switch. Link states include InSv, SysB, ManB, or PBsy. A fault at the near-end (SMS-R) when the A-link is ManB or PBsy prevents a protection switch. If SMS-R detects a fault on the A-link before the link goes ManB or PBsy, the protection link is switched to the A-shelf. The SMS-R scans for a near-end fault or fault clear if the DS-1 link is InSv or SysB. The SMS-R only recognizes the DS-1 status before the DS-1 goes ManB or PBsy. Refer to Examples 2 and 3.

If the RCS detects a fault on a ManB link that is not the A-link, a protection switch does not occur. If the RCS detects another fault on an in-service link

(other than the A-link), a protection switch does not occur. The RCS protection switching functionality prevents the switch.

The SMS-R handles the same condition in a different way. When SMS-R detects a fault on a ManB link (other than the A-link), a protection switch does not occur. If the SMS-R detects another fault on an in-service link, a protection switch occurs. Refer to Examples 4 and 5.

If the RCS detects a fault on a ManB link other than the A-link, no protection switch occurs. A protection switch does not occur if the SMS-R detects another fault on an InSv link (other than the A-link). A protection switch does not occur even if the link has greater priority than the ManB link with faults. For example, the D-link has priority over the C-link. If the RCS detects a fault on a ManB link other than the A-link, protection switch does not occur. A protection switch occurs for the defective INSV link. The protection switch occurs if the SMS-R detects another fault on an InSv link with lower priority than the ManB link with faults.

Note: If a fault is present on the A-link and the A-link is ManB, a protection switch does not occur for the B-, C-, or D-shelves. If a fault is present on the A-link, loss of DDL messaging occurs. Without DDL messaging, messages that request a protection switch are not sent between the RCS or the SMS-R. Refer to Example 9.

Examples of protection switching for ManB and PBsy primary links

The protection switching examples that follow apply to ManB and PBsy primary DS-1 links:

Example 1   The C-link is ManB. The protection link is in-service and available. Faults are not present on the C-link.

1   The RCS detects a fault on the C-link.

2   The protection link is not switched for the ManB link.

Example 2   The A-link is ManB. The protection link is in service and available. Faults are not present on the A-link.

1   The RCS detects a fault on the A-link.

2   The protection link is switched to the A-shelf.

Note: Call processing does not occur for the A-shelf until the A-link is InSv.

Example 3 The A-link is ManB. The protection link is in service and available. Faults are not present on the A-link.

1   A fault occurs on the A-link toward the SMS-R.

2   The protection link is not switched. The SMS-R does not scan for near-end faults on the A-link because the link is ManB. This condition means the SMS-R does not recognize the A-link fault.

Example 4 The C-link is ManB. The A-, B-, and D-links are in service. The protection link is in service and available. Faults are not present on any DS-1 link.

1   The RCS detects a fault on the C-link.

2   The protection link is not switched for the ManB link.

3   The RCS detects a fault on the B-link.

4   A protection switch does not occur because the RCS already detects a fault on another link (C-link).

5   The B-link becomes system busy.

Example 5 The C-link is ManB. The A-, B-, and D-links are in-service. The protection link is in service and available. Faults are not present on any DS-1 link.

1   A fault occurs on the C-link toward the SMS-R.

2   The protection link is not switched for the ManB link.

3   The SMS-R detects a fault on the B-link.

4   The protection link is switched to the B-link.

Example 6 The C-link is ManB. The RCS detects a fault on the C-link. The A-, B-, and D-links are in service. The protection link is in-service and available.

1   The SMS-R detects a fault on the D-link.

2   A protection switch does not occur (a RCS design consequence). The D-link becomes system busy.

Example 7 The C-link is ManB. The RCS detects a fault on the C-link. The A-, B-, and D-links are in service. The protection link is in-service and available.

1   The SMS-R detects a fault on the B-link.

2   The protection link is switched to the B-shelf.

Example 8 The C-link is ManB. A fault exists on the C-link toward the
SMS-R. The A-, B-, and D-links are in service. The protection link is
in-service and available.

1   The SMS-R detects a fault on the D-link.

2   The protection link is switched to the D-shelf.

Example 9 The A-link is ManB. The B-, C-, and D-links are in-service.
The protection link is in service and available. Faults are not present on any
DS-1 link.

1   A fault occurs on the A-link. For this example, either the SMS-R or
RCS end detects the fault.

2   The SMS-R or RCS detects a fault on the C-link.

3   The protection link is not switched for the C-shelf. The C-shelf is made
system busy.

Subscriber lines automatic maintenance

Automatic subscriber lines tests run on line circuits and loops. The tests run
on a scheduled basis, without switch operator involvement other than for
initial scheduling. In a DMS-100 office, the lines maintenance subsystem
(LNS) performs these tests.

The switch operator receives information about subscriber lines that fail to
meet quality standards. The failures are either posted at the line test position
(LTP) or the automatic line testing (ALT) log subsystem generates log
reports. Refer to *Input/Output System Reference Manual*, 297-1001-129.
Manually test and correct the identified failures.

Escalation to manual maintenance

Manual protection switch of the defective DS-1 link occurs when the
SMS-R detects a defective primary link. The SMS-R cannot switch a
protection link into service. Maintenance personnel at the MAP terminal
activate a protection line.

"Running lines tests" in section "Trouble isolation and correction" describes
tests conducted on lines. The tests run when the quality of subscriber lines
deteriorates or faults are present.

The diagnostics that follow run when the RCS line card contains data to run
the tests:

- channel loss

- noise

- echo return loss

- loop detector

- ANI and coin presence

- ringing

- coin collect and coin return

"Diagnostic tests for lines" in section "Trouble isolation and correction" describes these diagnostics.

Manual protection switching

A manual protection switch is performed for a primary DS-1 link despite the primary link status (INSV, SysB, ManB, or PBsy). The SMS-R and the protection link must be in-service for a manual protection switch to occur. When a manual protection switch runs, release of the protection link is not necessary. Release of the protection switch is not necessary if the link is already in use for another link. Refer to Scenarios 1 and 2.

If a manual protection switch attempt occurs and the protection link is already switched, a message appears. The message prompts operating company personnel. The prompt asks if the switch must occur. Operating company personnel choose if the protection switch continues.

When a manual protection switch occurs, the switch release occurs as follows:

- manual protection switch release. Refer to Example 6.

- manual protection switch for another link. Refer to Example 7.

- automatic protection switch requested for the A-shelf, and the SMS-R is manually switched for another shelf. The system drops the protection link from the B, C, or D-shelf and switches to the A-shelf. Automatic protection switching for the A-shelf overrides manual protection switching for the B, C, or D-shelf. Refer to Example 7.

- the SMS-R performs a system initialization, a cold SWACT of the SMS-R, or a BSY/RTS of both SMS-R units. Refer to Example 8.

An automatic switch request for the A-shelf overrides a manual switch for the B, C, or D-shelf. An automatic switch request for the B, C, or D-shelf does not override a manual switch request. Refer to Example 3 and 4.

If the A-link has a fault, a protection switch for shelves B, C, or D does not occur. The system does not maintain the protection switch. If a fault is present on the A-link, loss of DDL messaging occurs. Without DDL messaging, messages that request a protection switch for shelves B, C, or D are not sent between the RCS or SMS-R. Refer to Example 5.

Examples of manual protection switching The following are manual protection switching examples:

Example 1 The C-shelf is protection switched when the C-shelf detects a C-link fault. Faults are not present on any other primary link. The protection link is in service.

1   A manual switch to the B-shelf is requested.

2   The B-shelf is protection switched.

3   The C-link becomes system busy.

Example 2 Detection of a C-link fault causes protection switching of the C-shelf. There are no faults present on any other primary link. The protection link is in service.

1   A manual switch to the C-shelf is requested.

2   The protection link is manually switched to the C-shelf.

Example 3 The C-shelf is manually protection switched. Faults are not present on any primary links. The protection link is in service.

1   A fault is detected on the A-link.

2   The protection link is dropped from the C-shelf and switches to the A-shelf.

Example 4 The C-shelf is manually protection switched. Faults are not present on any primary link. The protection link is in service.

1   A fault is detected on the B-link.

2   The protection link remains switched to the C-shelf. The B-shelf becomes system busy.

Example 5 The A-shelf is defective. Faults are not present on any other primary link. The protection link is in service.

1   A manual switch request is issued for the B-shelf.

2   The manual switch request fails because of loss of the DDL that a damaged A-shelf causes.

Example 6 The A-shelf is manually protection switched. Faults are not present on any DS-1 link.

1   A manual release of the protection link is requested.

2   The protection link is released from the A-shelf.

Example 7 The C-shelf is manually protection switched. There are no faults present on any primary links. The protection link is in-service.

1 A manual switch to the B-shelf is requested.

2 The protection link is dropped from the C-shelf and switched to the B-shelf.

Example 8 The C-shelf is manually protection switched. Faults are not present on any primary links. The protection link is in-service.

1 A cold SWACT of the SMS-R is performed.

2 The protection link is released.

Manual protection link release
Manual or automatic protection switches can be manually released. If the protection link is released and the primary link has a fault, the protection link switches back to the damaged primary link. Refer to Scenario 1 in this section.

The protection link is switched for any other primary link with a fault. This procedure occurs if release of the protection link occurs and the primary link is not damaged. Refer to Scenarios 2 and 3. If a damaged primary link is to be permanently unswitched, protection switching is disabled for that primary link.

Examples of manual protection link release The following are manual protection switching scenarios:

Example 1 The C-shelf is protection switched because of a defective C-link. The protection link is in service.

1 The protection link is manually released.

2 The protection link is immediately switched back to the C-shelf.

Example 2 The C-shelf is manually protection switched. Faults are not present on any primary link. The protection link is in-service.

1 The protection link is manually released.

2 The protection link remains released until performance of an automatic or a manual protection switch.

Example 3 The C-shelf is manually protection switched. A fault is present on the B-link. The B-link is system busy. Faults are not present on the links A, C, or D. The protection link is in-service.

1 The protection link is manually released.

2 The protection link is switched for the B-link.

3   The B-link returns to service.

Enabling and disabling protection switching

Protection switching can be disabled for any primary link. If a link is protection switched and operating company personnel attempt to disable protection switching for the link, a message appears.

The message contains a prompt that asks operating company personnel if to continue. If yes, the system disables the link for protection switching and releases the protection link. Refer to Examples 1, 2, and 3 in this section.

If a disabled primary link is defective and protection switching for the link is enabled, an automatic protection switch is attempted. Refer to Automatic protection switching (InSv, SysB, ManB, and PBsy primary lines) in this document.

Protection switching is available for all primary links when adding a protection link to the RCS.

Note: To disable protection switching, both the DMS switch and the RCS ends must be disabled for protection switching.

Examples of enabling and disabling protection switching The protection switching examples that follow enable or disable primary DS-1 links:

Example 1 All primary DS-1 links and the protection link are in service. There are no faults present on any links.

1   The B-link is disabled for protection switching.

2   The SMS-R and RCS detect a fault on the B-link.

3   There are no protection switches. The B-link becomes system busy.

Example 2 Protection switching is disabled for the A-link. A fault is present on the A-link. The A-shelf is not protection switched. The A-link becomes system busy. Faults are not present on any other DS-1 link. The protection link is in service.

1   A fault is detected on the B-link.

2   Protection switches do not occur. Because the A-link is defective, a loss of DDL messaging occurs. When the loss of DDL messaging occurs, a protection switch to shelves B, C, or D cannot occur. The B-link becomes system busy.

3   The A-link is enabled for protection switching.

4   The protection link is switched to the A-shelf.

5   The A-link returns to service.

Example 3: The protection link is switched to the B-shelf because of a damaged B-link. The other DS-1 links do not have faults.

1   Protection switching is disabled for the B-shelf.

2   The protection link is released from the B-shelf, and the B-link becomes system busy.

Manually busy, switched primary links

The system can release the protection links of shelves B, C, or D. The system releases the links if the shelves are automatically protection switched and the primary link is not manually protection switched. Refer to Example 1 in this section.

The system does not release the protection link for shelves that are manually protection switched. The system does not release the link for these shelves if the link that corresponds is manually busy. Refer to Example 2.

The protection link remains switched to the A-shelf if the A-shelf is automatically or manually protection switched. The protection link remains if the A-link is manually busy. Refer to Example 3.

Examples of manually busy, switched primary links The following are manually busy, switched primary link examples:

Example 1: The C-shelf is protection switched because of a C-link that has faults. Faults are not present on any other primary link.

1   The C-link becomes manually busy.

2   The protection link is released.

Example 2: The C-shelf is manually protection switched.

1   The C-link becomes manually busy.

2   The protection link is not released. The protection link is switched for the C-shelf.

Example 3: The A-shelf is protection switched because of an A-link that has faults. Faults are not present on any other primary link.

1   The A-link becomes manually busy.

2   The protection link remains switched on the A-shelf.

Operational considerations

The operational considerations for protection switching are as follows:

- If a ManB primary link is protection switched, use the FORCE option to return the link to service. Use of the RTS command without the FORCE option causes DS-1 diagnostics to run on the link. These diagnostics fail when the link is protection switched. When DS-1 diagnostics fail, the link does not return to service. The FORCE option bypasses diagnostics.

- When an RCS request causes a protection switch, the CARRIER level of the MAP indicates the primary link is protection switched. Other indications do not appear at the CARRIER level. The system generates a log that indicates the far-end (RCS) started the protection switch.

  Enter the command string QUERY PM FLT and post the RCS at the PM level of the MAP to query the protection switching status. A message appears that indicates the far-end (RCS) started the protection switch.

- Call processing cannot occur over a protection link if the protection link is switched for a manually busy primary link.

- When a protection switch occurs the CARRIER level of the MAP indicates that the primary link is protection switched. Protection switching occurs when the SMS-R detects a fault. The CARRIER level also indicates the type of DS-1 fault. Examples of DS-1 faults are LCGA, BDV and OOS. The system generates a log to indicate that the near–end (SMS-R) starts the protection switch.

  Enter command string QUERY PM FLT and post the RCS at the PM level of the MAP to query the protection switching status. A displayed message indicates that the near-end SMS-R started the protection switch.

- When the RCS detects a fault that causes a protection switch, the A- and B- bits from the RCS are not determined. The A- and B- are not determined a maximum of 120 ms.

- The SMS-R can run a protection switch to the A-link. The SMS-R runs a protection switch if a fault is present on the protection link toward the RCS. The fault is present on the RCS protection link receive side. The SMS-R runs the protection switch if a fault is also present on the A-link or protection link. The protection switch causes one-way transmission.

  The SMS-R receives a minor alarm from the RCS and the protection link and A-link remain in-service. Check the protection line for faults when the SMS-R receives this alarm and SMS-R causes protection switch of the A-shelf.

- The system generates logs when a protection line switch or release occurs.

- The system generates logs when a primary link is enabled or disabled for protection switching. Logs indicate if the switch is automatic or manual. The logs also indicate if the RCS or SMS-R started the switch.

- The PM level of the MAP terminal displays the shelf alarm status and protection switching status for a specified RCS.

  The CARRIER level of the MAP displays the DS-1 link status. The CARRIER level also indicates any protection switch for a specified set of DS-1 lines.

  Enter manual protection switching commands at the CARRIER level of the MAP terminal.

SMS-R hardware

This chapter describes the subscriber carrier system hardware components. These components give the subscribers the full resources of a digital switching system for call processing and maintenance.

Hardware components

The hardware that the following sections discuss are:

- SMS–R module, page 2-3
- RCS module, page 2-5
- DS-1 links that connect the SMS–R and the RCS, page 2-6

The layout of central office equipment for the SMS-R/remote concentrator SLC-96 (RCS) configuration appears in the following figure.

SMS-R/RCS configuration

Central
office

Central control

Switch network

Line trunk controller or line group controller

Remote
switching
center

Remote cluster controller

DS30A links:
2 to 4 links
handle traffic
for all SMS-R
applications

SMS–R

DS-1 links: 2 to 4
per RCS plus an
optional protection
line; 2 to 20 for
each SMS-R

Up to 6 RCSs
for each
SMS–R

Remote
concentrator
SLC-96

Remote
concentrator
SLC-96

SMS-R module

The SMS-R module is in a subscriber module equipment (SME) frame or a cabinetized version of the frame. This module consists of two units. Unit 0 is in the lower shelf and unit 1 is in the upper shelf. The SME frame and the cabinetized version can have up to two SMS-R modules. The SMS-R module 0 refers to the lower two units. The SMS-R module 1 refers to the upper two units. The SME frame appears in the first figure below. A comparison between the SME frame and the cabinetized version appears in the figure that follows the SME frame figure.

The SMS-R is a redundant peripheral module (PM). Each unit supports call processing and system control. The units operate in hot standby configuration. One unit is active while the other unit is on standby. The other unit is the mate unit. When a fault occurs in the active unit, the standby control on the mate unit takes over. The mate unit maintains full control of the links until the failure is corrected.

The units consist of the following:

- line group controller (LGC) cards

- ring/pad card

- A/B derived data link (DDL) message card

- SLC-96 DS-1 interface cards

Comparing the SMS-R to other peripherals

The following limits apply to the SMS-R/RCS subsystem:

- supports SLC-96s or other TR-008 flexible digital loop carriers. The SMS-R does not support the following:

    — line concentrating modules (LCM)

    — remote line concentrating modules (RLCM)

    — switched digital trunk services

- does not support Integrated-Services Digital Network (ISDN) lines

- does not support P-phones

- does not support DS-1 links to a remotely located RSC

- does not support hairpins on lines between the RSC and the SMS-R

SMS–R SME frame

Unit 1

SMS–R module 1

Unit 0

Unit 1

SMS–R module 0

Unit 0

Cooling unit
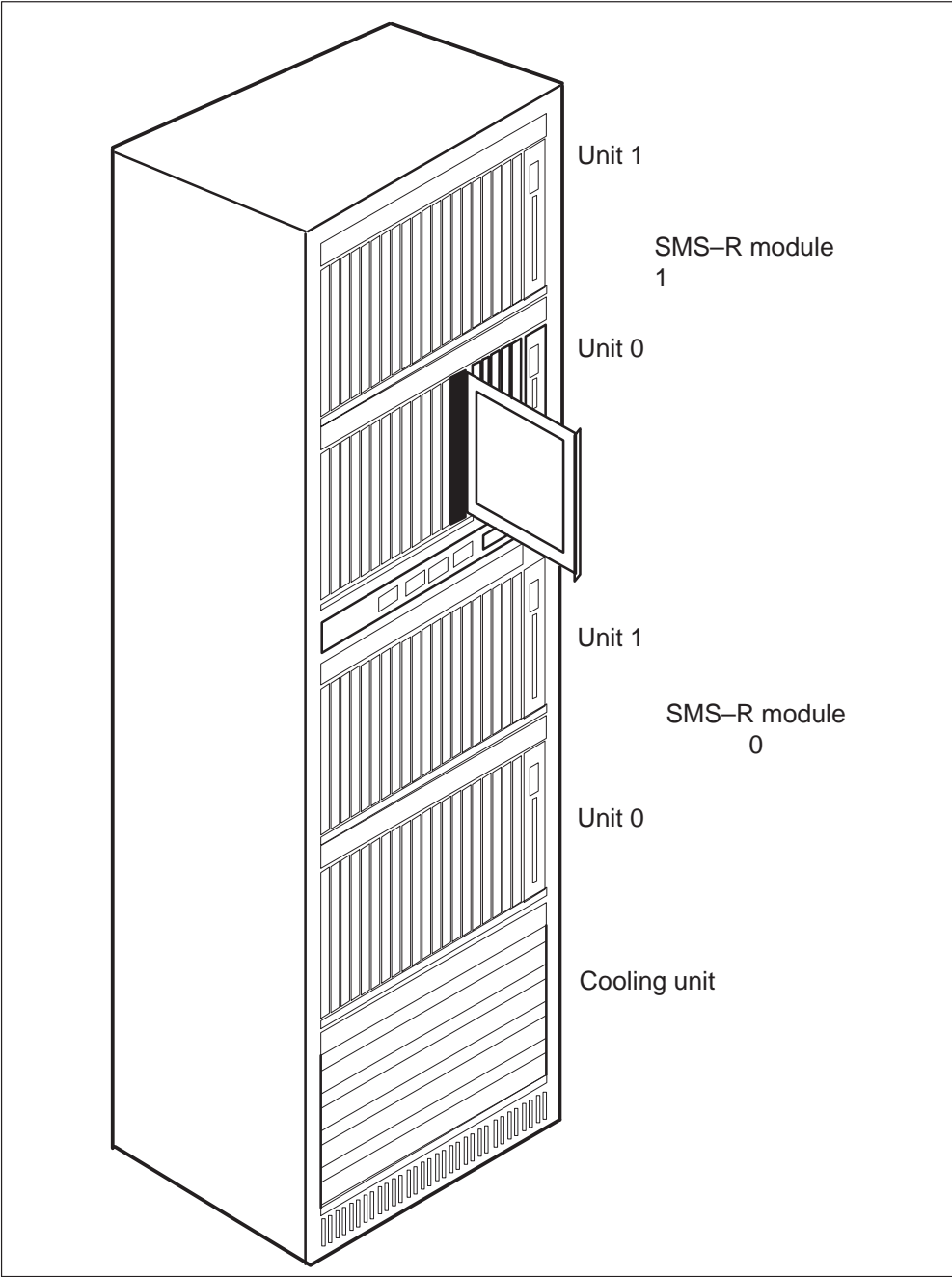
Comparison of the SME frame to the SME cabinet

Frame   Cabinet
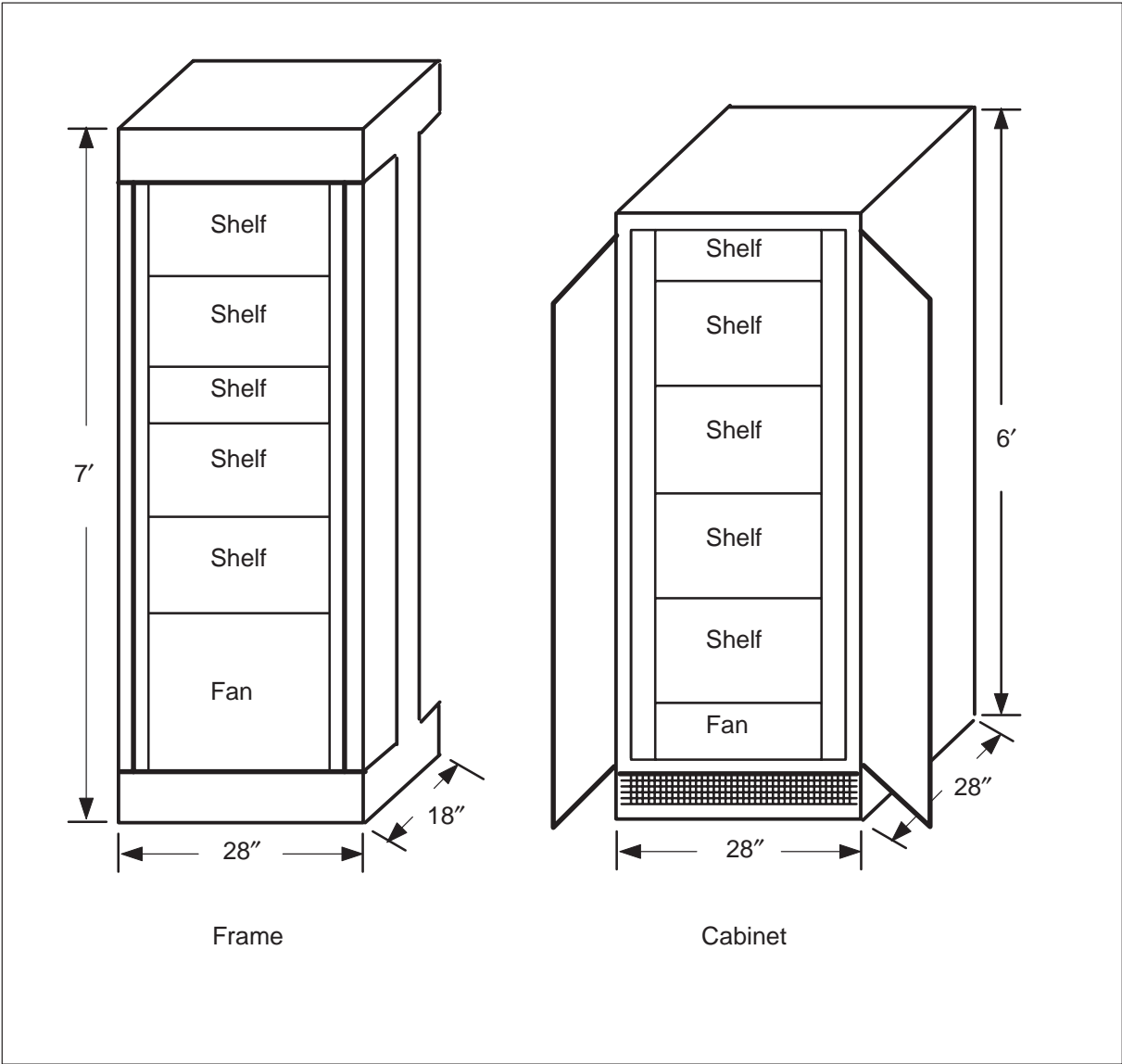
RCS module

The remote concentrator SLC-96 (RCS) module contains up to four line shelves, labeled A, B, C and D. Shelves A and B are the upper shelf group AB. Shelves C and D are the lower shelf group CD. Each shelf group operates separately in one of three modes.

Mode I

An RCS in Mode I has nonconcentrated shelf groups. This condition means that every subscriber loop that associates with a circuit number has a dedicated DS-1 channel. In Mode I, the RCS supports up to 96 subscriber lines and connects to the SMS-R through up to four primary DS-1 links. Mode I is primarily for singleparty and multiparty lines. Both types of lines use dual-circuit message line cards.

Mode II

An RCS in Mode II has concentrated shelf groups. Two primary DS-1 links connect the RCS to the SMS-R. This condition causes 48 subscribers to compete for the 24 time slots on a DS-1 link. Single-circuit and dual-circuit line cards are mixed in Mode II. Special-service and coin cards are only in the four slots to the far right of each shelf. A maximum of eight single-circuit line cards are available for each Mode II shelf group. In Mode II, an RCS supports up to 96 subscriber lines. The RCS also supports a group of 64 subscriber lines and 16 special-service and coin cards.

Mode III

An RCS in Mode III uses nonconcentrated shelf groups. This mode normally supports special services, but can also support coin cards. This mode operates with one DS-1 link for each shelf group. This mode also uses a multiplexer to multiplex channels from the two shelves on a shelf group on one DS-1 line. Shelves have single-circuit line cards only. In Mode III, an RCS supports up to 48 special-service and coin cards.

DS-1 links that connect the SMS-R and the RCS

An SMS–R provides a maximum of 20 DS-1 links to SMS-R remotes. Each remote terminates from two to four primary DS-1 links from an SMS-R. The remotes mode of operation determines the number of DS-1 links. Each remote also has an optional protection link. The protection link guarantees continued communication between an SMS-R and an RCS if a primary DS-1 link fails. The switch operator can place the link out-of-service to guarantee communication.

Note: All DS-1 links from an RCS module must terminate on the same SMS-R.

An RCS in Mode I has up to four primary DS-1 links to the SMS-R plus an optional protection link. This configuration allows a maximum of four Mode I remotes, including protection links, to connect to the SMS-R.

Note: If no protection links are configured, up to five RCS modules in Mode I are configured. If less than the maximum four-primary links are configured, the SMS-R supports up to six RCS Mode I modules.

An RCS in Mode II or Mode III has a maximum of two primary DS-1 links to the SMS-R . The RCS in Mode II or Mode III also has optional protection link. The SMS-R supports a maximum of six RCS modules in these modes.

Each shelf group in an RCS module can operate in one of the three modes. This mixed mode of operation allows the operating company to plan for the gradual growth of the SMS–R/RCS subsystem. Traffic requirements dictate the growth of the subsystem. For example, an RCS shelf group that operates in Mode I converts to Mode II operation. This configuration frees up a DS-1 link used to provide protection switching for the RCS module. Refer to the *Translations Guide* for mode-conversion procedures.

Derived data link

The derived data link (DDL) is not a hardware link. The DDL derives from 24 consecutive supervisory bits to form a special data path with a transmission rate of 2.2 Kb/s. This DDL is present on the RCS A-link. The RCS A-link is the DS-1 link that terminates at shelf A. If the RCS is in Mode II, the DDL is present on the C-link.

The DDL sends and receives information between the SMS-R and the RCS. The information includes the following:

- control of subscriber assignment

- de-assignment to specified DS-1 channels

- hookswitch changes

- activation of the pulse code modulation (PCM) looping test

Protection links

Protection switching is a DMS-100 backup feature. Protection switching guarantees continued communication between an SMS-R and an RCS if a DS-1 link that connects the two fails.

A protection link occupies one DS-1 P-side port of an SMS-R and connects a single RCS. Each RCS has from one to four primary lines and at maximum of one protection line. The modes of the RCS shelf groups determines the number of lines. Each protection line serves only the RCS to which the protection line connects. A normal protection line configuration appears in the following figure.

Protection switches initiate as follows:

- automatically by the RCS or SMS–R

- manually by operating company personnel with the CARRIER level protection switch (PROTSW) command

- manually during execution of the far-end loop test (FELP) command

Note: The FELP command enables a continuous loop back on all 24 DS-1 channels of a specified link.

When a protection switch occurs, the system maintains calls in the talking state. For plain old telephone service (POTS) and coin lines, the system maintains calls in the ringing state. The protection line carries voice and signaling information. When the A-link is protection switched (or C-link in Mode II), the protection line carries also system control information.

Protection link configuration

297-8301-550   Standard 07.01   August 1998
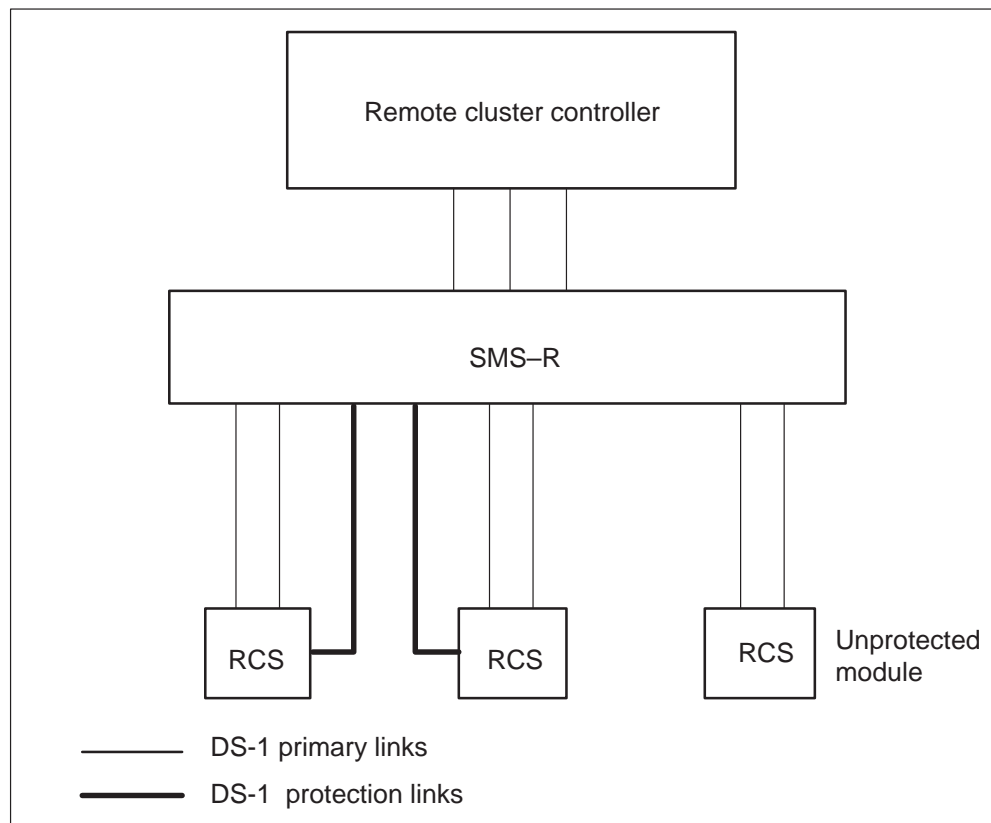
SMS-R signaling

Signaling for SMS-R

This section describes the signaling that the SMS-R/Remote Concentrator SLC-96 (RCS) subsystem uses. The section includes the SMS-R/RCS signaling format, signaling protocols and the features the protocols support.

SMS-R/RCS signaling links

The SMS-R and the RCS use an extended super frame design to exchange information over DS-1 lines. DS-1 lines operate at a rate of 1.544 Mbps with a sampling frequency of 8000 frames each second.

The DS-1 link consists of 24 channels. Each channel contains eight bits of pulse code modulation (PCM) data. A framing bit is called stuffing or an S-bit. Include this bit at the front of the sequence. The bit makes sure the SMS-R and the RCS recognize the beginning of each 24 channel sequence. 192 bits of information are sent during each 24 channel sequence, plus a framing bit. Refer to this sequence as a channel frame.

These channel frames carry speech information, signaling information or operations information. The following is the DS-1 frame format:

Format of a DS-1 frame
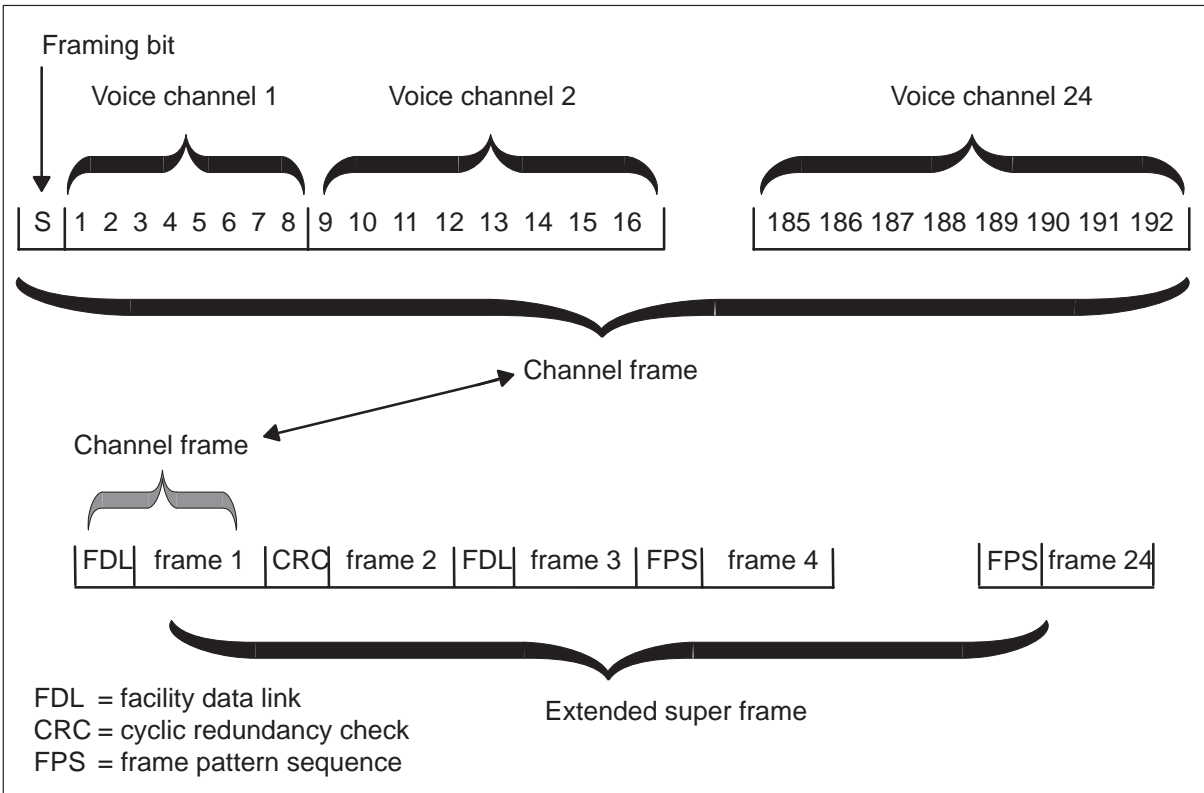
The extended super frame (ESF) consists of 24 DS-1 frames. In ESF, the framing bits form a 24 bit pattern. There is one framing bit for each 24 channel frame.

The 24 bit pattern is used to show three types of information

- frame pattern sequence (FPS)
- facility data link (FDL) performance
- cyclic redundancy check (CRC).

The FPS is 001110. Each fourth framing bit that begins at the fourth bit carries a FPS bit. The FPS, with the CRC, defines an in-frame condition.

The 4 kbit/s FDL bit begins with the first framing bit. An FDL messaged bit carries to each other frame.

The CRC bit begins with the second bit. Each fourth bit carries the check. In an extended superframe, a block check field is checked six times. The CRC-6 check detects bits that emulate an FSP bit, and determines if an out-of-frame condition is present.

A derived data link (DDL) frame, consists of six superframes or 72 channel frames.

Signaling protocols

The SMS-R/RCS subsystem uses the following signaling protocols to communicate and provide subscriber services:

- A- and B-bit messaging

- DDL messaging

- nailed-up cross-connections

- DMS-X protocol.

A- and B-bit messages

In each sixth and twelfth channel frame, the system takes the least important bits from each channel. This occurs at the RCS transmit/receive unit card or at the SMS time switch. The least significant bits from the sixth frame are replaced with A-bits. The least significant bits from the twelfth frame are replaced with B-bits. The A- and B-bits pass information for specified channels.

An 8085 microprocessor on the A/B DDL message card sends bits to the time switch to insert. Insertion of A- and B-bits occurs in the PCM data sent to the DS-1 lines. The 8085 microprocessor extracts A-and B-bits from the PCM data incoming from the time switch. The SMS-R signaling processor (SP) processes the A-and B-bits.

DDL messages

The framing bits used for channel frames alternate between frame timing bits (Ft) and frame signaling bits (Fs). Each superframe has the same sequence of six Ft bits and six Fs bits.

The Ft bits identify the first time slot in each channel frame. The Fs bits identify the A-(sixth), and B-(twelfth) channel frames of a superframe. The A-frame carries A-bits. The B-frame carries B-bits. The framing pattern of Ft and Fs bits appears in the following example:

```
1(Ft) 0(Fs) 0(Ft) 0(Fs) 1(Ft) 1(Fs) 0(Ft) 1(Fs) 1(Ft)
1(Fs) 0(Ft) 0(Fs)
```

The frame signaling pattern, formed with Fs bits, appears in the following example:

```
111 000 111 000
```

The 12 bits transfer the signaling pattern from two superframes. The following four superframes do not have the Fs bits in one of two places:

- the transmit receive unit card in the RCS

- the time switch card in the SMS-R.

Special supervisory bits are inserted in the place of the four superframes Fs bits. The 24 consecutive supervisory bits form a special data link called a DDL.

The DDL is a 2.2 kbit/s data path of supervisory bits present on the RCS A-link. The DDL is present on the C-link if shelf group CD is in Mode II. Only the C-field section of the DDL is used.

Nailed-up cross-connections

Different applications can require special-service cards. A nailed-up cross-connection is set and maintained through software. A nailed-up cross-connection is called a hairpin connection. This connection is a peripheral-side (P-side) cross-connection. All information flows from an RCS into the SMS.

Information from the SMS-R connects through a switch to a DS-1 link. The DS-1 link leads to a second RCS or other piece of digital equipment. Nailed-up P-side to P-side connections allow voice and signaling information to be routed. This route travels through the SMS-R instead of through the network. Signaling information is not inserted or extracted by the SMS-R.

DMS-X protocol

The DMS-X protocol is a half-duplex protocol used on DS30A links between the remote cluster controller (RCC) and the SMS-R. The DMS-X protocol includes a CRC code for error detection.

The DMS-X protocol is an inter-terminal process that includes handshaking messages. Two terminals engaged in message transfer inform each other of the present condition in regards to messaging. The following figure illustrates a general form of handshaking protocol, that constructs DMS-X protocol:

DMS-X handshaking protocol
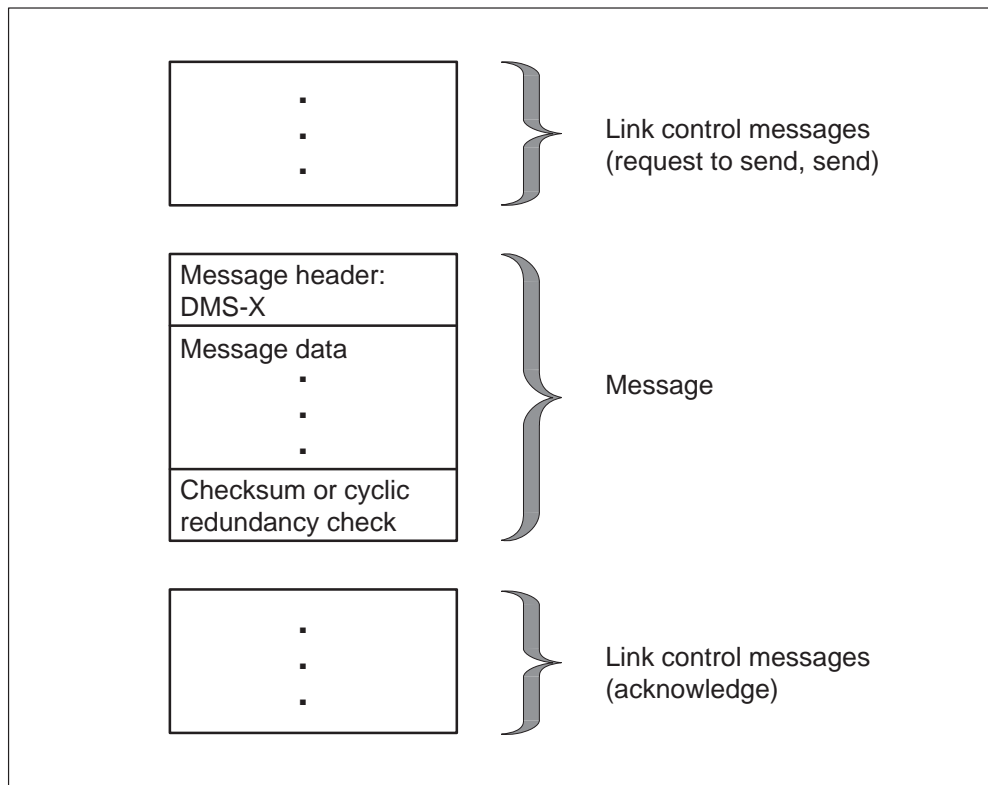
Perform message error detection by message time-out and message checksum or CRC calculation. In the event of protocol, checksum, or CRC failure on an outgoing message, the sending node tries the send sequence again. On an incoming message failure, the sending node reroutes the message over an alternate control side link. Hardware redundancies provide at least one alternative path to and from a node. A design of DMS–X messages appear in the following figure:

DMS-X message format
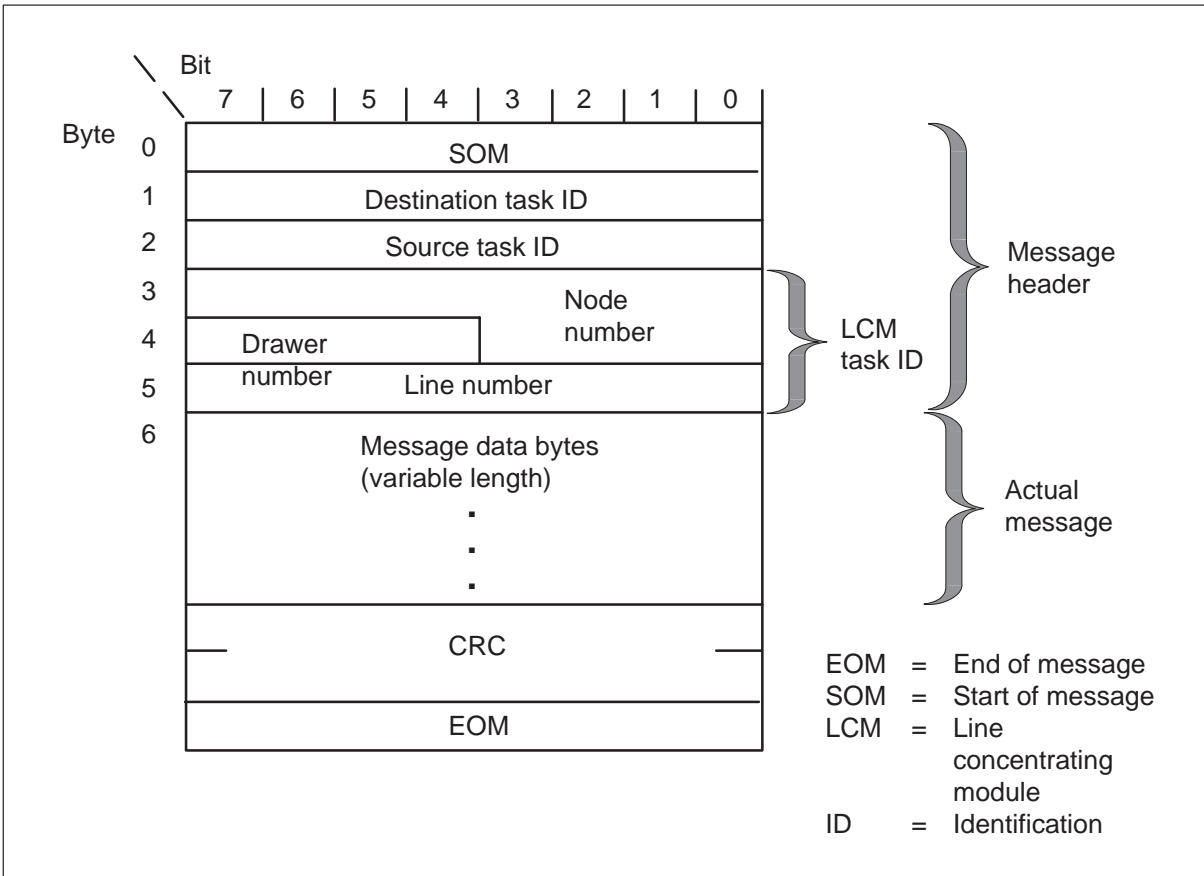
The system transmits the message over a link, with link control messages that precede and follow the link. Messaging occurs between programs that execute in the SMS-R and in the RCC. Many tasks for processes communicate with the other through messages over the DS30A links.

The DMS-X message header is the first six bytes. The following describes the first six bytes:

- the first byte is the start of message

- the second byte is the destination task identification (ID) of the message. This ID is used in an outgoing message to identify the process to receive the message

- the third byte is the source task ID.   This ID is used in an incoming message to identify the process that sent the message

- the last three bytes are the task ID number.

The number of bytes in the current message or data is variable. The CRC occupies two bytes and detects transmission errors. The end of message occupies one byte.

SMS-R/RCS signaling functions

A- and B-bit messaging

The A- and B-bit messaging supports the subscriber services described below.

Plain ordinary telephone service (POTS) Both single-party and multiparty can have POTS. Multiparty includes two-party automatic number identification (ANI) and operator number identification (ONI) four- or eight-party ONI.

Coin features The following coin features are provided:

- Coin First (CCF)

- Coin Dial Tone First (CDF)

- Coin Semi-Postpay (CSP).

The SMS-R sends the following signaling information to the RCS on a channel base:

- start or stop ringing

- start or stop forward disconnect

- scan for on-hook and off-hook

- collect ANI/coin information

- collect channel maintenance (MTC) information.

The SMS-R collects return signal information from the RCS that includes the following data:

- call origination
- call disconnect
- digit collection
- ANI/coin
- answer
- flash

The A- and B-bit messages are decoded for each type of RCS line card. A pattern indicates a different meaning for a single-party line card and coin card.

Call processing features Coin call and ANI processing are grouped as one feature because both features use the same software and hardware.

Coin call features apply to CDF and CCF lines and consist of the following capabilities:

- scan for off-hook
- checking for coin presence
- checking for coin presence during local call overtime
- return coins
- collect coins.

The ANI determines if a two-party line is active from the tip or the ring side of the line. This action obtains the correct billing responsibility for a call.

Both ANI and coin features are implemented through A- and B-bit signal patterns transmitted between the SMS-R and the RCS. These signal patterns consist of A- and B-bits. A maximum of nine signaling states can occur. The following signals transmit from the SMS-R to the RCS:

- negative loop mode
- channel test
- positive loop mode
- ground start
- R ringing
- positive coin check
- positive coin control

- negative coin control

- negative coin check.

The following signals transmit from the RCS to the SMS-R in response to SMS-R signals:

- on-hook

- off-hook

- coin ground

- not equipped.

The signaling states associate with an exact A- and B-bit pattern. The Bellcore document *Digital Interface Between the SLC96 Digital Loop Carrier System and a Local Digital Switch*, TR-TSY-000008 describes these patterns.

PBX line The private branch exchange (PBX) line provides capabilities for a loop start and a ground start.

Custom calling services The custom calling features that follow are provided:

- Speed Calling

- Call Waiting (CWT)

- Three-way Calling

- Call Forwarding (CF).

Ringing The following types of ringing are supported:

- bridged ringing—single-party

- ringing in addition to normal ringing—more than one party

  — four-party completely selective

  — eight-party semi-selective

- coded balance

- frequency selective ringing.

The SMS-R supports ringing on subscriber lines that attach to an RCS. The SMS-R sends different A- and B-bit signal patterns on DS-1 lines to a connected RCS. This pattern causes the RCS to ring subscriber telephone sets.

The DMS-100 switch uses exact signaling patterns for coin, special service, and single- and multiparty lines. The signaling patterns are described in a Bell Communications Research document. patterns. Refer to the *Digital Interface Between the SLC96 Digital Loop Carrier System and a Local Digital Switch*, TR-TSY-000008.

The SMS-R/RCS subsystem supports all currently available types of ringing, including coded, and all selective ringing types. Only one type of ringing is in use at a time on a single RCS.

FSR The SMS-R/RCS subsystem supports FSR for single-party, two-party, four-party, and Meridian Digital Centrex (MDC) lines. The FSR channel units or cards, are SCD222 for 900-Ω loops or SCD252 for 1500-Ω loops. This document refers to these cards as FDR cards.

In a specified RCS, one type of ringing is supported. For example, an RCS supports FSR but not coded, or coded but not FSR. A field in table RCSINV indicates the type of ringing an RCS uses. Refer to the data schema section of the *Translations Guide* for more information on table RCSINV datafill.

The line cards on an RCS use all available types of ringing. If FSR is employed and both single-party and coin line cards provision on the RCS with FSR cards. Single-party and coin cards employ -R ringing.

Three FSR systems are used:

- decimonic
- harmonic
- synchromonic.

Refer to the *Translations Guide* for more information about FSR.

Dialing Two types of dialing are supported:

- dial pulse (DP)
- Digitone.

Tones The tones that follow have support:

- dial tone
- audible ringback
- reorder
- busy.

DDL messaging

The 8085 microprocessor of the A/B DDL message card sends DDL messages to the time switch that the DS-1 PCM data includes. The microprocessor extracts the DDL message from incoming PCM. Software in the SP, called the DDL facility, processes DDL messages.

The DDL message includes 24 consecutive bits grouped as shown in the following DDL message table.

DDL message bits and field names

DDL bits	Field name	Description
Bits 1-11	Concentrator field (C-field)	Indicates shelf groups AB and CD use the C-field during operation in Mode II. This field carries information for shelves A, B, C, and D. The field includes control of subscriber assignment and deassignment to DS-1 channels, hook changes, and activation of the PCM looping test. Refer to note 1.
Bits 12-14	Spoiler bits (fixed pattern of 010)	Indicates spoiler bits are inserted at preassigned positions in the DDL. The insertion is to make sure the DDL does not duplicate the signal pattern.
Bits 15-17	Maintenance field (M-field)	Indicates the M-field on the A-link carries information for all shelves, and controls card and customer loop testing. Refer to note 2.
Bits 18-19	Alarm data link field (A-field)	The A-field on the A-link carries alarm and system control information for all shelves. Refer to note 2.

Note 1: When a C-field is not available to send, the 8085 microprocessor sends an idle pattern on the DDL link. The RCS sends an idle pattern when no new C-field is present.
Note 2: If the M-, A-, or S-fields remain unchanged between messages, the 8085 microprocessor sends the previous field patterns. The RCS, at the other end, sends the same patterns. The 8085 microprocessor sends information to the SP when a DDL field changes. Idle patterns are not transmitted.

—continued—

DDL message bits and field names

DDL bits	Field name	Description
Bits 20-23	Protection line switch field (S-field)	Indicates the S-field on the A-link controls the switching of the DS-1 protection link. Refer to note 2.
Bit 24	Spoiler bit field (fixed pattern of 1)	Insert the spoiler bit at the preassigned position in the DDL. This action makes sure that the DDL does not duplicate the signal pattern.

Note 1: When a C-field is not available to send, the 8085 microprocessor sends an idle pattern on the DDL link. The RCS sends an idle pattern when no new C-field is present.

Note 2: If the M-, A-, or S-fields remain unchanged between messages, the 8085 microprocessor sends the previous field patterns. The RCS, at the other end, sends the same patterns. The 8085 microprocessor sends information to the SP when a DDL field changes. Idle patterns are not transmitted.

—end—

Nailed-up cross-connections

Nailed-up connections support the following:

- MTC and table control for nailed-up specials on SMS-R

- SMS-R special services

- digital dataphone service (DDS) hairpin

- direct inward dial (DID) PBX by hairpin

- foreign exchange service

- integrated local specials.

One endpoint of the nailed-up connection must terminate on a switch that supports these special services. This connection provides support for applications like foreign exchange and off-premises extension.

Table control for nailed-up specials on SMS-R This feature implements central control (CC) code. The CC code support nailed-up P-side to P-side cross-connections on a DS-1 link on the same SMS-R.

Special services feature The special services feature implements peripheral processor code. The code supports nailed-up P-side to P-side cross-connections on a DS-1 link located on the same RCS.

This feature provides and maintains connections. The connections are between pairs of P-side channels, lines, or a collection of lines and channels on an SMS-R. The connections are in response to a CC request. These connections remain until the CC sends a message to disconnect these connections.

Connections for special services are as follows:

- line to line
- DS-0 to DS-0
- line to DS-0 or DS-0 to line.

DDS hairpin feature The DDS hairpin feature supports 2.4, 4.8, and 9.6 kbit/s data cards. These cards, that transfer data over DS-1 links, employ a nailed-up cross-connection set by the DMS switch. The following DDS hairpin connection figure shows a normal data path.

The 2.4, 4.8, and 9.6 data cards are used for data transmission only. In an NT channel bank an associated card is used. For example, the D4DP70 card works with the QPP550 card.

The DDS hairpin connection figure shows how information flows from the data card through the RCS and SMS-R. The information flows in a channel bank or another digital facility like a Nortel (Northern Telecom) channel bank. The data flows to the DMS-100 and switches to the terminating party. This party can be a computer, another digital switch, or another device.

DDS hairpin connection on an SMS–R/RCS subsystem
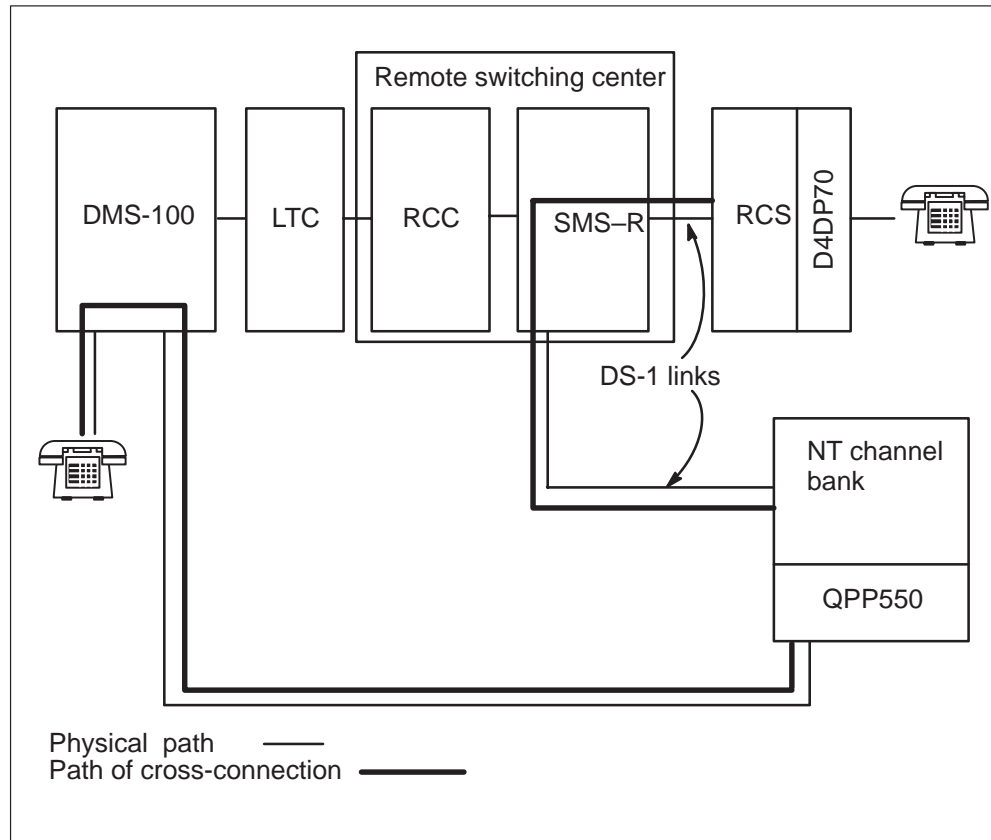
There is an important difference between DDS hairpin connections and other special-service connections. The A- and B-bits are not inserted into the information path for the DDS hairpin connection. The bits are not inserted because DDS protocol uses the same bits as A and B signal bits. The DDS protocol bit occupies position one in a byte.

DID PBX by hairpin The DID feature uses special services channel units in an RCS, a hairpin connection, and a DS-1 link. The link is from an SMS-R to an RCC or other piece of telephone equipment. Refer to the following DID PBX configuration figure:

DID PBX configuration example
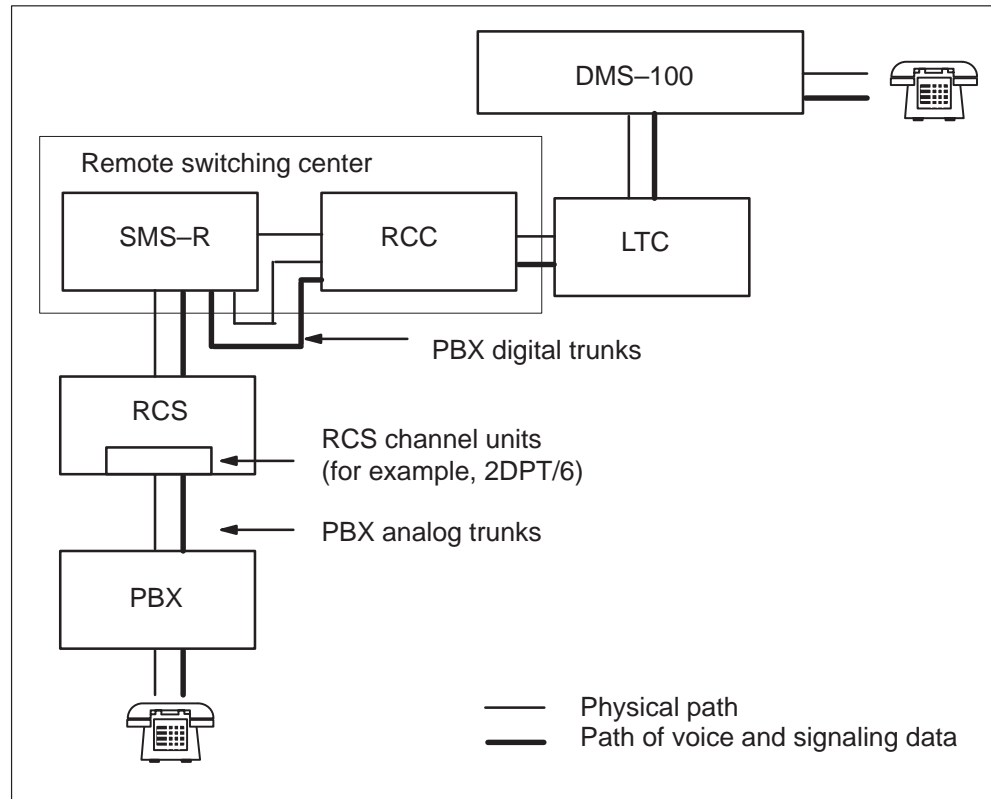
Foreign exchange service Special services supports the foreign exchange service. A remote or far central office can serve the subscriber instead of a close central office. Calls to other subscribers in the remote exchange area are treated as local calls instead of toll calls.

Foreign exchange service uses special services foreign exchange station (FXS) channel unit. These units, are in an RCS, a hairpin connection, and foreign exchange office (FXO) channel units in a channel bank. Refer to the following figure:

FXS
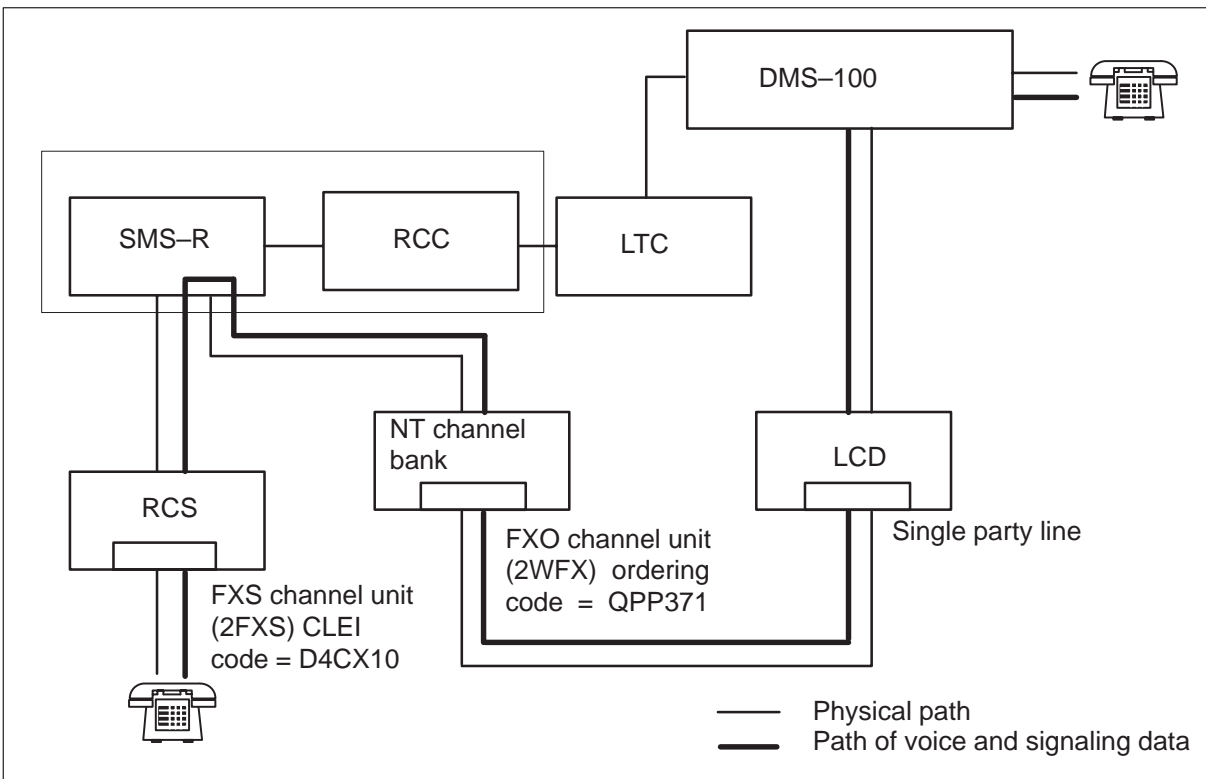
Integrated local specials The special plain old telephone service (SPOTS) channel unit S9CD271 supports POTS and special services like the following:

- INWATS

- OUTWATS

- TWX

- PBX.

The SPOTS channel unit is configured in loop or ground start mode. When SPOTS channel units are configured in loop start, the units do not support PBX. The PBX lines require ground-start signaling and ground-start mode.

Ground-start lines differ from loop-start lines because loop-start, tip and ring, are handled in a different way. The loop-start are handled in a different way to signal an off-hook. Ground-start off-hooks are acknowledged. Loop-start off-hooks are not acknowledged.

The SPOTS channel unit has the following characteristics:

- two voice-frequency, two-wire channels that associate with each channel unit

- mechanized loop testing accessibility

- does not have gain or frequency setting

- required special service unit (SSU) configured in the associated RCS

- single-party 20 Hz ringing (-R ringing).

Refer to the manufacturer documentation for more information.

The SPOTS channel unit in the SMS-R/RCS subsystem has the following limits:

- A channel assigned for both loop- and ground-start configurations. A minimum of one DS-0 channel must be free for non-dedicated channel units, if the units are on the RCS.

  Note: Mode I does not have this limit. A DS-0 channel is present for each circuit because four DS-1 links connect an RCS to an SMS-R.

- Do not use a SPOTS card in Mode III. A Mode III RCS multiplexes 48 circuits on to two DS-1 links. Channel units on a Mode III RCS must have a single circuit. The SPOTS channel unit has two circuits, loop and ground. The circuit that is not used cannot be disabled.

  Note: The S9CD271 SPOTS channel unit is not recommended for use in a Mode III RCS, but the unit is allowed. Only even-numbered circuits are assigned in Mode III.

- The SPOTS channel unit does not provide for tip-ring return. Many switches use this signal to indicate a toll call to the originating party. Limit the SPOTS channel unit to calls that do not have a toll. This limit occurs in connection to a PBX or other equipment that requires tip-ring reversal.

The SPOTS channel unit is tested the same as a single-party line. The following tests on the SPOTS channel unit are supported:

- off-hook detection
- on-hook detection
- echo return loss
- single party ringing
- carrier channel loss
- idle channel noise.

Converting from Mode I to Mode II

Use the following two procedures to convert from mode I to mode II operation. You can use conversion to make DS-1 links available to the remote site for additional SLC-96 systems.

Use the procedure on page 4-3 if at least two links are available (entered as NILTYPE in table LTCRPINV). The examples provided in the procedure apply to the example arrangement that appears in the following figure. The example shows two remote concentrator SLC-96 (RCS) modules in mode I; KRCS 00 0 that changes to mode II operation.

Example configuration for procedure Mode I to Mode II conversion (two available links)

Note: Ports 10-19 are not assigned.
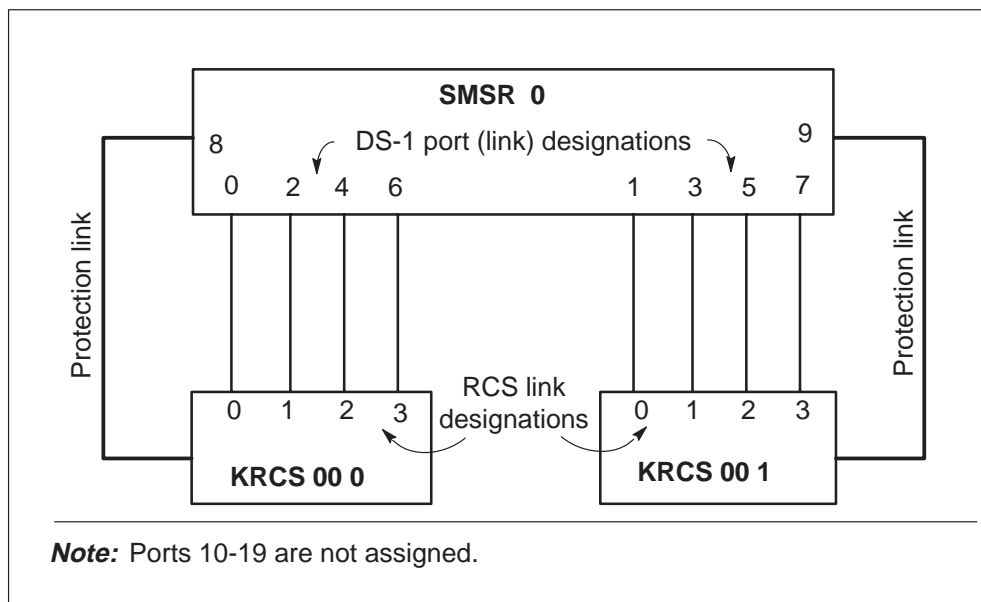
Use the procedure on page 1-9 if links are not available. The examples provided in the procedure apply to the example arrangement that appears in the following figure. The example shows four RCS modules that operate in mode I; REM1 00 2 that convert to mode II.

Example configuration for procedure Mode I to Mode II conversion (no available links)

REM1 00 0	SMSR 0		REM1 00 2
0	10	0	0
1	12	2	1
2	14	4	2
3	16	6	3

Protection link   18   8   Protection link

DS-1 port (link) designations

REM1 00 1			REM1 00 3
0	11	1	0
1	13	3	1
2	15	5	2
3	17	7	3

Protection link   19   9   Protection link

Note: The SMSR does not have available ports.
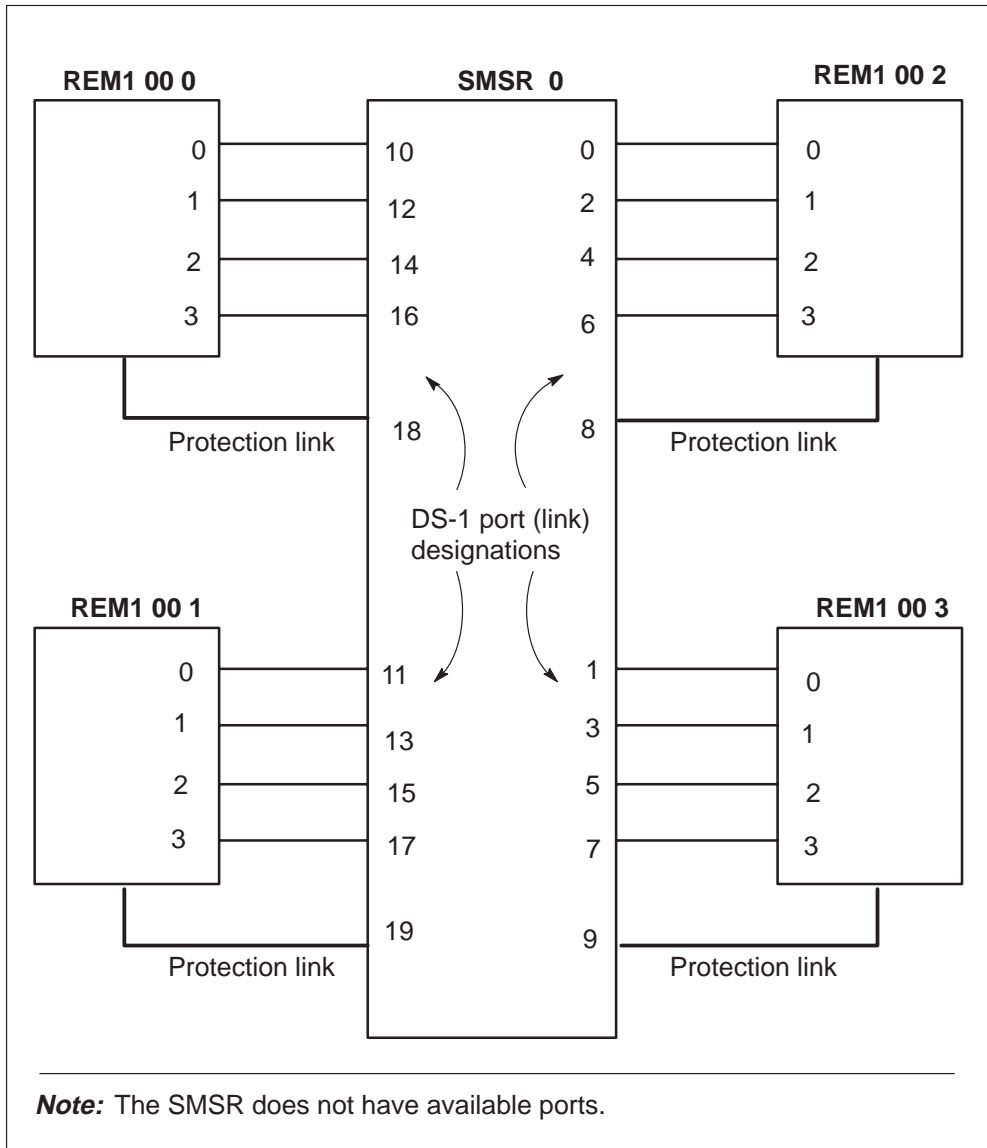
Two available links

In the procedure that follows, two links entered as NILTYPE in table LTCRPINV converts to DS-1. The user busies the remote. The user uses the two new DS–1 links to change the remote to mode II. When the conversion occurs, PORT numbers are reassigned to any two of the original four primary link designations. The system changes links that are not used to NILTYPE in table LTCRPINV. The system updates static data on the SMS-R and returns the remote to service.

Mode I to Mode II conversion (two available links)

At the MAP terminal

1   Obtain a hardcopy of table LNINV. Use this hardcopy, to verify the special service cards and the coin cards. The first eight remote shelf slots during mode II operation must not contain these cards.

The following are a list of steps that direct output to a printer.

>TABLE LNINV
>SEND printer
>POS len
>LIST 96
>SEND PREVIOUS
>QUIT

Example:

>TABLE LNINV

>SEND PRT

>POS KRCS 00 0 00 00

>LIST 96

>SEND PREVIOUS

>QUIT

Obtain a hardcopy of table LTCRPINV.

2   To change datafill in table RCSINV from MODE1 to MODE2, change
the SMSR ports. To accomplish this change, enter table LTCRPINV and
select two (NILTYPE) ports that are not in use.

>TABLE LTCRPINV
>POS SMSR smsr no

Example:

>TABLE LTCRPINV

>POS SMSR 0

```
SMSR 0
(0 DS1 DEFAULT N) (1 DS1 DEFAULT N) (2 DS1 DEFAULT N)
(3 DS1 DEFAULT N) (4 DS1 DEFAULT N) (5 DS1 DEFAULT N)
(6 DS1 DEFAULT N) (7 DS1 DEFAULT N) (8 DS1 DEFAULT N)
(9 DS1 DEFAULT N) (10 NILTYPE) (11 NILTYPE) (12 NILTYPE)
(13 NILTYPE) (14 NILTYPE) (15 NILTYPE) (16 NILTYPE)
(17 NILTYPE) (18 NILTYPE) (19 NILTYPE) $
```

3   Change two NILTYPE ports to DS1 ports. Make sure that DS-1 cards
     are present.
     >CHA
     >QUIT
     Example:

     >CHA

     ```
      MACHINES NOT IN SYNC - DMOS NOT ALLOWED
      JOURNAL FILE UNAVAILABLE - DMOS NOT ALLOWED
      ENTER Y TO CONTINUE PROCESSING OR N TO QUIT
     ```

     >Y

     To step through the fields until the port that you must change appears,
     press enter.

     ```
     PSLNTAB: 10 NILTYPE
     ```
     > 10 DS1 DEFAULT N

     ```
     PSLNTAB: 12 NILTYPE
     ```
     > 12 DS1 DEFAULT N

     Step through the fields that remain until the tuple that you must change
     appears.

     ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
     >Y

     ```
      TUPLE CHANGED
      JOURNAL FILE INACTIVE
     ```

     >QUIT

4   To post and busy the remote from the PM level of the MAP display, type

>MAPCI;MTC;PM
>POST RCS rcs no
>BSY
Example:

>MAPCI;MTC;PM

>POST KRCS 00 0

>BSY

```
"CALLS WILL BE AFFECTED.   PLEASE CONFIRM (YES OR NO)"
```
>YES

5   Change the remote from mode I to mode II in table RCSINV. Specify
the ports you changed from NILTYPE to DS1.

>TABLE RCSINV
>POS rcs no
>CHA
Example:

>TABLE RCSINV

>POS KRCS 00 0

>CHA

```
 MACHINES NOT IN SYNC – DMOS NOT ALLOWED
 JOURNAL FILE UNAVAILABLE – DMOS NOT ALLOWED
 ENTER Y TO CONTINUE PROCESSING OR N TO QUIT
```

>Y

To step through the fields, until the SHLFGRPMODE field appears, press enter.

```
SHLFGRPMODE: MODE1
```
>MODE2

```
PORT:   0
```
> 10

```
PORT:   2
```
>$

```
LOOPTEST:
```
>N

```
SHLFGRPMODE: MODE1
```
>MODE2

```
PORT:   4
```
> 12

```
PORT:   6
```
>$

```
LOOPTEST:
```
>N

To step through the remaining fields, until the tuple that you must change appears, press enter.

```
 KRCS  00 0 MIS 1    0     1    C   8   NOLOAD   SMSR 0
    MODE2   (10)$ N       MODE   (12)$ N     S      WP1B      Y   8
            N       MISC_ALARM       MAJOR
```

```
ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
```
>Y

```
 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

6 The remote changes to Mode II. The four links used before in the mode I operation are available. Enter table RCSINV again and assign the PORT numbers again to any two of the four free links. In the example, links 4 and 6 are assigned again.

>POS rcs no
>CHA
>QUIT
Example:

>TABLE RCSINV

>POS KRCS 00 0

>CHA

```
 MACHINES NOT IN SYNC – DMOS NOT ALLOWED
 JOURNAL FILE UNAVAILABLE – DMOS NOT ALLOWED
 ENTER Y TO CONTINUE PROCESSING OR N TO QUIT
```

>Y

To step through the fields until the PORT field appears, press enter.

```
SHLFGRPMODE: MODE2
PORT:  10
> 4
```

```
LOOPTEST: N
SHLFGRPMODE: MODE2
PORT:  12
> 6
```

```
LOOPTEST: N
```
To step through the fields that remain until the tuple you must change appears, press enter.

```
 KRCS  00 0 MIS 1    0    1   C   8  NOLOAD  SMSR 0
    MODE2   (4)$ N       MODE2   (6)$ N    S      WP1B    Y  8
            N      MISC_ALARM      MAJOR
```

```
ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
>Y
```

```
 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

>QUIT

7   Change the two free links and the two links used to make the conversion in table LTCRPINV to NILTYPE.

>TABLE LTCRPINV
>POS SMSR smsr no
>CHA
>QUIT
Example:

>TABLE LTCRPINV

>POS SMSR 0

>CHA

```
 MACHINES NOT IN SYNC – DMOS NOT ALLOWED
 JOURNAL FILE UNAVAILABLE – DMOS NOT ALLOWED
 ENTER Y TO CONTINUE PROCESSING OR N TO QUIT
```

>Y

To step through the fields, until the port to be changed appears, press enter.

```
PSLNTAB: 0 DS1 DEFAULT N
```
> 0 NILTYPE

```
PSLNTAB: 2 DS1 DEFAULT N
```
> 2 NILTYPE

```
PSLNTAB: 10 DS1 DEFAULT N
```
> 10 NILTYPE

```
PSLNTAB: 12 DS1 DEFAULT N
```
> 12 NILTYPE

To step through the fields that remain, until the tuple you must change appears, press enter.

```
ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
```
>Y

```
 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

>QUIT

8   Translate the P-side links and return to service any busy links.

>TRANSL P
>RTS LINK link no
Example:

>TRANSL P

```
LINK  0: RCS KRCS 00 0  0;CAP MS; STATUS: OK ,P; MSGCOND: CLS
LINK  1: RCS KRCS 00 1  0;CAP MS; STATUS: OK ,P; MSGCOND: OPN
LINK  2: RCS KRCS 00 0  1;CAP MS; STATUS: OK ,P; MSGCOND: CLS
LINK  3: RCS KRCS 00 1  1;CAP MS; STATUS: OK ,P; MSGCOND: OPN
LINK  4: RCS KRCS 00 0  2;CAP MS; STATUS: OK ,P; MSGCOND: CLS
LINK  5: RCS KRCS 00 1  2;CAP MS; STATUS: OK ,P; MSGCOND: OPN
LINK  6: RCS KRCS 00 0  3;CAP MS; STATUS: OK ,P; MSGCOND: CLS
LINK  7: RCS KRCS 00 1  3;CAP MS; STATUS: OK ,P; MSGCOND: OPN
LINK  8: RCS KRCS 00 0   ;PROTLINE
LINK  9: RCS KRCS 00 1   ;PROTLINE
```

In this example, all links are in service. All links have STATUS OK.

Note: MSGCOND for links 0, 2, 4, and 6 is CLS (closed).   This condition occurs because KRCS 00 0 is busy.

9   Post the remote and return the remote to service.

>POST RCS rcs no
>RTS
Example:

>POST RCS KRCS 00 0

>RTS

No available links

Use the following procedure if no links are available. When there are no available links, the ports that PROTLINES use from two other remotes, are borrowed to make the conversion. When the conversion to mode II occurs, the PORT numbers change back to any two of the original four primary links. The PROTLINEs are restored to remotes of the PROLINESs.

Mode I to Mode II conversion (no available links)

At the MAP terminal

1   Obtain a hardcopy of table LNINV. Use the hardcopy to verify the
    soecial cards and coin cards are not entered in the first eight remote shelf
    slots.

    The following steps direct output to a printer.

    >TABLE LNINV
    >SEND printer
    >POS len
    >LIST 96
    >SEND PREVIOUS
    >QUIT
    Example:

    >TABLE LNINV

    >SEND PRT

    >POS REM1 00 0 00 00

    >LIST 96

    >SEND PREVIOUS

    >QUIT

    Obtain a hardcopy of table LTCRPINV.

2   To change datafill in table RCSINV from MODE1 to MODE2, change
    the SMSR ports. If there are no NILTYPE ports available in table
    LTCRPINV, borrow the ports the PROTLINEs use from two other
    remotes.

    Note: These PROTLINEs are off-lined in this procedure. These
    off-line PROTLINES do not allow switching for these remotes.

    To determine the links used as protection links (PROTLINEs), perform
    the following steps.

    >MAPCI;MTC;PM
    >POST SMSR smsr no
    >TRANSL P
    Example:

    >MAPCI;MTC;PM

>POST SMSR 0

>TRANSL P

```
LINK  0: RCS REM1 00 2  0;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK  1: RCS REM1 00 3  0;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK  2: RCS REM1 00 2  1;CAP MS; STATUS: OK ;MSGCOND: OPN.
LINK  3: RCS REM1 00 3  1;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK  4: RCS REM1 00 2  2;CAP MS; STATUS: OK ;MSGCOND: OPN.
LINK  5: RCS REM1 00 3  2;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK  6: RCS REM1 00 2  3;CAP MS; STATUS: OK ;MSGCOND: OPN.
LINK  7: RCS REM1 00 3  3;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK  8: RCS REM1 00 2   ;PROTLINE
LINK  9: RCS REM1 00 3   ;PROTLINE
LINK 10: RCS REM1 00 0  0;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK 11: RCS REM1 00 1  0;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK 12: RCS REM1 00 0  1;CAP MS; STATUS: OK ;MSGCOND: OPN.
LINK 13: RCS REM1 00 1  1;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK 14: RCS REM1 00 0  2;CAP MS; STATUS: OK ;MSGCOND: OPN.
LINK 15: RCS REM1 00 1  2;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK 16: RCS REM1 00 0  3;CAP MS; STATUS: OK ;MSGCOND: OPN.
LINK 17: RCS REM1 00 1  3;CAP MS; STATUS: OK ;MSGCOND: OPN
LINK 18: RCS REM1 00 0   ;PROTLINE
LINK 19: RCS REM1 00 1   ;PROTLINE
```

3   Choose two protection links and go to table RCSINV. Use this table to
    verify the PROTLINEs do not belong to the remote that you are
    changing to mode II.

    >TABLE RCSINV
    >POS rcs no
    Example:

    >TABLE RCSINV

    >POS REM1 00 2

    ```
    REM1  00 2 MIS 1    0    1   C   8  NOLOAD  SMSR 0
       MODE1   (0) (2)$      MODE1  (4) (6)$     S     WP1B    Y  8
               N        MISC_ALARM        MAJOR
    ```

    The remote converted in this example uses SMSR port 8 for a protection
    link. The example borrows protection links 9 and 19 to convert REM1
    00 2 to mode II operation.

4   To offline the two necessary links at the CARRIER level of the MAP
    display, perform the following steps:

>MAPCI;MTC;TRKS;CARRIER
>POST SMSR smsr no
>BSY carrier no
>OFFL carrier no
Repeat for the other link.

Example:

>MAPCI;MTC;TRKS;CARRIER

>POST SMSR 0

The maximum size of the posted set is five. This condition can require
you to enter the NEXT command until the protection lines appear in the
posted set.

```
  N   CLASS   SITE SMSR Ck  D ALRM   SLIP FRME BER ES   SES STATE PROT
  ----------------------------------------------------------------

  0   REMOTE  HOST  0   5   C        0    0  <-7   0    0    INSV
  1   REMOTE  HOST  0   6   C        0    0  -7.0  0    0    INSV
  2   REMOTE  HOST  0   7   C        0    0  -7.0  0    0    INSV
  3   REMOTE  HOST  0   8   C        0    0  -7.0  0    0    INSV
  4   PROTLN  HOST  0   9   C        0    0  -7.0  0    0    INSV
```

>BSY 4; OFFL 4

```
OK
  N   CLASS   SITE  SMSR Ck D ALRM   SLIP FRME BER ES SES STATE PROT
  ----------------------------------------------------------------

  0   REMOTE  HOST  0   5   C        0    0  <-7   0    0    INSV
  1   REMOTE  HOST  0   6   C        0    0  -7.0  0    0    INSV
  2   REMOTE  HOST  0   7   C        0    0  -7.0  0    0    INSV
  3   REMOTE  HOST  0   8   C        0    0  -7.0  0    0    INSV
  4   PROTLN  HOST  0   9   C        0    0  -6.9  0    0    OFFL
```

Repeat for the other link.

5   Post and offline the remote that changes to mode II.

     >MAPCI;MTC;PM
     >POST RCS rcs no
     >BSY
     >OFFL
     Example:

     >MAPCI;MTC;PM

     >POST REM1 00 2

     >BSY

```
“CALLS WILL BE AFFECTED.  PLEASE CONFIRM (YES OR NO)”
```
     >YES
     >OFFL

6   In table RCSINV, delete the PROTLINEs from the two remotes (in the example, REM1 00 1 and REM1 00 3).

     >TABLE RCSINV
     >POS rcs no
     >CHA
     Example:

     >TABLE RCSINV

     >POS REM1 00 1

     >CHA

     To step through the fields, until the PROT field appears, press Enter .

```
PROT:  Y
```
     >N

     Step through the fields that remain until the tuple you must change appears.

```
ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
```
     >Y

```
 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

     Repeat for the other remote. The remote in the example is REM1 00 3.

7   In table RCSINV change the remote that you must convert to MODE2.
Specify the SMSR ports where the PROTLINEs were deleted. The ports
in the example are ports 9 and 19.

>POS rcs no
>CHA
Example:

>POS REM1 00 2

>CHA

To step through the fields, until the SHLFGRPMODE field appears,
press Enter

```
SHLFGRPMODE: MODE1
```
>MODE2

```
PORT: 0
```
> 9

```
PORT: 2
```
>$

```
LOOPTEST:
```
>N

```
SHLFGRPMODE: MODE1
```
>MODE2

```
PORT: 4
```
> 19

```
PORT: 6
```
>$

```
LOOPTEST:
```
>N

```
 REM1  00 2 MIS 0    0     1    A   8  NOLOAD  SMSR 0
    MODE2   (9)$ N        MODE2   (19)$ N    S     WP1B     Y  8
            N       MISC_ALARM       MAJOR


ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
```
>Y

```
 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

8   The remote changes to MODE 2 Four links are available. The lines in
the example are links 0, 2, 4, and 6. To return the PROTLINEs to the
original port designations of the PROTLINEs change the PORT numbers
in table RCSINV to any two of these links

>POS rcs no
>CHA
Example:

>POS REM1 00 2

>CHA

To step through the fields, until the PORT field appears, press Enter

```
SHLFGRPMODE: MODE2
PORT:  9
> 0

LOOPTEST: N
SHLFGRPMODE: MODE2
PORT:  19
> 2

LOOPTEST: N
```

To step through the fields that remain, until the tuple you must change
appears,press Enter .

```
 REM1  00 2 MIS 0    0    1    A    8   NOLOAD   SMSR 0
    MODE2   (0)$ N        MODE2   (2)$ N    S     WP1B    Y  8
           N        MISC_ALARM       MAJOR


ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
```
>Y

```
 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

9   In table RSCINV, return the two PROTLINEs deleted when the remote
was converted. The remote was converted to the two remotes where the
remotes were borrowed.

>POS rcs no
>CHA
>QUIT
Example:

>POS REM1 00 1

>CHA

To step through the fields, until the PROT field appears, press Enter.

```
PROT:   N
>Y

PORT:
>9
```

Step through the fields that remain until the tuple you must change
appears.

```
ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
>Y

 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

Repeat for the other remote. In the example,the other remote is REM1
00 3. Specify the original PORT number of the remote. In the example,
the original port number is 19.

>QUIT

10   Change the two links that remain made available in Step 7 to NILTYPE
in table LTCRPINV.

>TABLE LTCRPINV
>POS smsr no
>CHA
>QUIT
Example:

>TABLE LTCRPINV

>POS SMSR 0

>CHA

```
 MACHINES NOT IN SYNC – DMOS NOT ALLOWED
 JOURNAL FILE UNAVAILABLE – DMOS NOT ALLOWED
 ENTER Y TO CONTINUE PROCESSING OR N TO QUIT
```

>Y

To step through the fields, until the port you must change appears, press Enter.

```
PSLNTAB: 4 DS1 DEFAULT N
```
> 4 NILTYPE

```
PSLNTAB: 6 DS1 DEFAULT N
```
> 6 NILTYPE

Step through the fields that remain until the tuple you must change appears.

```
ENTER Y TO CONFIRM, N TO REJECT OR E TO EDIT.
```
>Y

```
 TUPLE CHANGED
 JOURNAL FILE INACTIVE
```

>QUIT

11 Go to the carrier level of the MAP display and return to service the
PROTLINEs offlined in step 4.

>MAPCI;MTC;TRKS;CARRIER
>POST SMSR smsr no
>BSY carrier no
>RTS carrier no
Example:

>MAPCI;MTC;TRKS;CARRIER

>POST SMSR 0

The maximum size of the posted set is five. This condition can require
you to enter the NEXT command until the protection lines appear in the
posted set.

```
N  CLASS  SITE SMSR  Ck  D  ALRM  SLIP FRME BER ES SES STATE PROT
-----------------------------------------------------------------

0  REMOTE  HOST  0   5   C       0    0  <-7  0  0  INSV
1  REMOTE  HOST  0   6   C       0    0  -7.0 0  0  INSV
2  REMOTE  HOST  0   7   C       0    0  -7.0 0  0  INSV
3  REMOTE  HOST  0   8   C       0    0  -7.0 0  0  INSV
4  PROTLN  HOST  0   9   C       0    0  -6.9 0  0  OFFL
```

>BSY 4; RTS 4

```
OK
 N  CLASS  SITE  SMSR  Ck  D ALRM SLIP FRME BER ES SES STATE PROT
 -----------------------------------------------------------------

 0  REMOTE  HOST  0    5   C       0    0   <-7  0  0  INSV
 1  REMOTE  HOST  0    6   C       0    0   -7.0 0  0  INSV
 2  REMOTE  HOST  0    7   C       0    0   -7.0 0  0  INSV
 3  REMOTE  HOST  0    8   C       0    0   -7.0 0  0  INSV
 4  PROTLN  HOST  0    9   C       0    0   -7.0 0  0  INSV
```

12 Translate the P-side links and return busy links to service.

>TRANSL P
>RTS LINK link no
Example:

>TRANSL P

```
LINK  0:  RCS REM1 00 2  0;CAP MS; STATUS:   OK ,P;MSGCOND: CLS
LINK  1:  RCS REM1 00 3  0;CAP MS; STATUS:   OK   ;MSGCOND: OPN
LINK  2:  RCS REM1 00 2  1;CAP MS; STATUS:   OK ,P;MSGCOND: CLS.
LINK  3:  RCS REM1 00 3  1;CAP MS; STATUS:   OK   ;MSGCOND: OPN
LINK  4:  RCS REM1 00 2  2;CAP MS; STATUS:   OK ,P;MSGCOND: CLS.
LINK  5:  RCS REM1 00 3  2;CAP MS; STATUS:   OK   ;MSGCOND: OPN
LINK  6:  RCS REM1 00 2  3;CAP MS; STATUS:   OK ,P;MSGCOND: CLS.
LINK  7:  RCS REM1 00 3  3;CAP MS; STATUS:   OK   ;MSGCOND: OPN
LINK  8:  RCS REM1 00 2   ;PROTLINE
LINK  9:  RCS REM1 00 3   ;PROTLINE
LINK  10: RCS REM1 00 0  0;CAP MS; STATUS: OK     ;MSGCOND: OPN
LINK  11: RCS REM1 00 1  0;CAP MS; STATUS: OK     ;MSGCOND: OPN
LINK  12: RCS REM1 00 0  1;CAP MS; STATUS: OK     ;MSGCOND: OPN.
LINK  13: RCS REM1 00 1  1;CAP MS; STATUS: OK     ;MSGCOND: OPN
LINK  14: RCS REM1 00 0  2;CAP MS; STATUS: OK     ;MSGCOND: OPN.
LINK  15: RCS REM1 00 1  2;CAP MS; STATUS: OK     ;MSGCOND: OPN
LINK  16: RCS REM1 00 0  3;CAP MS; STATUS: OK     ;MSGCOND: OPN.
LINK  17: RCS REM1 00 1  3;CAP MS; STATUS: OK     ;MSGCOND: OPN
LINK  18: RCS REM1 00 0   ;PROTLINE
LINK  19: RCS REM1 00 1   ;PROTLINE
```

In this example, all links are in service. All links have STATUS OK).

Note: The MSGCOND for links 0, 2, 4, and 6 is CLS (closed). This condition occurs because REM1 00 2 is off-line.

13 Post, busy and return to service the remote converted to mode II.

>POST RCS rcs no
>BSY
>RTS
Example:

>POST RCS REM1 00 2

>BSY

>RTS

SMS-R recovery procedures

This chapter contains a recovery procedure that restores a Subscriber Carrier Module-100S Remote host computer to service. Maintenance personnel can use this procedure in a DMS-100/200 office.

Recovering an SMS-R

Application

Use this procedure to return an SMS-R to service (RTS).

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Recovering an SMS-R (continued)

Summary of recovering an SMS-R

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

```
┌──────────────┐
│ ManB the PM  │
└──────┬───────┘
       │
       ▼
┌──────────────┐
│ Load the PM  │
└──────┬───────┘
       │
       ▼
┌──────────────┐
│ Return the   │
│ SMS-R to     │
│ service      │
└──────┬───────┘
       │
       ▼
   ╱────────╲        N     ┌────────────────┐
  ╱  RTS      ╲──────────▶ │ Contact next   │
  ╲  pass?    ╱            │ level of support│
   ╲────────╱             └────────────────┘
       │
       │ Y
       ▼
┌──────────────┐
│ End of       │
│ procedure    │
└──────────────┘
```

Recovering an SMS-R (continued)

Recovering an SMS-R

At the MAP terminal

1   Enter this recovery procedure when MAP display indicates the following conditions occur:

   • both units of a posted SMS-R are out of service
   • there is a critical alarm

2   To access the PM MAP level and post the SMS-R, type

   >MAPCI;MTC;PM;POST SMSR smsr no
   where

   smsr no   is the number of the SMS-R to return to service

3   To manbusy (ManB) the SMS-R, type

   >BSY PM
   and press the Enter key.

4   To load both units of the SMS-R, type

   >LOADPM PM
   and press the Enter key.

5   Determine which units are loaded.

If	Do
0 units load	Step 9
1 unit loads	Step 6
both units load	Step 7

6   To return the unit loaded to service, type

   >RTS UNIT sms-r_unit_no
   and press the Enter key.

   where

   unit no   is the number of the loaded SMS-R unit

   To confirm this RTS command, type

   >YES
   and press the Enter key. Go to Step 8.

7 To return the PM to service, type

>**RTS PM**
and press the Enter key.

To confirm this RTS command, type

>**YES**
and press the Enter key.

Go to step 8.

8

CAUTION
Data match in progress
An ISTb alarm appears after an RTS passes on both units. Wait 3-5 min before you clear this alarm. This action allows a dynamic data match between active and inactive units.

Determine which units return to service.

If	Do
0 units return to service	Step 9
1 unit returns to service	Step 10
both units return to service	Step 10
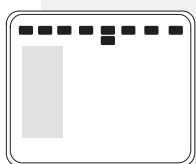
9 For additional help, contact the next level of support.

10 The procedure is complete. If other alarms display, refer to the appropriate procedure to clear the indicated alarms in the *Clearing alarms Procedures* section of this manual.

SMS-R alarm clearing procedures

This chapter contains the procedures to monitor and clear alarms. The alarms are for the Subscriber Carrier Module-100S Remote (SMS-R) and equipment in DMS-100/200 offices. Maintenance personnel use the procedures to clear alarms.

PM SMS-R
critical

Alarm display

CM	MS	IOD	Net	PM	CCS	Lns	Trks	Ext
.	.	.	.	**nSMSR**	.	.	.	.
				C				

Indication

An SMS-R under the PM subsystem header at the MTC level of the MAP terminal indicates a PM critical alarm.

Meaning

The indicated number (n) of SMS-Rs are in the critical state.

Result

Call processing ceases.

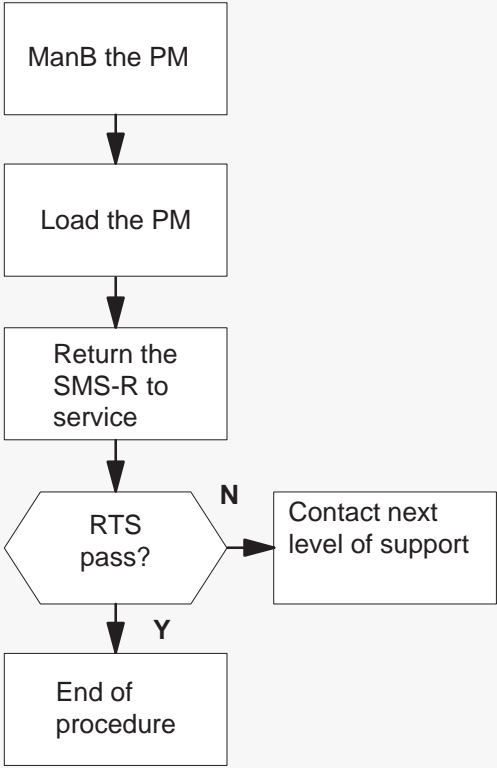## Common procedures

There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

PM SMS-R
critical (continued)

Summary of clearing an PM SMS-R critical alarm

```
        ┌──────────────┐
        │ Silence      │
        │ alarm        │
        └──────┬───────┘
               │
               ▼
        ┌──────────────┐
        │ Post SysB    │
        │ SMS-R        │
        └──────┬───────┘
               │
               ▼
        ┌──────────────┐
        │ Query SysB   │
        │ SMS-R        │
        └──────┬───────┘
               │
               ▼
         ╱────────────╲      Y    ┌─────────────────────┐
        ╱ List of cards ╲─────────▶│ Proceed to the      │
        ╲ with faults?  ╱          │ Card Replacement    │
         ╲────────────╱            │ Procedures.         │
               │ N                 └─────────────────────┘
               ▼
    ┌──────────────────────┐
    │ Proceed to the       │
    │ Recovery Procedures. │
    └──────────────────────┘
```

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure

PM SMS-R
critical (end)

Clearing a PM SMS-R critical alarm

At the MAP display

1 To access the PM level and silence the alarm, type

>**MAPCI;MTC;SIL**
and press the Enter key.

2 To identify the SMS-R module that is in a critical state, type

>**PM; DISP STATE SYSB SMSR**
and press the Enter key.

Example of a MAP response:

```
SYSB SMSR:  0
```

3 To post SysB SMS-R, type

>**POST SMSR smsr_no**
and press the Enter key.

where

smsr_no   is the number of the SMS-R displayed in step 2
Example of a MAP display.

```
SMSR    SysB     ManB    OffL    CBsy    ISTb    InSv
    PM        1         0      10      0       0        130
    SMSR      1         0       0      0       0          4
 SMSR   0  SysB  Links_OOS:   CSide  0, PSide 0
 Unit  0:  InAct    SysB
 Unit  1:  Act      SysB
```

4 To identify the problems with the posted SMS-R, type

>**QUERYPM FLT**
and press the Enter key.

5 Proceed to the *Recovery Procedures*.

PM SMS-R
major

Alarm display
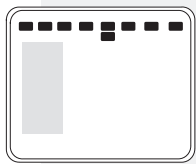
CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	EIO
.	.	.	.	**nSMSR**	.	.	.	.	.
				M					

Indication

At the MAP subsystem display, the SMSR alarm code appears under the PM header. This alarm indicates that an alarm condition is present in the SMS-R. The *n* indicates the number of SMS-R modules with alarms. The letter *M* that appears under the alarm indicates that the alarm class is major.

Meaning

This alarm normally indicates that one or more common peripheral controller cards in the SMS-R has faults.

Result

A major alarm class code indicates that the SMS-R has an in-service trouble (ISTb) condition. The SMS-R continues to process calls, but a fault condition that can affect service is present.

To reduce the potential impact to subscriber service, isolate the fault condition to the component that has faults. Replace the component that has faults.

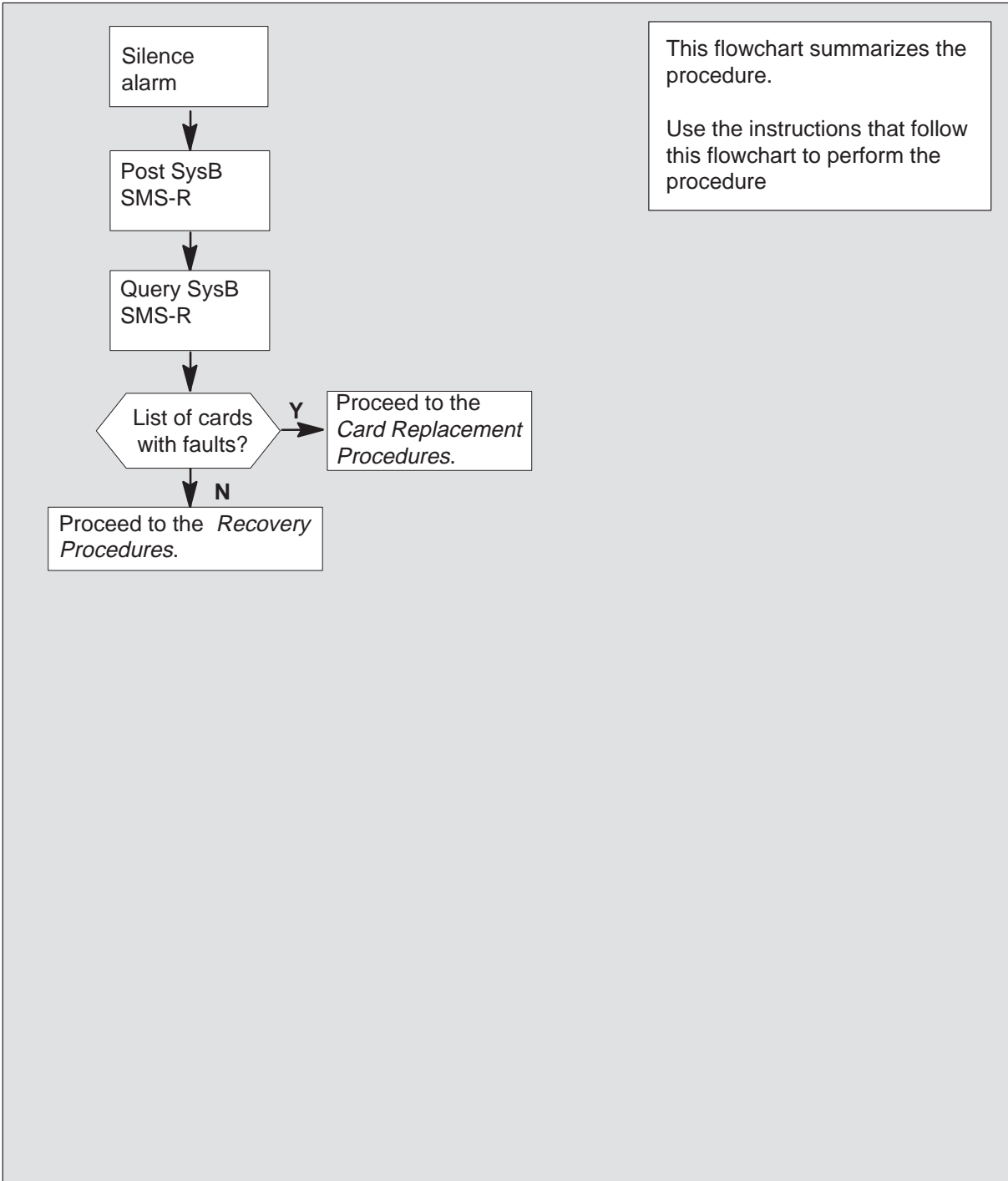## Common procedures

This procedure refers to the procedure "Updating static data".

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

PM SMS-R
major (continued)

Summary of clearing a PM SMS-R major alarm

```
                    ┌──────────────┐
                    │ Silence alarm │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐
                    │ Post ISTb    │
                    │ SMS-R        │
                    └──────┬───────┘
                           │
              ⑥    ┌──────▼───────┐
                    │ Query for faults │
                    └──────┬───────┘
                           │
                    ┌──────▼───────┐ Y   ┌──────────────┐   ┌──────────────┐        ╱‾‾‾‾‾‾‾╲ Y
                    │ List of cards?│───▶│ Replace cards │──▶│ Load, test, and│──▶  ╱ Pass?  ╲──▶ ①
                    ╲_____╱     │ that have faults│  │ return inactive│      ╲_____╱
                           │ N            └──────────────┘   │ unit to service│         │ N
                    ┌──────▼───────╲ Y   ┌──────────────┐                              ▼ ②
                    │ P-side links out│──▶│ Busy, test, and│    ╱‾‾‾‾‾‾‾╲ Y
                    │ of service?    │    │ RTS links that │──▶ ╱ Pass?  ╲──▶ ①
                    ╲_____╱      │ have faults    │    ╲_____╱
                           │ N            └──────────────┘        │ N
                    ┌──────▼───────╲ Y   ┌──────────────┐         ▼ ②
                    │ Static data    │──▶│ Update static │──▶ ③
                    │ mismatch?      │    │ data          │
                    ╲_____╱      └──────────────┘
                           │ N                                            ③
                    ┌──────▼───────╲ Y   ┌──────────────┐   ┌──────────────┐    ╱‾‾‾‾‾‾‾╲ Y
                    │ PM load        │──▶│ Update load in│──▶│ Update static │──▶ ╱ Mismatch╲──▶ ①
                    │ mismatch?      │    │ inventory table│  │ data          │   ╲ clears? ╱
                    ╲_____╱      └──────────────┘    └──────────────┘     ╲_____╱
                           │ N                                                        │ N
              ④    ┌──────▼───────╲ Y   ┌──────────────┐  ╱‾‾‾‾‾‾‾╲ N  ┌──────────────┐
                    │ Data out of    │──▶│ Busy, load, and│─╱ Pass?  ╲──▶│ Contact next │
                    │ date?          │    │ return inactive│ ╲_____╱   │ level of support│
                    ╲_____╱      │ unit to service│     │ Y      └──────────────┘
                           ▼ N            └──────────────┘  ┌────▼─────╲ Y  ┌──────────────┐
                           ②                                │ Is active unit│─▶│ End of       │── ①
                                                            │ InSv?        │   │ procedure    │
                                                            ╲_____╱     └──────────────┘
                                                                 │ N
                                                            ┌────▼─────┐
                                                            │ SwAct to │── ⑥
                                                            │ inactive unit│
                                                            └──────────┘
```
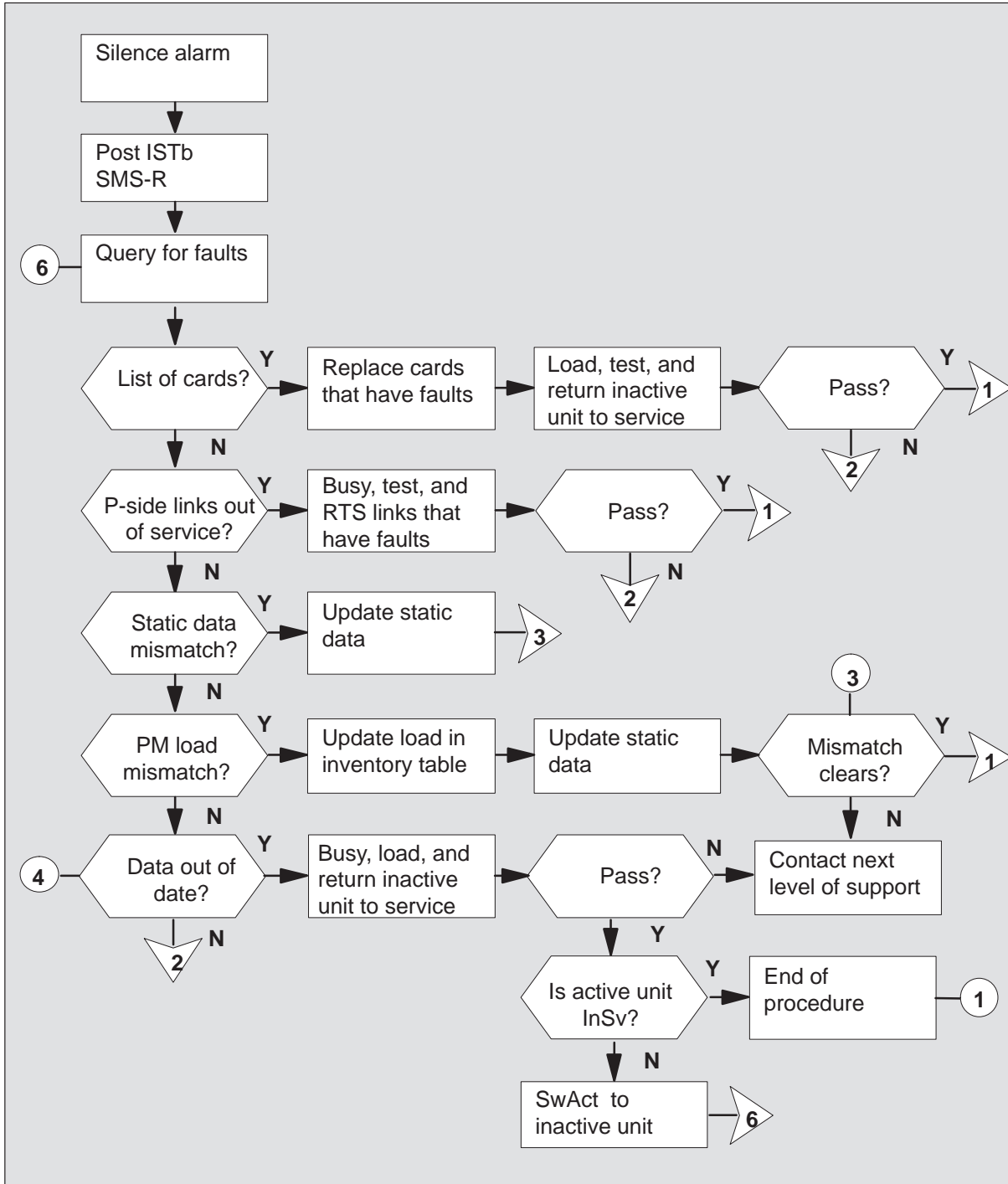
Clearing a PM SMS-R major alarm

At the MAP display

1   When the system detects a fault, the system can trigger an audible alarm. To access the MTC level of the MAP display and silence the alarm, type

 >MAPCI;MTC;SIL
 and press the Enter key.

2   To access the PM level of the MAP display and determine which SMS-R is ISTb, type

 >PM;DISP STATE ISTB SMSR
 and press the Enter key.

 Example of a MAP response:

 ```
 ISTb SMSR:   1
 ```

3   To access the ISTb XPM, type

 >POST SMSR smsr_no
 and press the Enter key.

 where

 smsr_no   is the number of the SMS-R displayed in step 2
 Example of a MAP response:

 ```
 SMSR       SysB  ManB  Offl  CBsy   ISTb   InSv
     PM       3     0     1     0      2     13
     SMSR     0     0     0     0      1      7
 SMSR 0 ISTb  Links_OOS:  CSide 0, PSide 0
 Unit0:  Act    ISTb
 Unit1:  Inact  InSv
 ```

If	Do
one unit is SysB	step 26
one unit is CBsy	step 24
one unit is ManB	step 4
both units are InSv	step 10
both units are ISTb	step 10
one unit is ISTb and inactive	step 10
one unit is ISTb and active	step 5

PM SMS-R
major (continued)

4 To return the inactive unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	Do
passes	step 38
fails	step 37

5

> ⚠ **Caution**
> **Service disruption: calls can be dropped!**
> When the system prompts you to confirm a cold
> SwAct, only perform this activity during a period of
> low traffic. The PM will end calls, including data
> calls.

To switch the activity of the units, type

>SWACT
and press the Enter key.

The system determines the type of SwAct (warm or cold) that the system can perform. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
cannot continue at this time	step 6
can continue at this time	step 7

6 Do not switch the activity of the units. To reject the switch, type

>NO
and press the Enter key.

The system does not continue the switch of activity.

Return to step 5 during a period of low traffic.

PM SMS-R
major (continued)

7   To switch the activity of the unit, type

>YES

and press the Enter key.

The system runs a pre-SwAct audit to determine if the inactive unit can accept activity correctly.

Note: A maintenance flag (`Mtce`) appears when maintenance tasks are in progress. Wait until the flag disappears before you proceed with the next maintenance action.

Example of a MAP response:

```
SMSR 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act   ISTb    Mtce
Unit1:  Inact InSv    Mtce
```

If the message	Do
is `SwAct passes`	step 10
is `SwAct fails`	step 37
is `SwAct fails  Reason:` `XPM SwActback`	step 8
is `SwAct refused by SwAct` `controller`	step 9

8   The inactive unit cannot establish two-way communication with the CC. The inactive unit switched activity back to the first active unit.   Clear all faults on the inactive unit first. Attempt to clear the alarm condition on the active unit second.

Go to step 10.

9   The SwAct controller does not recommend a SwAct for the reason(s) stated. Clear all faults on the inactive unit first. Attempt to clear the alarm condition on the active unit second.

Go to step 10.

10   To check for fault indicators on the inactive unit, type

>QUERYPM FLT

and press the Enter key.

PM SMS-R
major (continued)

Example of a MAP response:

```
Node is ISTb
  One or both units inservice trouble
Unit 0
The following inservice troubles exist:
   Static data mismatch with CC
Unit 1
The following inservice troubles exist:
   Static data mismatch with CC
```

If	Do
the system generates a card list	step 28
P-side links are out of service	step 31
static data mismatch with CC	step 14
PM load mismatch with inventory table	step 16
data is out of date	step 11
none of the above conditions occur	step 26

11   To busy the inactive unit, type

>BSY UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

12   To load the inactive unit, type

>LOADPM UNIT unit_no CC DATA
and press the Enter key.

where

unit_no   is the number of the inactive unit

If LOADPM	Do
passes	step 13
fails	step 37

13 To return the inactive unit to service, type

>**>RTS UNIT unit_no**
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	Do
passes	step 38
fails	step 37

14 Perform the procedure "Updating static data" in this document. Return to this procedure. Go to step 15.

15 Determine if the system cleared the ISTb fault.

If the system	Do
cleared the ISTb fault	step 38
did not clear the ISTb fault	step 37

16 To find out which load the SMS-R that has faults can use, type

>**>QUERYPM CNTRS**
and press the Enter key.

Example of a MAP response:

```
UNSOLICITED MSG LIMIT = 250, UNIT0 = 0, UNIT1 = 0

UNIT 0:
RAM LOAD:  SSR35CO
ROM LOAD:  SMSRRFA10

UNIT 1:
RAM LOAD:  SSR35CO
ROM LOAD:  SMSRRFA10
```

> **Note:** Dashed box highlights the correct SMS–R load.

PM SMS-R
major (continued)

17 To access table LTCRINV, type

   >TABLE LTCRINV
   and press the Enter key.

18 To position on the tuple for the SMS-R that has faults, type

   >POS SMSR smsr_no
   and press the Enter key.

   where

   smsr_no   is the number of the SMS-R that has faults

19 To change the load name, type

   >CHA LOAD
   and press the Enter key.

   Example of a MAP response:

   ```
   LOAD:   SSR35CO
   ```

20 To enter the correct load name, type

   >load_name
   and press the Enter key.

   where

   load_name   is the load name identified in step 16
   Example of a MAP response:

   ```
   TUPLE TO BE CHANGED:
      SMSR 0
         SME  0  32  0  C  1  6X02AA  SSR35CO
                                      (POTS POTSEX)$
                       ( 16) ( 17) ( 18) ( 19)$
                                      ( MSG6X69 )$
      NORTHAM   6X45BA 6X45BA                  $

    ENTER Y TO CONFIRM, N TO REJECT, OR E TO EDIT.
   ```

   To respond affirmatively to the confirmation request, type

   >Y
   and press the Enter key.

21 To leave table LTCRINV, type

   >QUIT
   and press the Enter key.

22 Perform the procedure "Updating static data" in this document. Return to this procedure. Go to step 23.

23 To check for fault indicators, type

>**QUERYPM FLT**

and press the Enter key.

If PM load mismatch with CC	Do
appears again	step 37
does not appear again	step 38

24 To display the SMS-R C-side link information, type

>**TRNSL C**

and press the Enter key.

Example of a MAP response:

```
LINK 0 RCC 0 16;CAP MS;STATUS OK, MSGCOND: OPN
LINK 1 RCC 0 17;CAP MS;STATUS OK, MSGCOND: OPN
LINK 2 RCC 0 18;CAP S;STATUS OK
LINK 3 RCC 0 19;CAP S;STATUS OK
```

25 For additional help to clear this alarm, contact the network maintenance level of support.

26 To manually busy the inactive unit, type

>**BSY UNIT unit_no**

and press the Enter key.

where

unit_no   is the number of the inactive unit

27 To test the inactive unit, type

>**TST UNIT unit_no**

and press the Enter key.

where

PM SMS-R
major (continued)

unit_no   is the number of the inactive unit

If test	Do
passes	step 30
fails, and the system generates a card list	step 28
fails, and the system does not generate a card list	step 37

28   Check the card list that appears at the MAP terminal.

Example of a MAP display.

```
Site Flr RPos  Bay_id Shf Description Slot EqPEC
HOST  00  M07   SME 00  51  SMSR: 000    08  6X45
HOST  00  M07   SME 00  51  SMSR: 000    22  8X18
HOST  00  M07   SME 00  65  SMSR: 000    22  8X18
HOST  00  M07   SME 00  51  SMSR: 000    12  6X45
```

If you	Do
replaced all cards on the list	step 37
did not replace all cards on the list	step 29

29   To replace the next card on the list, go to the *Card Replacement Procedures*. Complete the card replacement procedures. Go to step 27 of this procedure.

30   To return the inactive unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	Do
passes	step 38
fails	step 37

PM SMS-R
major (continued)

31   To display information about the P-side links, type

>TRNSL P
and press the Enter key.

Example of a MAP response:

```
LINK 0 RCS RCS0 00 1 0;CAP MS;STATUS: OK,MSGCOND:OPN
LINK 1 RCS RCS0 00 1 1;CAP MS;STATUS: SYSB,MSGCOND:CLS
LINK 2 RCS RCS0 00 1 ;PROTLINE
LINK 4 RCS RCS0 00 1 2;CAP MS;STATUS: OK,MSGCOND:OPN
LINK 5 RCS RCS0 00 1 3;CAP MS;STATUS: OK,MSGCOND:OPN
LINK 6 RCS RCS0 00 1 ;PROTLINE
LINK 8 RCS RCS0 00 1 4;CAP MS;STATUS: OK,MSGCOND:OPN
```

32   To busy the SysB link, type

>BSY LINK link_no
and press the Enter key.

where

link_no   is the number of the SysB link displayed in step 31

33   To test the link busied in step 32, type

>TST LINK link_no
and press the Enter key.

where

link_no   is the number of the link busied in step 32

If test	Do
passes	step 36
fails	step 34

34   Observe the card list that appears at the MAP terminal.

PM SMS-R
major (continued)

Example of a MAP display.

```
Site Flr RPos  Bay_id Shf Description Slot EqPEC
HOST  00  M07   SME 00  51  SMSR: 000    01  6X85
HOST  00  M07   SME 00  51  SMSR: 000    05  6X85
```

If you	Do
replaced all cards	step 37
did not replace all cards	step 35

35 To replace the next card on the list, go to the *Card Replacement Procedures*. Complete the card replacement procedures. Go to step 32 of this procedure.

36 To return the link to service, type

>RTS LINK link_no
and press the Enter key.

where

link_no   is the number of the link tested in step 33

If RTS	Do
passes	step 38
fails	step 37

37 For additional help to clear this alarm, contact the next level of support.

38 You returned the inactive unit to service. Determine if the active unit is in-service.

If active unit	Do
is InSv	step 44
is ISTb	step 39

PM SMS-R
major (continued)

39

> ⚠️ **Caution**
> **Service disruption: calls can end!**
> If the system prompts you to confirm a cold SwAct,
> only perform this activity during a period of low
> traffic. The system end all calls that this PM handles,
> including data calls.

To switch the activity of the units, type

>SWACT
and press the Enter key.

The system determines the type of SwAct the system can perform. The system can perform a warm SwAct or a cold SwAct. The system displays a confirmation prompt for the selected SwAct.

If SwAct	Do
cannot continue at this time	step 40
can continue at this time	step 41

40   Do not switch activity of the units. To reject the switch, type

>NO
and press the Enter key.

The system does not continue the switch of activity.

Return to step 39 during a period of low traffic.

PM SMS-R
major (end)

41 To switch the activity of the unit, type

>YES

and press the Enter key.

The system runs a pre-SwAct audit to determine if the inactive unit can accept activity correctly.

Note: A maintenance flag (`Mtce`) appears when maintenance tasks are in progress. Wait until the flag disappears before you proceed with the next maintenance action.

If the message	Do
is `SwAct passes`	step 43
is `SwAct fails`	step 37
is `SwAct fails  Reason:` `XPM SwActback`	step 42
is `SwAct controller` `refuses SwAct`	step 42

42 To force a switch of activity to the active unit, type

>SWACT FORCE

and press the Enter key.

The SwAct controller can use short term history reasons to refuse the SwAct. When the SwAct is complete, the short term history reasons are reset.

43 To clear the alarm condition on the new inactive unit, go to step 10.

44 The procedure is complete. If other alarms appear, refer to the correct alarm clearing procedures for the indicated alarms.

PM SMS-R
minor

Alarm display
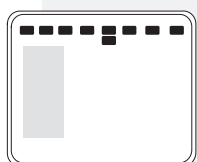
	CM	MS	IOD	Net	**PM**	CCS	Lns	Trks	Ext	Appl
	.	.	.	.	**nSMSR**	.	.	.	.	.

Indication

The Subscriber Carrier Module - 100S Remote (SMS-R) alarm appears under the peripheral module (PM) header in the MAP subsystem display. This alarm indicates that an alarm condition is present in the SMS-R. The letter *n* indicates the number of SMS-R modules with alarms. The blank space below the alarm indicates a minor alarm.

Meaning

This alarm normally indicates that one or more common peripheral controller cards in the SMS-R is defective. This alarm can indicate that message links on the network side are out of service.

Result

A minor alarm class code indicates that the SMS-R has an in-service trouble (ISTb) or central-side busy (CBsy) condition. If ISTb, the SMS-R continues to process calls, but a potential service-affecting fault condition is present. To reduce the potential impact to subscriber service, isolate the fault condition to the defective component. Use the procedure that follows to replace the defective component. If CBsy, the SMS-R cannot process calls until a message link on the SMS-R network side returns to service.
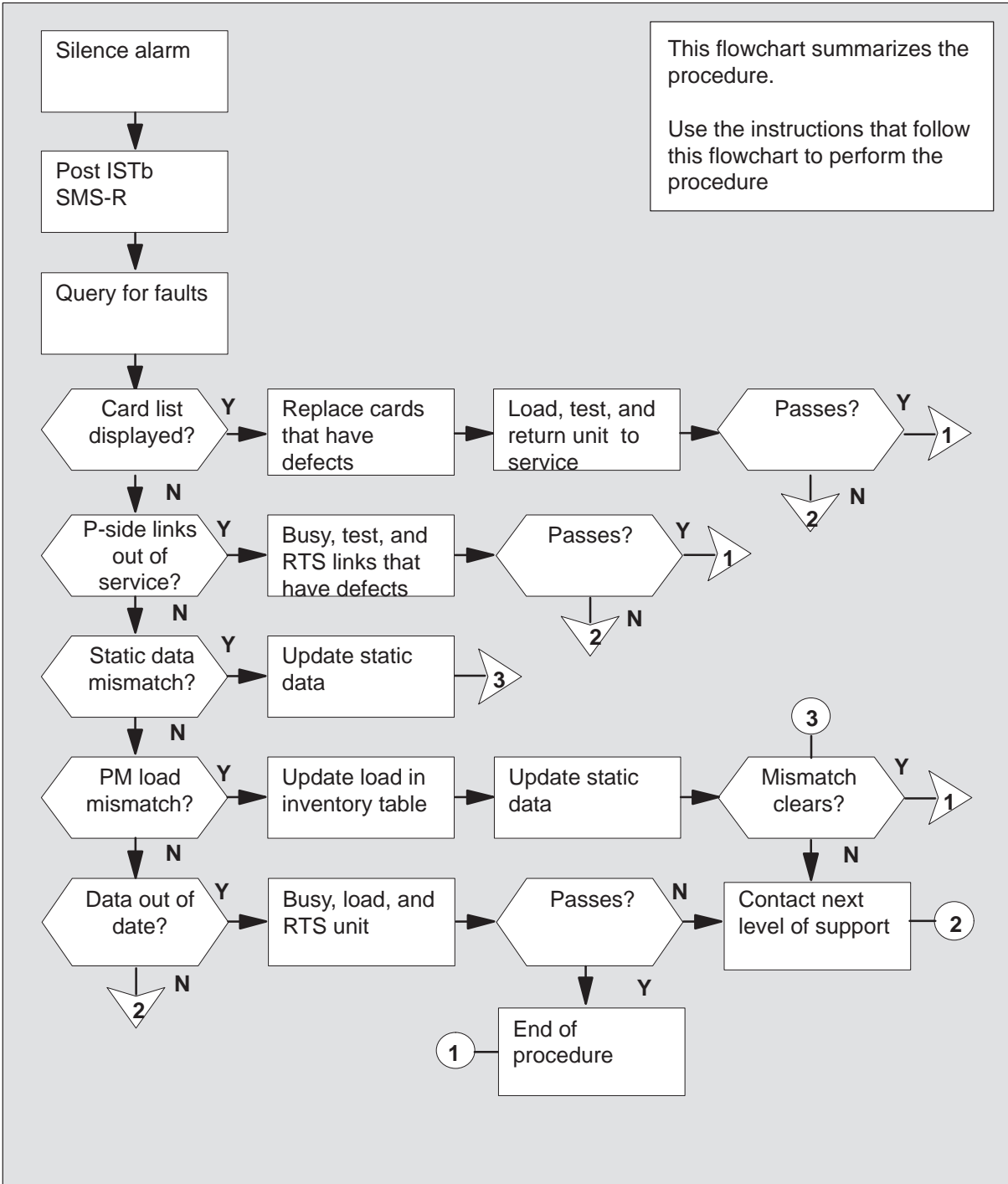
Common procedures

This procedure refers to updating static data.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

PM SMS-R
minor (continued)

Summary of PM SMS-R minor alarm

Silence alarm

↓

Post ISTb
SMS-R

↓

Query for faults

↓

Card list
displayed? — **Y** → Replace cards
that have
defects → Load, test, and
return unit to
service → Passes? — **Y** → **1**

Passes? — **N** → **2**

Card list displayed? **N** ↓

P-side links
out of
service? — **Y** → Busy, test, and
RTS links that
have defects → Passes? — **Y** → **1**

Passes? — **N** → **2**

P-side links out of service? **N** ↓

Static data
mismatch? — **Y** → Update static
data → **3**

Static data mismatch? **N** ↓

PM load
mismatch? — **Y** → Update load in
inventory table → Update static
data → Mismatch
clears? — **Y** → **1**

3 ↓ (into Mismatch clears?)

Mismatch clears? — **N** ↓ → Contact next
level of support

PM load mismatch? **N** ↓

Data out of
date? — **Y** → Busy, load, and
RTS unit → Passes? — **N** → Contact next
level of support — **2**

Data out of date? — **N** → **2**

Passes? — **Y** ↓

1 → End of
procedure

This flowchart summarizes the
procedure.

Use the instructions that follow
this flowchart to perform the
procedure

PM SMS-R
minor (continued)

Clearing a PM SMS-R minor alarm

At the MAP display

1   When the system detects a fault, the system can trigger an audible alarm. To access the MTC level of the MAP display and silence the alarm, type

>MAPCI;MTC;SIL
and press the Enter key.

2   To access the PM level of the MAP display and determine if the subscriber carrier module-100 uban (SMU) is CBsy, type

>PM;DISP STATE CBSY SMSR
Example of a MAP response:

```
CBsy SMSR:   0
```

If SMS-R is	Do
CBsy	step 3
not CBsy	step 5

3   To display the SMS-R central-side (C-side) links, type

>TRNSL C
and press the Enter key.

Example of a MAP response:

```
LINK 0 RCC 0 10;CAP MS;STATUS SysB, MSGCOND: CLS
LINK 1 RCC 0 12;CAP MS;STATUS SysB, MSGCOND  CLS
LINK 2 RCC 0 11;CAP S;STATUS OK
LINK 3 RCC 0 13;CAP S;STATUS OK
```

4   Take note of the numbers and conditions of the links. Report this information to the personnel responsible for network level maintenance.

5   To determine the SMS-R that is ISTb, type

>DISP STATE ISTB SMSR
and press the Enter key.

Example of a MAP response:

```
ISTb SMSR:   1
```

PM SMS-R
minor (continued)

6 To access the ISTb SMS-R, type

>POST SMSR smsr_no
where

smsr_no   is the number of the SMS-R displayed in step 5

Example of a MAP response:

```
SMSR      SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0     1     0     2    13
    SMSR    0     0     0     0     1     7

SMSR 0 ISTb  Links_OOS   CSide 0, PSide 0
Unit0:  Act    ISTb
Unit1:  Inact InSv
```

> **Note:** The dashed box displays where the status of units appears.

If	Do
one unit is busied by the system (SysB)	step 14
one unit is manually busied (ManB)	step 7
both units are in-service (InSv)	step 43
both units are ISTb	step 13
one unit is ISTb and inactive	step 13
one unit is ISTb and active	step 8

7 To return the inactive unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	Do
passes	step 43
fails	step 15

8

⚠️ **Caution**
Service disruption
If the system prompts you to confirm a cold SWACT,
perform this activity during a period of low traffic.
The system drops all calls that this PM handles,
including data calls.

To switch the activity of the units, type

>SWACT
and press the Enter key.

The system determines the type of SWACT (warm or cold) the system can
perform. The system displays a confirmation prompt for the selected SWACT.

If SwAct	Do
cannot continue at this time	step 9
can continue at this time	step 10

9   Do not switch activity of the units. To reject the switch, type

>NO
and press the Enter key.

The system does not continue the switch of activity.

Return to step 8 during a period of low traffic.

PM SMS-R
minor (continued)

10 To switch the activity of the unit, type

>YES

and press the Enter key.

The system runs a pre-SWACT audit to determine if the inactive unit can accept activity correctly.

Note: A maintenance flag (Mtce in the following example) appears when maintenance tasks are in progress. Wait until the flag disappears before you proceed with the next maintenance action.

Example of a MAP response:

```
SMSR 0  ISTb     Links_OOS:  CSide  0, PSide  0
Unit0:  InAct    ISTb    Mtce
Unit1:  Act      InSv    Mtce
```

If the message	Do
is SWACT passes	step 13
is SWACT fails	step 11
is SWACT fails, with reason XPM SWACTback	step 12
is SWACT refused by SWACT controller	step 12

11 The inactive unit cannot establish two-way communication with the central control (CC) and switches activity back to the original active unit. You must clear all faults on the inactive unit before you attempt to clear the alarm condition on the active unit.

Go to step 13.

12 The SWACT controller does not recommend a SWACT for the reason(s) stated. You must clear all faults on the inactive unit before you attempt to clear the alarm condition on the active unit.

13   To check for fault indicators on the inactive unit, type

   >QUERYPM FLT
   and press the Enter key.

   Example of a MAP response:

   ```
   Node is ISTb
     One or both units inservice trouble
   Unit 0
   The following inservice troubles exist:
      Static data mismatch with CC
   Unit 1
   The following inservice troubles exist:
      Static data mismatch with CC
   ```

If	Do
the system displays a card list	step 31
peripheral-side (P-side) links are out of service	step 34
static data mismatch with CC	step 17
PM load mismatch with inventory table	step 20
data is out of date	step 14
none of the above conditions occur	step 41

14   To busy the inactive unit, type

   >BSY UNIT unit_no
   and press the Enter key.

   where

   unit_no   is the number of the inactive unit

PM SMS-R
minor (continued)

15   To load the inactive unit, type

>LOADPM UNIT unit_no CC DATA
and press the Enter key.

where

unit_no   is the number of the inactive unit

If LOADPM	Do
passes	step 16
fails	step 41

16   To return the inactive unit to service, type

>RTS UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	Do
passes	step 42
fails	step 41

17   Perform the procedure *Updating static data in this book*. When you return to this procedure, go to step 18.

18   Determine if the system clears the ISTb fault.

If ISTb fault	Do
clears	step 42
does not clear	step 41

19   To determine which load the SMS-R that has defects uses, type

>QUERYPM CNTRS
and press the Enter key.

Example of a MAP response:

```
UNSOLICITED MSG LIMIT = 250, UNIT0 = 0, UNIT1 = 0


UNIT 0:
RAM LOAD:  ECR07BA1
EPRom Version:AC01
              EEPRom load: Loadable:NB01, Executable:NB01


UNIT 1:
RAM LOAD:  ECR07BA1
EPRom Version:AC01
              EEPRom load: Loadable:NB01, Executable:NB01
```

> *Note:*   The dashed box highlights SMS-R loads that are not correct.

20   To access table LTCRINV, type

>TABLE LTCRINV
and press the Enter key.

21   To position on the tuple for the SMS-R that has defects, type

>POS SMSR smsr_no
and press the Enter key.

where

smsr_no   is the number of the SMS-R that has defects

22   To change the load name, type

>CHA LOAD
and press the Enter key.

Example of a MAP response:

```
LOAD:   ECR08BC1
```

PM SMS-R
minor (continued)

23 To enter the correct load name, type

>**load_name**
and press the Enter key.

where

load_name   is the load name changed in step 22
Example of a MAP response:

```
TUPLE TO BE CHANGED:
   SMSR 0
       SME  0  32  0  C  1  6X02AA  ECR08BC1
                                 (POTS POTSEX)$
              ( 0 40) ( 0 42) ( 1 40) ( 0 30)$
                                    ( MSG6X69 )$
   NORTHAM   MX77AA MX77AA MX77NB03          $

 ENTER Y TO CONFIRM, N TO REJECT, OR E TO EDIT.
```

To respond to the confirmation request, type

>**Y**
and press the Enter key.

24 To leave table LTCRINV, type

>**QUIT**
and press the Enter key.

25 Perform the procedure *Updating static data in this book*. When you return to this procedure, go to step 33.

26 To check for fault indicators, type

>**QUERYPM FLT**
and press the Enter key.

If PM load mismatch with CC	Do
continues to appear	step 27
does not appear	step 42

27 To manually busy the inactive unit, type

>BSY UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

28 Reload the inactive unit if any of the cards in the following list are replaced:

- MX77
- 6X69
- 2X70

If inactive unit	Do
requires a reload	step 29
does not require a reload	step 33

29 To reload the inactive unit, type

>LOADPM UNIT unit_no CC DATA
and press the Enter key.

where

unit_no   is the number of the inactive unit

If LOADPM	Do
passes	step 30
fails	step 41

PM SMS-R
minor (continued)

30 To test the inactive unit, type

>TST UNIT unit_no
and press the Enter key.

where

unit_no   is the number of the inactive unit

If test	Do
passes	step 33
fails and the system generates a card list	step 31
fails, and the system generates a card list	step 41

31 Check the card list that appears at the MAP display. The card that can have defects appears first on the list.

Example of a MAP response.

```
Site Flr RPos  Bay_id Shf Description Slot EqPEC
HOST  00  M07  SME 00  51  SMSR: 000    12  MX77
HOST  00  M07  SME 00  51  SMSR: 000    22  8X18
HOST  00  M07  SME 00  65  SMSR: 000    22  8X18
```

If all cards in the card list	Do
are replaced	step 41
are not replaced	step 32

32 Go to *Card Replacement Procedures* section of this manual for the first (or next) card on the list. When you return from the card replacement procedures, go to step 30 of this procedure.

33   To return the inactive unit to service, type

>**RTS UNIT unit_no**
and press the Enter key.

where

unit_no   is the number of the inactive unit

If RTS	Do
passes	step 43
fails	step 41

34   To display information about the P-side links, type

>**TRNSL P**
and press the Enter key.

Example of a MAP response:

```
LINK 0 RCS RCS0 00 1 0;CAP MS;STATUS: OK, MSGCOND:OPN
LINK 1 RCS RCS0 00 1 0;CAP MS;STATUS:SysB,MSGCOND:CLS
LINK 2 RCS RCS0 00 1 ;PROTLINE
```

35   To busy the SysB link, type

>**BSY LINK link_no**
and press the Enter key.

where

link_no   is the number of the SysB link displayed in step 34

PM SMS-R
minor (continued)

36 To test the link busied in step 35, type

>TST LINK link_no
and press the Enter key.

where

link_no   is the number of the ManB link

If test	Do
passes	step 39
fails and the system generates a card list	step 37
fails, and the system does not generate a card list	step 41

37 Check the card list that appears at the MAP display. The card that can have defects appears first on the list.

Example of a MAP response.

```
Site Flr RPos   Bay_id Shf Description Slot EqPEC
HOST  00  M07   SME 00  51  SMSR: 000    01  6X85
HOST  00  M07   SME 00  51  SMSR: 000    05  6X85
```

If all cards	Do
are replaced	step 41
are bot replaced	step 38

38 Go to the *Card Replacement Procedures* for the next card on the list. When you return from the card replacement procedures, go to step 39 of this procedure.

39 To return the link to service, type

>**RTS LINK link_no**
and press the Enter key.

where

link_no   is the number of the link tested in step 36

If RTS	Do
passes	step 40
fails	step 41

40 Determine if additional SysB links are present.

If additional SysB links	Do
are present	step 35
are not present	step 42

41 For additional help to clear this alarm contact the next level of support.

42 You returned the inactive unit to service. Determine if the active unit is in-service.

If active unit is	Do
InSv	step 43
STb	step 13

43 The procedure is complete. If other alarms display, refer to the correct alarm procedures for the indicated alarms.

Updating static data
SMS-R

Application

Use this procedure to update static data in the subscriber carrier module-100 remote (SMS-R).

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Updating static data
SMS-R (continued)

Summary of clearing Updating static data and SMS-R alarm

```
┌─────────────────┐                          ┌──────────────────────────┐
│ Busy the        │                          │ This flowchart summarizes│
│ inactive unit   │                          │ the procedure.           │
└────────┬────────┘                          │                          │
         │                                   │ Use the instructions that│
         ▼                                   │ follow this flowchart to  │
┌─────────────────┐                          │ perform the procedure     │
│ RTS with        │                          └──────────────────────────┘
│ NODATASYNC      │
│ option          │
└────────┬────────┘
         │
         ▼
┌─────────────────┐       ╱‾‾‾‾‾‾‾‾╲    Y    ┌──────────────┐
│ Switch unit     │──────▶  SwAct   ───────▶ │ End of       │
│ activity (SwAct)│       ╲ passes?╱         │ procedure    │
└─────────────────┘        ╲──┬──╱           └──────────────┘
                              │   N
                              ▼
                    ┌──────────────┐
                    │ Contact next │
                    │ level of     │
                    │ maintenance  │
                    └──────────────┘
```
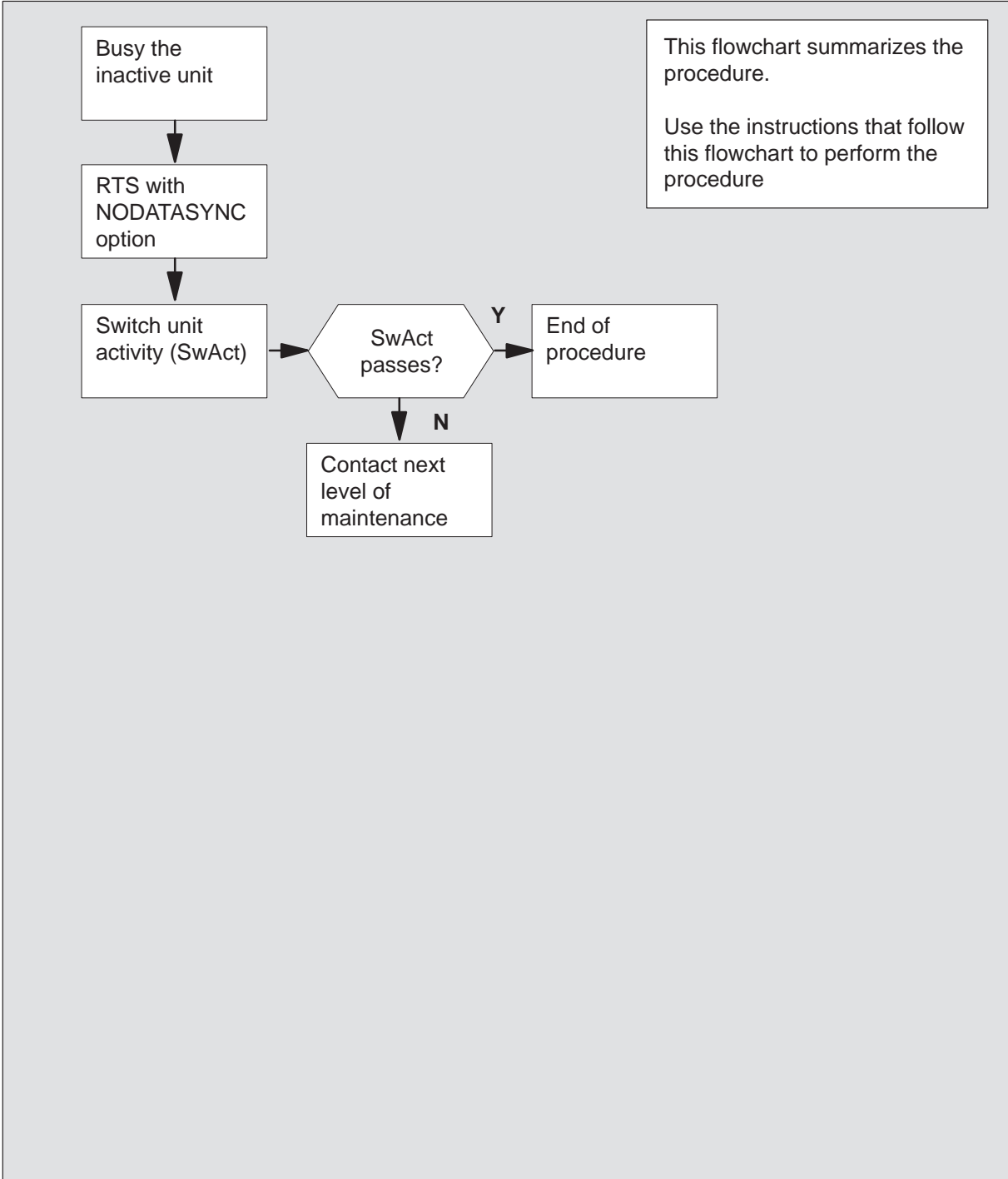
Updating static data
SMS-R (continued)

Updating static data and SMS-R

At the MAP display

1   Proceed if a step in a maintenance procedure directed you to this procedure.
    Separate use of this procedure can cause equipment damage or loss of
    service.

2   To busy the inactive unit, type

    >BSY UNIT unit_no
    and press the Enter key.

    where

    unit_no   is the number of the inactive unit

3
+--+
| ⚠   **Caution** |
| **Loss of service** |
| The system will lose all calls, including data calls, that |
| this peripheral module (PM) handles. Perform the |
| next step during a period of low traffic. |
+--+

    To return the inactive unit to service, type

    >RTS UNIT unit_no NODATASYNC
    and press the Enter key.

    where

    unit_no   is the number of the inactive unit

4   To perform a SwAct, type

    >SWACT UNIT unit_no
    and press the Enter key.

    MAP prompt:

    ```
    A Cold SwAct will be performed
    This action will take this PM and all of
    Its Subtending Nodes temporarily out of service
    and <n> active terminals may be affected
    Please confirm ("YES" or "NO"):
    ```

    To affirm the request for confirmation, type

    >YES
    and press the Enter key.

Updating static data
SMS-R (end)

Example of a MAP response:

```
SMSR 0    SwAct Passed
```

If SWACT	Do
passes	step 6
fails	step 4

5   For additional help, contact the next level of maintenance.

6   The procedure is complete. Return to the main procedure that directed you to this procedure. Continue as directed.

SMS-R card replacement procedures

This chapter contains card replacement procedures for the Subscriber Carrier Module-100S Remote within DMS-100/200 offices. These detailed procedures are used by maintenance personnel to remove and replace a circuit pack.

NT2X70
SMS-R

Application

Use this procedure to replace the following card in an SMS–R shelf.

PEC	Suffixes	Name
NT2X70	AE	Power Convertor (5V/12V)

Common procedures

None

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT2X70
SMS-R (continued)

Summary of card replacement procedure for an NT2X70 in an SMS-R
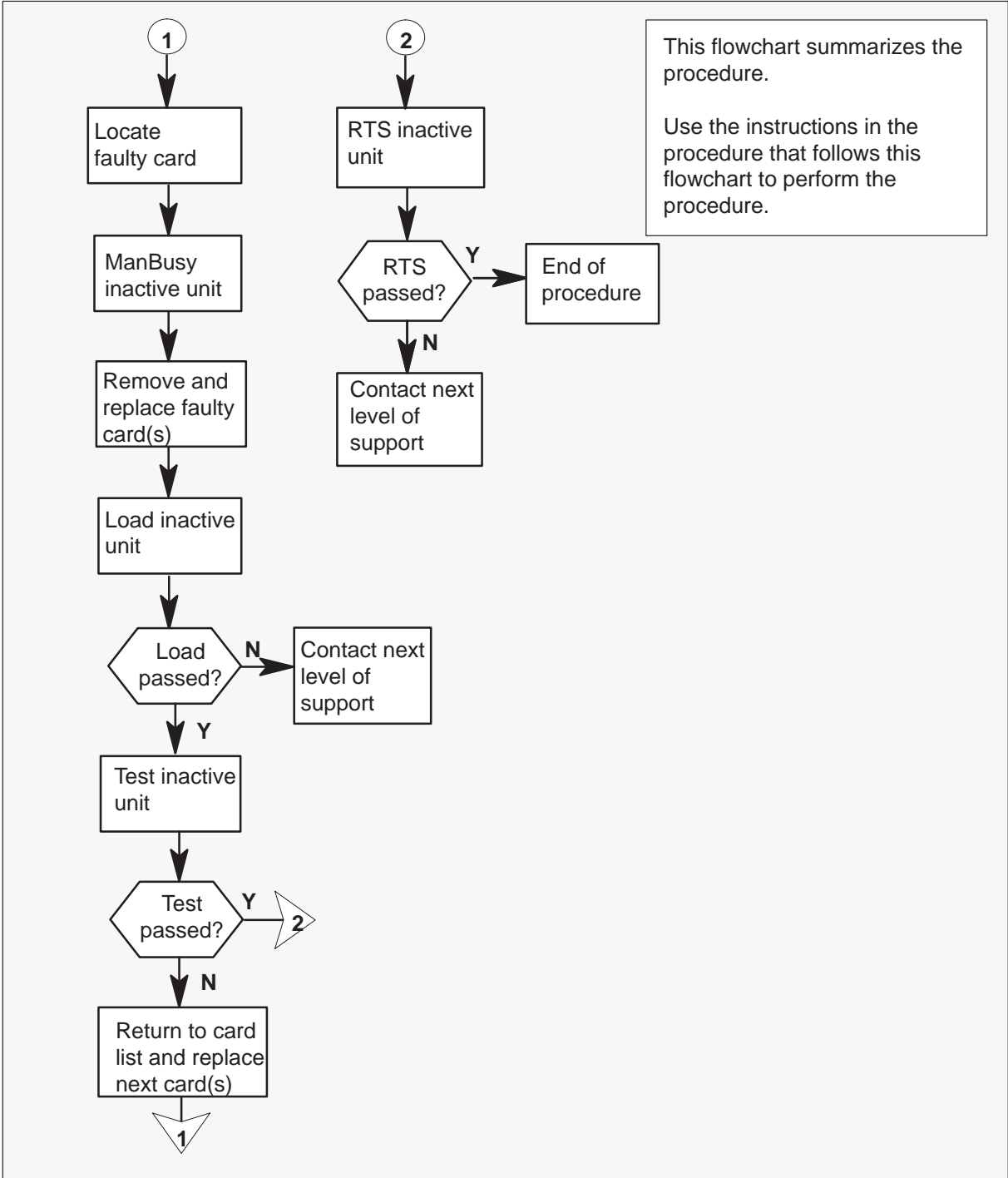
NT2X70
SMS-R (continued)

Replacing an NT2X70 in an SMS-R

At your Current Location

1   Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using this procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

> ⚠ **Caution**
> **Loss of service**
> When replacing a card in the SMS–R, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP display

3   Access the PM level of the MAP display by typing

>MAPCI;MTC;PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMS–R to be posted

Example of a MAP response

```
SMSR 3   INSV     LINKS_OOS    CSIDE 0     PSIDE 0
    Unit0      Act       InSv
    Unit1      InAct     ISTb
```

4   By observing the MAP display, ensure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5   Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 28

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
SwAct passed	step 8
SwAct failed	step 7
SwAct failed Reason: XPM SwActback	step 7
SwAct refused by SwAct controller	step 7

7 Return to the alarm clearing procedure to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8 Hang a sign on the active unit bearing the words: **"Active unit–Do not touch."** This sign should not be attached by magnets or tape.

At the MAP terminal

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

NT2X70
SMS-R (continued)

> *At the frame*

10

> **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and
> connect it to the wrist strap grounding point on the left
> side of the frame supervisory panel of the SMS–R.
> This protects the equipment against damage caused by
> static electricity.

Put on a wrist strap.

11

> **WARNING**
> **Equipment damage**
> Take the following precautions when removing or
> inserting a card:
> 1. Do not apply direct pressure to the components.
> 2. Do not force the cards into the slots.

Power down the unit by setting the ON/OFF switch on the power converter
faceplate to the OFF position. Both the converter FAIL LED and FRAME FAIL
lamp on the frame supervisory panel (FSP) will be ON. An audible alarm may
sound. If an alarm does sound, silence it by typing

>SIL

and pressing the Enter key.

12 Remove the NT2X70 card as shown in the following figures.

NT2X70
SMS-R (continued)

    a.   Locate the card to be removed on the appropriate shelf.
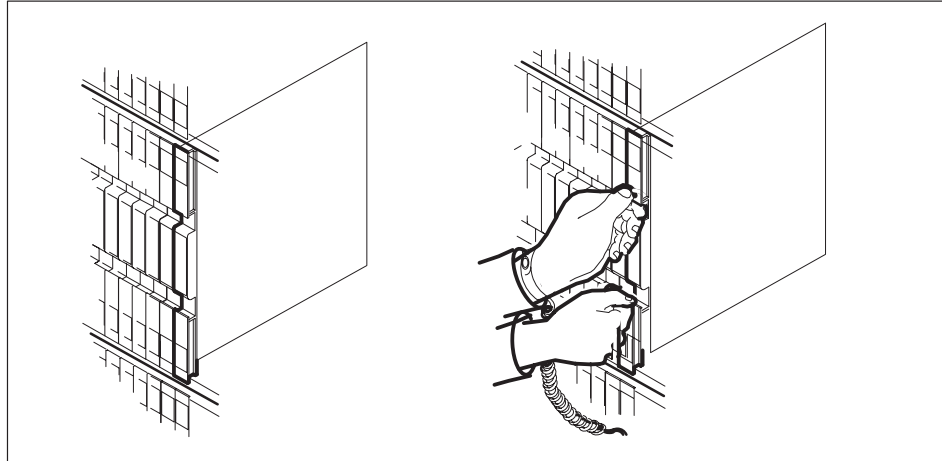
    b.   Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.
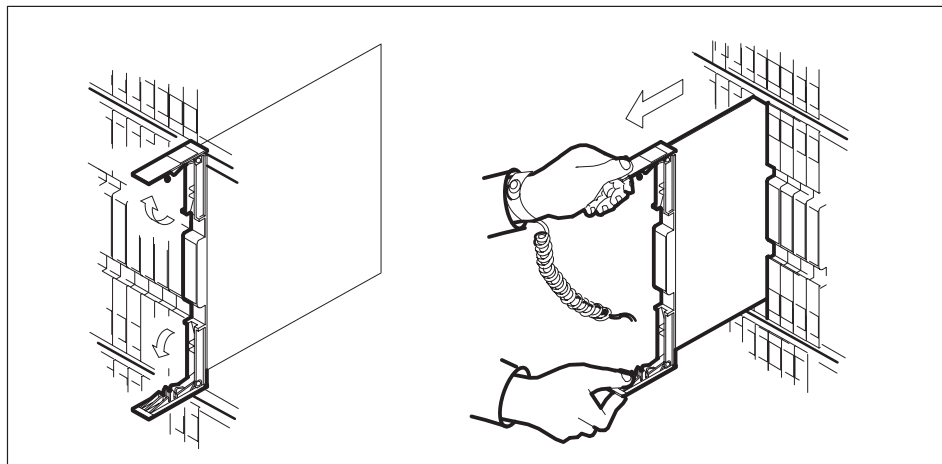
    c.   Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

13 Open the locking levers on the replacement card.

NT2X70
SMS-R (continued)

    a. Align the card with the slots in the shelf and gently slide the card into the shelf.
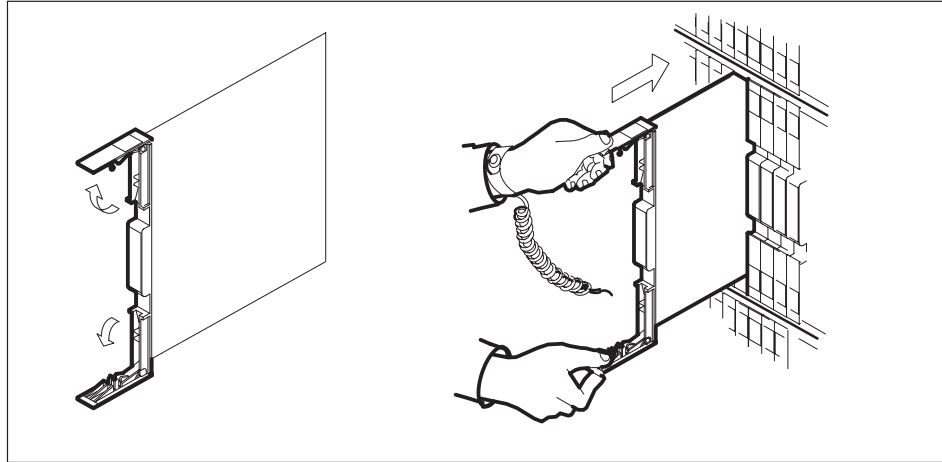
14 Seat and lock the card.

    a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

    b. Close the locking levers.
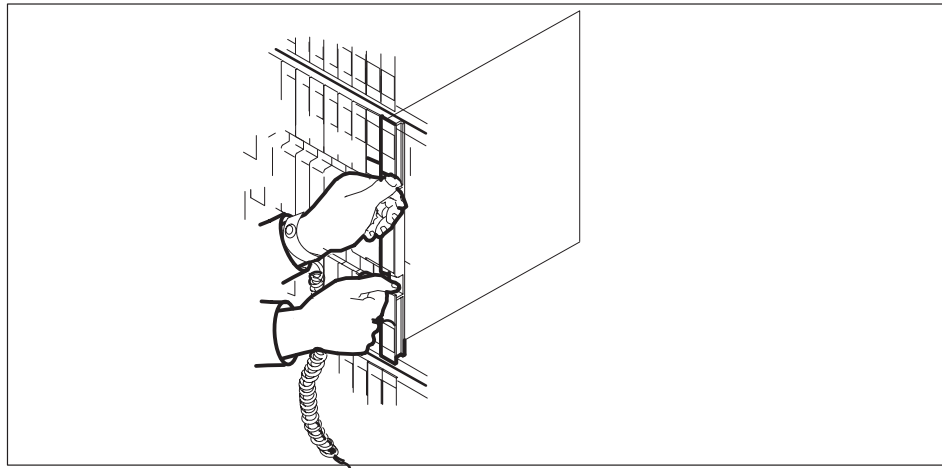
15 Power up the inactive SMS–R unit as follows:

a. Ensure that the power converter (NT2X70) is inserted. A major audible alarm may sound. This alarm is silenced when power is restored to the converter.

b. Set the power switch to the ON position.

If FSP is equipped with	Do
fuses	step 16
circuit breakers	step 17

16 Press and hold the reset button for 1 s. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will be ON.

Go to step 18.

17 Press the reset button while setting the circuit breaker to the ON position. Both the converter FAIL LED and FRAME FAIL lamp on the FSP will be ON.

Go to step18.

At the MAP display

18 Load the inactive SMS–R unit by typing

>LOADPM UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If LOADPM	Do
passes	step 19
fails	step 26

19 Use the following information to determine the next step in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 25
other	step 20

NT2X70
SMS-R (continued)

20   Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If TST	Do
passes	step 21
fails	step 25

21   Return the inactive SMS–R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 22
fails	step 26

At the frame

22   Remove the sign from the active SMS–R unit.

23   Send any faulty cards for repair according to local procedure.

24   Record the following items in office records in accordance with local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

Go to step 27.

25   Return to *Alarm Clearing Procedures* section of this manual or to the procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

NT2X70
SMS-R (end)

26 Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

27 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

28 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X41
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

PEC	Suffixes	Name
NT6X41	AA, AC	Speech Bus Formatter

Common procedures

Not applicable

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X41
SMS-R (continued)

Summary of card replacement procedure for an NT6X41 card in an SMS-R

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.
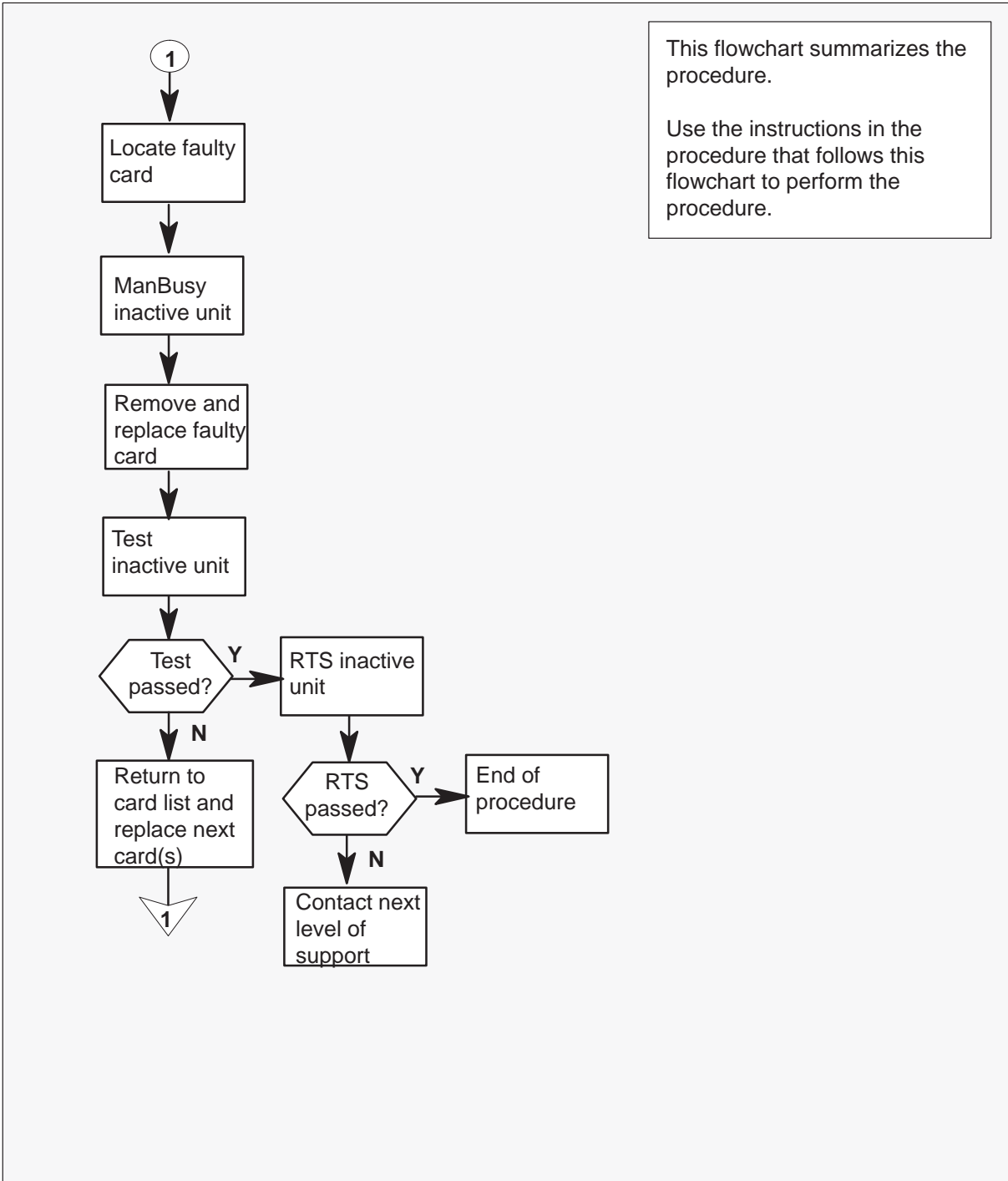
NT6X41
SMS-R (continued)

Replacing an NT6X41 card in an SMS-R

At your Current Location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

⚠	**CAUTION** **Loss of service** When replacing a card in the SMSR, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP display

3 Access the PM level of the MAP display by typing

>MAPCI;MTC;PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMSR to be posted

Example of a MAP response

```
SMSR 3   INSV    LINKS_OOS    CSIDE 0     PSIDE 0
   Unit0      Act       InSv
   Unit1      InAct     ISTb
```

4 By observing the MAP display, ensure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 23

6   Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
SwAct passed	step 8
SwAct failed	step 7
SwAct failed Reason: XPM SwActback	step 7
SwAct refused by SwAct controller	step 7

7   Return to the alarm clearing procedure to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8   Put a sign on the active unit bearing the following words: **"Active unit—Do not touch."**

At the MAP display

9   Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

NT6X41
SMS-R (continued)

At the frame

10

⚠️ **WARNING**
Static electricity damage
Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS–R. This protects the equipment against damage caused by static electricity.

Put on a wrist strap.

11
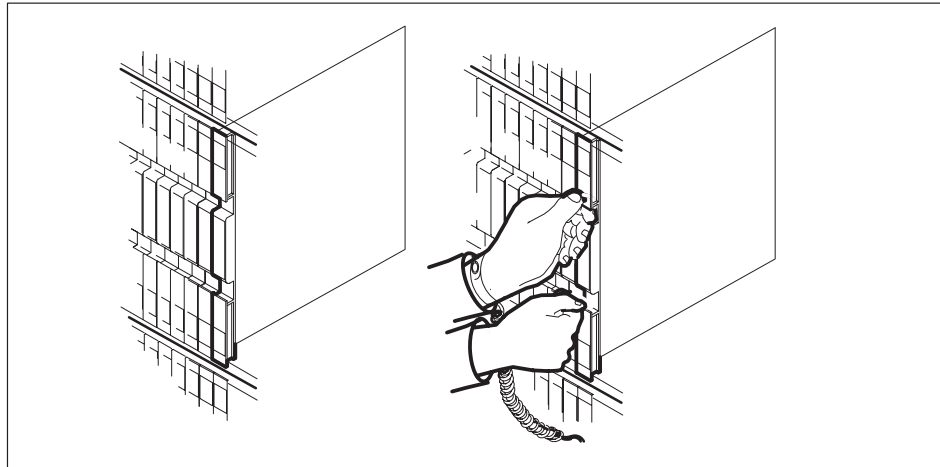
⚠️ **WARNING**
Equipment damage
Take the following precautions when removing or inserting a card:
1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

Remove the NT6X41 card as shown in the following figures.

a. Locate the card to be removed on the appropriate shelf.

NT6X41
SMS-R (continued)

b. Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.

c. Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

12 Open the locking levers on the replacement card.

a. Align the card with the slots in the shelf and gently slide the card into the shelf.
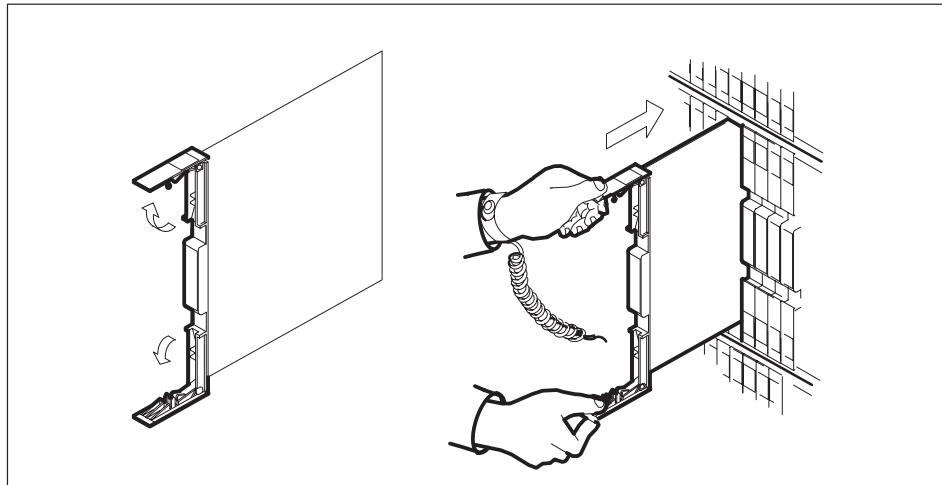
13 Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

NT6X41
SMS-R (continued)

> **b.** Close the locking levers.
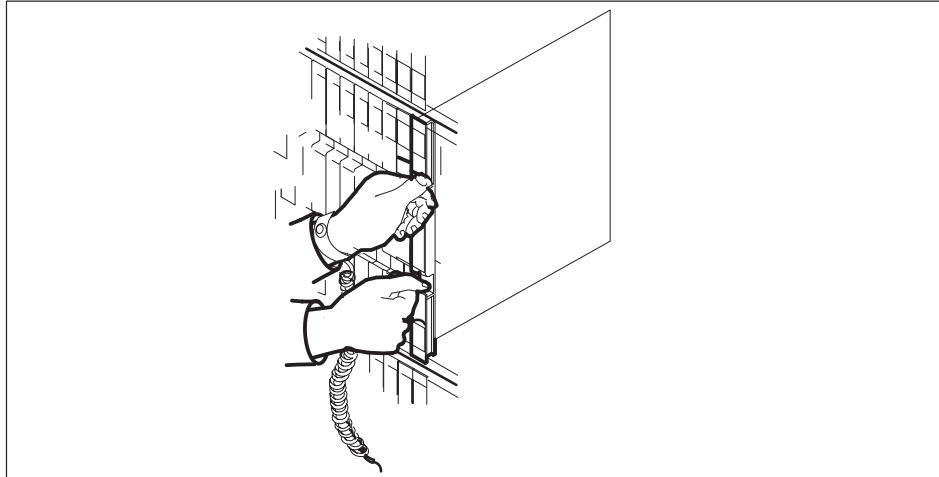
14 Use the following information to determine the next step in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 17
other	step 15

At the MAP display

15 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If TST	Do
passes	step 16
fails	step 17

16   Return the inactive SMSR unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 19
fails	step 18

17   Return to the *Alarm Clearing Procedures* section of this manual or procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

18   Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

 At the frame

19   Remove the sign from the active unit.

20   Send any faulty cards for repair according to local procedure.

21   Record the following items in office records in accordance with local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card.

22   You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

23   For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X42
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

PEC	Suffixes	Name
NT6X42	AA	Channel Supervision Message

Common procedures

Not applicable

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

Summary of card replacement procedure for an NT6X42 card in an SMS-R

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.
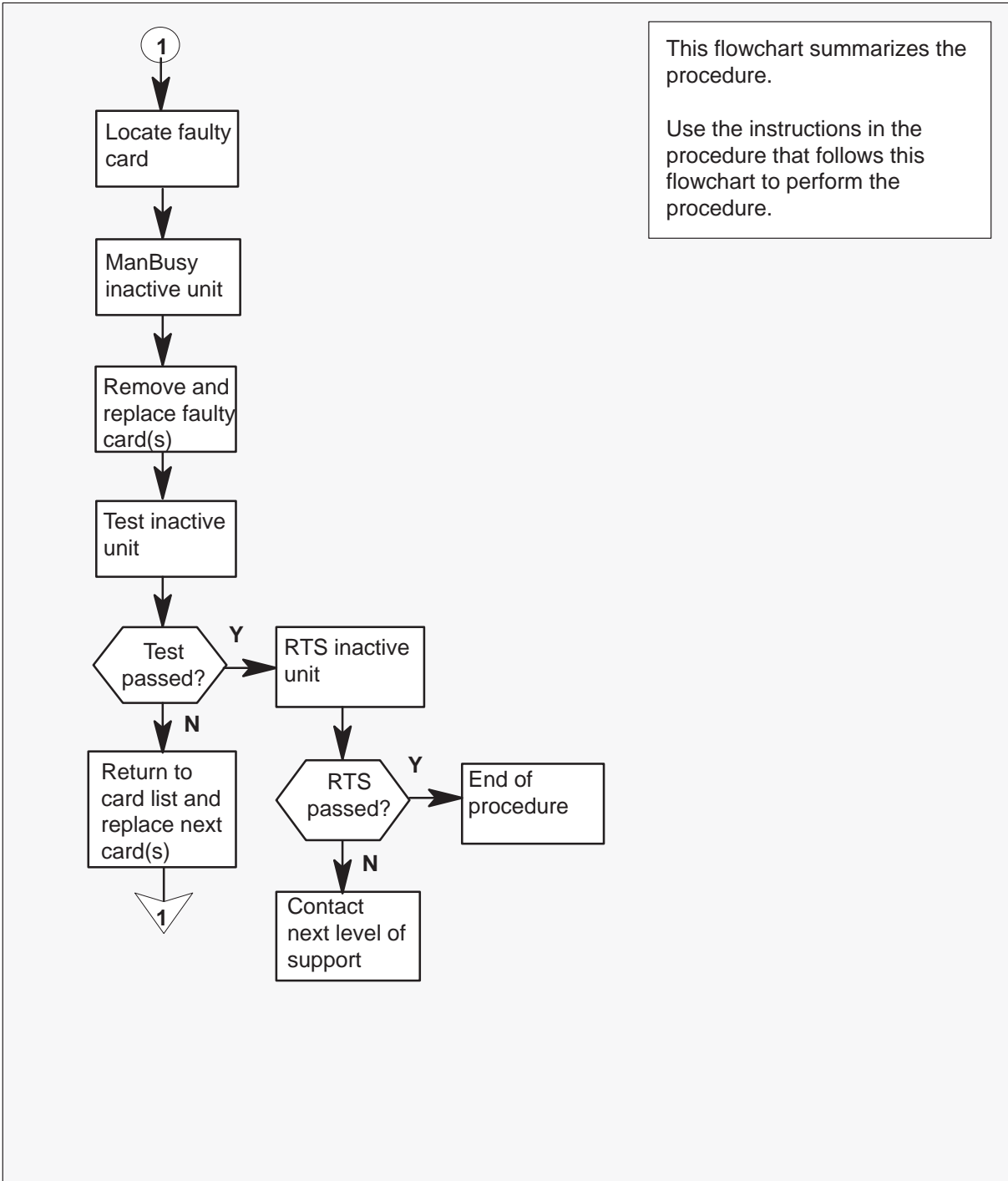
NT6X42
SMS-R (continued)

Replacing an NT6X42 card in an SMS-R

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

> ⚠️ **CAUTION**
> **Loss of service**
> When replacing a card in the SMS–R, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP display

3 Access the PM level of the MAP display by typing

>MAPCI;MTC;PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMS–R to be posted

Example of a MAP response

```
SMSR 3    INSV    LINKS_OOS    CSIDE 0     PSIDE 0
   Unit0      Act       InSv
   Unit1     InAct      ISTb
```

4 By observing the MAP display, ensure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5 Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a
confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 23

6   Switch the activity of the unit by typing

>**YES**
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit
to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress.
Wait until the flag disappears before proceeding with the next maintenance
action.

If the message is	Do
SwAct passed	step 8
SwAct failed	step 7
SwAct failed Reason: XPM SwActback	step 7
SwAct refused by SwAct controller	step 7

7   Return to the alarm clearing procedure to clear the alarm condition on the
inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8   Put a sign on the active unit with the words: **"Active unit—Do not touch."**

At the MAP

9   Busy the inactive PM unit by typing

>**BSY UNIT unit_no**
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

NT6X42
SMS-R (continued)

At the frame

10

	WARNING **Static electricity damage** Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS–R. This strap protects the equipment against damage caused by static electricity.

Put on a wrist strap.

11

	WARNING **Equipment damage** Take the following precautions when removing or inserting a card: 1. Do not apply direct pressure to the components. 2. Do not force the cards into the slots.
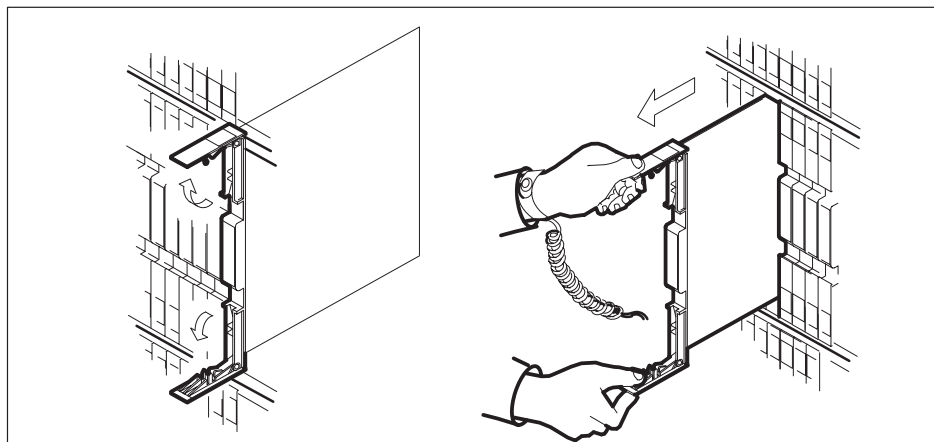
Remove the NT6X42 card as shown in the following figures.

a. Locate the card to be removed on the appropriate shelf.
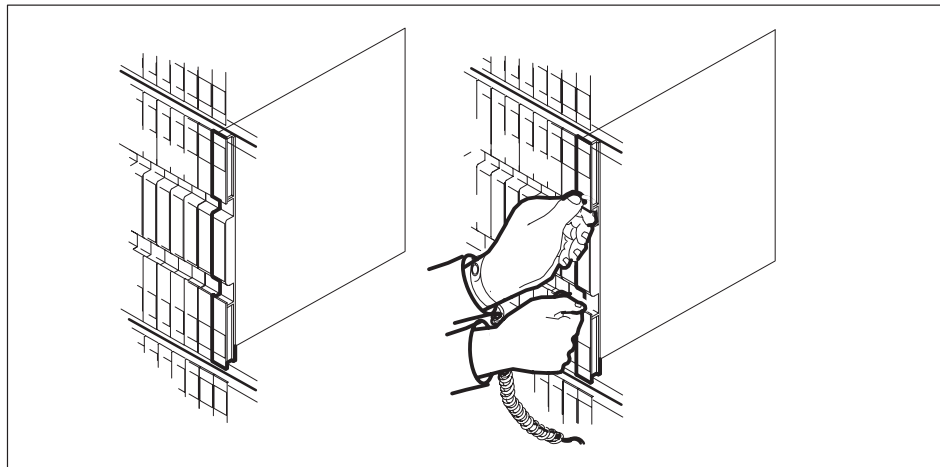
NT6X42
SMS-R (continued)

b. Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.

c. Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

12 Open the locking levers on the replacement card.

a. Align the card with the slots in the shelf and gently slide the card into the shelf.

13 Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

NT6X42
SMS-R (continued)

    b. Close the locking levers.

    14 Use the following information to determine the next step in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 17
other	step 15

    15 Test the inactive unit by typing

        >TST UNIT unit_no
        and pressing the Enter key.

        where

        unit_no   is the number of the faulty SMS–R unit

If TST	Do
passes	step 16
fails	step 17

    16 Return the inactive SMS–R unit to service by typing

        >RTS UNIT unit_no
        and pressing the Enter key.

NT6X42
SMS-R (end)

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 19
fails	step18

17   Return to *Alarm Clearing Procedures* section of this manual or to the procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

18   Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

At the frame

19   Remove the sign from the active SMS–R unit.

20   Send any faulty cards for repair according to local procedure.

21   Note in office records according to local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

22   You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

23   For further assistance with switch of activity, contact the personnel responsible for the next level of support.

   Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X44
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

PEC	Suffixes	Name
NT6X44	AB, CA	Time Switch

Common procedures

Not applicable

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X44
SMS-R (continued)

Summary of card replacement procedure for an NT6X44 card in an SMS-R

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.
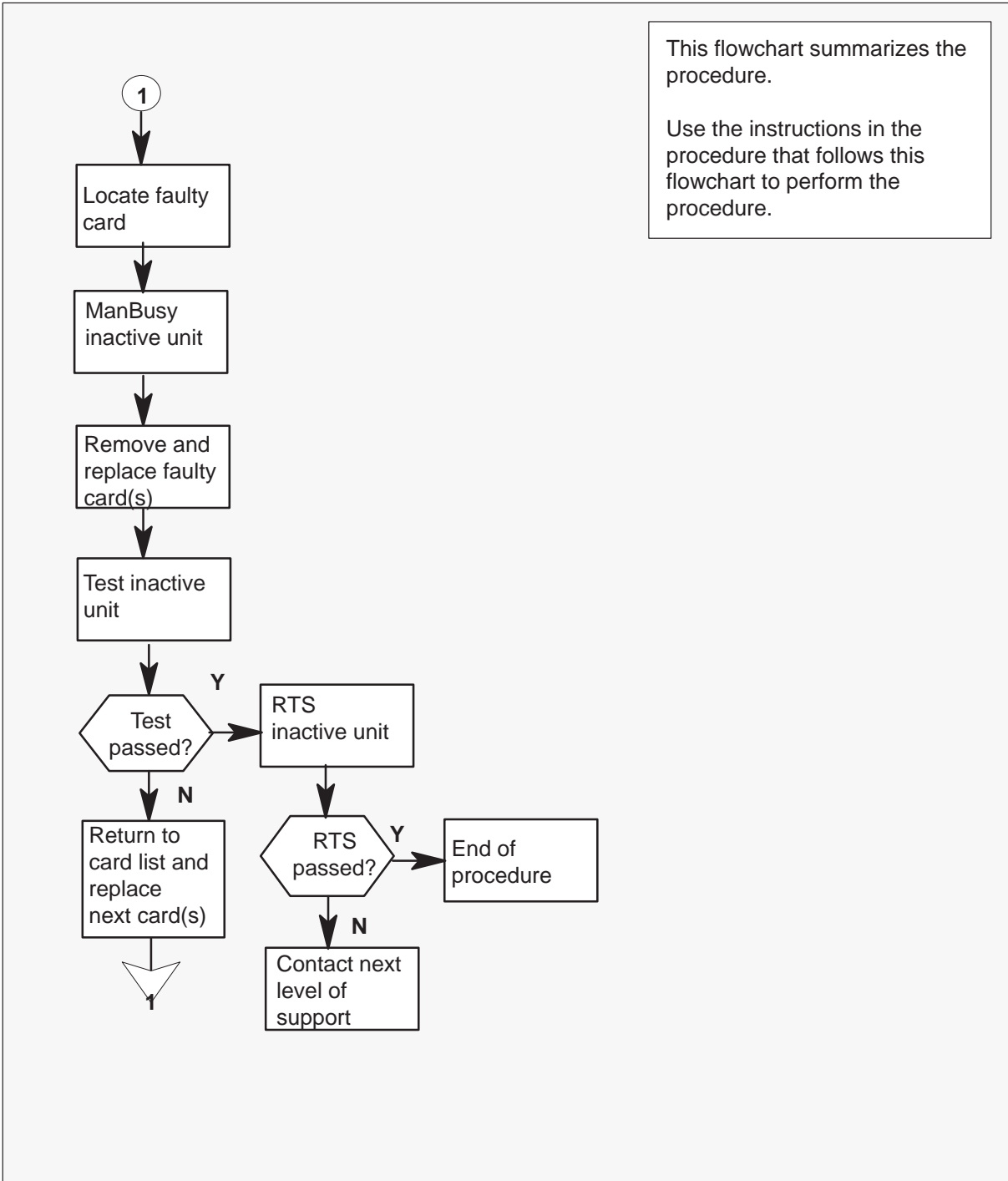
NT6X44
SMS-R (continued)

Replacing an NT6X44 card in an SMS-R

At your Current Location

1 Proceed only if you were directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMS–R, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP display

3 Access the PM level of the MAP display by typing

   >MAPCI;MTC;PM;POST SMSR smsr_no
   and pressing the Enter key.

   where

   smsr_no   is the number of the SMS–R to be posted

   Example of a MAP response:

   ```
   SMSR 3    INSV     LINKS_OOS    CSIDE 0      PSIDE 0
      Unit0       Act       InSv
      Unit1       InAct     ISTb
   ```

4 By observing the MAP display, ensure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5 Switch the activity of the units by typing

   >SWACT
   and pressing the Enter key.

NT6X44
SMS-R (continued)

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 23

6   Switch the activity of the unit by typing

>**YES**

and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed  Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7   Return to the alarm clearing procedure to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8   Put a sign on the active unit with the words: **"Active unit—Do not touch."**

At the MAP display

9   Busy the inactive PM unit by typing

>**BSY UNIT unit_no**
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

NT6X44
SMS-R (continued)

At the frame

10

⚡	**WARNING** **Static electricity damage** Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS–R. This strap protects the equipment against damage caused by static electricity.

Put on a wrist strap.

11

⚡	**WARNING** **Equipment damage** Take the following precautions when removing or inserting a card: 1. Do not apply direct pressure to the components. 2. Do not force the cards into the slots.

Remove the NT6X44 card as shown in the following figures.

a. Locate the card to be removed on the appropriate shelf.

b. Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.

c. Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

12 Open the locking levers on the replacement card.

a. Align the card with the slots in the shelf and gently slide the card into the shelf.

13 Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

NT6X44
SMS-R (continued)

    b. Close the locking levers.
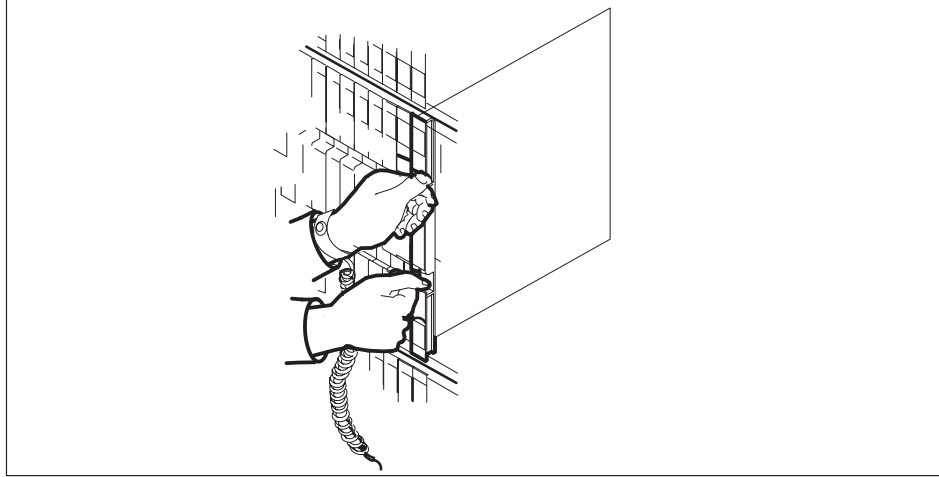
14 Use the following information to determine the next step in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 20
other	step 15

15 Test the inactive SMS–R unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If TST	Do
passes	step 16
fails	step 20

16 Return the inactive SMS–R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

NT6X44
SMS-R (end)

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 17
fails	step 21

At the frame

17 Remove the sign from the active SMS–R unit.

18 Send any faulty cards for repair according to local procedure.

19 Record the following items in office records according to local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

Go to step 22.

20 Return to *Alarm Clearing Procedures* section of this manual or other procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

21 Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

22 You have successfully completed this procedure. Remove the sign from the active unit and return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

23 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X69
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

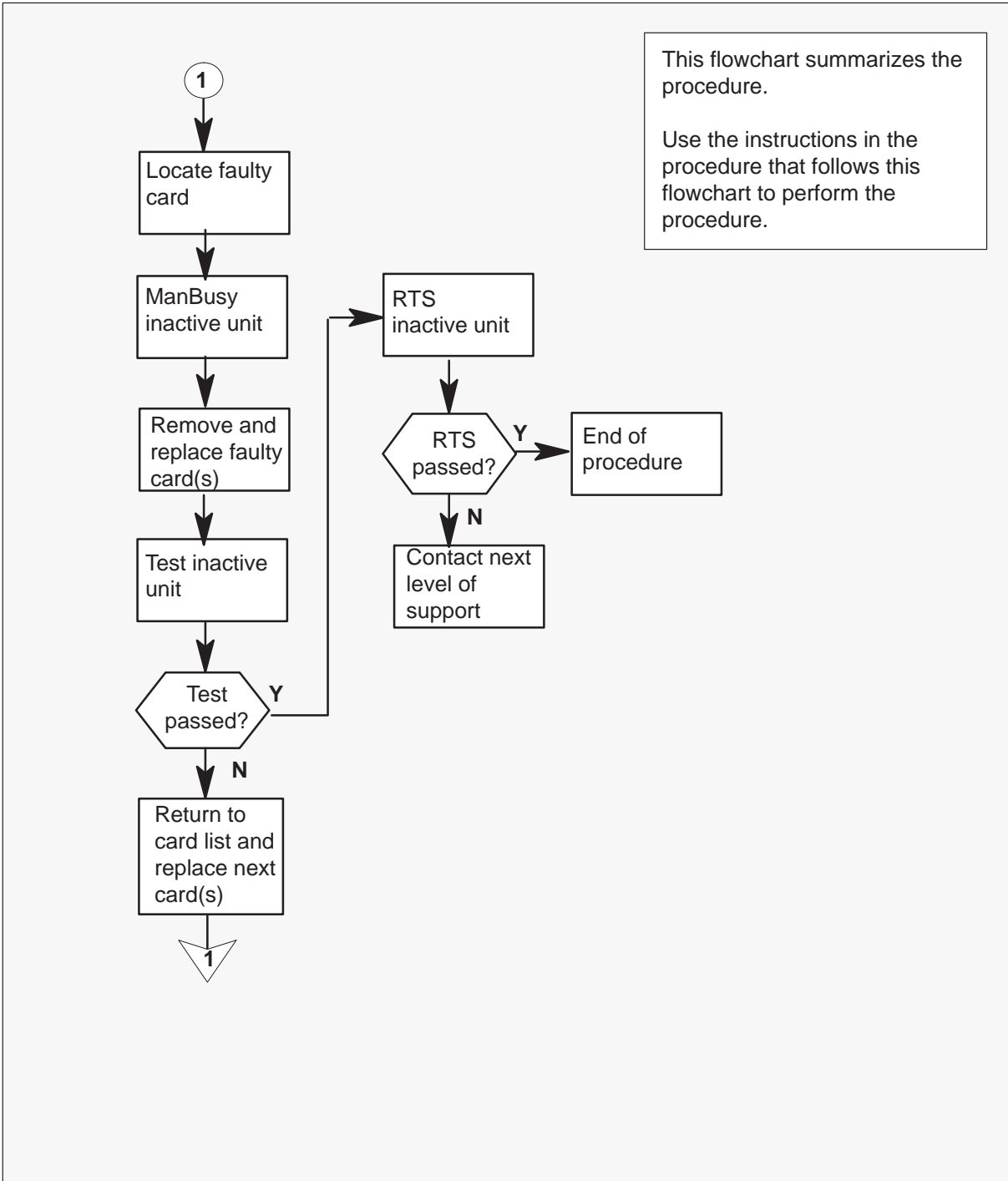| PEC	Suffixes	Name
NT6X69	AC, AD, QA	CPP Message Protocol and Tone Generator

Common procedures

None

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X69
SMS-R (continued)

Summary of card replacement procedure for an NT6X69 card in an SMS-R

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

```
        ( 1 )
          │
          ▼
  ┌─────────────┐
  │ Locate faulty│
  │ card         │
  └─────────────┘
          │
          ▼
  ┌─────────────┐      ┌─────────────┐
  │ ManBusy     │─────▶│ RTS         │
  │ inactive unit│      │ inactive unit│
  └─────────────┘      └─────────────┘
          │                    │
          ▼                    ▼
  ┌─────────────┐          ╱ RTS  ╲   Y   ┌─────────────┐
  │ Remove and  │         ⟨ passed? ⟩────▶│ End of      │
  │ replace faulty│        ╲      ╱        │ procedure   │
  │ card(s)     │              │ N        └─────────────┘
  └─────────────┘              ▼
          │              ┌─────────────┐
          ▼              │ Contact next│
  ┌─────────────┐        │ level of    │
  │ Test inactive│        │ support     │
  │ unit        │        └─────────────┘
  └─────────────┘
          │
          ▼
      ╱ Test  ╲   Y
     ⟨ passed? ⟩──────┘
      ╲      ╱
          │ N
          ▼
  ┌─────────────┐
  │ Return to   │
  │ card list and│
  │ replace next│
  │ card(s)     │
  └─────────────┘
          │
          ▽
          1
```

NT6X69
SMS-R (continued)

Replacing an NT6X69 card in an SMS-R

At your Current Location

1   Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

⚠ !	**Caution** **Loss of service** When replacing a card in the SMS–R, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP display

3   Access the PM level of the MAP display by typing

>MAPCI;MTC;PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMS–R to be posted

Example of a MAP response:

```
SMSR 3    INSV     LINKS_OOS    CSIDE 0      PSIDE 0
   Unit0      Act        InSv
   Unit1      InAct      ISTb
```

4   By observing the MAP display, ensure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5   Switch the activity of the units by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 25

6   Switch the activity of the unit by typing

>**YES**

and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed  Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7   Return to the alarm clearing procedure to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8   Put a sign on the active unit with the words: **"Active unit—Do not touch."**

At the MAP display

9   Busy the inactive PM unit by typing

>**BSY UNIT unit_no**

and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

NT6X69
SMS-R (continued)

10 Set the PM to the ROM level by typing

>**PMRESET UNIT unit_no NORUN**
and pressing the Enter key.

where

unit_no   is the number of the inactive SMS–R unit (0 or 1)

At the frame

11

> ⚠ **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS–R. This protects the equipment against damage caused by static electricity.

Put on a wrist strap.

12

> ⚠ **WARNING**
> **Equipment damage**
> Take the following precautions when removing or inserting a card:
> 1. Do not apply direct pressure to the components.
> 2. Do not force the cards into the slots.

Remove the NT6X69 card as shown in the following figures.

NT6X69
SMS-R (continued)

a.   Locate the card to be removed on the appropriate shelf.
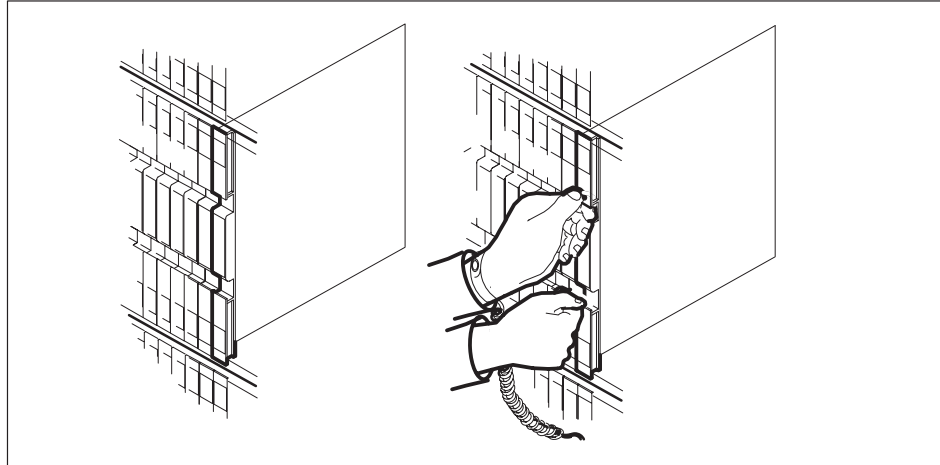
b.   Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.
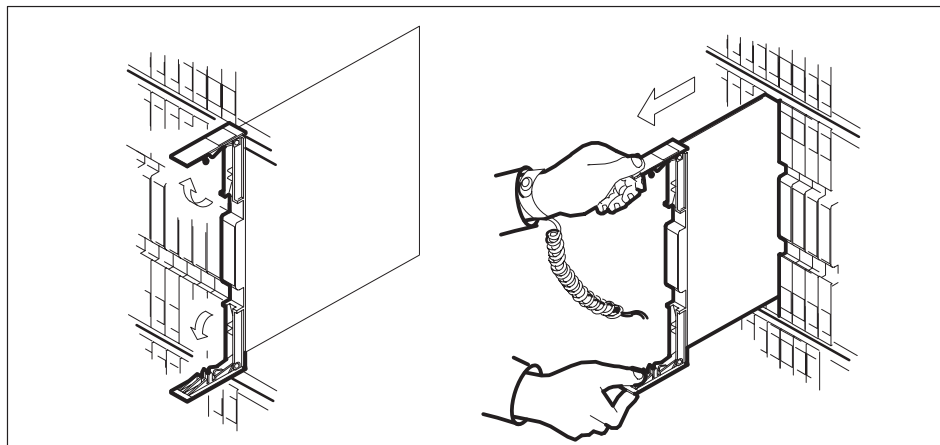
c.   Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

NT6X69
SMS-R (continued)

13

> ⚠ **Caution**
> **Loss of subscriber service**
> Subscriber service may be lost in the active unit when reseating the NT6X69 card. It is recommended that this procedure be performed during low traffic periods.

Open the locking levers on the replacement card.

a. Align the card with the slots in the shelf and gently slide the card into the shelf.
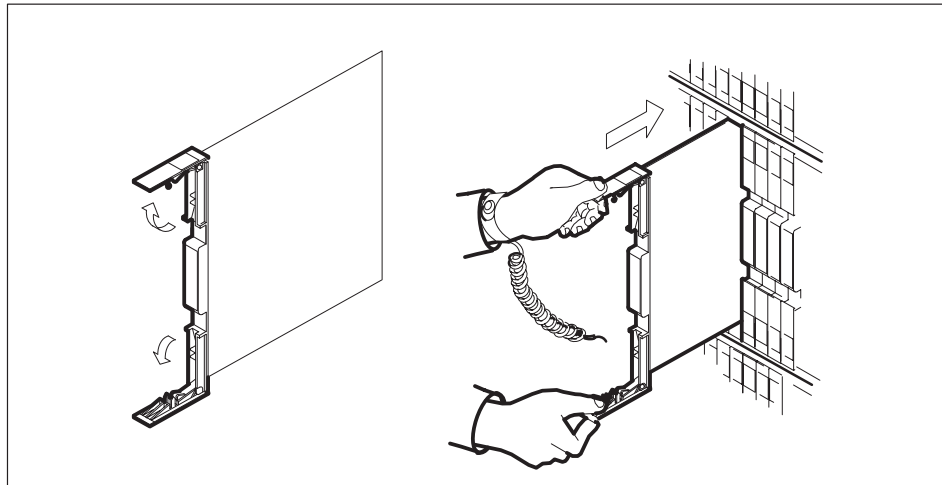
14 Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

b. Close the locking levers.
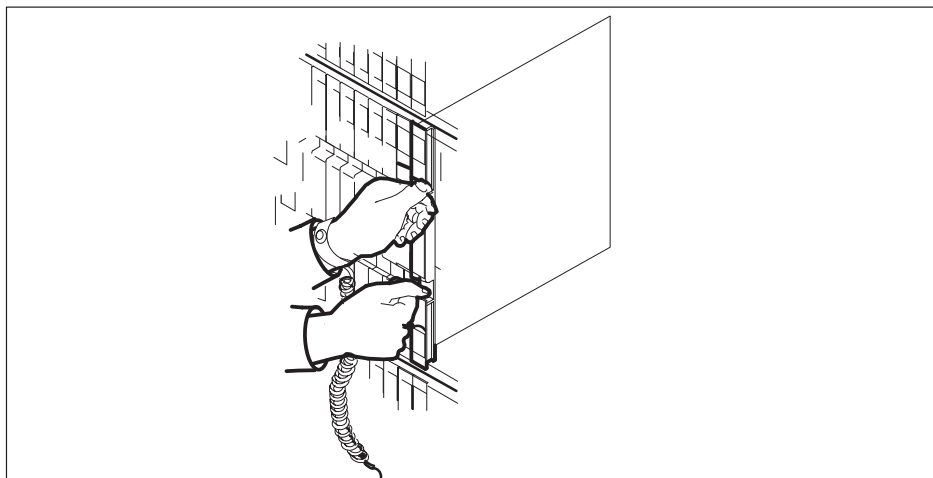
15 Use the following information to determine the next step in this procedure.

If you entered this procedure from	**Do**
alarm clearing procedures	step 22
other	step 17

At the MAP display

16 Perform a full reset of the inactive unit of the PM by typing

>PMRESET UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the inactive SMS–R unit (0 or 1)

17 Test the inactive SMS–R unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

NT6X69
SMS-R (continued)

If TST	Do
passes	step 18
fails	step 22

18 Return the inactive SMS–R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 19
fails	step 23

At the frame

19 Remove the sign from the active SMS–R unit.

20 Send any faulty cards for repair according to local procedure.

21 Record the following items in office records according to local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

Go to step 24.

22 Return to *Alarm Clearing Procedures* section of this manual or to the procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

23 Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

24 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X69
SMS-R (end)

25 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X80
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

PEC	Suffixes	Name
NT6X80	BA, BB	SCM Pad/Ring

Common procedures

Not applicable

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X80
SMS-R (continued)

Summary of card replacement procedure for an NT6X80 card in an SMS-R

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

① → Locate faulty card → ManBusy inactive unit → Remove and replace faulty card(s) → Test inactive unit → Test passed?

Test passed? — **Y** → RTS inactive unit → RTS passed? — **Y** → End of procedure

RTS passed? — **N** → Contact next level of support

Test passed? — **N** → Return to card list to replace next card(s) → ①

NT6X80
SMS-R (continued)

Replacing an NT6X80 card in an SMS-R

At your Current Location

1   Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or have been directed to this procedure by your maintenance support group.

2

> ⚠️ **CAUTION**
> **Loss of service**
> When replacing a card in the SMS–R, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

   Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

At the MAP display

3   Access the PM level of the MAP display by typing

   >MAPCI;MTC;PM;POST SMSR smsr_no
   and pressing the Enter key.

   where

   smsr_no   is the number of the SMSR to be posted

   Example of a MAP response

   ```
   SMSR 3   INSV     LINKS_OOS    CSIDE 0      PSIDE 0
      Unit0      Act        InSv
      Unit1      InAct      ISTb
   ```

4   By observing the MAP display, ensure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5   Switch the activity of the units by typing

   >SWACT
   and pressing the Enter key.

NT6X80
SMS-R (continued)

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 23

6 Switch the activity of the unit by typing

>YES
and pressing the Enter key.

The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
`SwAct passed`	step 8
`SwAct failed`	step 7
`SwAct failed.  Reason: XPM SwActback`	step 7
`SwAct refused by SwAct controller`	step 7

7 Return to the alarm clearing procedure to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8 Put a sign on the active unit with the words: **"Active unit—Do not touch."**

At the MAP display

9 Busy the inactive PM unit by typing

>BSY UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

NT6X80
SMS-R (continued)

At the frame

10

> ⚠️ **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS–R. This protects the equipment against damage caused by static electricity.

> ⚠️ **WARNING**
> **Equipment damage**
> Take the following precautions when removing or inserting a card:
> 1. Do not apply direct pressure to the components.
> 2. Do not force the cards into the slots.

Put on a wrist strap.

11 Remove the NT6X80 card as shown in the following figures.

   a. Locate the card to be removed on the appropriate shelf.
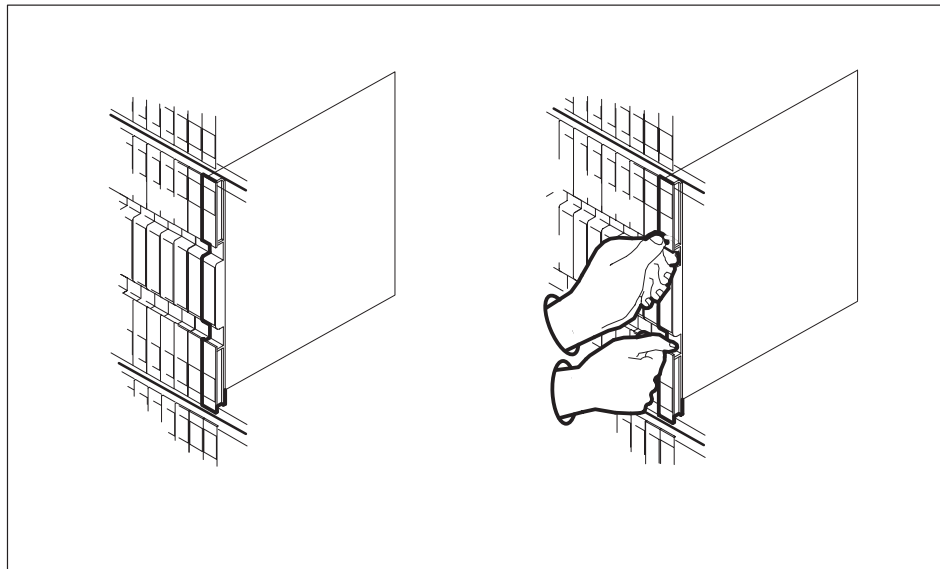
b.   Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.
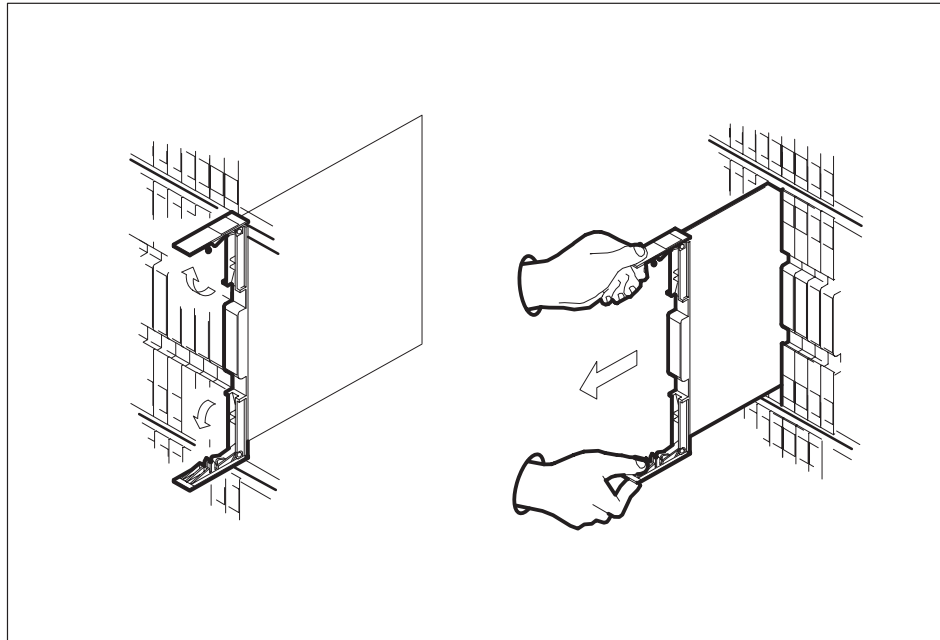
c.   Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

NT6X80
SMS-R (continued)

12 Open the locking levers on the replacement card.

   a. Align the card with the slots in the shelf and gently slide the card into the shelf.

13 Seat and lock the card.

   a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

b. Close the locking levers.

14 Use the following information to determine the next step in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 17
other	step 15

15 Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit
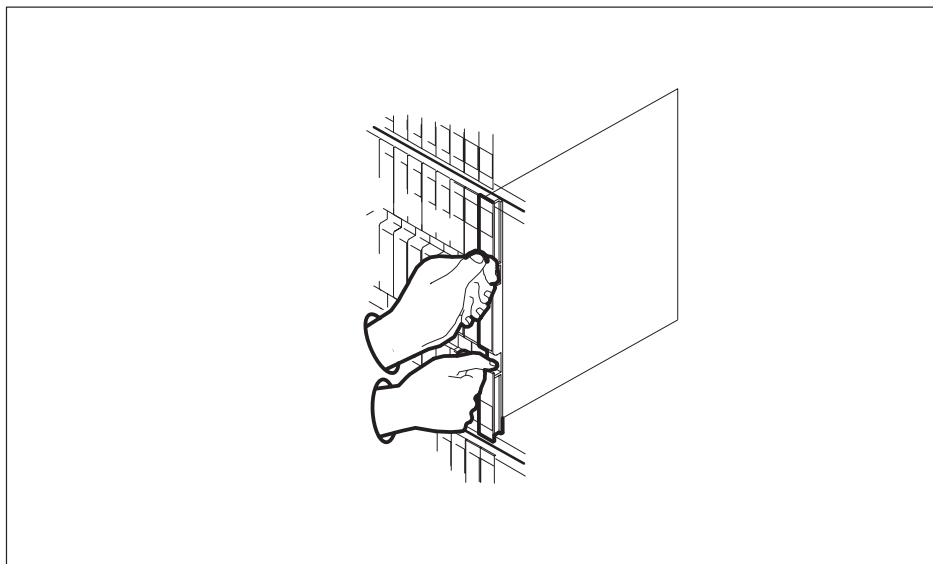
If TST	Do
passes	step 16
fails	step 17

NT6X80
SMS-R (end)

16 Return the inactive SMS–R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 19
fails	step 18

17 Return to *Alarm Clearing Procedures* section of this manual or to the procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

18 Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

 At the frame

19 Remove the sign from the active SMS–R unit.

20 Send any faulty cards for repair according to local procedure.

21 Note the following in office records according to local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

22 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

23 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT6X85
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

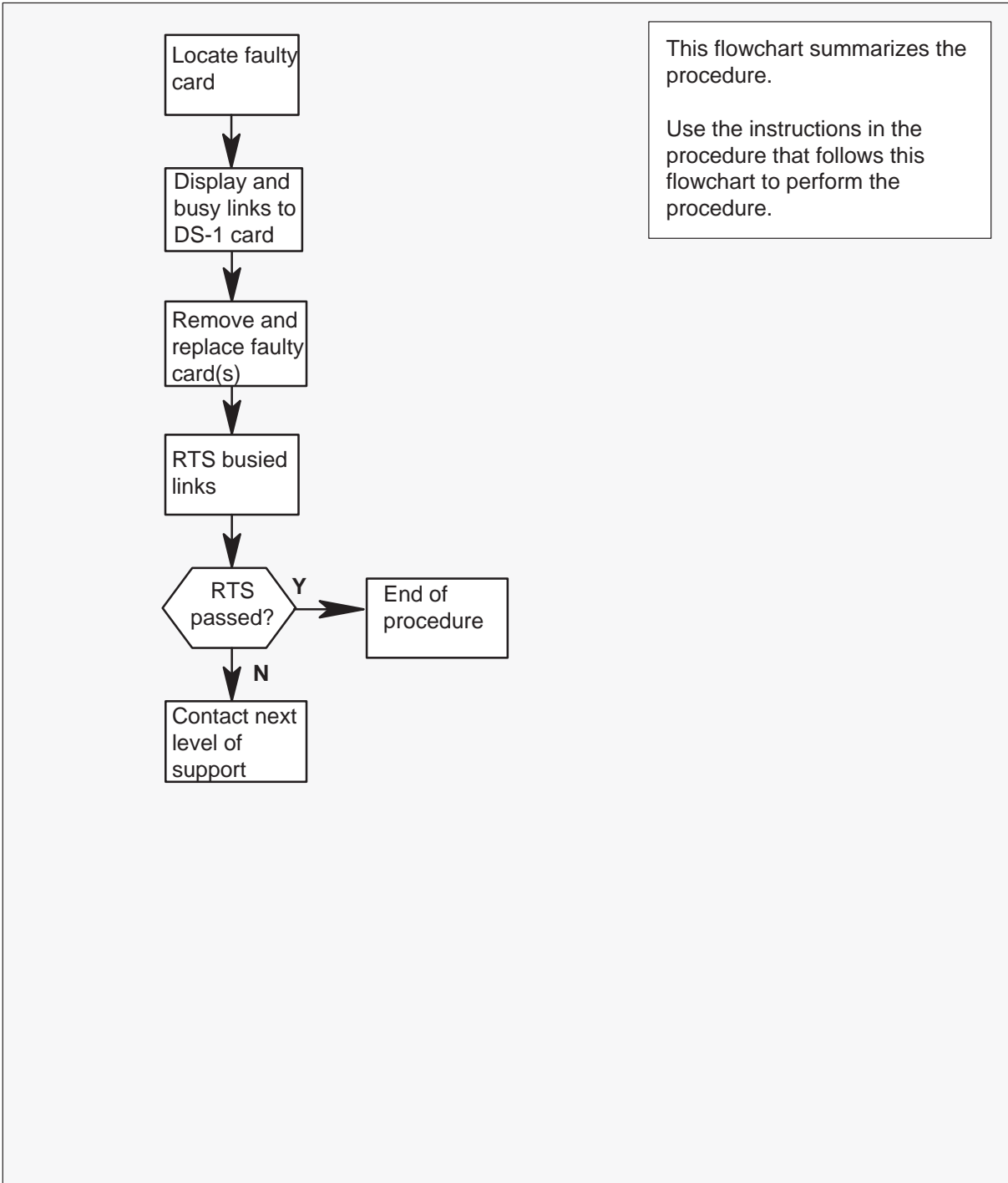| PEC	Suffixes	Name
NT6X85	AA, AB	DS-1 Interface for SLC-96

Common procedures

None

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X85
SMS-R (continued)

Summary of card replacement procedure for an NT6X85 card in an SMS-R

Locate faulty card

↓

Display and busy links to DS-1 card

↓

Remove and replace faulty card(s)

↓

RTS busied links

↓

RTS passed? —**Y**→ End of procedure

↓ **N**

Contact next level of support

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

NT6X85
SMS-R (continued)

Replacing an NT6X85 card in an SMS-R

At your Current Location

1 Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2 Obtain a replacement card. Ensure that the replacement card has the same product engineering code (PEC) including suffix, as the card to be removed and the dual in-line package (DIP) switch settings are set the same as the card being replaced.

At the MAP display

3 Access the PM level of the MAP display by typing

   >MAPCI;MTC;PM;POST SMSR smsr_no
   and pressing the Enter key.

   where

   smsr_no   is the number of the SMS-R to be posted
   Example of a MAP response:

```
 SMSR 3    INSV     LINKS_OOS    CSIDE 0      PSIDE 1
    Unit0      Act        InSv
    Unit1      InAct      ISTb
```

NT6X85
SMS-R (continued)

4   Display the DS-1 links associated with the faulty DS-1 interface card by typing

   >TRNSL P
   and pressing the Enter key.

   Record all link numbers, information on faulty links, and any protection line information. Each 6X85 card has two ports; for instance, ports 0 and 1 are on one 6X85 card. Look at the link, RCS location, and port numbers in the following MAP display. The first line indicates that link 0 is routed to RCS location BRCS 00 0. Link 0 is a protection line.

   Example of a MAP response:

   ```
   LINK 0: RCS     BRCS 00 0   ;Protline;
   LINK 1: RCS     BRCS 00 1   ;Protline;
   LINK 2: RCS     BRCS 00 2   0;CAP MS;STATUS:OK   ;MSGCOND:OPN
   LINK 3: RCS     BRCS 00 2   1;CAP MS;STATUS:SysB  ;MSGCOND:CLS
   ```

If	Do
no protection lines recorded in step 4	step 9
one protection line recorded in step 4	step 5
two or more protection lines recorded in step 4	step 7

5   Access the carrier level of the MAP display by typing

   >TRKS;CARRIER;POST SMSR smsr_no link_no
   and pressing the Enter key.

   where

   smsr_no   is 0–127 range for NT40 and 0–255 range for DMS SuperNode.
   link_no   is the number of a protection line connected to the faulty card.

   Note: This command ensures that a protection line will be displayed.

   Example of a MAP response:

   ```
   CLASS      ML   OS    ALARM    SYSB    MANB UNEQ OFFL CBSY PBSY INSV
   TRUNKS     2    0     4        1       0    22   5    0    0    255
   REMOTE     1    1     3        5       1    0    0    1    0    10

   N   CLASS  SITE  SMS  CK  D ALARM  SLIP FRME   BER  ES  SES  STATE
   0   REMOTE BRSC  0    2   C         0    0   <-7   0    0  SysB
   ```

NT6X85
SMS-R (continued)

6 Proceed to step 8.

7 Access the carrier level of the MAP display by typing

>TRKS;CARRIER;POST SMSR smsr_no link_no SMSR smsr_no link_no ...
and pressing the Enter key.

where

smsr_no   is 0–127 for NT40 and 0–255 for DMS SuperNode.
link_no   is the number of a protection line connected to the faulty card.

Note: As many as five SMS–R smsr_no link_no commands can be executed in a string command, with spacing as shown in the command string above.

Note: This command ensures that a protection line will be displayed.

Example of a MAP response:

```
CLASS      ML   OS    ALARM    SYSB    MANB UNEQ OFFL CBSY PBSY INSV
TRUNKS     2    0     4        1       0    22   5    0    0    255
REMOTE     1    1     3        5       1    0    0    1    0    10

N   CLASS   SITE  SMS  CK  D ALARM   SLIP FRME   BER  ES  SES   STATE
0   REMOTE  BRSC  0    2   C         0    0   <-7   0    0   SysB
1   REMOTE  BRSC  0    3   C         0    0   <-7   0    0   SysB
```

8 Busy the protection line or lines connected to the faulty NT6X85 card by typing

>BSY n
and pressing the Enter key.

where

n   is the number of the protection line connected to the faulty NT6X85 card
Protection line numbers are listed in the **NO** column in the MAP display in step 7 above. Repeat this busy command for each protection line connected to the faulty card.

If	Do
both protection lines busied on same NT6X85 card	step 11
one protection line on NT6X85 card busied and other line on same card is unprotected	step 9

NT6X85
SMS-R (continued)

9   Access the PM level of the MAP display by typing

>PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMS–R to be posted
Example of a MAP response:

```
SMSR 3   INSV    LINKS_OOS   CSIDE 0    PSIDE 2
   Unit0     Act     InSv
   Unit1     InAct   ISTb
```

10   Busy all links connected to the faulty NT6X85 card by typing

>BSY LINK n
and pressing the Enter key.

where

n   is the number of the link connected to the faulty NT6X85 card.

Note: Repeat this command for each link to the faulty card.

At the frame

11

> **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and
> connect it to the wrist strap grounding point on the left side
> of the frame supervisory panel of the SMS-R. This
> protects the equipment against damage caused by static
> electricity. Do not replace more than one NT6X85 card at a
> time.

> **WARNING**
> **Equipment damage**
> Take the following precautions when removing or
> inserting a card:
> 1. Do not apply direct pressure to the components.
> 2. Do not force the cards into the slots.

Put on a wrist strap.

12   Remove the NT6X85 card as shown in the following figures.

   a.   Locate the card to be removed on the appropriate shelf.
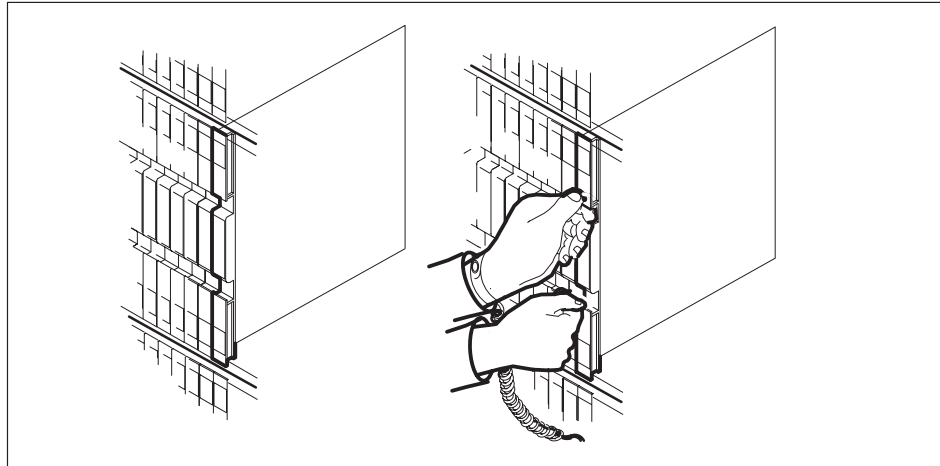
   b.   Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.
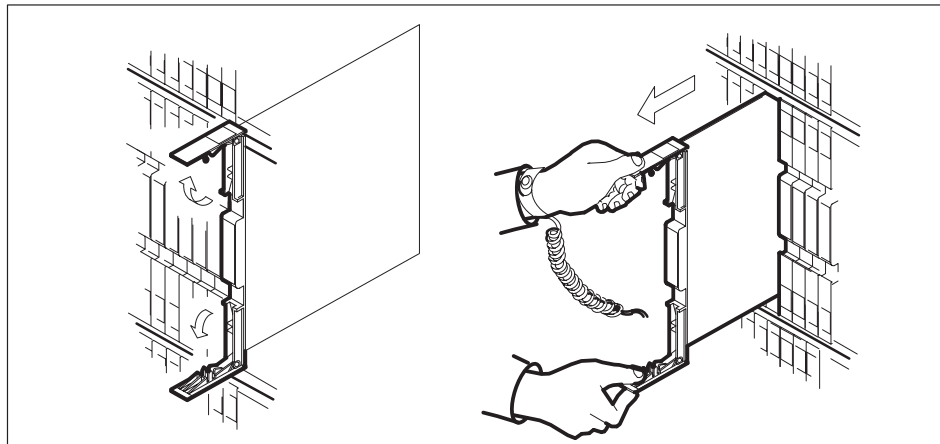
   c.   Verify that the replacement card has the same PEC including suffix, as the card you just removed.

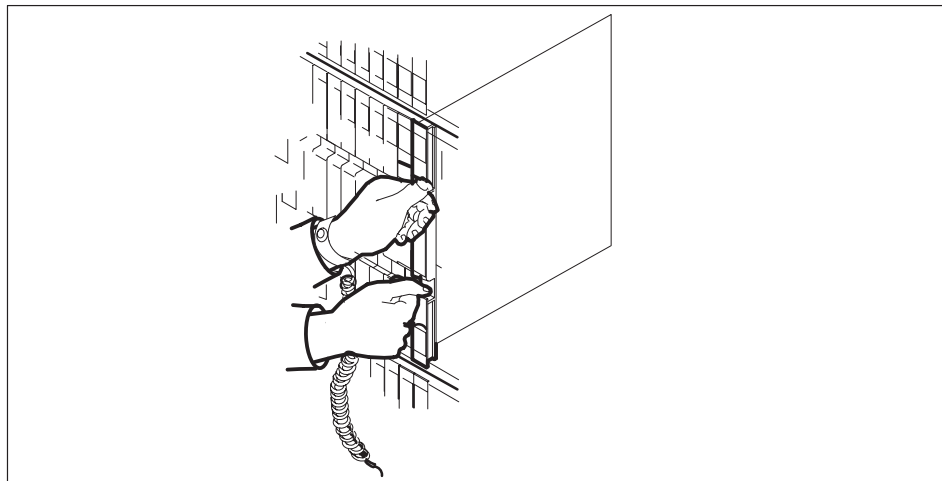**13**   Open the locking levers on the replacement card.

NT6X85
SMS-R (continued)

    a. Align the card with the slots in the shelf and gently slide the card into the shelf.
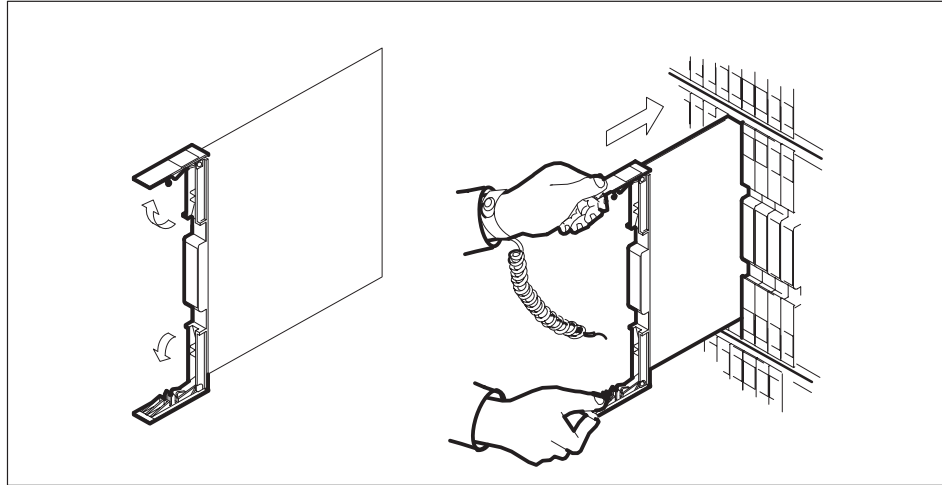
    14 Seat and lock the card.

        a. Align the card with the slots in the shelf and gently slide the card into the shelf.

        b. Close the locking levers.

NT6X85
SMS-R (continued)

At the MAP display

15 Return all busied protection lines to service by typing

If	Do
one protection line busied in step 8 and you're at PM level	step 5, then step 15
two protection lines busied in step 8 and you're at carrier level	step 15

>RTS   n
and pressing the Enter key.

where

n   is the number of the link connected to the new NT6X85 card
   Note: Repeat this command for each busied protection line.

If	Do
no protection line returned to service	step 17
one protection line returned to service and another link was busied at the PM level	step 9, then step 16
two protection lines returned to service	step 18

16 Return all busied links to service by typing

>RTS LINK n
and pressing the Enter key.

where

n   is the number of the link connected to the new NT6X85 card
   Note: Repeat this command for each busied protection line.

If RTS	Do
passes	step 18
fails	step 17

NT6X85
SMS-R (end)

17 Contact the appropriate support personnel if busied links do not return to service.

18 Send any faulty cards for repair according to local procedure.

19 Note the following in office records according to local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

20 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

NT6X86
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

PEC	Suffixes	Name
NT6X86	AA, AB	A-Bit Message Card

Common procedures

Not applicable

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT6X86
SMS-R (continued)

Summary of card replacement procedure for an NT6X86 card in an SMS-R

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

1

Locate faulty card

↓

ManBusy inactive unit

↓

Remove and replace faulty card(s)

↓

Test inactive unit

↓

Test passed?

Y → RTS inactive unit

N ↓

Return to card list to replace next card(s)

↓

1

RTS inactive unit

↓

RTS passed?

Y → End of procedure

N ↓

Contact next level of support
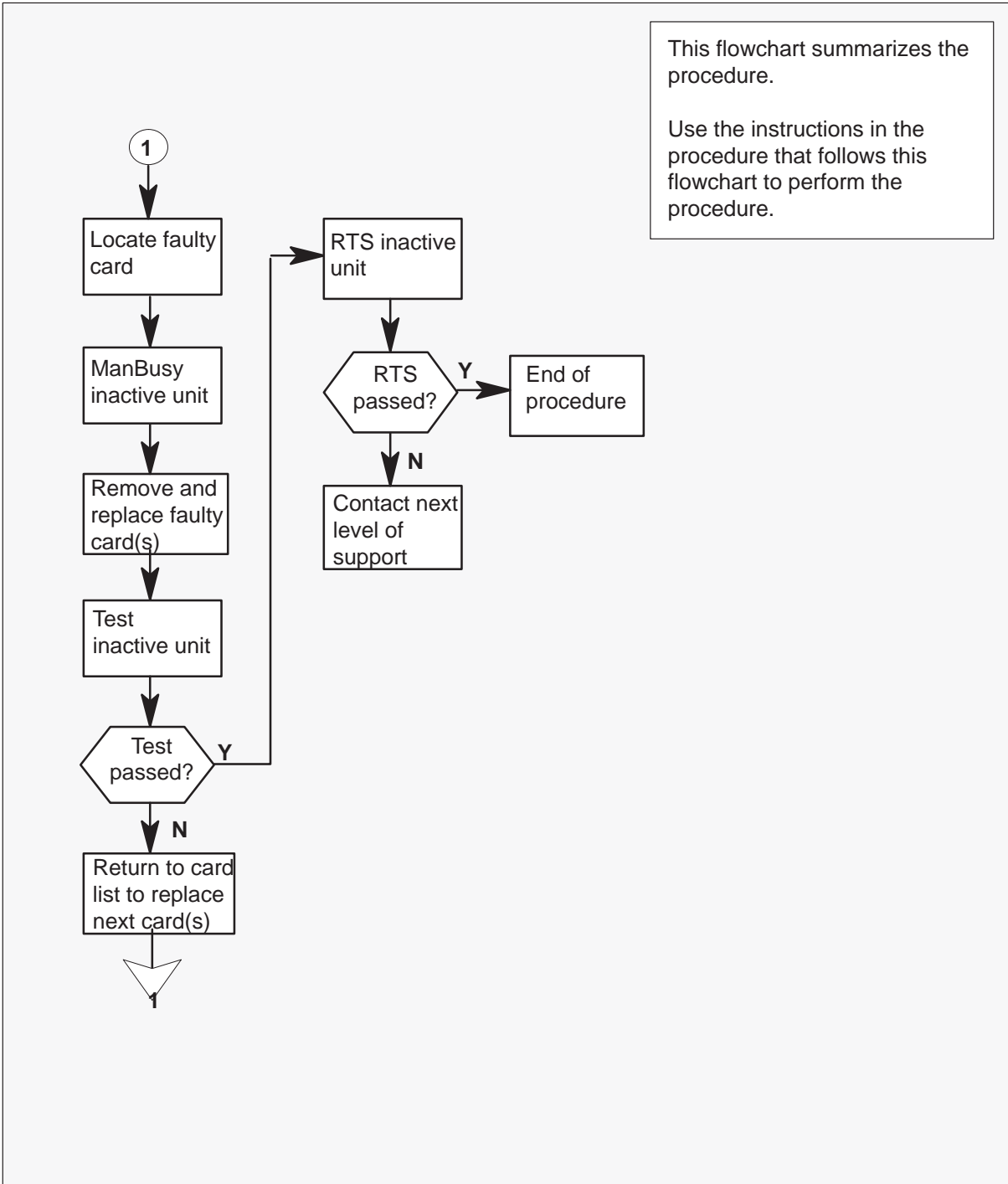
Replacing an NT6X86 card in an SMS-R

At your Current Location

1   Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

> ⚠ **CAUTION**
> **Loss of service**
> When replacing a card in the SMS–R, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card to be removed.

Note: When the SMS peripheral is equipped with XPM PLUS (NTMX77AA Unified Processor), the NT6X86AB card is required. The 6X86AB is backward compatible and can be used with the Master Processor/Signal Processor (MP/SP) complex (NT6X45, 6X46, 6X47). The 6X86AA version can be used only in MP/SP SMSs and *cannot* be used in XPM PLUS equipped SMSs. When replacing the NT6X86 card, ensure the correct card is replaced with the appropriate AA or AB version.

At the MAP display

3   Access the PM level of the MAP display by typing

>MAPCI;MTC;PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMSR to be posted

Example of a MAP response

```
 SMSR 3    INSV     LINKS_OOS    CSIDE 0     PSIDE 0
    Unit0      Act       InSv
    Unit1      InAct     ISTb
```

NT6X86
SMS-R (continued)

4   By observing the MAP display, ensure that the card to be removed is on the
    inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

5   Switch the activity of the units by typing

    >SWACT
    and pressing the Enter key.

    The system determines the type of SWACT it can perform and displays a
    confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 23

6   Switch the activity of the unit by typing

    >YES
    and pressing the Enter key.

    The system runs a pre-SWACT audit to determine the ability of the inactive unit
    to accept activity reliably.

    Note: A maintenance flag appears when maintenance tasks are in progress.
    Wait until the flag disappears before proceeding with the next maintenance
    action.

If the message is	Do
SwAct passed	step 8
SwAct failed	step 7
SwAct failed. Reason: XPM SwActback	step 7
SwAct refused by SwAct controller	step 7

NT6X86
SMS-R (continued)

7   Return to the alarm clearing procedure to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8   Put a sign on the active unit with the words: **"Active unit—Do not touch."**

At the MAP display

9   Busy the inactive PM unit by typing

 >BSY UNIT unit_no
 and pressing the Enter key.

 where

 unit_no   is the number of the faulty SMS–R unit

At the frame location

10

> **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS–R. This protects the equipment against damage caused by static electricity.

> **WARNING**
> **Equipment damage**
> Take the following precautions when removing or inserting a card:
> 1 Do not apply direct pressure to the components.
> 2 Do not force the cards into the slots.

 Put on a wrist strap.

11   Remove the NT6X86 card as shown in the following figures.

NT6X86
SMS-R (continued)

    a. Locate the card to be removed on the appropriate shelf.
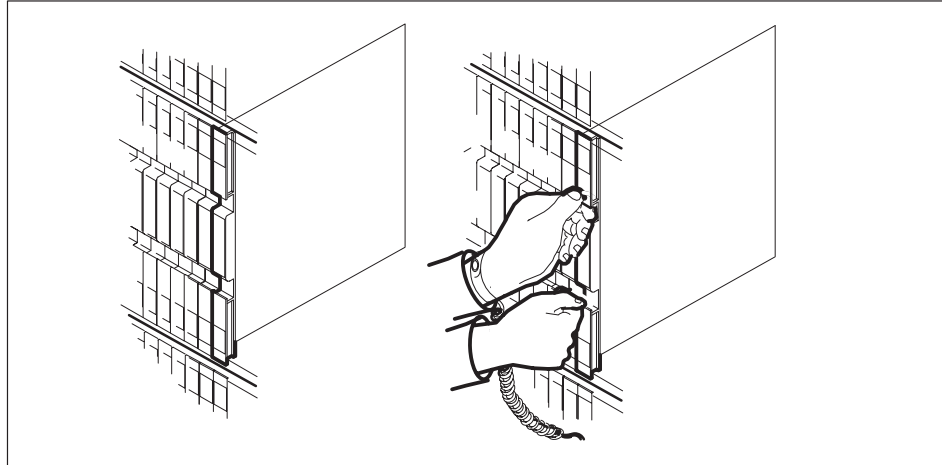
    b. Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.
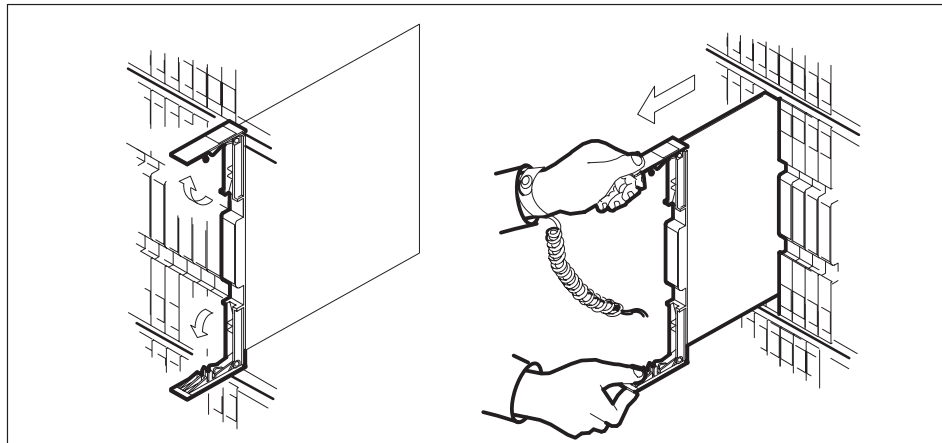
    c. Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

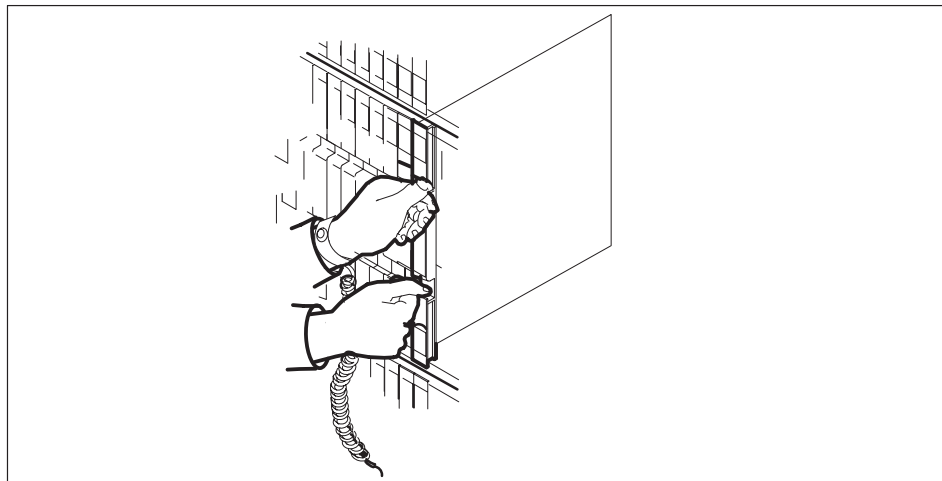 **12** Open the locking levers on the replacement card.

NT6X86
SMS-R (continued)

    a.   Align the card with the slots in the shelf and gently slide the card into the shelf.
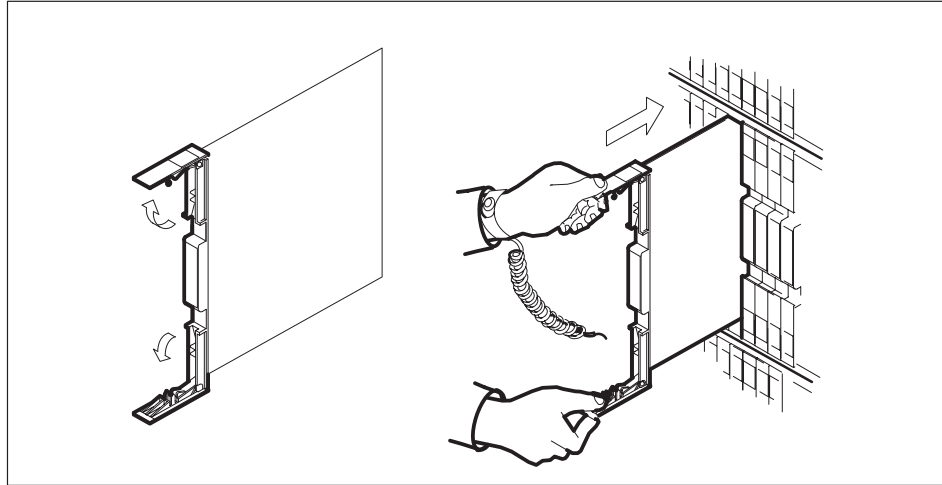
13 Seat and lock the card.

    a.   Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

    b.   Close the locking levers.

NT6X86
SMS-R (continued)

14   Use the following information to determine what step to go to next in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 17
other	step 15

15   Test the inactive unit by typing

>TST UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If TST	Do
passes	step 16
fails	step 17

16   Return the inactive SMS–R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 19
fails	step 18

17   Return to *Alarm Clearing Procedures* section of this manual or to the procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

18   Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

At the frame

19   Remove the sign from the active SMS–R unit.

20   Send any faulty cards for repair according to local procedure.

21   Note the following in office records according to local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

22   You have successfully completed this procedure. Remove the sign from the active unit and return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

23   For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT7X05
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

PEC	Suffixes	Name
NT7X05	AA	Peripheral remote loader

Common procedures

None

Action

The following flowchart is a summary of the procedure. To replace the card, use the instructions in the procedure that follows the flowchart.

NT7X05
SMS-R (continued)

Summary of card replacement procedure for an NT7X05 card in an RSC SMS-R
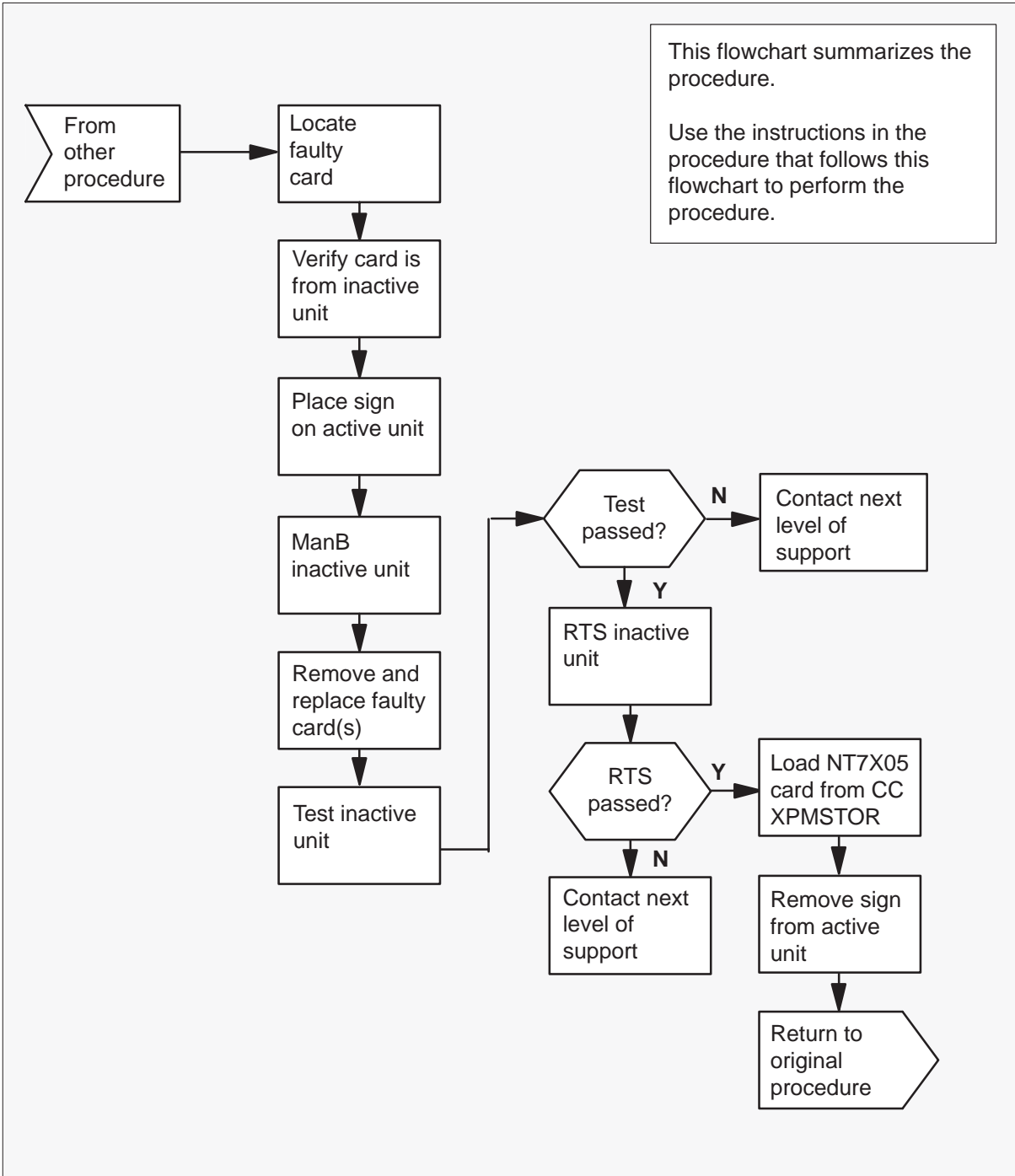
NT7X05
SMS-R (continued)

Replacing an NT7X05 card in an SMS-R

At your Current Location

1   Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

> **CAUTION**
> **Loss of service**
> When replacing a card in the SMS-R ensure the unit where you are replacing the card is INACTIVE and the mate unit is ACTIVE.

Obtain a replacement card. Ensure the replacement card has the same product equipment code (PEC) including suffix, as the card to be removed.

At the MAP display

3   Access the PM level and post the SMS-R by typing

>MAPCI;MTC;PM;POST SMS-R sms-r_no
and pressing the Enter key.

where

sms-r_no   is the number of the SMS-R to be busied

Example of a MAP display:

```
    CM    MS    IOD    Net    PM    CCS    LNS    Trks    Ext    APPL
    .     .     .      .    1SMS-R    .      .      .      .      .

SMS-R               SysB     ManB     OffL     CBsy     ISTb     InSv
 0 Quit    PM        0        0        2        0        2       25
 2 Post_   SMS-R     0        0        0        0        1        1
 3 ListSet
 4         SMS-R     0 ISTb  Links_OOS:  CSide  0, PSide   0
 5 TRNSL_  Unit0:   Inact ISTb
 6 TST_    Unit1:   Act   InSv
 7 BSY_
 8 RTS_
 9 OffL
10 LoadPM_
11 Disp_
12 Next
13
14 QueryPM
15
16 IRLINK
17 Perform
18
```

4   By observing the MAP display, be sure the card to be removed is on the inactive unit.

If the faulty card is on an	Do
ACTIVE unit	step 5
INACTIVE unit	step 8

5   Switch the processing activity to the inactive unit by typing

>SWACT
and pressing the Enter key.

The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 21

NT7X05
SMS-R (continued)

6   Switch the activity of the unit by typing

   >YES

   and pressing the Enter key.

   The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

   Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
SWACT passed	step 8
SWACT failed	step 7
SWACT failed	step 7
Reason: XPM SWACTback	
SWACT refused by SWACT controller	step 7

7   Return to the *Alarm Clearing Procedure*, to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8   Put a sign on the active unit bearing the words **Active unit—Do not touch.**

At the MAP display

9   Busy the inactive SMS-R unit by typing

   >BSY INACTIVE

   and pressing the Enter key.

NT7X05
SMS-R (continued)

At the frame

10

> ⚠ **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS-R. This protects the equipment against damage caused by static electricity.
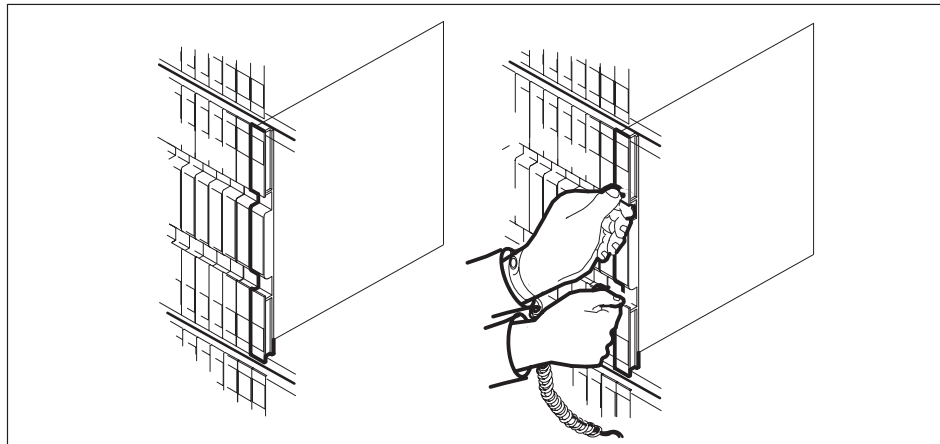
> ⚠ **WARNING**
> **Equipment damage**
> Take the following precautions when removing or inserting a card:
> 1. Do not apply direct pressure to the components.
> 2. Do not force the cards into the slots.

Put on a wrist strap.

11 Remove the NT7X05 card as shown in the following figures.

 a. Locate the card to be removed on the appropriate shelf.

NT7X05
SMS-R (continued)

b. Open the locking levers on the card to be replaced and gently pull the card towards you until it clears the shelf.

c. Ensure the replacement card has the same PEC, including suffix, as the card you just removed.

12 Open the locking levers on the replacement card.

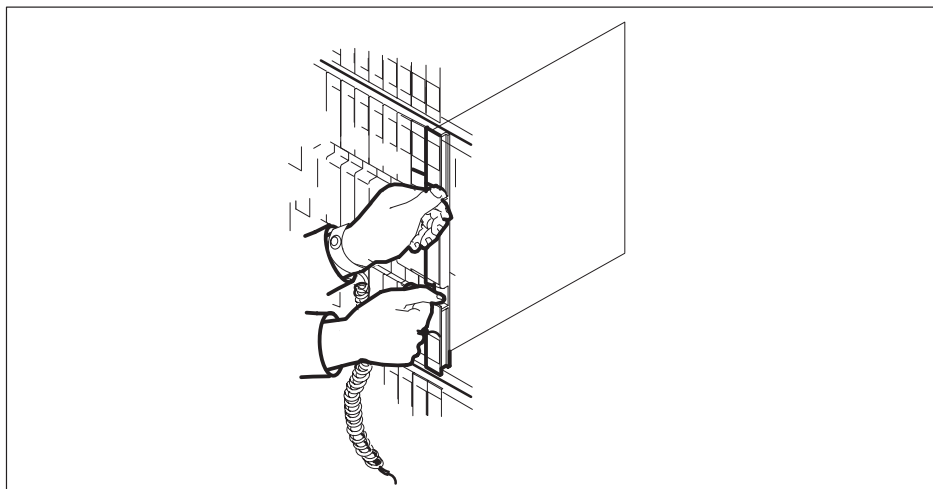a. Align the card with the slots in the shelf and gently slide the card into the shelf.

13 Seat and lock the card.

a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure the card is fully seated in the shelf.

b.   Close the locking levers.

At the MAP display

14   Test the inactive SMS-R unit by typing

>TST UNIT sms-r_unit_no
and pressing the Enter key.

where

sms-r_unit_no   is the number of the inactive SMS-R unit

Example of a MAP response:

```
Test Passed
```
or
```
Test Failed
```

If TST	Do
passed	step 15
failed	step 19

15   Return the inactive SMS-R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the SMS-R unit (0 or 1) tested in step 14

16 Load the inactive SMS-R unit by typing

>**LOADPM INACTIVE CC [load_file_name]**
and pressing the Enter key.

If load	Do
passed	step 17
failed	step 19

17 Send any faulty cards for repair according to local procedure.

18 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

Go to step 20.

19 Obtain further assistance in replacing this card by contacting personnel responsible for higher level of support.

20 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

21 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NT8X18
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

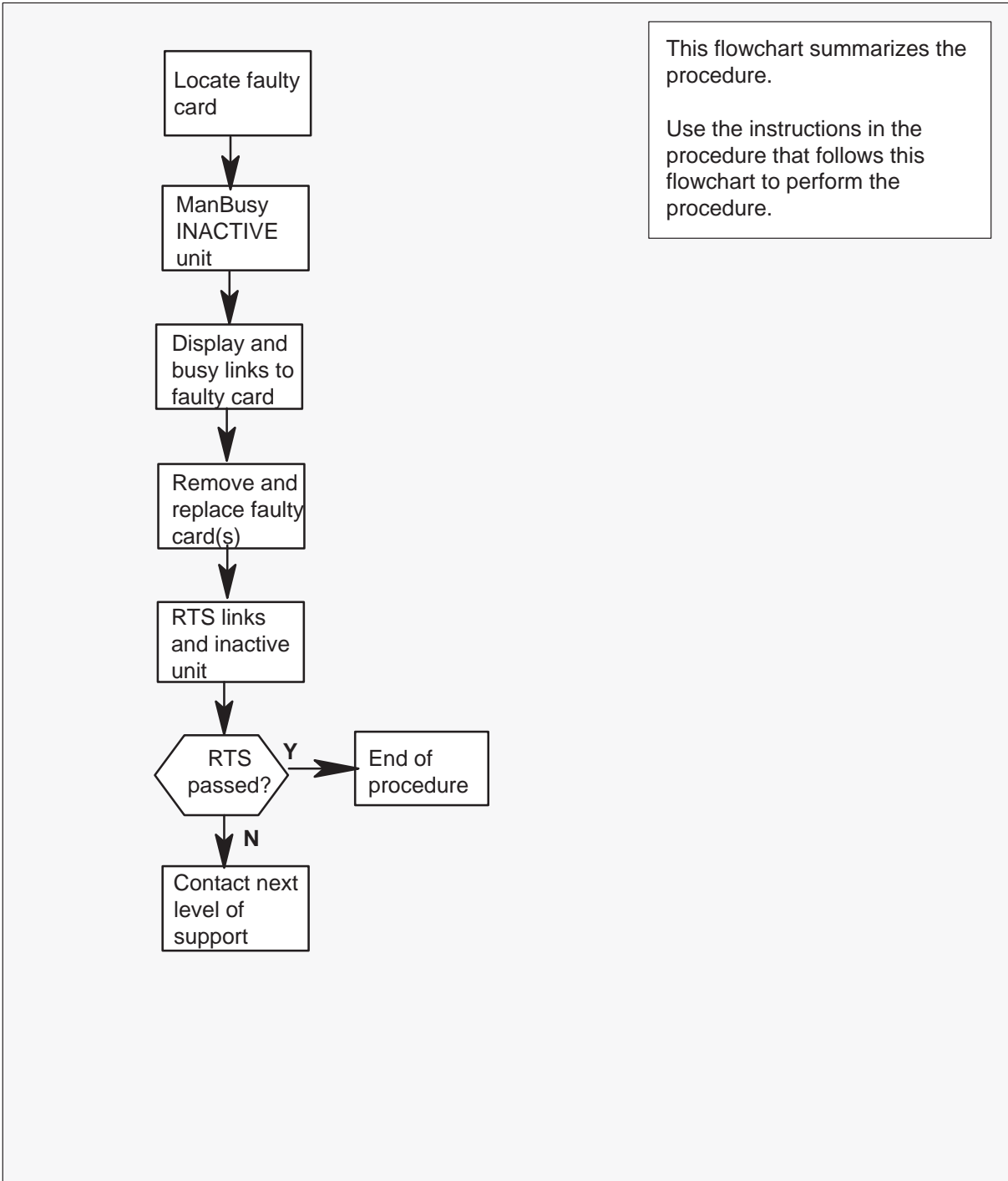| PEC	Suffixes	Name
NT8X18	BA	SCM DS30A Interface

Common procedures

Not applicable

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.

NT8X18
SMS-R (continued)

Summary of card replacement procedure for an NT8X18 card in an SMS-R

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

Locate faulty card

↓

ManBusy INACTIVE unit

↓

Display and busy links to faulty card

↓

Remove and replace faulty card(s)

↓

RTS links and inactive unit

↓

RTS passed? —**Y**→ End of procedure

↓ **N**

Contact next level of support

Replacing an NT8X18 in an SMS-R

At your current location

1   Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure to verify or accept cards, or were directed to this procedure by your maintenance support group.

2

<table>
<tr><td>⚠</td><td>

CAUTION
Loss of service
When replacing a card in the SMS–R, ensure that the unit in which you are replacing the card is inactive and that the mate unit is active.

</td></tr>
</table>

Obtain a replacement card. Verify that the replacement card has the same product engineering code (PEC), including suffix, as the card that is to be removed.

At the MAP display

3   Access the PM level of the MAP display by typing

>MAPCI;MTC;PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMS–R to be posted

Example of a MAP response

```
SMSR 3   INSV    LINKS_OOS    CSIDE 0     PSIDE 0
   Unit0     Act       InSv
   Unit1     InAct     ISTb
```

4   By observing the MAP display, ensure that the card to be removed is on the inactive unit.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NT8X18
SMS-R (continued)

5   Switch the activity of the units by typing

   >SWACT

   and pressing the Enter key.

   The system determines the type of SWACT it can perform and displays a confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 29

6   Switch the activity of the unit by typing

   >YES

   and pressing the Enter key.

   The system runs a pre-SWACT audit to determine the ability of the inactive unit to accept activity reliably.

   Note: A maintenance flag appears when maintenance tasks are in progress. Wait until the flag disappears before proceeding with the next maintenance action.

If the message is	Do
SwAct passed	step 8
SwAct failed	step 7
SwAct failed. Reason: XPM SwActback	step 7
SwAct refused by SwAct controller	step 7

7   Return to the alarm clearing procedure to clear the alarm condition on the inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the frame

8   Put a sign on the active unit with the words: **"Active unit—Do not touch."**

At the MAP display

9   Busy the inactive SMS–R unit by typing

   >BSY UNIT unit_no

   and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

10   Identify the RCC associated with the inactive SMS–R unit by typing

>TRNSL C
and pressing the Enter key.

Example of a MAP response

```
LINK 0:RCC 1   6;Cap MS;Status:OK    ;MsgCond:SPC,Restricted
LINK 1:RCC 1   7;Cap  S;Status:OK
LINK 2:RCC 1   8;Cap MS;Status:OK    ;MsgCond:OPN,Unrestricted
LINK 3:RCC 1   9;Cap  S;Status:OK
```

Record the number of the RCC associated with the inactive SMS–R unit. In
this example, RCC 1 is associated with the inactive SMS–R unit.

11   Access the RCC you just identified by typing

>POST RCC unit_no
and pressing the Enter key.

where

unit_no   is the number of the RCC unit

Example of a MAP response

```
 RCC 1    INSV     LINKS_OOS     CSIDE 0     PSIDE 0
   Unit0      Act        InSv
   Unit1     InAct       InSv
```

12   Display the RCC's P-side links connected to the inactive SMS–R unit by typing

>TRNSL P
and pressing the Enter key.

Example of a MAP response

```
 LINK    0:  RMM  4        0;Cap    MS;Status:OK   MsgCond:OPN
LINK 2:   Carrier of Class-Trunk;Status:OK
LINK 3:   Carrier of Class-Trunk;Status:OK
LINK 6:   SMSR 0   0;Cap    MS:Status:OK   MsgCond:SPC,Restricted
LINK 7:   SMSR 0        1;Cap     S:Status:OK
LINK 8:   SMSR 0    2;Cap    MS:Status:OK   MsgCond:OPN,Unrestricted
LINK 9:   SMSR 0           3;Cap     S:Status:OK
```

NT8X18
SMS-R (continued)

Record the link numbers of the links connected to the inactive SMS–R unit. SMS–R links 0 and 1 always correspond to SMS–R unit 0. SMS–R links 2 and 3 always correspond to SMS–R unit 1. Since SMS–R unit 0 was busied earlier in this procedure, the RCC's P-side links 6 and 7 should be busied in this example.

13

> ⚠ **CAUTION**
> **Loss of subscriber service**
> If the DMS-100 switch displays a message at the MAP terminal indicating the number of active calls on the SMS–R's C-side link to be busied, determine by local policy if these calls should be disconnected and respond accordingly to the confirmation request.

Busy the RCC's P-side links associated with the NT8X18 by typing

>BSY LINK link_no
and pressing the Enter key.

where

link_no   is the number of the link connected to the faulty NT8X18 card

See the note below, then repeat this command for each link to the faulty card.

Note: When the user enters the command string BSY LINK link_no, the system checks for active calls on the link. If there are active calls on the link, the first MAP display response identified below is displayed (where ## is the number of active calls). After the first MAP display response indicating the number of active calls, the user is prompted whether to continue. The response (Yes or No) must be based on operating company policy. If the user responds *Yes*, then the active calls will be disconnected. However, if there are no calls active on the link (as indicated by the second response), then the link is busied.

Example of a MAP response

```
## active calls may be lost
            or
There are no calls active on the link
```

At the frame

14

> ⚠ **WARNING**
> **Static electricity damage**
> Before removing any cards, put on a wrist strap and connect it to the wrist strap grounding point on the left side of the frame supervisory panel of the SMS–R. This protects the equipment against damage caused by static electricity. Do not replace more than one 8X18 card at a time.
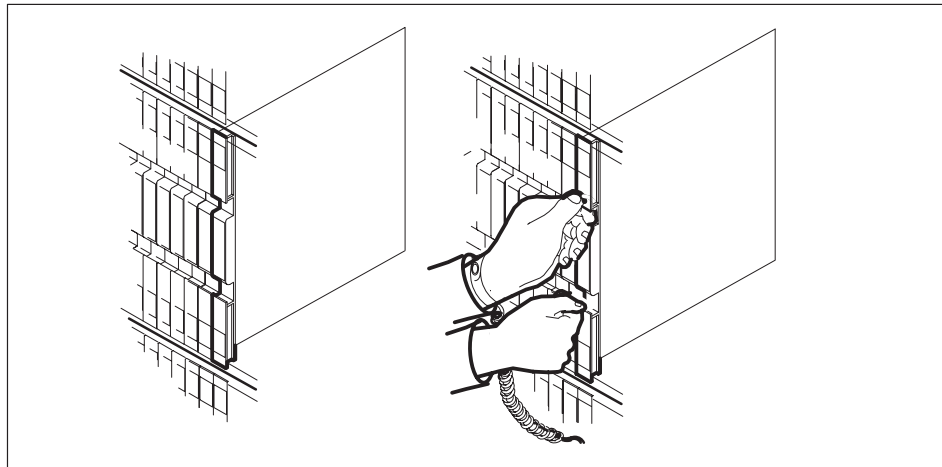
> ⚠ **WARNING**
> **Equipment damage**
> Take the following precautions when removing or inserting a card:
> 1. Do not apply direct pressure to the components.
> 2. Do not force the cards into the slots.

Put on a wrist strap.

15 Remove the NT8X18 card as shown in the following figures.

a. Locate the card to be removed on the appropriate shelf.
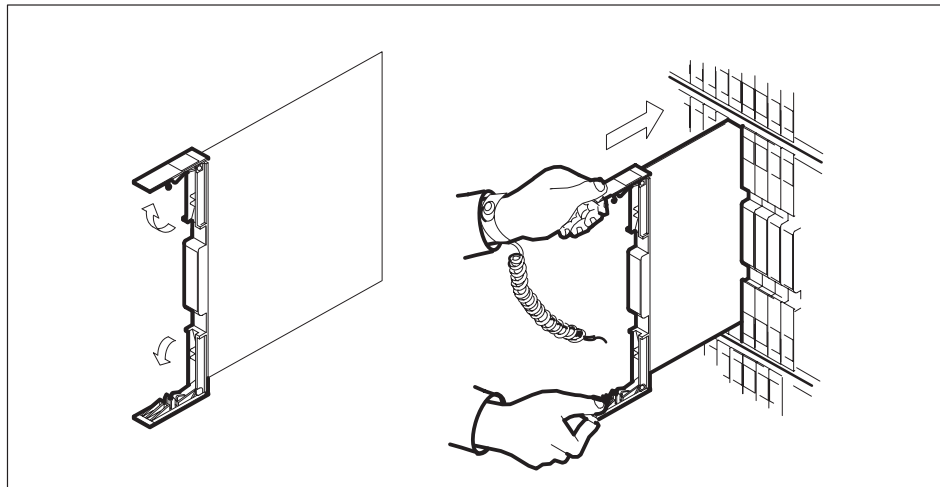
NT8X18
SMS-R (continued)

b. Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.
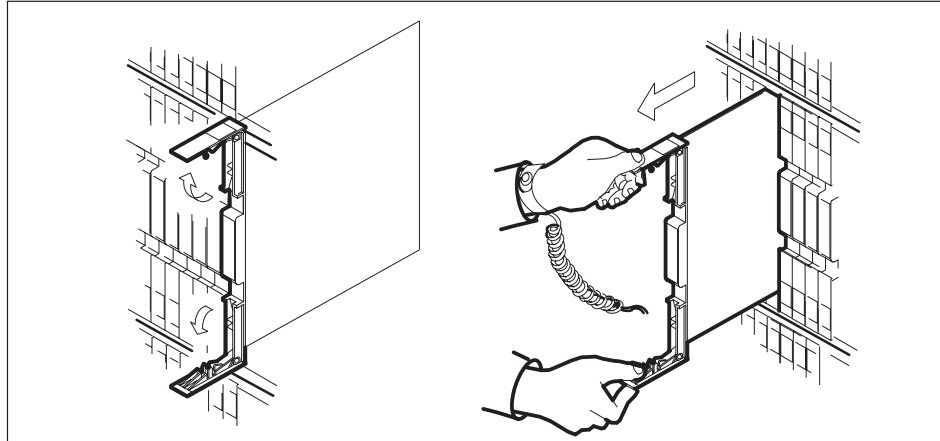
c. Verify that the replacement card has the same PEC, including suffix, as the card you just removed.

16 Open the locking levers on the replacement card.

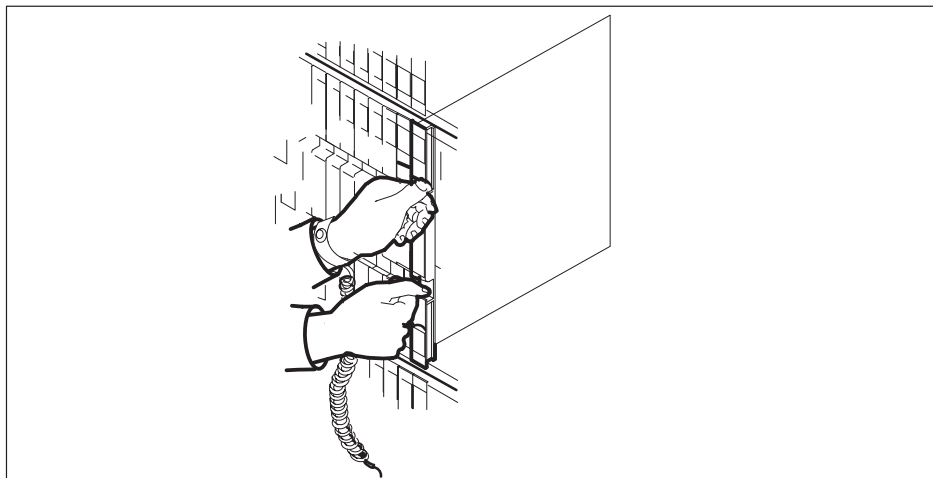Align the card with the slots in the shelf and gently slide the card into the shelf.

17 Seat and lock the card.

Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure that the card is fully seated in the shelf.

Close the locking levers.

18   Use the following information to determine the next step in this procedure.

If you entered this procedure from	Do
alarm clearing procedures	step 26
other	step 19

At the MAP display

19   Test the busied P-side links by typing

>TST link_no
and pressing the Enter key.

where

link_no   is the number of the busied link connected to the faulty NT8X18 card

Repeat this command for each busied link to the faulty card.

If TST	Do
passes	step 20
fails	step 27

NT8X18
SMS-R (continued)

20 Return the busied P-side links to service by typing

>RTS link_no
and pressing the Enter key.

where

link_no   is the number of the busied link connected to the faulty NT8X18 card

Repeat this command for each busied link to the faulty card.

If RTS	Do
passes	step 21
fails	step 27

21 Access the inactive SMS–R unit by typing

>POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMS–R to be posted

Example of a MAP response

```
SMSR 3    INSV    LINKS_OOS    CSIDE 0    PSIDE 0
   Unit0    InAct    ManB
   Unit1     Act     InSv
```

22 Return the inactive SMS–R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS–R unit

If RTS	Do
passes	step 23
fails	step 27

At the frame

23 Remove the sign from the active SMS–R unit.

24 Send any faulty cards for repair according to local procedure.

25 Note the following in office records according to local policy:

- the date the card was replaced
- the serial number of the card
- the symptoms that prompted replacement of the card

Proceed to step 28.

26 Return to *Alarm Clearing Procedures* section of this manual or to the procedure that directed you to this procedure. At the point where a faulty card list was produced, identify the next faulty card on the list and go to the appropriate card replacement procedure for that card in this manual.

27 Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

28 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

29 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

NTMX77
SMS-R

Application

Use this procedure to replace the following card in an SMS-R.

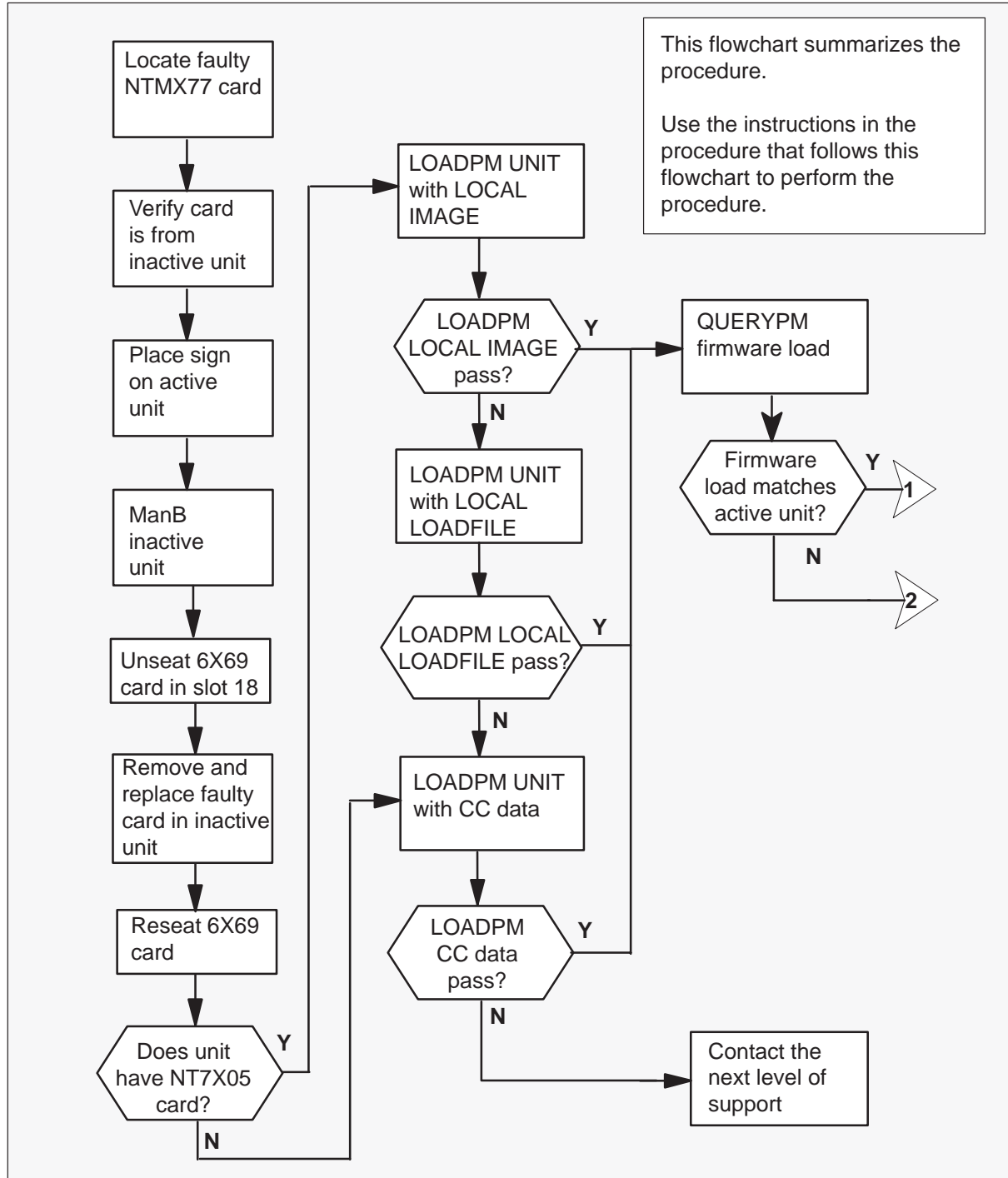| PEC	Suffixes	Name
NTMX77	AA	Unified Processor (UP)

Common procedures

Not applicable

Action

The following flowchart is only a summary of the procedure. To replace the card, use the instructions in the step-action procedure that follows the flowchart.
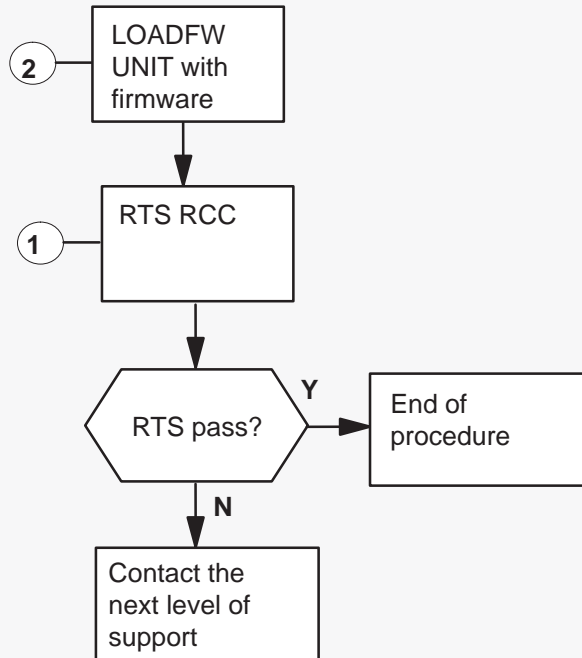
NTMX77
SMS-R (continued)

Summary of card replacement procedure for an NTMX77 card in an SMS-R

```
┌──────────────┐
│ Locate faulty│
│ NTMX77 card  │
└──────┬───────┘
       │
       ▼
┌──────────────┐          ┌──────────────┐     This flowchart summarizes the
│ Verify card  │          │ LOADPM UNIT  │     procedure.
│ is from      │─────────▶│ with LOCAL   │
│ inactive unit│          │ IMAGE        │     Use the instructions in the
└──────┬───────┘          └──────┬───────┘     procedure that follows this
       │                         │             flowchart to perform the
       ▼                         ▼             procedure.
┌──────────────┐          ┌──────────────┐          ┌──────────────┐
│ Place sign   │          │ LOADPM       │   Y      │ QUERYPM      │
│ on active    │          │ LOCAL IMAGE  │─────────▶│ firmware load│
│ unit         │          │ pass?        │          └──────┬───────┘
└──────┬───────┘          └──────┬───────┘                 │
       │                         │ N                        ▼
       ▼                         ▼                   ┌──────────────┐
┌──────────────┐          ┌──────────────┐           │ Firmware     │  Y    ▷ 1
│ ManB         │          │ LOADPM UNIT  │           │ load matches │──────▶
│ inactive     │          │ with LOCAL   │           │ active unit? │
│ unit         │          │ LOADFILE     │           └──────┬───────┘
└──────┬───────┘          └──────┬───────┘                  │ N
       │                         │                           ▷ 2
       ▼                         ▼
┌──────────────┐          ┌──────────────┐  Y
│ Unseat 6X69  │          │ LOADPM LOCAL │─────────┐
│ card in slot │          │ LOADFILE pass?│        │
│ 18           │          └──────┬───────┘         │
└──────┬───────┘                 │ N               │
       │                         ▼                 │
       ▼                  ┌──────────────┐         │
┌──────────────┐          │ LOADPM UNIT  │◀────────┘
│ Remove and   │          │ with CC data │
│ replace faulty│         └──────┬───────┘
│ card in inactive│              │
│ unit         │                 ▼
└──────┬───────┘          ┌──────────────┐  Y
       │                  │ LOADPM       │──────────┐
       ▼                  │ CC data      │          │
┌──────────────┐          │ pass?        │          │
│ Reseat 6X69  │          └──────┬───────┘          │
│ card         │                 │ N                 │
└──────┬───────┘                 ▼                   │
       │                  ┌──────────────┐           │
       ▼                  │ Contact the  │           │
┌──────────────┐  Y       │ next level of│           │
│ Does unit    │──────┐   │ support      │           │
│ have NT7X05  │      │   └──────────────┘           │
│ card?        │      │                              │
└──────┬───────┘      │                              │
       │ N            │                              │
       └──────────────┴──────────────────────────────┘
```

NTMX77
SMS-R (continued)

Summary of card replacement procedure for an NTMX77 card in an SMS-R

Replacing an NTMX77 card in an SMS-R

At your Current Location

1   Proceed only if you were either directed to this card replacement procedure from a step in a maintenance procedure, are using the procedure for verifying or accepting cards, or were directed to this procedure by your maintenance support group.

2

CAUTION
Loss of service
When replacing a card in the SMS-R, ensure the unit where you are replacing the card is inactive and the mate unit is active.

Obtain a replacement card. Ensure that the replacement card has the same product equipment code (PEC), including suffix, as the card that is to be removed.

At the MAP terminal

3   Access the PM level of the MAP terminal by typing

>MAPCI;MTC;PM;POST SMSR smsr_no
and pressing the Enter key.

where

smsr_no   is the number of the SMS-R to be posted

Example of a MAP display response

```
SMSR      SysB  ManB  Offl  CBsy  ISTb  InSv
    PM      3     0     1     0     2    13
    SMSR    0     0     0     0     1     7

SMSR 0 ISTb  Links_OOS:  CSide 0, PSide 0
Unit0:  Act    ISTb
Unit1:  Inact InSv
```

4   To verify that the faulty NTMX77AA card is in the inactive unit, ensure that the LED labeled Active is off or observe the MAP display.

If faulty card is on	Do
active unit	step 5
inactive unit	step 8

NTMX77
SMS-R (continued)

5   Switch the activity of the units by typing

    >SWACT

    and pressing the Enter key.

    The system determines the type of SWACT it can perform and displays a
    confirmation prompt for the selected SWACT.

If SWACT	Do
can continue at this time	step 6
cannot continue at this time	step 32

6   Switch the activity of the unit by typing

    >YES

    and pressing the Enter key.

    The system runs a pre-SWACT audit to determine the ability of the inactive unit
    to accept activity reliably.

    Note: A maintenance flag appears when maintenance tasks are in progress.
    Wait until the flag disappears before proceeding with the next maintenance
    action.

If the message is	Do
SwAct passed	step 8
SwAct failed	step 7
SwAct failed. Reason: XPM SwActback	step 7
SwAct refused by SwAct controller	step 7

7   Return to the *Alarm Clearing Procedures* to clear the alarm condition on the
    inactive unit. When the alarm is cleared, return to step 1 of this procedure.

At the SMS-R frame

8   Put a sign on the active unit bearing the following words: **"Active unit–Do not
    touch."**

NTMX77
SMS-R (continued)

At the MAP terminal

9   Busy the inactive SMS-R unit by typing

>**BSY UNIT unit_no**
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS-R unit

10   Set the PM to the ROM level by typing

>**PMRESET UNIT unit_no NORUN**
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS-R unit busied in step 9

At the SME frame

11

WARNING
Static electricity damage
Before removing any cards, put on a wrist strap and
connect it to the wrist strap grounding point on the left
side of the frame supervisory panel of the SMU. This
protects the equipment against damage caused by
static electricity.

Put on a wrist strap.

NTMX77
SMS-R (continued)

12

WARNING
Equipment damage
Take these precautions when removing or inserting a card:
1. Do not apply direct pressure to the components.
2. Do not force the cards into the slots.

CAUTION
Service disruption
If the message interface card NT6X69 is not unseated, the active unit will go out-of-service, which will interrupt call processing.

Unseat the NT6X69 card in slot 18.

13

CAUTION
Service disruption
If the replacement MX77 card you are installing has dip switch S1, ensure dip switch S1 is in the XPM position. If switch S1 is not in the XPM position, the active unit will go out-of-service, which will interrupt call processing.

Remove the NTMX77 card as shown in the following figures.

NTMX77
SMS-R (continued)

a. Locate the card to be removed on the appropriate shelf.
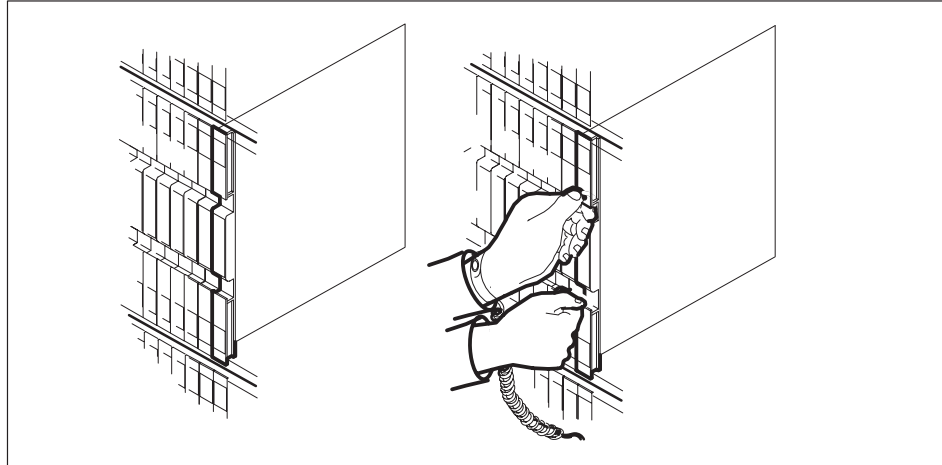
b. Open the locking levers on the card to be replaced and gently pull the card toward you until it clears the shelf.
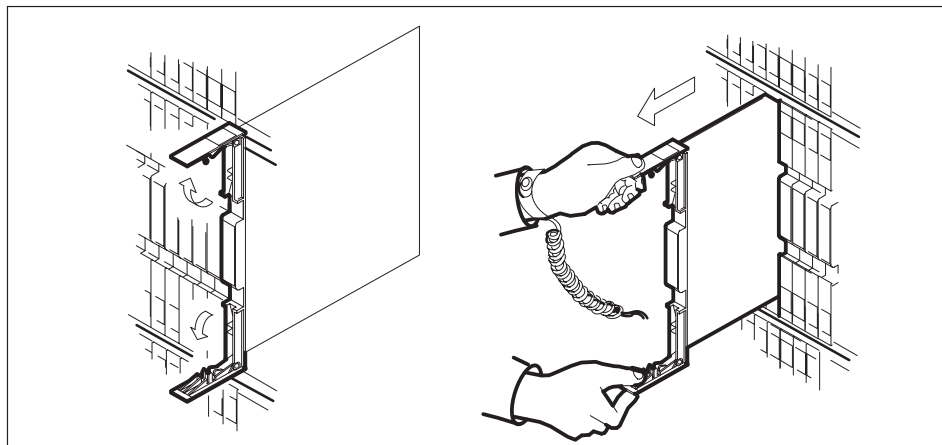
c. Ensure the replacement card has the same PEC, including suffix, as the card you just removed. Also ensure that all replacement card dip switch settings match settings of the card just removed. Ensure that dip switch S1 (if equipped) is in the XPM position.

14 Open the locking levers on the replacement card.

NTMX77
SMS-R (continued)

15 Align the card with the slots in the shelf and gently slide the card into the shelf.
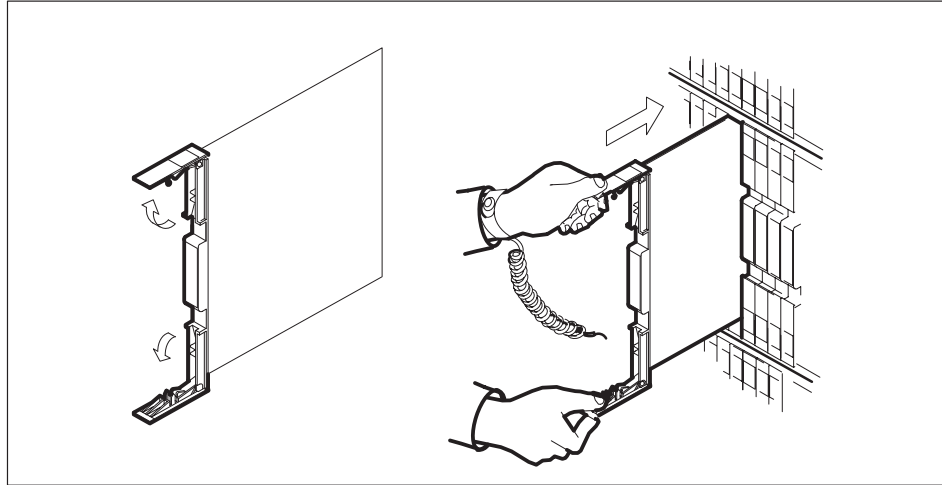
16 Seat and lock the new NTMX77 card.

    a. Using your fingers or thumbs, push on the upper and lower edges of the faceplate to ensure the card is fully seated in the shelf.

    b. Close the locking levers.
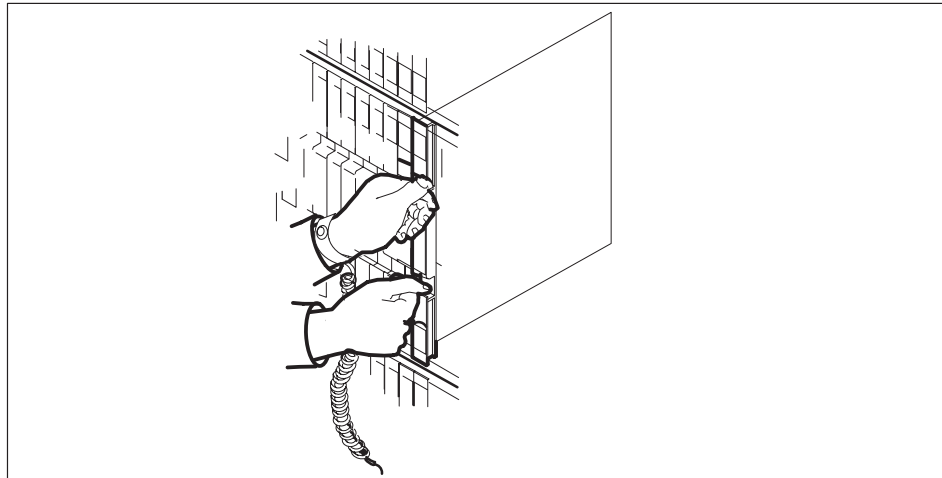
17 Reseat the NT6X69 card in slot 18.

NTMX77
SMS-R (continued)

At the MAP terminal

18 The peripheral remote loader (PRL) card (NT7X05) allows local loading of the
SMS-R data. Local data loading reduces recovery time. Check if the NT7X05
card is provisioned by typing:

>QUERYPM FILES
and pressing the Enter key.

Example of a MAP display:

```
    CM    MS    IOD    Net    PM    CCS    LNS    Trks    Ext    APPL
     .     .     .      .    1SMSR   .      .      .       .      .

  SMSR           SysB     ManB     OffL     CBsy     ISTb     InSv
  0 Quit    PM    2        0        2        0        2       25
  2 Post    SMSR  1        0        0        0        1        1
  3 ListSet
  4         SMSR    0 ISTb  Links_OOS:  CSide  0,  PSide   0
  5 TRNSL_  Unit 0:  Inact ManB
  6 TST_    Unit 1:  Act   InSv
  7 BSY_
  8 RTS_    QUERYPM files
  9 OffL    Unit 0:
 10 LoadPM_    NT7X05 load File: ESR06BD
 11 Disp_      NT7X05 Image File:ESR06BD
 12 Next_      CMR Load: CMR03A
 13 SwAct   Unit 1:
 14 QueryPM    NT7X05 load File: ESR06BD
 15            NT7X05 Image File:ESR06BD
 16            CMR LOad: CMR03A
 17 Perform
 18                                     NT7X05 image file_name
```

Note: If the NT7X05 card is not provisioned the MAP response is:

Example of a MAP response:

```
Nt7X05 not datafilled,  QueryPm files invalid
```

If the NT7X05 card is	Do
provisioned	step 19
not provisioned	step 21

NTMX77
SMS-R (continued)

19 Load the SMS-R from the local image by typing

>**LOADPM UNIT unit_no LOCAL IMAGE**
and pressing the Enter key.

where

smsr_unit_no   is the number of the inactive SMS-R unit

If the load	Do
passed	step 25
failed	step 20

20

WARNING
Possible service interruption
The LOCAL LOADFILE option of the LOADPM
command has a parameter of [<file> string}], if this
file_name parameter is used, the loadfile named in the
parameter will be used which is not patched. Do not
use this parameter unless the NOPATCH option of the
loadfile is desired.

Load the SMS-R from the local loadfile by typing

>**LOADPM UNIT unit_no LOCAL LOADFILE**
and pressing the Enter key.

where

smsr_unit_no   is the number of the inactive SMS-R unit

If the load	Do
passed	step 25
failed	step 21

21 After replacing the faulty card, load the inactive SMS-R unit by typing

>LOADPM UNIT unit_no CC
and pressing the Enter key.

where

unit_no   is the number of the faulty SMS-R unit busied in step 9

If the load	Do
passes	step 22
fails	step 28

22 Query the SMS-R counters for the firmware load on the NTMX77 by typing:

>QUERYPM CNTRS
and pressing the Enter key.

Example of a MAP display:

```
Unsolicitited MSG limit = 250, Unit 0 = 0, Unit 1 = 0
Unit 0:
Ram Load: ECR06BD
EPRom Version: AB02
EEPRom Load: Loadable: MX77NG03, Executable: MX77NG03
CMR LOAD: CMR03A
UP:MX77AA
Unit 1:
Ram Load: ECR06BD
EPRom Version: AB02
EEPRom Load: Loadable: MX77NH08 , Executable  MX77NH08 ,
CMR LOAD: CMR03A
UP:MX77AA
```
NTMX77 Firmware loadname

If firmware is	Do
valid	step 25
invalid	step 23

NTMX77
SMS-R (continued)

23 Load the firmware in the inactive SMS-R unit by typing

>LOADFW INACTIVE
and pressing the Enter key.

Note: If the firmware load is not specified with the LOADFW command, the command applies the firmware file datafilled in the appropriate inventory table.

If the LOADFW	Do
passes	step 24
fails	step 28

24 Update the firmware in the inactive SMS-R unit by typing

>LOADFW INACTIVE UPGRADE
and pressing the Enter key.

If the LOADFW UPGRADE	Do
passes	step 25
fails	step 28

25 Return the inactive SMS-R unit to service by typing

>RTS UNIT unit_no
and pressing the Enter key.

where

unit_no   is the number of the inactive SMS-R unit

If the RTS	Do
passes	step 26
fails	step 28

26 Send any faulty cards for repair according to local procedure.

27 Return to *Alarm Clearing Procedures* section of this manual. At the point where a faulty card list is initiated, identify the next faulty card on the list, and go to the appropriate card replacement procedure for that card in this manual.

NTMX77
SMS-R (end)

28 Obtain further assistance in replacing this card by contacting personnel responsible for a higher level of support.

29 Remove the sign from the active SMS-R unit.

30 Record the following items in office records:

- date the card was replaced
- serial number of the card
- symptoms that prompted replacement of the card

31 You have successfully completed this procedure. Return to the maintenance procedure that directed you to this card replacement procedure and continue as directed.

32 For further assistance with switch of activity, contact the personnel responsible for the next level of support.

   Note: If the system recommends using the SWACT command with the FORCE option, consult office personnel to determine if use of the FORCE option is advisable.

Returning a card for repair or replacement

Application

Use this procedure to return a circuit card for repair or replacement. An example of a circuit card is a power converter. Your location, Canada or the United States, will determine the type of documents and the return address of the circuit card.

Interval

Perform this procedure .

Common procedures

Does not apply

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Returning a card for repair or replacement

(continued)

Summary of Returning a card for repair or replacement

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

```
┌─────────────────┐
│ Place card in   │
│ ESD protective  │
│ bag             │
└────────┬────────┘
         │
         ▼
┌─────────────────┐
│ Fill out the    │
│ return label    │
└────────┬────────┘
         │
         ▼
┌─────────────────┐
│ Pack card in an │
│ approved        │
│ shipping carton │
└────────┬────────┘
         │
         ▼
┌─────────────────┐
│ Address carton  │
│ to appropriate  │
│ service center  │
└────────┬────────┘
         │
         ▼
┌─────────────────┐
│ End of          │
│ procedure       │
└─────────────────┘
```
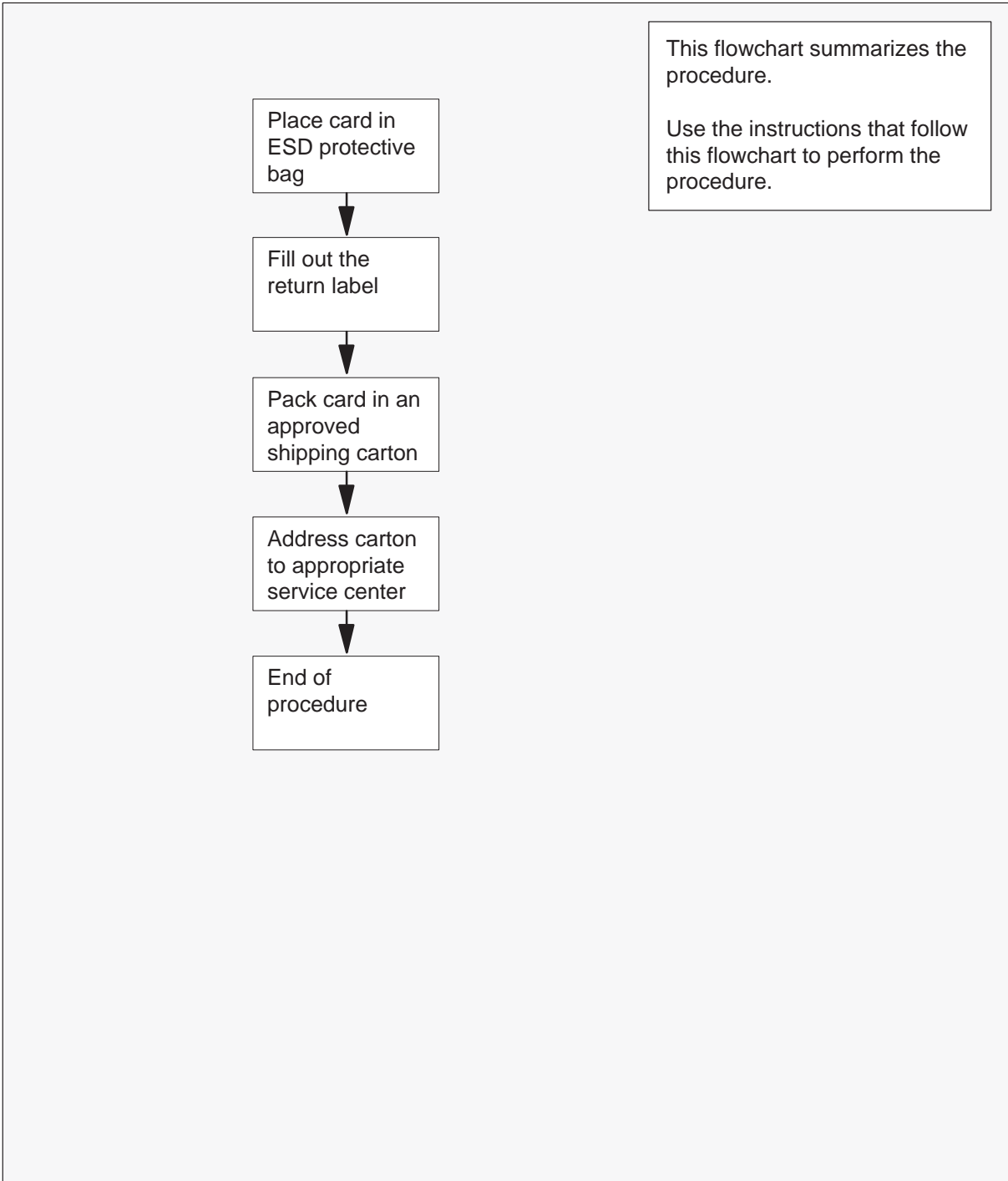
Returning a card for repair or replacement
(continued)

Returning a card for repair or replacement

At your current location

1   Place the circuit card in an electrostatic-discharge protective bag.

If your location	Do
is in Canada	step 6
is in the United States of America	step 2

2   Fill in the return label for each card. For additional help, call 1–800–347–4850.

   Include all of the following information:

   - return authorization number from customer service
   - NT product engineering code (PEC)
   - serial number
   - release number
   - BCS release software in use at the time of replacement
   - peripheral module load name
   - description of the failure and action taken to repair
   - fault code that describes the fault (see the bottom of the label)
   - name of your company
   - office identifier code
   - your name
   - site name

3   Pack the card or assembly in a Nortel card shipping carton and seal it.

   If a Nortel shipping carton is not available, use another carton, and ensure each card or assembly is

   - enclosed in packing paper
   - surrounded in bubble pack or foam
   - secure in the carton, the card cannot shift around

4   Address the carton to: Nortel Customer Service Center, 4600 Emperor Blvd., Morrisville, North Carolina, 27560

5   Go to step 11.

6   Fill in one return label, form 24–115 for each card or assembly to return.

Returning a card for repair or replacement
(end)

Include all of the following information:

- return authorization number from customer service
- NT product engineering code (PEC)
- serial number
- release number
- BCS release software in use at the time of replacement
- peripheral module load name
- description of the failure and action taken to repair
- fault code that describes the fault (see the bottom of the label)
- name of your company
- office identifier code
- your name
- site name

If you need additional help with the label information, call 905–454–2808. In the event of an emergency, 905– 457–9555.

7 Attach a duplicate of the card label to a card latch.

8 Keep the other copies of the label for your records.

9 Pack the card or assembly in a Nortel shipping carton and seal it.

If a Nortel shipping carton is not available, use another carton and for each card or assembly:

- wrap in packing paper
- surround in bubble pack or foam
- secure within the carton, the card cannot shift around

10 Address the carton to: Nortel Customer Operations, c/o Wesbell Transport, 1630 Trinity Road, Unit #3 Door #4, Mississauga, Ontario, L5T 1L6

11 This procedure is complete.

Locating and clearing SMS-R trouble

Maintenance engineering and field maintenance personnel use this section. Personnel must have knowledge of the following:

- the Subscriber Carrier Module-100S Remote (SMS-R) interface to the SLC-96 remote terminal (RCS), and the DS-1 links between the SMS-R and RCS

- the subscriber loop.

This section does not provide step-by-step procedures to perform maintenance tasks.

Trouble isolation and correction

This section describes fault isolation and diagnostic tests for the SMS–R/RCS subsystem, the DS–1 links, and the subscriber lines.

Locating and clearing faults

Operating company personnel locate and clear faults by means of trouble condition indicators.

Trouble condition indicators

Trouble conditions are indicated by the following:

- operational measurements

- log reports

- alarms

Operational measurements

Operational measurements (OM), which monitor and count events in the system, detect actual and potential system troubles. The OM thresholding feature monitors and reports SMS-R activity. These reports should be made routinely (daily or weekly) and should be the primary method of trouble detection.

Log reports

Logs, used primarily for analysis, provide 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

- message not printed reports

- large number of similar logs

Alarms

Audible and visual alarms indicate that something requires corrective action. Proper routine system maintenance and the use of OMs and logs minimizes the occurrence of alarms.

Alarm severity and corresponding urgency for corrective action is indicated by the level of the alarm: minor, major, or critical. The following table describes alarm conditions.

Alarm description

Alarm	MAP display	Description
Minor	(blank)	Usually nonservice affecting
Major	(M)	Usually indicates a service degrading, threatening condition
Critical	(*C*)	Usually indicates a service outage or potential service outage

Assessing alarms Alarms are produced by the various MAP (maintenance and administration position) subsystems for the SMS-R configuration.

Clearing alarms Clear alarms as follows:

- When more than one alarm of the same severity is displayed on the screen of the MAP terminal, clear the alarms from the left of the screen to the right.

- If, while fixing an alarm, an alarm of greater severity occurs, respond to the new alarm. Do not continue attempts to clear the less severe alarm.

For alarm clearing procedures, see the following publications:

- *Alarm Clearing Procedures*
- *Card Replacement Procedures*

Standard troubleshooting steps

Standard troubleshooting steps for locating and clearing SMS-R faults are as follows:

1 Silence audible alarms caused by the system when alarm conditions are detected.

2 Isolate the fault by reading status displays and tracing fault codes to the menu level needed to clear the fault.

3 Busy the hardware to remove system access to the faulty component. This allows maintenance activity to be performed without system interference.

4 Test the faulty component and identify the card to be replaced. Replace the faulty card and test it again.

5   Return the hardware to service.

Fault isolation tests for the SMS-R

When a fault condition is detected in the SMS-R/RCS subsystem, a maintenance action is required. A fault can occur in any SMS-R/RCS component. Operating company maintenance personnel use fault isolation procedures to determine which component is faulty, and to remove the fault condition or report it to the appropriate maintenance support organization. When troubleshooting the SMS-R, operating company personnel usually access the SMS-R level of the MAP terminal and enter the command string QUERYPM FLT. Methods for handling specific scenarios are provided in the following paragraphs.

Handling a SysB SMS-R unit

When an SMS-R unit is busied by the system, it is no longer in service (InSv); therefore, it cannot process calls. If the unit is active, a warm switch of activity (SWACT) occurs. When troubleshooting the SMS-R, operating company personnel usually access the SMS-R level of the MAP terminal and enter the command string QUERYPM FLT. The following table lists possible reasons for a SysB SMS-R alarm and possible scenarios. In most cases, the log report mirrors the QUERYPM FLT response.

Assessing SysB alarms for the SMS–R

Message at SMS–R level	Possible scenarios
`All C-side Links are Down`	The C-side PM (RCC or RCC2) cannot talk with the SMS-R.
`Audit Detected Inconsistent PM Activity`	For example, CC thinks that unit 0 is active but really unit 1 is active. In other words, CC is unaware that a SWACT occurred. The CC busies and returns-to-service both units and the units come back with the active/inactive unit configuration that CC had originally.
`Audit Detected Inconsistent PM State`	The internal state of the active unit is not ready. The state is busy, restart, or syncing. This is usually a software error. CC busies and returns-to-service both the SMS-R and the C-side links, and then tries to return them to service.
`Autonomous Activity Drop`	A system-generated SWACT occurred, usually because of a trap or facility audit.
`Diagnostics Failed`	Unit failed TST or RTS.
`Inact Unit Lost Data Synch`	Unit-to-unit communication failed, meaning that a SWACT cannot be performed.
—continued—	

Assessing SysB alarms for the SMS–R (continued)

Message at SMS–R level	Possible scenarios
PM Audit Detects Fault	A background hardware audit detects a fault.
PM SWACT	A SWACT occurred.
Require Data Load	An error occurred on a DS-1 link to the unit, and the unit is awaiting a reset by the maintenance system.
Reset While In-Service	An error occurred on a DS-1 link to the unit, and the unit is awaiting a reset by the maintenance system.
REX Incomplete (Terminated)	At least one unit is ISTb
	Inactive unit is BSY
	The routine exercise test (REX) cannot complete the series of tests because of an abnormal condition.
REX Failed	At least one unit is ISTb
	Inactive unit is BSY
	Achieving superframe/data sync
	Inactive OOS tests
	Inactive RTS
	Warm SWACT
	Inactive OOS tests after SWACT
	A failure occurred while a test was running. The messages tell what the system is doing to compensate for the failure.
Self Test Failed	A background hardware audit detects a fault.
Trap Message Received From PM	The unit sent an "initiation complete" message to CC following an auto-restart.
Unsolicited Message Limit Exceeded	The unit sent more than 100 unsolicited messages to CC within one minute.

—end—

C-side link problems are outside the scope of PM-level maintenance.

Standard troubleshooting methods require that a specific unit of a SysB SMS-R be tested. If the unit passes tests and is returned to service, the SysB

fault clears. Test failures may be accompanied by a list of SMS-R cards suspected to be faulty, as shown in the following example:

```
SMS-R 60 Unit 0 Tst Failed
Failed to open link
Site Flr RPos Bay_id Shf  Description     Slot   EqPEC
HOST 00  C05  SME 00 51   SMSR : 60        :22   8X18
HOST 00  C05  SME 00 65   SMSR : 60        :22   8X18
HOST 00  C05  SME 00 51   SMSR : 60        :21   6X41
HOST 00  C05  SME 00 51   SMSR : 60        :18   6X69
HOST 00  C05  SME 00 51   SMSR : 60        :12   MX77
```

Replace one card at a time (in the order listed) and retest the unit until the identified fault clears.

Sometimes the test fails and a message, such as `No Reply From PM`, accompanies the failure. Resetting the SMS-R using the PMRESET command sometimes clears the fault. If the reset fails, a list of suspected faulty cards (such as the one seen for test failures) sometimes accompanies the failure. The cards must be replaced one at a time. If one of the cards is faulty, replacing it may clear the SysB problem.

Clearing faults in a SysB SMS-R sometimes requires reloading the SMS-R with software.

If resetting, reloading, or replacing suspected faulty cards does not clear the SysB fault, a software problem in the SMS-R may be indicated. Contact your maintenance support group.

Handling an ISTb SMS-R unit

When an SMS-R goes ISTb, the unit has a fault but can still process calls. The following table specifies the typical responses when the command string QUERYPM FLT is used at the SMS-R MAP terminal level, and possible reasons for the ISTb SMS-R alarm. In most cases, the log report mirrors the QUERYPM FLT response.

Assessing ISTb alarms for the SMS–R

Message at SMS–R level	Alarm	Possible scenarios
`One/Both Unit (s) ISTb`	Minor	One or both units are in-service trouble.
`PM Overloaded`	Minor	Traffic load exceeds the PM's ability to process calls.

Assessing ISTb alarms for the SMS–R (continued)

Message at SMS–R level	Alarm	Possible scenarios
CSLinks Out of Service	Minor	C-side message links failed the periodic in-service C-side links test (one per minute).
PSLinks Out of Service	Minor	A P-side link is SysB. DS-1 link maintenance is required.
Node Redundancy Lost	Major	A unit is out-of-service, so the SMS-R cannot perform a SWACT if necessary.
Major CSLink Failure	Major	A C-side link failure caused a major alarm.
Critical CSLink Failure	Critical	A C-side link failure caused a critical alarm.
Bad 6X69 IMC link	Minor	An intermodule communication link is bad.
PM node table mismatch	Minor	Node table data in the SMS-R and CC do not match.
Dynamic data sync	Minor	The SMS-R has not achieved dynamic data sync.
Static data mismatch with CC	Minor	SMS-R static data does not match CC static data. The SMS-R requires a download of static data. It is busied and returned to service, or the inactive unit is busied and returned to service using the NODATASYNC paramete. See "Handling data mismatch (using the NODATASYNC option)" in section, "Trouble isolation and correction."
Data mismatch with inventory table	Minor	The load datafilled in table LTCRINV does not match the load name according to CC. The SMS-R load is shown by issuing the command string QUERYPM CNTRS.
Data out of date	Minor	The PM requires reloading.
—end—		

Sometimes a unit of the SMS-R requires testing. Similar to a SysB SMS-R, a fault in an ISTb SMS-R is cleared by replacing faulty cards, resetting the SMS-R, or reloading the SMS-R.

Handling an IMC link fault

When the intermodule communication (IMC) link audit detects data loss or corruption of messages over IMC links, the status of the SMS-R becomes ISTb and a PM128 log is generated. Operating company personnel issuing the command string QUERYPM FLT receive the following system response:

```
NON-CRITICAL HARDWARE FAULT
```

Operating company personnel then perform the following steps:

1   Test both units to confirm the audit result.

2   Busy and off-line the inactive unit and replace the faulty cards listed (NT6X69 or NTMX77 or both).

3   Return the inactive unit to service.

If the node remains ISTb for more than 5 minutes and the response to the command string QUERYPM FLT is unchanged, the fault is probably in the active unit. If the RTS of the inactive unit is successful, perform the following steps:

1   Switch the activity of the units.

2   Busy the newly inactive unit.

3   Test the inactive unit.

4   Off-line the unit with faulty cards and replace them with good cards.

5   Return the inactive unit to service.

If replacing the cards does not remove the fault, the problem is likely to be in the backplane.

Handling a parity error fault

In most cases, if a parity fault is detected, the fault can be corrected without a loss of service. This section provides information on the types of parity faults and an overview of the actions the CM takes to deal with parity faults. Also included are the actions that operating company personnel should take.

The three types of parity faults are

- An intermittent fault, which occurs when a fault is detected, but no error is found during the reread of the location.

- A soft fault, which occurs when a parity error is detected, and an error is found when the XPM tries to reread the location. However, no error is found when the XPM tries to write to the location. The error can occur in either the program store or memory store.

- A hard fault, which occurs when an XPM detects a fault and can neither reread nor write to the memory location.

When a parity fault occurs, the CM determines what action to perform on the XPM unit, depending on the status of the unit reporting the fault (active or inactive). All three types of faults are handled the same by the CM.

Once the CM detects a parity fault in the active unit of the XPM, the CM sets the unit ISTb with a reason of 'parity' and the unit will be recovered by the CM during a maintenance window. The maintenance window for

recovering a parity fault on the active unit is the XPM REX test window. If the time for the XPM REX test window is the same as the current time of the switch then an audit will check to see if the active unit of the XPM has an ISTb of 'parity'. If an ISTb exists, the CM will SWACT and reload the XPM if no dependencies exist. This action will clear the ISTb 'parity' fault and the short term failure (STF) parity fault peg and resolve the parity fault in the XPM.

When the parity fault is reported by the active unit, a PM181 log is generated to notify operating company personnel of the problem. The recovery actions by the CM include a SWACT of the XPM and loading the newly inactive unit with the XPM software load defined in the corresponding inventory table. This loading action is considered an autoload by the CM. The ISTb is cleared by a manual or CM or mate reload of the XPM software to the affected unit.

The CM does not permit a REX test to occur

- on a P-side or C-side node of the XPM that is being recovered from a parity fault

- on the XPM if a P-side or C-side node is being recovered from a parity fault

The CM will not let two XPMs perform a parity reload that are in the same configuration. This means a P-side node cannot perform a parity reload at the same time as its C-side node, nor can a C-side parity reload occur at the same time as its P-side node. This restriction ensures that only one XPM in a configuration is in simplex at a time.

The CM informs operating company personnel of a parity fault through PM181 log reports. This log is, therefore, the primary trouble indicator. Operating company personnel can also check for associated logs, such as the PM128, to understand what actions, if any, the CM is taking. Examples of the messages associated with the PM181 and PM128 logs are provided in this section.

The XPM unit can be set ISTB with multiple reasons concurrently. When performing a QUERYPM FLT at the MAP level, all of the ISTb reasons that have occurred on the unit and that have not yet been cleared will be seen.

Hard parity fault   When a hard parity fault is reported to the CM by the active unit of the XPM, a PM181 informational log is generated. This log notifies operating company personnel that

- a parity fault has occurred on the active unit, and the unit has been set ISTb

- the unit will be reloaded by the CM during the next XPM REX test window

A manual SWACT and reload can also be performed to clear the ISTb and the parity fault.

An example of a PM181 log report follows:

```
PM181 JUL23 23:29:16 7700 INFO SMSR 0 Unit 0
Node: Istb, Unit0 Inact: ISTb, Unit1 Act: ISTb
Parity audit has detected a hard parity fault.
The system will autoload the unit during the next
XPM REX test window.
Monitor the system for maintenance and recovery.
Site Flr  RPos  Bay_id  Shf Description Slot  EqPEC
RAL1 00   C05   CMVI 00  18  SMSR : 000   3    AX74
```

When a unit changes state to ISTb of 'UP RAM parity' fault, a PM128 log report is generated. This log informs operating company personnel that the unit has changed status.

An example of a PM128 log follows:

```
*PM128 MAY09 09:49:56 9000 TBL ISTB SMSR 1
 Node: ISTb (Unit ISTb)
 Unit0 Inact: InSv
 Unit1   Act: ISTb (UP RAM Parity)
```

The command string QUERYPM FLT is used to display the faults on a posted XPM. The following example MAP response shows a hard parity fault exists in unit 1 of the posted XPM:

```
>querypm flt
Node is ISTb
    One or both Units inservice trouble
Unit 0
    no fault exists
Unit 1
    The following inservice troubles exists:
        Parity audit has detected a hard parity fault.
        A reload is required to clear this fault.
        The system will autoload this unit during the next
        XPM REX test window.
```

Action by the CM: The CM will SWACT and reload the XPM during the next XPM REX test window. After the reload the XPM will be cleared of this ISTb fault.

User action: No action is required by operating company personnel. However, a manual SWACT and reload can be initiated to clear the parity fault.

Handling data mismatch (using the NODATASYNC option)

When the SMS-R has data mismatch problems (such as a static data mismatch with the CC) one possible scenario is to busy and RTS the entire SMS-R. Using the NODATASYNC parameter with RTS, the user minimizes the time needed to have the correct data in both SMS-R units.

When the RTS NODATASYNC command is issued for the inactive unit, the following occurs:

1   The node translation table transfer from the active to the inactive unit is blocked. The node tables are checked to see if they match.

2   Static data is loaded from the CC to the inactive unit.

3   Once the inactive unit returns to service; data sync between the active and inactive unit is disabled.

Note 1: The NODATASYNC option is valid only for the inactive unit.

Note 2: Operating company personnel should follow the instructions provided at the MAP terminal when using the NODATASYNC option.

A maintenance scenario illustrating the NODATASYNC option follows. Assume that there is a static data mismatch for the SMS-R. Operating company personnel perform the following steps:

1   Busy the inactive unit by typing:

   >BSY UNIT n
   and pressing Enter.

2   RTS the inactive unit using the NODATASYNC option by typing:

   >RTS UNIT n NODATASYNC
   and pressing Enter.

   The inactive unit returns to service.

   Note 1: If, during the RTS, static data changes, a PM128 log is produced with the message

   ```
   Mismatch found in node table between the two units.
   ```
   Note 2: Also, the QUERYPM FLT command for the SMS-R reports node table mismatch.

Fault isolation tests for the RCS

When a fault condition is detected in the RCS, alarms are generated and maintenance is required. The fault can occur in any RCS components. Operating company maintenance personnel use fault isolation tests specified in this section to determine which component is causing the fault, and to remove the fault condition or report it to the appropriate maintenance support organization. When troubleshooting the RCS, operating company personnel usually access the RCS level of the MAP display and enter the QUERYPM FLT command.

RCS alarms

Alarm message transfer with the following types of alarms is supported:

- major

- minor

- power/miscellaneous

- shelf

These alarms are displayed as PM128 log reports at the MAP terminal.

Major alarm

A major alarm indicates that a fault occurred that affects service to subscribers. If a major alarm occurs without a shelf alarm, the RCS is system busied. If a major alarm occurs with a shelf alarm, the RCS goes ISTb.

When system busied, a CC audit attempts to return the RCS to service every ten minutes. If this audit successfully returns the RCS to service or if the RCS is manually returned to service, the alarm clears.

When the RCS is ISTb, enter the command string QUERYPM FLT to determine the cause of the alarm; usually, a faulty line interface unit or transmit receive unit card.

An example of a failure causing a major and a shelf alarm is failure of the DDL looping test, which tests messaging capability between the SMS-R and RCS. Another example is the SMS-R detecting a failure of a DS-1 link for a shelf (local carrier group alarm).

Minor alarm

A minor alarm indicates that a fault occurred that does not affect subscribers. This alarm causes the RCS to go ISTb.

Disabling protection switching is a unique instance of a nonfault condition causing a minor alarm.

Failure of the PCM looping test used to check transmission over an assigned DS-1 channel in Mode II is an example of a fault condition causing a minor alarm.

Power/miscellaneous alarm
A power/miscellaneous alarm indicates a power failure or an optional, miscellaneous fault. The RCS goes ISTb for this alarm.

Shelf alarm
A shelf alarm indicates a failure on the specified RCS shelf. This failure is major and sets the RCS to ISTb. A local carrier group alarm (LCGA), where the SMS-R detects a fault on a DS-1 link, is an example of a fault that causes a shelf alarm.

Note: Alarm LEDs light up on the alarm control unit (ACU) card when alarms occur on an RCS shelf. When faults are corrected, through such actions as replacing faulty common equipment cards, the LED goes out. Subscribers fail to get dial tone immediately, however. Dial tone is provided within 1 minute after an audit runs that clears the alarm in the DMS switch.

RCS looping tests
The following looping tests are supported:

- PCM looping test
- DDL looping test
- far-end loop test (FELP)

PCM looping test
This test runs when a DS-1 channel is assigned to a subscriber in Mode II. The SMS-R autonomously runs this test, which checks the integrity of the assigned DS-1 channel. In this test, the SMS-R sends three test words on the DS-1 channel to the RCS and checks the looped return of these test words from the RCS.

If the test fails, the DS-1 channel is disabled and the RCS goes ISTb.

DDL looping test
The SMS-R autonomously runs this test, which tests the DDL link by checking the C-field of the derived data link (DDL). The SMS-R sends a message to the RCS in the DDL and checks for a responding RCS message.

If the DDL looping test or A-link fails, a major alarm occurs. The RCS continues to run if other links are still operating correctly.

FELP command

FELP is a CARRIER level command that enables all DS-1 channels on a DS-1 link to be looped at the RCS. During FELP, all 24 channels on a DS-1 link are looped from the SMS-R over the DS-1 link to the RCS and back to the SMS-R.

When the FELP command is issued for a carrier, one of four options is entered. TEST is one of these options. When FELP TEST is issued, all 24 DS-1 channels on the specified link are looped, and PCM is sent on DS-1 channel 4. The PCM is looped, and the sent and received PCM are compared.

FELP is executed on in-service, protection, and busy DS-1 links. Protection links must be manually busied before FELP is issued; in-service, manually busy, or system busy links must have a protection link available to be protection switched during execution of the FELP command. Therefore, the RCS to which they attach must be datafilled for protection switching.

If a protection link is not available for an in-service, manually busy, or system busy link, FELP can be issued, but loopback is not enabled.

When PCM samples are looped on DS-1 links, they check the DS-1 link and some RCS control cards for correct operation.

If the A-link fails and cannot be protection switched (for example, if protection switching is disabled), DDL messaging is lost. DDL messaging includes alarm and protection switching messaging. Failure of the A-link means that FELP capability is lost for all other DS-1 links on the RCS.

Fault isolation tests for DS-1 links

When a fault condition is detected on DS-1 links, maintenance action is required. Operating company maintenance personnel use fault isolation tests to determine which component is causing the fault, and to remove the fault condition or report it to the appropriate maintenance support organization. When troubleshooting DS-1 links, operating company personnel usually post the link at the CARRIER level of the MAP terminal and enter the DETAIL command to obtain information on the link in question. Methods for handling specific scenarios are provided in the following paragraphs.

Overview of carrier maintenance

Operating company personnel execute the following operations on DS-1 carrier links at the CARRIER level of the MAP terminal:

- detail information about a specified carrier
- display carriers in a specified state

- post a carrier or group of carriers

- protection switch a carrier

The following commands are not executed on a remote carrier, even though they appear on the CARRIER menu display:

- TST

- BSY

- RTS

- OFFL

Audits of DS-1 links are executed automatically by the DMS switch.

Alarms

When frame losses, slips, bipolar violations (BpV), or other faults occur on a carrier, the signals transmitted between the SMS-R and RCS do not meet specifications. The DMS-100 switch monitors these signals and, when they do not meet specifications, OMs are pegged and maintenance limits (ML) and out-of-service (OOS; also OS) limits are incremented. Steady frame loss or excessive frame losses, slips, or BpV normally cause a carrier to go out-of-service.

Note: Operating company personnel use the SETACTION command at the MAP terminal to allow a carrier to go out-of-service when it exceeds its OS limit. Excessive BpV causes a carrier to go out-of-service, regardless of how the SETACTION command is used.

Local carrier group alarm (LCGA) and remote carrier group alarm (RCGA) are the two DS-1 carrier alarms. LCGA is associated with signals from the RCS to the SMS-R; RCGA is associated with signals from the SMS-R to the RCS. Steady-state frame loss for a time specified in table CARRMTC causes an LCGA, and the LCGA clears when the frame is regained for a time datafilled in table CARRMTC.

Isolated or intermittent faults (such as frame losses, slips, or BpV) are accumulated. When they reach the ML, the ML field is updated on the MAP display. This warns operating company personnel that faults have occurred or are occurring on the carrier.

A carrier goes temporarily system busy (SysB-T) or permanently system busy (SysB-P), depending on how many times the system returns the carrier to service.

The carrier goes SysB-T if both the following events occur:

- A steady state alarm is raised for a carrier, excess bipolar violations occurred, or the carrier exceeds the OS limit for frame losses or slips.

- The SETACTION command is being used with the carrier, but the carrier does not exceed the OS limit for return-to-service.

If the same carrier then exceeds its out-of-service limit for return-to-service, it goes SysB-P and is manually returned to service.

The DMS-100 places a carrier out-of-service when an LCGA is raised, and returns the carrier to service when the alarm is cleared (frame regained). Operating company personnel can place a limit on the number of times a carrier returns to service. This limitation prevents a carrier from bouncing between system-busy and in-service states indefinitely. The default for the consecutive number of times the system returns the carrier to service is 255.

A carrier remains SysB-T until the carrier successfully returns to service. The RTS occurs by manual action (the tests of the RTS sequence pass, indicating that no faults persist in the carrier) or by system action when the carrier audit finds that no alarms persist in the carrier.

A carrier in the SysB-P state is manually returned to service.

The following table shows the ML, OS, and audit interval defaults for frame losses, BpV, slips, and RTS.

ML, OS, and audit interval defaults

Item	ML	OS	Audit interval
Frame loss	17	511	10.0 min
Slip	4	255	10.0 min
BpV	1 in 10^6	1 in 10^3	4.8 sec
RTS	255	255	10.0 min

The DMS-100 switch counts frame losses, slips, BpV, and RTS for specified time or audit intervals. At the end of an accumulative audit interval (usually midnight to midnight), the counters reset to zero.

Bipolar violation ML clears when the count falls below 1 in 10^6 bits, and the OS limit clears when the estimated long-term count falls below 1 in 10^3 bits.

Frame losses, slips, and RTS operations are also counted and, if enough occurrences accumulate, the ML and OS limits are reached.

The following carriers exist:

- trunks

- timing

- remote

- protection line

DS-1 lines connecting SMS-R and RCS modules belong to classes *remote* and *protection line*. *Trunk* indicates that the carrier is used as a trunk to another central office, and *timing* indicates that the carrier is used as a timing trunk to another central office.

Note: The BSY, OFFL, RTS, and TST commands are not executed on lines that belong to the class *remote*.

Up to five carriers are posted in a MAP display. These carriers have numbers 0 through 4. If the posted set contains more than five carriers, the prompt MORE... appears. The NEXT command produces a second display showing the next five carriers, and the NEXT command can be issued again to display additional carriers in the posted set.

The MAP display shown in the following figure results from entering the command string DETAIL 0 REM. Carrier 0 (circuit 0) is connected to SMS-R 0. Data specific to this carrier are near the bottom of the MAP display. The field *D* indicates the direction of the carrier in relation to the SMS-R. *P* means P-side or away from the switch; *C* indicates C-side or toward the switch.

DETAIL MAP display showing carrier information

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

DETAIL    CLASS     ML  OS    Alarm    SysB ManB Uneq Offl     CBsy PBsy InSv              .·.·

0  Quit_   TRUNKS 0  0       1   1   0        0          16      0    0   6
2  Post_   REMOTE 0  0       4   0   9        0          0       0    0  28
3    PROTLN 0  0       1   0   1        0          1       0    0  3
4
5  Loop_   N CLASS SITE SMS-R CK D ALRM SLIP FRME BER ES SES STATE PROT
6  Tst_    0 REMOTE HOST 0  0  C         0<-7.
7  Bsy_    SIZE OF POSTED SET :     1
8  RTS_
9  Offl_   N CLASS SITE RCS CK     D ALRM SLIP FRME BER ES SES STATE
10 DispOpt_    0 REMOTE KRCS 0-1 0 P      0    0   0    0    0   INSV
11 Disp_
12 Next   DETAIL:
13
14 Detail_
15
16 ProtSw
17 Felp_
18


     userid
  TIME hh:mm>
```

Card refers to the DS-1 interface card. IN means the card is installed; OUT means the card was removed from its slot.

TOSC refers to the temporary out-of-service count. When excessive faults (such as BpV, slips, or frame losses) occur on the carrier, it goes SysB-T. TOSC refers to the number of times within the last carrier audit cycle that the carrier went SysB-T.

Fault isolation for subscriber lines

Fault isolation and line testing helps determine if a line circuit, loop, or line circuit and loop combination are functioning properly.

Subscriber lines maintenance

Lines maintenance for the RCS consists of the following areas:

- commands issued from the LTP and ALT levels of the MAP terminal
- line diagnostics initiated by a system diagnostic scheduler (a DMS-100 software process) when a call fails twice
- subscriber station tests

- line test executed through a mechanized loop test (MLT) or a test desk facility

Line circuits, subscriber loops, and stations are tested under the lines maintenance subsystem. Line circuits and subscriber loops are tested manually and automatically in this subsystem.

Line testing helps determine if a line circuit, loop, or line circuit and loop combination are functioning properly. If the line is faulty, line tests determine if the fault is in the line circuit or in the attached loop. If the fault is in the loop, it is usually referred to another department (for example, plant maintenance). If the fault is in the line circuit, the line card is replaced and the line is retested to verify that the fault is cleared.

Line maintenance occurs under the following conditions:

- a command is entered from the LTP level
- tests are scheduled from the ALT level
- digit reception is faulty, causing a line to be tested automatically by the DMS-100 switch for foreign potential
- a call fails twice, causing it to be placed in the shower queue for full diagnostic testing
- tests are initiated from the subscriber telephone set
- tests are initiated from a test desk

Manual lines testing

Manual line tests are performed by the switch operator on line circuits, loops, and stations. Line circuits and loops are tested individually with results displayed to the switch operator, immediately after testing, at a visual display unit (VDU).

Lines are tested manually as part of routine maintenance, or when either a customer report is generated or an ALT failure occurs.

Maintenance scenarios

Errors can arise during lines diagnostics. These errors are described in the following section. Besides the DIAG command, these error messages can also arise during execution of the VDC, VAC, RES, CAP, and LNTST commands. The error messages appear as part of ALT101 or LINE101 logs.

Tests are aborted under the following conditions:

- connection fail
- PM not ready
- no SMS-R P-side channel

- check channel test unit/line card
- PM reply time-out
- unexpected PM reply
- software error
- test alarm return code

The following actions are recommended when tests abort:

1   Check the RCS for PM reply time-out and an unexpected PM reply. Post the RCS at the MAP display and enter the command string QUERYPM FLT. Any faults present at the RCS appear. Replace any faulty equipment.

2   Try the test again for PM not ready and no SMS-R P-side channel. The following messages usually result from temporary conditions:

   a.   `PM not ready`   Another MAP command was entered for the line, and this command was still running when the line diagnostic was requested.

   b.   `No SMS-R P-side channel` All DS-1 channels are busy. If, during this condition, repeated attempts result in an aborted test, ensure that the line card is properly inserted.

3   A check channel test unit/line card message displays when communication between the DMS switch and the line card being tested cannot be established. The most likely causes for this problem are a missing line card or a faulty channel test unit card.

4   Check log reports for software error. The DMS switch generates PM180 and SWERR logs when software errors occur. These logs indicate possible faulty software.

5   Test link A for a failed connection.

6   Replace the line card for any failure message.

The following table shows several error messages that apply to specific diagnostics.

Diagnostic error messages and failed tests

Failed test	Error message
Negative tip party ringing	Tip ringing, ANI ground
Positive tip party ringing	Positive tip party
—continued—	

Diagnostic error messages and failed tests (continued)

Failed test	Error message
Positive ring party ringing	Positive ring party
Positive coin control voltage	Coin collect or positive coin off-hook
Positive coin control ground	Positive coin presence
Negative coin control voltage	Coin return or negative coin off-hook
Negative coin control ground	Negative coin presence
—end—	

Tests for the DIAG command fail for the following reasons:

- off-hook
- on-hook
- tip ringing, automatic number identification (ANI) ground
- positive ring party
- positive tip party
- idle channel noise
- echo return loss
- carrier channel loss
- coin collect
- positive coin off-hook
- positive coin presence
- negative coin presence
- coin return
- negative coin off-hook
- talk battery

Running lines tests

To access subscriber lines from the LTP or the ALT level, a metallic test access (MTA) minibar switch (NT3X09AA) is used with a metallic test pair. The following figure shows how MTA is used with an RCS line card.

The NT3X09AA MTA provides metallic connections between test circuits and RCS line circuits. The MTA occupies one slot in a metallic test module (MTM) (in the host office) or a remote maintenance module (RMM) (in the

Remote Switching Center). The MTA consists of a matrix; the vertical is connected to an individual line or a CTU, and the horizontal is joined to test equipment. The CTU is a card in the RCS used to test RCS lines.

MTA for the RCS line card in the MTM

LTU = Line test unit
TTU = Transmission test unit
TTT = Transmission test trunk
CTU = Channel test unit
LC = Line card
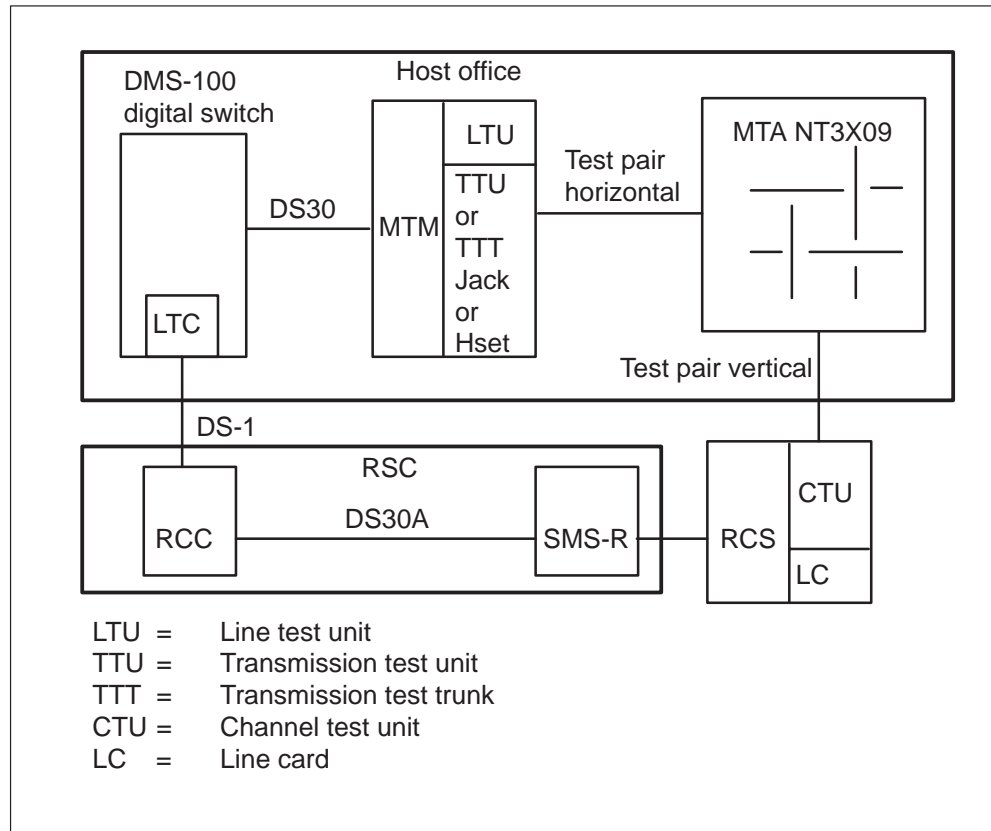
Up to 32 RCS modules share a metallic test pair. No more than 2000 subscriber lines re supported off one test pair. This ensures that minimal subscriber line test requests are rejected because the test pair is being used by another line.

RCS modules can share a metallic test pair, but all modules sharing a test pair must be of the same type. If an RCS is using a test pair, only additional RCS modules can share the test pair. Remote concentrator terminals (RCT) and RCS modules cannot share the pair with RCS modules. The following figure shows the configuration for sharing an MTA.

Share MTA configuration

DMS-100 digital switch

LTC

DS-1

RSC

MTA NT3X09

Test pair horizontal

RMM

RCC

DS30A

SMS-R

DS-1

To other   Test pair verticals

RCSs

RCS

RCS

. . . .

Phones

Phones
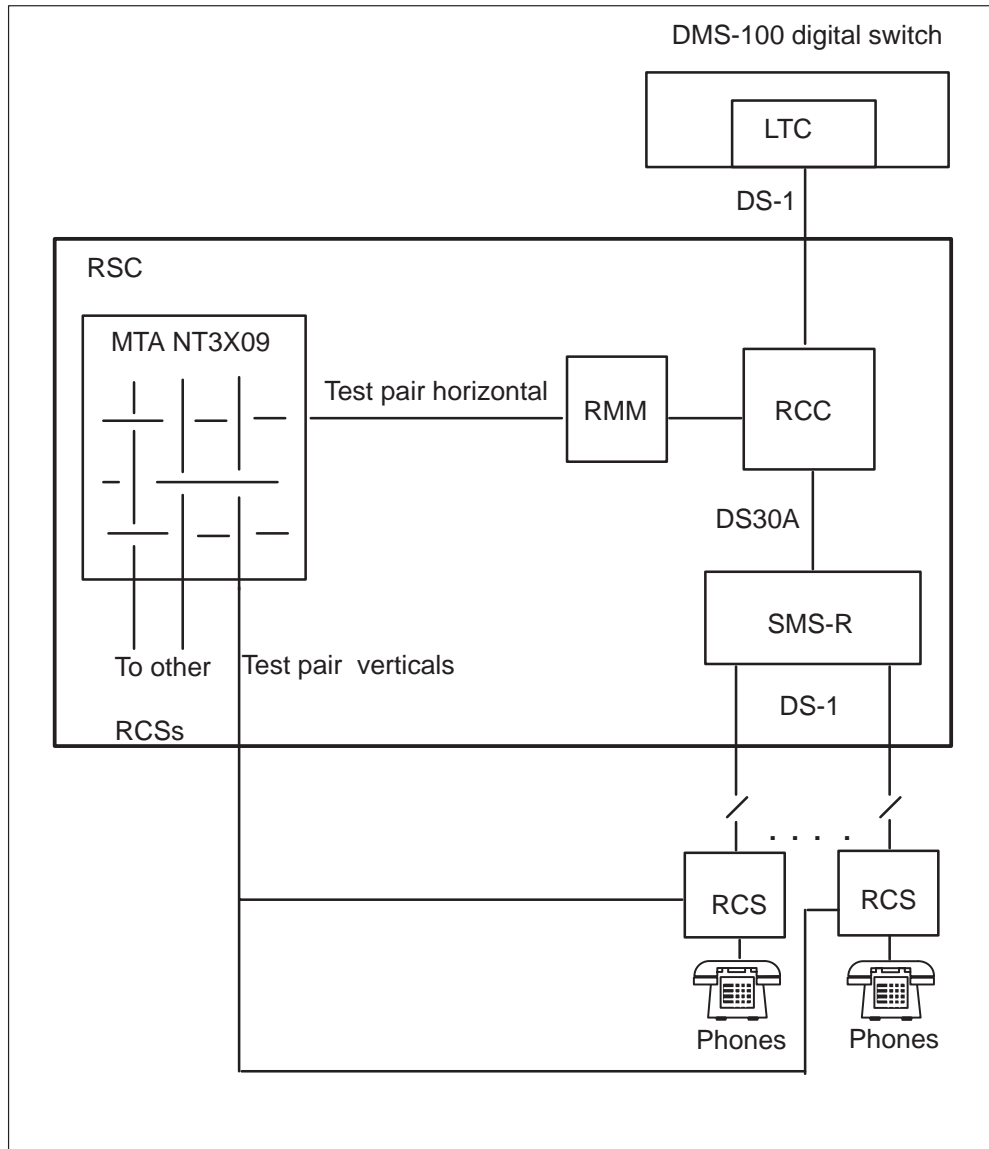
The following figure shows MTA for the RCS line card in the RMM.

MTA for the RCS line card in the RMM

LTU =   Line test unit
CTU =   Channel test unit
LC   =   Line card
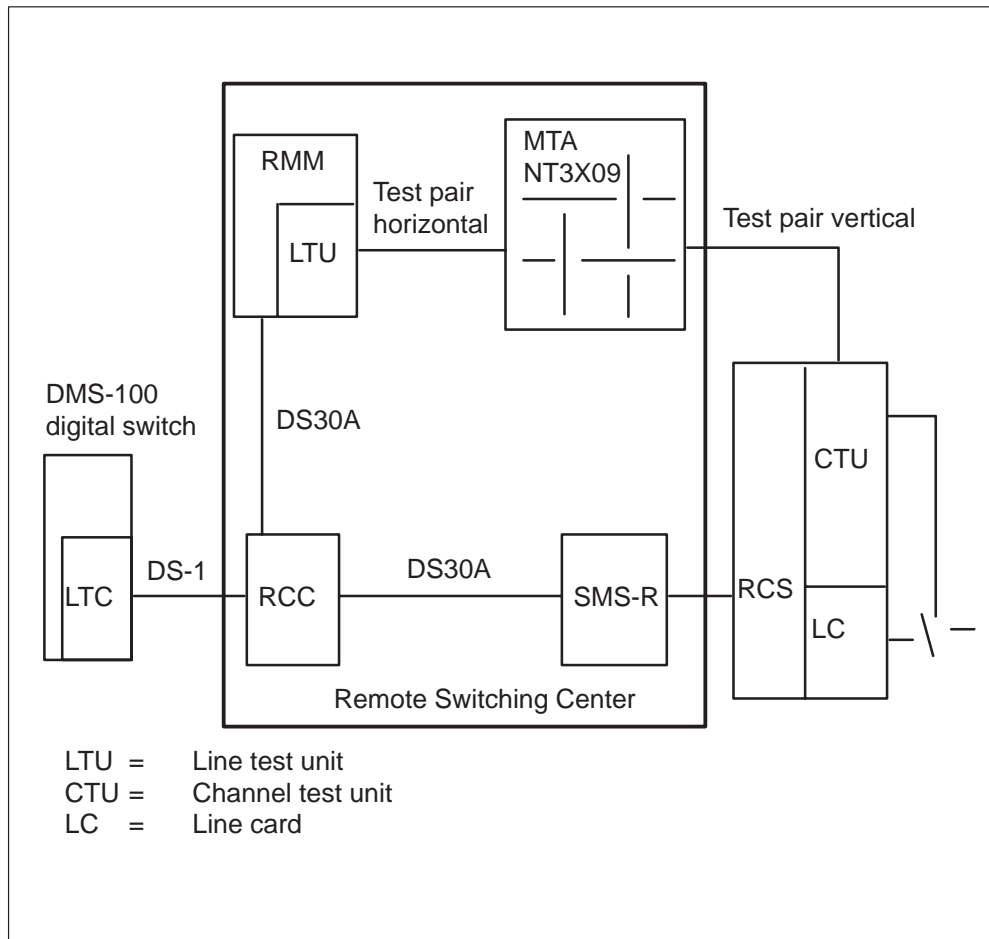
When a subscriber loop is connected to the MTA, it is tested from the LTP or ALT levels.

RCS line cards have test access (TA) and cutoff (CO) functions on the same relay. When this relay operates, the line card is cut off from the MTA so that metallic testing is restricted to subscriber lines. This process is called the *OUT* testing configuration.

When the subscriber loop is connected to a metallic test pair for testing, the associated line card is connected to a passive termination for testing. The RCS places the correct termination across the tip and ring of the RCS line circuit in response to specific A- and B-bit patterns that the SMS-R sends to the RCS. These patterns are described in the Bell Communications Research document *Digital Interface Between the SLC-96 Digital Loop Carrier System and a Local Digital Switch*.

The following types of passive termination are provided in the RCS:

- Absorb

  A 900-Ω resistor is connected between the tip and ring of the line card circuit. This termination causes an incoming signal to be absorbed

  This termination is setup when the SMS-R sends the RCS the A- and B-bit pattern used to ring a ring party with positive dc voltage in a superimposed ringing, multiparty line circuit.

- Reflect

  A loop is connected between the tip and ring of the line card circuit (that is, the tip and ring are shorted together). This termination causes an incoming signal to be reflected.

  The termination is setup when the SMS-R sends the RCS the A- and B-bit pattern used to ring a ring party with negative dc voltage in a superimposed ringing, multiparty line circuit. The termination is also setup when the SMS-R sends the RCS an A- and B-bit pattern used to ring a single-party or coin line.

- Absorb-PTPG

  This termination is the same as the absorb termination, except that a positive tip party ground (PTPG) is provided. This is a dc path to ground that is detected only if the RCS provides a positive dc voltage to the tip or ring.

  The termination is setup when the SMS-R sends the RCS the A- and B-bit pattern used to ring a tip party with positive dc voltage in a superimposed ringing, multiparty line circuit. This termination is also setup when the SMS-R sends the A- and B-bit pattern used to execute coin collect for a coin card.

- Reflect-NTPG

  This termination is the same as the reflect termination, except that a negative tip party ground (NTPG) is provided. This is a dc path to ground that is detected only if the RCS provides a negative dc voltage to the tip or ring.

  The termination is setup when the SMS-R sends the RCS the A- and B-bit pattern used to ring a tip party with negative dc voltage in a superimposed ringing, multiparty line circuit. This termination is also setup when the SMS-R sends the A- and B-bit pattern used to execute coin return for a coin card.

To remove a termination, the SMS-R sends an on-hook message to the RCS in the M-field of the DDL.

The following events occur during test setup of an RCS line card:

1   The CC sends a test request to the SMS-R.

2   The SMS-R initiates test setup in the RCS by sending an A- and B-bit pattern to the RCS, called the *per-channel signaling bit test pattern* or *channel test pattern*.

3   Within 100 ms, the RCS returns a *seize RC* message to the SMS-R in the M-field of the DDL. This message indicates that the RCS hardware needed to set up a test configuration is functioning properly.

4   The SMS-R responds by sending a *proceed RC* message to the RCS in the M-field of the DDL.

5   Within 800 ms, the RCS returns a *proceed RC* message to the SMS-R using the M-field of the DDL. This message indicates that a metallic test pair is connected to the subscriber loop and an absorb-PTPG termination is connected to the line circuit in the line card.

After test setup, the SMS-R sends the RCS specific A- and B-bit patterns to select test terminations for specific tests. Test sequences for single-party, multiparty, and coin cards are shown in the following examples.

Single-party test sequence
The test sequence for a single-party card follows:

1   The SMS-R sends the RCS channel a test setup request sequence.

2   The RCS connects the absorb-PTPG termination.

3   The SMS-R sends idle A/B-bits and scans for an off-hook message; the RCS detects the absorb termination as off-hook and sends the SMS-R an off-hook pattern of A/B-bits.

4   The TTU is used for the echo return loss test.

5   The SMS-R sends the RCS an on-hook message to remove termination, sends idle A/B-bits, and scans for on-hook.

6   The SMS-R sends an on-hook message to the RCS to remove termination.

7   The RCS detects termination removal as on-hook and sends the SMS-R an on-hook A/B-bit pattern.

8   The SMS-R requests a single-party ringing test and scans for off-hook; the RCS connects a reflect termination; and the RCS detects the termination as off-hook (if ringing) and signals off-hook to the SMS-R.

9   The TTU is used for the channel loss test.

10 The TTU is used for the noise test.

11 The SMS-R completes the diagnostic by sending the RCS a message to terminate the channel test and sending idle A/B-bits.

Multi-party test sequence

The test sequence for a multiparty card follows:

1 The SMS-R sends the RCS a channel test setup request.

2 The RCS connects absorb-PTPG termination.

3 The SMS-R sends idle A/B-bits and scans for off-hook. The RCS detects absorb termination as off-hook and sends the SMS-R an off-hook pattern of A/B-bits.

4 The TTU is used for the echo return loss test.

5 The SMS-R sends the RCS on-hook message to remove termination, idle A/B-bits, and scans for on-hook.

6 The RCS detects termination removal as on-hook and sends the SMS-R an on-hook A/B-bit pattern.

7 The SMS-R signals the RCS to test ringing; the RCS connects reflect termination; the RCS detects termination as off-hook (if it is ringing) and signals off-hook to the SMS-R.

8 The TTU is used for the loss test.

9 The TTU is used for the noise test.

10 The SMS-R sends the RCS a message to remove termination.

11 The SMS-R signals the RCS to test –T party; the RCS connects reflect-NTPG termination; the RCS detects termination if –T ringing and signals tip party ground to the SMS-R.

12 The TTU is used for the channel loss test (determines if reflect termination made).

13 The SMS-R requests an ANI test (indicates tip ground); the RCS signals tip party ground. The SMS-R sends A/B-bits for reflective termination.

14 The SMS-R sends the RCS a message to remove termination.

15 The SMS-R signals the RCS to test +R ringing; the RCS connects absorb termination, detects the termination as off-hook if +R ringing occurs, and signals off-hook to the SMS-R.

16 The TTU is used for the echo return loss test (determines if absorb termination made).

17 The SMS-R sends the RCS message to remove termination.

18 The SMS-R signals the RCS to test +T ringing and scans for off-hook; the RCS connects absorb-PTPG termination, detects the termination as off-hook if +T ringing is present, and signals off-hook to the SMS-R.

19 The TTU is used for echo return loss test (determines if absorb termination made).

20 The SMS-R completes the diagnostics by sending the RCS a message to terminate channel test and sending idle A/B-bits.

Coin test sequence

The test sequence for a coin card follows:

1   The SMS-R sends the RCS a channel test setup request.

2   The RCS connects absorb-PTPG termination.

3   The SMS-R sends negative loop mode A/B-bits and scans for off-hook.

4   The RCS detects termination as off-hook and sends off-hook A/B-bits.

5   The TTU is used for the echo return loss test.

6   The SMS-R sends an on-hook message to the RCS to remove termination, sends negative loop mode A/B-bits, and scans for on-hook.

7   The RCS detects termination removal as on-hook and sends the SMS-R an on-hook A/B-bit pattern.

8   The SMS-R signals the RCS to test –R ringing and scans for off-hook; the RCS connects reflect termination if –R ringing is present and detects termination as off-hook, then signals off-hook. The SMS-R sends negative loop mode A/B-bits.

9   The TTU is used for the channel loss test.

10 The TTU is used for the noise test.

11 The SMS-R sends an on-hook message to the RCS to remove termination.

12 The SMS-R signals the RCS to test coin collect; the RCS connects absorb-PTPG termination and sends coin ground A/B-bits.

13 The SMS-R sends negative loop mode A/B-bits and scans for off-hook; the RCS detects termination as off-hook only if the channel unit is providing positive coin control voltage and sends off-hook A/B-bits.

14 The SMS-R signals the RCS to run positive coin check; the RCS sends coin ground A/B-bits.

15 The SMS-R sends negative loop mode A/B-bits, while the TTU is used for echo return loss test (determines if correct termination is made).

16 The SMS-R sends a request to the RCS for the reverse battery test and scans for off-hook. If positive talk battery, the RCS detects off-hook and sends off-hook A/B-bits to the SMS-R.

17 The TTU is used for the channel loss test (determines if correct termination is made).

18 The SMS-R sends the RCS a message to remove termination.

19 The SMS-R signals the RCS to test coin return; the RCS connects reflect-NTPG termination and sends coin ground A/B-bits as off-hook, only if channel unit is providing negative coin control voltage.

20 The SMS-R requests the RCS to run negative coin check; the RCS sends coin ground A/B-bits.

21 The SMS-R sends negative loop mode A/B-bits, while the TTU conducts a channel loss test.

22 To complete the diagnostic, the SMS-R sends the RCS a message to terminate the channel test.

The SMS-R removes a test termination by sending the RCS an on-hook message in the M-field of the DDL. Either the SMS-R or the RCS halts an ongoing test by sending a *test alarm* message in the M-field of the DDL.

Using external test equipment

When using external test equipment to test a line, a bridge connection to the line is set up using a conference circuit when the line is in the talking state (if the line is idle, test equipment is connected to the line through the metallic test access network). This bridge connection enables operating company personnel to verify that the line is in use.

The following figure shows an example of bridged access to a subscriber line extending from an RCS.

Bridged access using a conference card
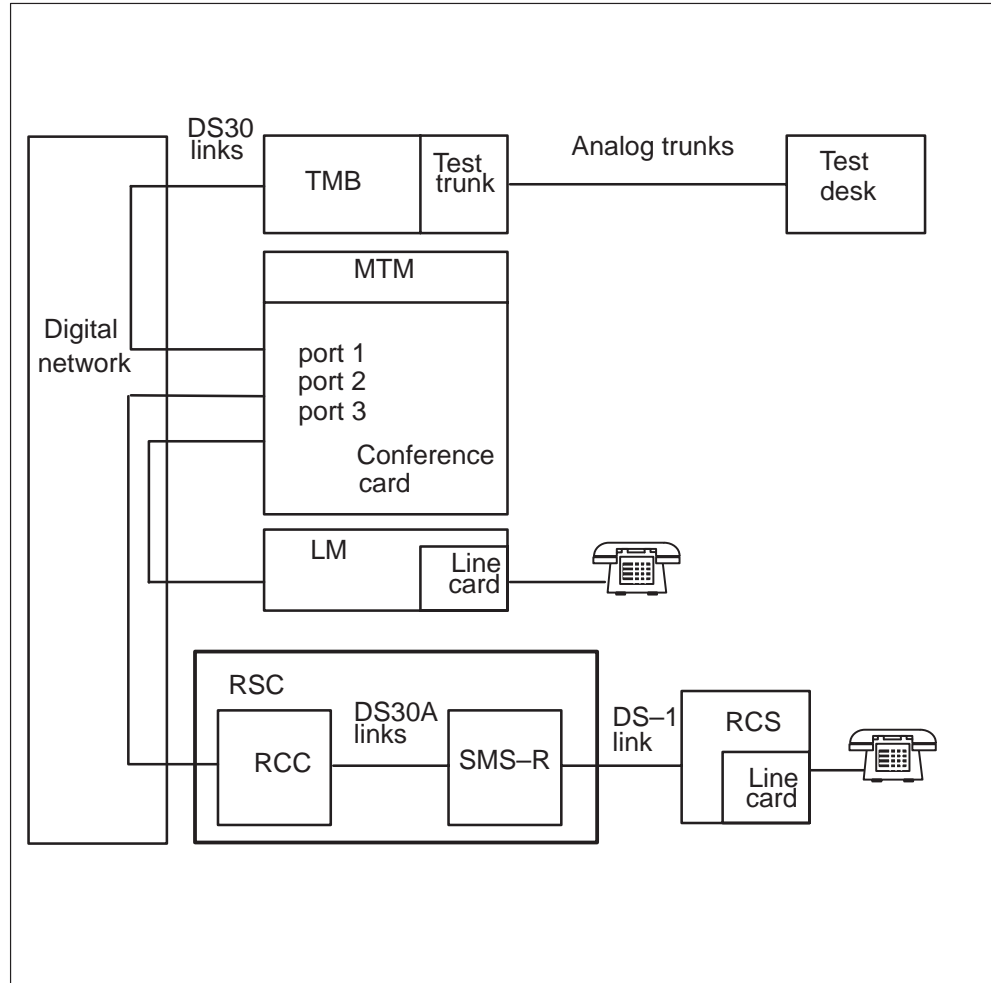
When operating company personnel dial the directory number (DN) or line equipment number (LEN) of the subscriber line to be tested from the test desk, the DMS-100 switch collects and translates the digits. If the line is a valid destination and is idle, usually the test desk is connected to the line through a metallic test access network. If the line is in the talking state, a conference card is used to set up a bridged connection.

If, during the conference, the line being checked (RCS line) goes on-hook and then reoriginates, a busy tone is returned to the test desk.

If the RCS line goes on-hook and does not reoriginate, the test desk is connected through the metallic test access network to the line.

If the other party (connected in call processing to the RCS line) goes on-hook while the RCS line remains off-hook, no monitor access is gained. But, if the RCS line goes on-hook and remains on-hook, monitor access occurs.

If the RCS line goes on-hook and then reoriginates, a busy tone is returned to the test desk.

If a conference call is set up and the test desk disconnects, the two original lines remain connected (no conference card used).

Instances of a conference call failing to be set up follow. The first list specifies conditions that cause a busy tone to be sent to the test desk. The second list specifies conditions that cause a reorder tone to be sent to the test desk.

- test desk receives busy tone (60 ipm)
    — line has an activated custom calling feature
    — line is already connected to an operator or PBX is connected to another test trunk
    — line has no double connection option
    — line has plug-up option
    — line has suspended service option
    — line has requested suspended service option
    — line has random make busy option
    — line has no line insulation test option
    — line is connected to an attendant console
    — line is in ringing or digit collection states
    — line is undergoing a station test, such as the station ringer or silent switchman test
    — line has three-way calling option and is engaged in a three-way call
    — the test trunk is datafilled as type TSTDK and version regular in table TRKGRP
    — the BARGE field of the TRKGRP table is set to N in table TRKGRP instead of Y
- test desk receives reorder tone (120 ipm)
    — the MTA network is unavailable
    — the line is hardware unassigned
    — the line is manually busy

— the line is line module busy

— the line is in the PLO state

— the line is call processing busy but the state is not the talking state

— the line is installation busy

— all conference circuits are busy

Limitations

Monitor access through a conference card has the following limitations:

- Custom calling features are not used while a line is bridged

- If a custom calling feature is active on a line, that line cannot be bridged using a conference card.

Station testing

Station testing determines if a station is functioning properly while connected to a loop and a line circuit combination. Station testing is performed either under the LNS subsystem at a MAP terminal or, in the cases of the station ringer and dialable short circuit tests, from a station. Stations are tested manually. Results from station tests are returned to the station.

The silent switchman test is not supported since a subscriber loop in cutoff interferes with ringing.

Information that appears in log reports (ALT101 or LINE101) or at the MAP terminal for aborted station ringer and dialable short circuit tests follows:

- connection failure

- PM not ready

- check channel test unit/line card

- no SMS-R P-side channel

- PM reply time-out

- unexpected PM reply

- software error

Tests initiated from the subscriber premises

Two tests initiated from the subscriber's telephone set are the dialable short circuit and the station ringer tests. Both of these tests are supported for RCS lines.

The dialable short circuit test establishes a short circuit across the tip and ring leads of the subscriber loop. The following figure shows an example of

the dialable short circuit configuration. The horizontal test pair leads of the MTA are not attached to any test equipment; instead, they are simply shorted together. The short circuit is maintained for the length of time established by office parameter CABLE_SHORT_TIMEOUT (verified with an Ohm meter) in table OFENG (0 to 600 sec; the default is 180 sec).

Dialable short circuit configuration
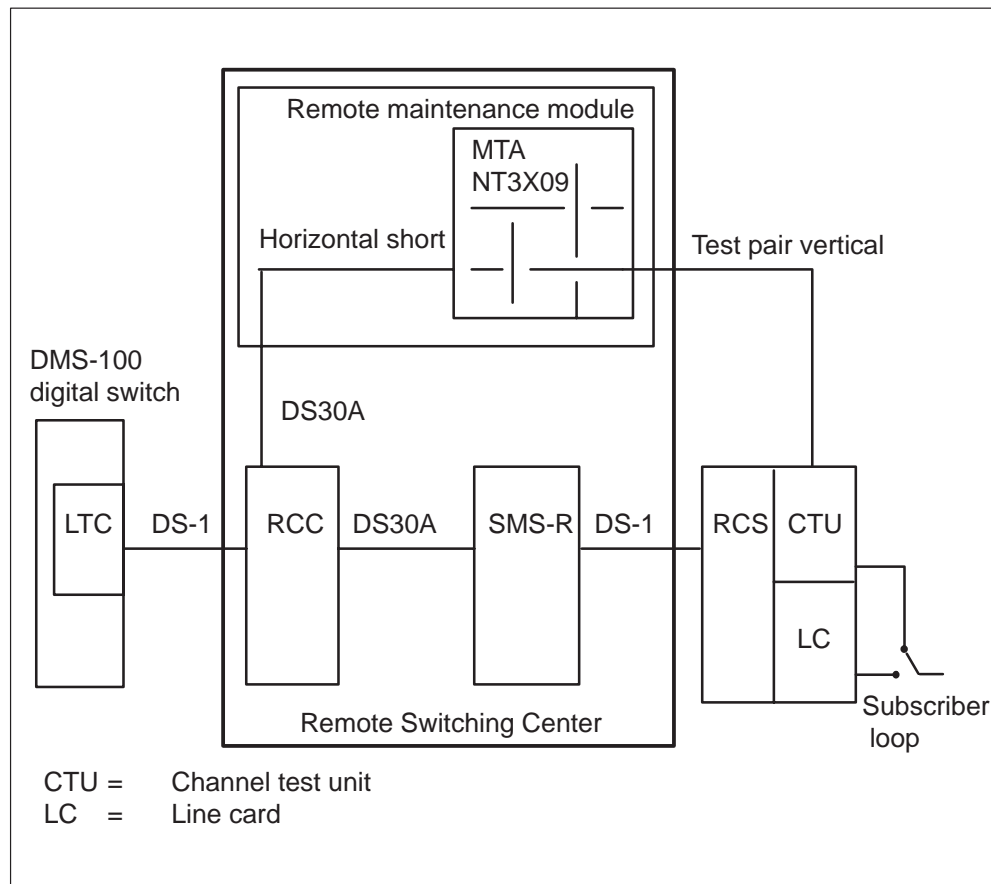
The station ringer test tests POTS single party Digitone lines, POTS single party dial pulse lines, multiparty Digitone tip side lines, multiparty ring side lines, and coin Digitone lines. This test compares digits received at the central office with known digits transmitted at the subscriber station.

The following tests are also performed using the station ringer test configuration:

- digit collection

  Accessed by dialing or keying a code at a station. The test passes if two 60 IPM low tones are returned to the subscriber station. If one 60 IPM low tone is returned to the subscriber station, the test failed.

- party identification

  Confirms a single party line by returning a steady low tone to the station subscriber after flashing the hook switch.

- on-hook ground check

  Verifies the station is ringing after placing the receiver station on-hook.

See the following figure for an example of station ringer test configuration.

Station ringer test configuration
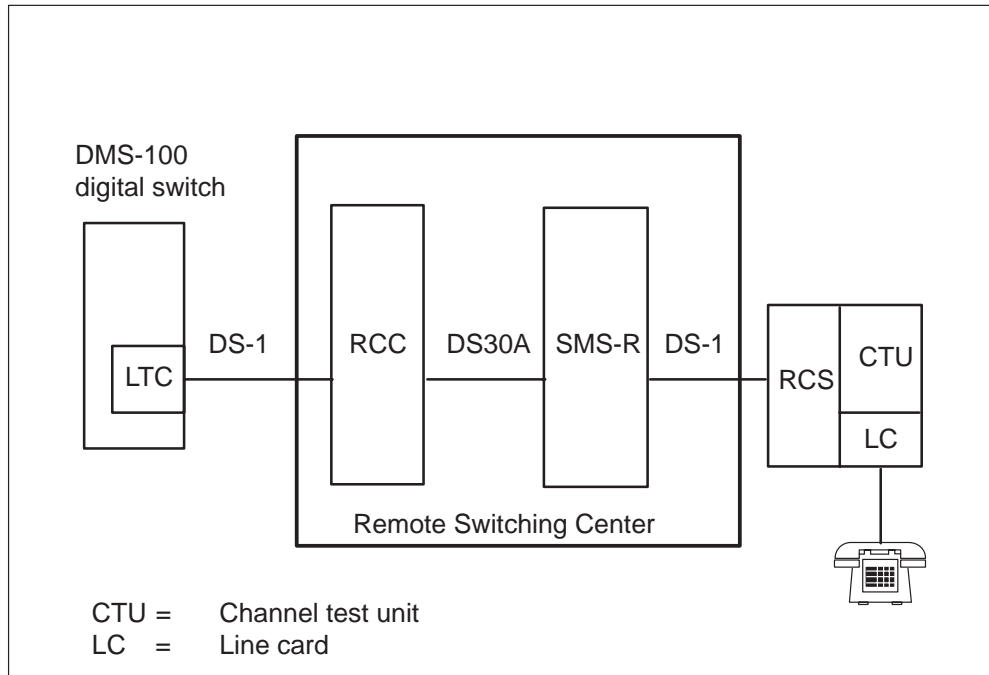
Diagnostic tests for the SMS-R

Diagnostic tests, either system or manually initiated, locate hardware faults down to a replaceable card level. System initiated diagnostics are generated when internal counters exceed fixed levels. Manually initiated diagnostics are used when either log reports indicate a common equipment problem, system-detected alarms are generated, or OMs show high error counts.

ROM diagnostic

The read-only memory (ROM) diagnostic detects faults in the processor and memory cards. It is initiated when the SMS-R unit is in the who-am-I (WAI) state.

The following memory card circuits are tested:

- memory circuitry

- parity circuitry

- direct memory access (DMA) circuitry

- activity circuitry

- holding registers

The following processor card circuits are tested:

- memory mapper unit

- universal synchronous/asynchronous receive/transmit (USART) integrated circuits

- programmable timers (integrated circuits)

Note: The unit must be reloaded after this diagnostic is run.

A- and B-bit diagnostic

The A- and B-bit diagnostic tests the A- and B-bit circuitry on the NT6X44 timeswitch card. It also tests the global loop-around of the timeswitch card and the channel supervision message (CSM) loop-around of the NT6X41 formatter card. This diagnostic performs random-access memory (RAM) tests on the A/B transmit and receive memories, tests the time switching function of the timeswitch, tests the generation and reception of A- and B-bits, and tests the enable-disable function of the A/B-bit receive memory.

The following SMS-R hardware components are involved in this diagnostic:

- NT6X85 DS-1 interface card

- NT6X44 time switch card

- NT6X69 message card

- NT6X41 formatter card

- speech bus

CSM diagnostic

The CSM diagnostic tests the hardware involved in the transmission, reception, and use of the channel supervision message (CSM). Most of this hardware resides on the NT6X42 CSM card. This diagnostic tests all of the memories on the NT6X42 card and the memory on the NT6X41 formatter card.

Also tested are the integrity match-mismatch logic, the speech bus parity error generation (NT6X41 formatter card) and detection (NT6X42 CSM

card) logic, and the channel data byte (CDB) transmission and reception logic. Finally, this diagnostic checks for interactions among bits of the parity error RAM, correct interaction between the integrity match-mismatch and CDB update logic, and correct operation of the CSM loop on the NT6X41 formatter card.

The following hardware components are involved in this diagnostic:

- NT6X42 CSM card
- NT6X41 formatter card
- speech bus

Formatter diagnostic

The formatter diagnostic tests the NT6X41 formatter card. This diagnostic tests the control RAM and the C-side loop enable-disable function. This diagnostic also checks for correct functioning of the network framing interrupts, C-side messaging, and P-side messaging. Also checked are the integrity of the speech bus connection and message memories, both located on the NT6X69 message card.

The following hardware components are involved in this diagnostic:

- NT6X41 formatter card
- NT6X69 message card
- NT6X44 time switch card
- speech bus

Message diagnostic

The message diagnostic tests the hardware of the NT6X69 message card. Specifically, the diagnostic checks for correct functioning of the on-board processor's time slice processes, speech bus interface, intermodule communication (IMC) link, and cyclic redundancy check (CRC) ROM. The integrity of the message buffer memory and P- and C-side messaging are also validated.

The following hardware components are involved in this diagnostic:

- NT6X69 message card
- NT6X44 time switch card
- NT6X41 formatter card
- NT6X85 DS-1 interface cards
- speech bus

Tones diagnostic

The tones diagnostic serves two purposes. First, it runs pulse coded modulation (PCM) checksums on the tones of ports 16 and 17 (phantom ports) and ensures that these checksums agree with the checksums in the tone ROM located on the NT6X69 message card. Secondly, it checks the speech bus connection memory for all channels (except 0 and 16) of ports 16 and 17 to ensure that the tones are enabled onto the speech bus.

The following hardware components are involved in this diagnostic:

- NT6X69 message and tone card
- speech bus

Speech path diagnostic

The speech path diagnostic checks all of the XPM speech channels for data integrity. This test checks all C-side and P-side loop-arounds and all time slots of the speech bus. Also tested are the highway multiplex and the PCM enable-disable gates.

The following hardware components are involved in this diagnostic:

- NT6X41 formatter card
- NT6X69 message and tones card
- NT6X44 timeswitch card
- NT6X85 DS-1 interface cards
- speech bus

Time switch card diagnostic

The SMS-R time switch card switches speech, control, and supervisory signals from the C-side (toward the remote cluster controller [RCC]) to the P-side (away from the RCC) of the SMS-R. The time switch card diagnostic tests the time switching of the time switch (NT6X44) card. This diagnostic runs only if the SMS-R is out-of-service. This diagnostic tests for the presence of the time switch card, its incoming and outgoing connection memories, and its time switching functions. The time switch diagnostic tests the NT6X44 phase comparators in both in-service and out-of-service states. This diagnostic also checks the values of the office-sync phase comparators to detect faulty comparators used in office synchronization.

The following hardware components are involved in this diagnostic:

- NT6X44
- NT6X69

Ring/pad card diagnostic

The ring/pad diagnostic tests the hardware and functionality of the NT6X80 ring/pad card. This diagnostic tests the card reset, memory, and ring/pad interrupt. Tests are also performed on the pad ROM and dc voltages. The hardware tested is restricted to the NT6X80 card.

DS-1 card diagnostic

The DS-1 card diagnostic verifies that DS-1 cards operate correctly. The DS-1 link is sometimes verified during diagnostics, depending on how the diagnostics are invoked. The DS-1 card diagnostic runs during CC link audits, either when the SMS-R or a DS-1 link returns to service from the MAP display or when a DS-1 link is tested from the MAP terminal. PCM looping tests occur during the test of the DS-1 link from the MAP terminal.

There are two link audits: the in-service audit tests all in-service DS-1 links; and the out-of-service audit tests all system busy DS-1 links.

DS-1 DDL diagnostic

The DS-1 DDL diagnostic tests the derived data link circuitry of the SLC-96 DS-1 interface card. This diagnostic checks for correct functioning of DDL synchronization, correct insertion of DDL supervisory message bits into the outgoing DS-1 framing bit time slots, and extraction of corresponding bits from incoming frames. The DDL messaging capability of the card is tested when the A/B DDL message card transmits a known message on the DDL. This message is sent from the time switch card into the SLC-96 DS-1 interface card, and looped around in the card and returned to the time switch.

A relay in the SLC-96 DS-1 makes this loop-around possible. When this relay is open, data is sent out normally on DS-1 lines.

The SP checks the received message against the transmitted message and, if the two messages are not identical, it indicates a fault in the SLC-96 card.

The DS-1 board diagnostic is part of the TST command that operating company personnel issue from the MAP terminal. For the diagnostic to run successfully, the following diagnostics must first pass:

- DS-1 diagnostic
- time switch diagnostic
- A/B-DDL message card diagnostic
- message-tones card diagnostic

The TST command allows operating company personnel to issue the subtest command at the MAP terminal and run the DS-1 board diagnostic alone.

If the diagnostic fails, a failure message, similar to the one in the following example, appears:

```
SMSR 0  Unit 1  Tst  Failed,  SMSR DS1 Test
Fail message received from PM

Site  Flr  RPos  Bay_Id   Shf  Description  Slot  EqPEC
HOST  00   A00   SME  000 14    SMSR:00      :02   6X85
```

The following hardware components are involved in this diagnostic:

- NT6X85 DS-1 interface cards
- NT6X86 A/B-DDL message card
- NT6X44 timeswitch card
- NT6X69 message card

P-side link diagnostic

To test a DS-1 link at the PM level, post the associated SMS-R, ensure that the SMS-R and the associated RCS are InSv, and then issue the command string TST LINK <number>.

With an InSv link, the TST command causes the SMS-R to execute a PCM loopback test on the link. The SMS-R sends a specific PCM pattern over the DS-1 link to the RCU. The RCS loops the pattern in its time switch card and returns it to the SMS-R, which compares sent and received samples.

If the PCM loopback test fails, the DMS-100 switch generates PM181, PM183, and PM128 logs (refer to examples below). The failed link is busied and the associated SMS-R and RCS are placed ISTb, as follows:

```
PM181 MAY16 09:22:12 4588 INFO SMSR 60
Node:  ISTb, Unit0 Inact: InSv,  Unit1 Act:  ISTb
PCM Loopback test failed on P-side link 5
PM183 MAY16 09:23:00 4677 SYSB SMSR 60  P-side LINK: 2,
FROM:
 InSv
PM128 MAY16 09:23:33 4877 TBL ISTb SMSR 60
Node      : ISTb (PSLink OOS) From InSv
Unit0 Inact: InSv
Unit1  Act: InSv
```

When a system audit detects a SysB link, the DMS generates the following PM110 log:

```
PM110 MAY16 09:27:33 4899 INFO CARRIER SMS-R 60
CARRIER-NO: 8, REASON: REMOTE LINK SYSBSY
```

When a link returns to service, the SMS-R and RCS exit ISTb and go InSv if no other faults are present. If no other faults exist the DMS generates a PM106 log. See the example that follows. Otherwise, it generates a PM128 log. When a link returns to service the DMS-100 switch generates a PM184 log. See the example that follows.

```
PM106 MAY16 11:23:33 4877 RTS SMSR 60
Node       : InSv From ISTb
           : ISTb Cleared (PSLink OOS)
Unit0 Inact: InSv

Unit1 Inact: InSv
PM184 MAY16 09:33:00 7677 RTS SMSR 60  P-side LINK: 2,
              FROM: SysB
```

With an out-of-service link, the TST command causes the RCS to execute a common equipment digroup loopback test. This test checks the ability of the RCS to assign channels on a link through its time switch card. The test checks all RCS common equipment involved in the PCM path: maintenance, supervisory, switch, and digroup cards.

CMR diagnostic

The CMR card in the RCC is self-diagnosing. It contains on-board firmware that provides the actual card level diagnostic. This diagnostic detects service-affecting faults as soon as possible.

Note: The CMR card resides in the RCC or RCC2, not in the SMS-R.

This diagnostic provides the RCC with both in-service and out-of-service diagnostics along with a CMR audit that invokes the in-service diagnostic on a regular basis. Thus, this feature provides a diagnostic interface to report CMR failures as follows:

- The in-service diagnostic provides an interface with and controls the on-board firmware diagnostics, which continuously test various critical components of the CMR card. This diagnostic runs once every minute as requested by an in-service audit. In addition, operating company personnel can request the in-service diagnostic using the command string TST UNIT NO at the MAP terminal. These diagnostic–triggering techniques result in thorough in-service coverage of the CMR card.

- The out-of-service diagnostic tests the functionality of vital CMR hardware. This diagnostic uses some of the same on-board firmware diagnostics as in-service tests, but more thoroughly tests all resources that normal in-service traffic/time constraints do not permit.

- The CMR audit is used to run this audit on a regular basis. The facility audit normally used for this purpose has too low a repetition time (7.5 minutes) to provide adequate detection time for the CMR card. Thus a new audit was created for this feature.

Results of the CMR diagnostic test are logged as a PM181 audit exception report. The PM181 audit exception report lists the failed card list and indicates that the CMR diagnostics detected the fault.

The CMR diagnostic can be run entering the command string TST UNIT from the MAP terminal.

XBERT diagnostic

The XPM bit error rate test (XBERT) is a tool for detecting and measuring bit errors induced by high-speed data transmission in the XPM and its P-side nodes.

For bit error rate performance (BERP) MAP level commands from which BERP tests are conducted on the SMS-R and SMS-R C-side and P-side links, refer to "BERP level maintenance commands".

Three XBERT tests, XPMINT, XPMPSL, and XPMHLP, initially check for the presence of the NT6X44 timeswitch and 6X69 message cards. If these cards are not accessible, XBERT displays a message and the remainder of the test is aborted. If these two cards are accessible, XBERT then checks for the presence of the XPM P-side interface card controlling the port to be tested.

If all preliminary hardware presence tests pass, individual XBERT tests are initiated to set up the channel connections. XBERT passes data through the looped test path and verifies it as it comes through the loop.

When a specific XBERT test path is established and A/B-signaling bits are disabled on the test channel, the test proceeds by connecting a tone to the channel under test. The tone PCM then passes through the loop; checksum calculations are performed on the looped PCM for a user-specified time (up to 9 hours).

This checksum calculation is done by calling a procedure that writes an opcode to the NT6X69 message card, and then instructing it to calculate a checksum on a specific speech channel. If the test path is error-free, the calculated checksum is the same as the known checksum value for the tone being used. If the calculated checksum is different from the known checksum, there is at least one bit in error in the transmitted tone.

The tone used in the tests is the milliwatt tone. This tone has a length of 502 bytes (4016 bits). As a result, any number of bits in error in the 4016 bits causes the checksum to be incorrect. As a result, the bit error results are reported in terms of errored blocks, with one block being one tone cycle (4016 bits).

The bit error rate displayed by the XBERT tests is calculated by dividing the number of errored blocks by the number of bits tested. This method assumes that there is only one errored bit in each errored block. XBERT is a fault detection and isolation tool; XBERT does not provide accurate bit error ratio assessments. It does not use the CCITT standard test patterns in its test procedures, instead it uses XPM tone PCM to provide the 64-Kbit/second test bit stream.

XBERT, does not test more than one test path at a time in any single XPM unit. Although the user specifies XPM P-side port(s) to be tested, the user cannot request a particular channel on that port (except for the XPMHLP test in which a specific channel must be specified). XBERT runs on in-service XPM units, so there is no degradation to call processing functions when the tests run. At the end of a test run, XBERT releases the test path connections and displays the bit error statistics based on the completed test run. These statistics can also be displayed any time during the test run.
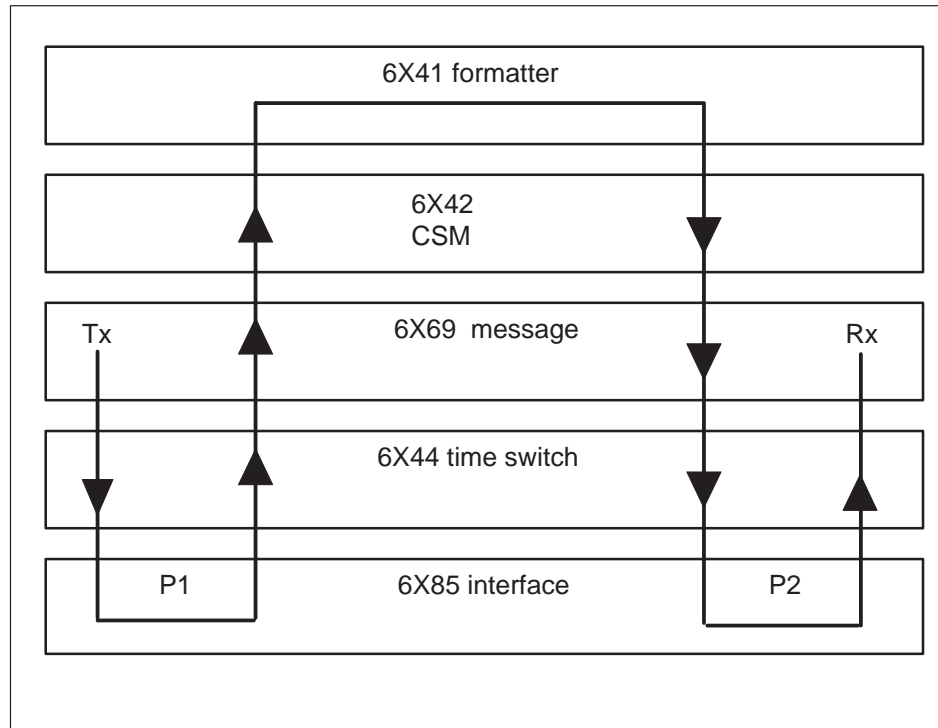
The following XBERT tests are used by the SMS-R:

- ISOLATE   This option provides a facility for automatic fault isolation. If this option is added to the test command string, XBERT automatically runs other applicable XBERT tests to detect and isolate a fault to a particular set of circuit packs. The number of cards in a card list isolated in this manner varies between one and three cards, depending on individual test results.

- XPMINT This option sets up the test path as seen in the following figure, XPMINT test path. The test tries to allocate two loop-arounds at the XPM P-side interface cards on the two ports specified by the user. If the test is unsuccessful in allocating these loop-arounds, it displays a message and the test is aborted. If the P-side loop-around allocations are successful, the test attempts to allocate a C-side loop-around to loop data back toward the P-side at the NT6X41 formatter card. Again, if the test is unsuccessful in allocating this C-side loop-around, a message is displayed and the test is aborted. If all loop-arounds are successfully established, the two P-side channels are cross-connected with the C-side channel.

  This test requires that the user specify two P-side ports to be tested. The ports can be both DS30A, both DS-1, or one DS30A and one DS-1.

XPMINT test path

FW-xxxxx

```
+-----------------------------------------------+
|                                               |
|   +---------------------------------------+   |
|   |            6X41 formatter             |   |
|   |                                       |   |
|   +---------------------------------------+   |
|   +---------------------------------------+   |
|   |               6X42                    |   |
|   |               CSM                     |   |
|   +---------------------------------------+   |
|   +---------------------------------------+   |
|   | Tx         6X69  message          Rx  |   |
|   |                                       |   |
|   +---------------------------------------+   |
|   +---------------------------------------+   |
|   |           6X44 time switch            |   |
|   |                                       |   |
|   +---------------------------------------+   |
|   +---------------------------------------+   |
|   |   P1      6X85 interface       P2     |   |
|   |                                       |   |
|   +---------------------------------------+   |
|                                               |
+-----------------------------------------------+
```

- XPMPSL This option sets up the test path as seen in following figure, XPMSL test path. The test tries to allocate a loop-around at the XPM P-side interface card on the port specified by the user. If the test is unsuccessful in allocating this loop, a message is displayed and the test is aborted. If the loop-around allocation is successful, the test proceeds.

  This test requires that the user specify one P-side port to be tested. The port can be either DS30A or DS-1.

XPMPSL test path

FW-xxxxx
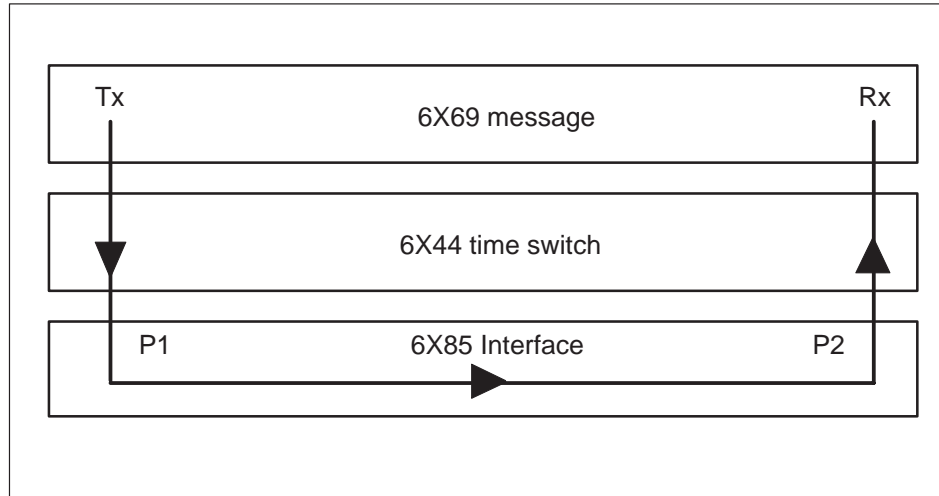
- XPMHLP   This option sets up the test path as seen in the following figure, XPMHLP. The test relies on a physical hard loop-around provided at the remote end of a carrier. The carrier is looped back onto itself so that a node at the remote end of the carrier is not required. For all peripheral types except the IAC, the carrier being tested must be in a busy state.

  This test requires that the user specify one P-side port and one channel on that port to be tested. The specified port must be the DS-1/PCM30 port whose associated carrier is looped back at the remote end.

XPMHLP test path

Tx	6X69 message	Rx
	6X44 time switch	
P1	6X85 interface	P2

P1 (Tx)   P2 (Rx)

Carrier looped at remote end
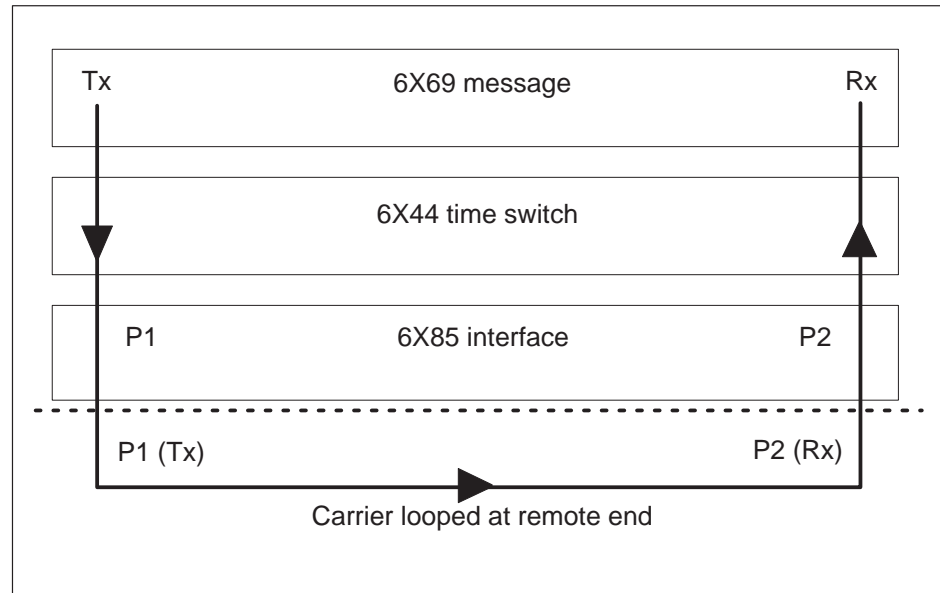
XBERT command

XBERT is accessed at any level of the MAP display by typing:

>XBERT smsr no
and pressing Enter.

Once in XBERT, the user can access all XBERT commands. The INITIATE
command starts an XBERT test. This command has several parameters that
define the characteristics of the test to be run. If any of the parameters are
omitted, XBERT does not proceed with the initiation request.

XPM diagnostic history

Extended Peripheral Modules Diagnostics History, feature number AF5006
provides a resident database to record selected diagnostic results of XPMs.
This feature captures diagnostic results that indicate the SMS-R's sanity.
The data in this database may be used to influence DMS-100 maintenance
activities. This database provides operating company personnel with MAP
command access to data on the accumulated results of diagnostics. Data in
the history database is retained over warm, cold, and reload restarts. This
feature is part of software package New Peripheral Maintenance
(NTX270AA), and is not an optional feature.

This feature is one of a group of three inter-related features. The two
remaining features are: XPM PreSWACT/Post SWACT Audit, feature
number AF5007, and XPM REX Control and Trouble Notification
Improvements, feature number AF5008. Feature AF5007 uses a subset of

diagnostic results, along with past REX tests and SWACT results to determine if a SWACT should be performed. The functionality introduced by feature AF5007 is referred to in this text as the SWACT controller. Feature AF5008 modifies the XPM REX test to use the SWACT controller and provides log enhancements.

An SMS-R may execute diagnostics to test the functionality of its hardware. Diagnostics may run as a result of CC or SMS-R requests. Diagnostics the SMS-R performs are usually part of SMS-R audits. The diagnostic results provided by feature AF5006 are used for system analysis by the SWACT controller and operating company personnel.

SWACT controller
This feature provides short term diagnostic performance data to the SWACT controller. A set of query procedures are provided for applications which desire such information. The SWACT controller determines if a SWACT is advisable. Short term data for a given unit means diagnostic and audit failure counts measured since the last time a unit successfully gained activity.

Operating company personnel analysis
Feature AF5006 provides data on the failure history of diagnostics. This data is in the form of the number of failures that occur and which cards are at fault. MAP commands are provided to display data for a given SMS-R or for all SMS-Rs supported by this feature. Two sets of data are available through the use of MAP commands: short term failure counts and long term failure counts.

Short term failure counts are accumulated from the last time a unit successfully gained activity. This data may be useful to operating company personnel in guiding their maintenance activities and supporting organizations for outage analysis. If an outage occurs, it is recommended the XPM Diagnostic History data for that peripheral be included with other pertinent data.

Long term failure counts are accumulated from the last time long term failure counts are reset, by manual action or BCS application. Long term failure counts are intended to last for the life of the BCS. This data is channeled back to the design community to provide data for further diagnostic system improvements.

Functionality described in this feature is implemented on SuperNode and BNR Reduced Instruction Set Computing (BRISC) platforms. Only the diagnostics and associated cards essential to the *SWACT controller* are supported on NT-40 platforms. This restriction is because of NT-40 data

store requirements. For the NT-40 platform the diagnostic results and suspect cards captured is smaller than the SuperNode or BRISC platforms.

Description of diagnostics

Because different PMs contain different hardware, different diagnostics are run on every type of PM. There are approximately 75 diagnostics for XPMs. Only a subset of the 75 diagnostics is run on any given PM. This feature captures failures for the following types of diagnostics:

- in-service
- out of service
- single diagnostic
- facility audit
- other audits

Each diagnostic implicates zero or more cards as determined by the XPM. In some instances, card lists are generated by CC for display at the MAP terminal or in logs. Any card implicated by a XPM diagnostic or audit, and reported to CC is included in a list of card failures.

Note: Feature AF5006 records only those cards implicated by an SMS-R and not cards generated by CC.

Diagnostics may be grouped together and run as a set of diagnostics or run as a single test. Commonly defined sets are

- in-service tests
- out-of-service tests
- facility audit tests
- mate diagnostics
- ROM diagnostics

In-service and out of service tests

In-service and out-of-service tests are solicited tests; they are run only as a result of CC requests. When CC requests to test an SMS-R unit by using the manual TST command, manual or system RTS, SWACT, BSY or REX commands, the XPM runs a set of diagnostics. The diagnostics included in the set vary according to the PM type of the XPM, the state of the XPM unit, and the activity of the XPM unit. If the unit is in service, the XPM runs a set of in-service diagnostics. If the unit is out of service, the XPM runs a set of out-of-service diagnostics.

The results of individual diagnostics are returned to CC along with a final result for the entire set. If any cards are faulty, a card list is generated and transferred to CC at the termination of the set of tests.

Facility audit
The facility audit is a set of diagnostics the SMS-R runs periodically to test itself. If problems are encountered, a message is sent to CC indicating the problem along with a list of faulty cards.

Mate diagnostics
If communications are lost with one unit, that unit may be diagnosed by its mate unit, and the results sent to CC by the mate unit.

ROM diagnostics
This feature does not capture failures, nor does it capture the cards implicated by mate and ROM diagnostics. For each diagnostic, a card list or log is generated at the MAP terminal, but no card list or diagnostic failure is recorded in the diagnostic history.

The following table lists and describes diagnostics supported by this feature. The diagnostics are classified as solicited, audit, or both. In addition, diagnostics the SWACT controller requires are identified.

TXPM diagnostic history supported diagnostics

Diagnostic name	Description	Type	Required by SWACT controller
ABDIAG	A/B Bits	solicited	no
CSMDIAG	CSM Diag	solicited	no
CSSPCH	Network Links	solicited	no
DS1DIAG	P-Side DS-1	solicited	no
FAC AUD	Facility Audit	audit	no
FORMATR	Local Formatter	solicited	no
MSGDIAG	6X69 Messaging Card	solicited	yes
MSGIMC	IMC Link	both	yes
PADRING	6X80 Pad/Ring	solicited	no
PARITY	Parity Audit	audit	yes
—continued—			

TXPM diagnostic history supported diagnostics (continued)

Diagnostic name	Description	Type	Required by SWACT controller
PSLOOP	P-Side Loops	solicited	no
PSSPCH	P-Side Speech Links	solicited	no
SCM AB	6X81 A/B Bits	solicited	no
SCM MSG	SCM A/B DDL Msg	solicited	no
SPCH DG	Speech Path	solicited	no
SYNC DG	Sync Diag	both	yes
TONES DG	Tone Diag	both	no
TS DIAG	Time Switch Diag	solicited	no
—end—			

The following table lists the cards supported by this feature.

XPM diagnostic history supported cards

Card name	Description
NT6X41	Speech Bus Formatter and Clock
NT6X42	CSM
NT6X44	Timeswitch and A/B Bit Logic
NTMX77	Unified Processor
NT6X69	Messaging Card
NT6X80	SCM Pad/Padring
NT6X81	SCM A/B Bit
NT6X85	SCM DS-1
NT6X86	SCM MSG
NT8X18	SMSR CSide DS30A Interface

How diagnostics are stored

This feature stores diagnostic results in the form of counters. Each unit of
each peripheral supported by this feature has its own set of counters.
Counters are kept for diagnostic failures and for cards found to be faulty

Three types of counters are kept:

- diag: the number of times a diagnostic fails

- card: the number of times a card is reported as faulty

- diag and card combination: the number of times a diagnostic and card combination occurs

Two subcounters are kept for each of the three counters: a short term failure counter, and a long term failure counter. The short term failure counters are used by feature AF5007 to determine if a SWACT is advisable. Short term failure counters are reset frequently throughout the BCS cycle. Long term failure counters record the diagnostic history of a peripheral or office over a extended period of time. Long term failure counters are reset using the command string QUERYPM DIAGHIST RESET or by a BCS application.

A single test failure can report one or more diagnostic failures and zero or more cards which are faulty. It is possible for a diagnostic running in one unit to report cards in that unit and also its mate unit. When a diagnostic fails, the individual diagnostic routine sends the failure information to the history database. The following table summarizes how each type of counter is incremented and the differences necessary on NT-40 platforms.

Counter Increments

Counter	SuperNode, BRISC	NT–40
Diag	Increments short and long term failure counts for all diagnostics on the unit the diagnostic is run.	Increments short and long term failure counts for diagnostics required by the SWACT controller.
Card	Increments short and long term failure counts for all cards in the unit or units in which the card is physically located.	Increments short and long term failure counts for cards associated with diagnostics required by the SWACT controller.
Diag and card	Increments short and long term failure counts for all combinations of diagnostics and cards. This counter is for cards in the same unit the diagnostic is run.	Diagnostic and card combinations are not stored by the NT-40 because of data store limitations.

Resets and timestamps
The history database stores five timestamps for every peripheral:

- for the node: the time when long term failure counters are last reset

- for unit 0: the time when short term failure counters for unit 0 are last reset

- for unit 0: the time when the last diagnostic failure occurred on unit 0

- for unit 1: the time when short term failure counters for unit 1 are last reset

- for unit 1: the time when the last diagnostic failure occurred on unit 1

Short term counters are reset (set to zero) internally on a unit basis when a unit successfully gains activity. This gain of activity may happen as a result of an RTS or SWACT command. Long term counters are reset on a node basis from an XPM posted at the MAP terminal. When long term counters are reset, a log is generated with a summary of the data collected for that node prior to the reset.

A BCS application resets all diagnostic history data, including short and long term failure counts. In this case, a log with long term failure counts is not generated.

Diagnostic tests for lines

When the RCS line card is set up for testing, the following diagnostics can be executed. These diagnostics are executed as part of the DIAG command issued at the LTP level of the MAP terminal.

Channel loss

The channel loss test is essentially the same as the transhybrid loss test. It checks the PCM and analog path on a line card circuit. A transmission test unit (TTU) sends four ac signals to a line card with a reflect or reflect-negative tip party ground (NTPG) termination connected. These signals are reflected back to the TTU and analyzed by the DMS-100 switch.

The channel loss test is also used with the ringing and coin (return and collect) tests to determine if a proper termination is set up for these tests. For example, if an absorb termination is supposed to be set up in the RCS line card, the ac signals of the channel test should be absorbed, with no signals returned to the DMS-100.

Noise

The noise test uses The TTU and a reflect or reflect-NTPG termination.

Echo return loss

The echo return loss checks the flux cancellation circuitry of a line card. The TTU and an absorb or absorb-positive tip party ground (PTPG) termination are used.

Loop detector

The loop detector test checks the capability of the line circuit to detect off-hook or on-hook conditions; it is run as part of test setup. The SMS-R sends an A- and B-bit pattern that causes the RCS to apply an absorb termination. This termination simulates an off-hook at the RCS. The RCS detects this termination as an off-hook (idle A/B bits must be sent before the RCS detects termination as off-hook) and send to the SMS-R the A- and B-bit pattern associated with off-hook.

The SMS-R removes the termination by sending the RCS an on-hook message in the M-field of the DDL. The RCS detects removal of the termination as a simulated on-hook and send to the SMS-R the on-hook A- and B-bit pattern associated with on-hook subscriber lines.

ANI and coin presence

The ANI and coin presence tests check the ability of the line card to simulate tip party off-hook and coin presence, detect the termination that simulates tip party off-hook or coin presence, and return an A- and B-bit signaling pattern to the SMS-R indicating tip party off-hook or coin presence.

The SMS-R sends A- and B-bit patterns associated with different polarities of ringing on multiparty lines that cause the RCS to set up terminations with and without NTPG/PTPG. For example, A- and B-bit pattern associated with negative superimposed ringing on the tip (–T) causes a reflect-NTPG termination to be set up.

When the termination is reflect-NTPG or absorb-NTPG, the ANI test indicates a tip party off-hook; other terminations indicate ring party off-hook. Similarly, a reflect-NTPG or absorb-NTPG termination simulates coin presence; other terminations simulate lack of coin presence. The test fails if the SMS-R receives no reply or an incorrect reply.

Ringing

The ringing test checks the ability of an RCS line card to ring a subscriber line. The SMS-R sends a specific A- and B-bit pattern for –R ringing; and other A- and B-bit patterns for +R, –T, and +T ringing on multiparty lines.

When the SMS-R sends the RCS an A- and B-bit pattern requesting that the RCS ring a subscriber line, the RCS sets up a termination. This simulates a subscriber off-hook and causes the RCS to return an off-hook A- and B-bit pattern to the SMS-R.

With multiparty ringing, the SMS-R sends the RCS signals to execute a loss and ANI/coin test after the ringing test. These tests determine if the correct termination is connected at the RCS.

Coin collect and coin return

The coin collect and coin return test checks the ability of RCS coin cards to collect and return coins. The SMS-R sends the RCS an A- and B-bit pattern to execute a coin-return or coin-collect function.

For coin collect, the RCS provides an absorb-PTPG termination; for coin return, the RCS provides a reflect-NTPG termination. Only when a reflective-NTPG is present does the RCS detect coin presence and send the SMS-R an A- and B-bit indicating such. The loss and coin presence determine if proper terminations are made in the RCS.

These diagnostics are part of the DIAG command issued at the LTP level of the MAP display.

Along with line circuit and subscriber loop tests, the station ringer test is also supported.

The silent switchman test is not supported, and metallic test access testing to subscriber loops is restricted. Supporting the silent switchman test would place the subscriber loop in cutoff. Placing the subscriber loop in cutoff would interfere with ringing, since the RCS has a single relay that connects ringing and test access pathways to the loop. Attempting to run the silent switchman test causes a reorder tone to be returned to the RCS line.

The same relay also cuts off the line card from the subscriber loop. Consequently, the test pair coming from the MTA switch accesses only the subscriber loop.

Product specific test tools

Many tools test components from peripheral modules and remote terminals. However, no product-specific test tools are used to test the SMS-R/RCS configuration.

Problem solving chart

SMS-R

The following problem solving chart provides operating company personnel with easy access to problem solving procedures for Subscriber Carrier Module–100S Remote (SMS-R) alarms. For an explanation of critical, major, and minor alarms, refer to Alarms in section Problem isolation and correction. More complete problem solving methods for the SMS-R appear in *Alarm Clearing Procedures*.

Clearing an SMS-R alarm

Alarm condition	Possible cause	Action
Critical	Both central side (C-side) cards are defective	Proceed as follows: 1 Identify the SMS-R module in the critical state. 2 Post the SMS-R module in the critical state. 3 Identify problems with the posted SMS-R. 4 Proceed to *Recovery Procedures*.
	Both C-side (DS30) links are defective	Proceed as follows: 1 Identify the SMS-R module in the critical state. 2 Post the SMS-R module in the critical state. 3 Identify problems with the posted SMS-R. 4 Proceed to *Recovery Procedures*.

Clearing an SMS-R alarm (continued)

Alarm condition	Possible cause	Action
	Both power converter cards are defective	Proceed as follows:
		1 Identify the SMS-R module in the critical state.
		2 Post the SMS-R module in the critical state.
		3 Identify problems with the posted SMS-R.
		4 Proceed to *Recovery Procedures.*
Major	Defective C-side card	Proceed as follows:
		1 Silence the alarm.
		2 Identify the SMS-R unit in the in-service trouble (ISTb) condition.
		3 Post the SMS-R unit in the ISTb condition.
		4 Identify the problems with the posted SMS-R unit.
		5 Busy and test the posted SMS-R unit.
		6 Return to service (RTS) the posted SMS-R unit.
—continued—		

Clearing an SMS-R alarm (continued)

Alarm condition	Possible cause	Action
	Defective power converter card	Proceed as follows:
		1 Silence the alarm.
		2 Identify the SMS-R unit in the ISTb condition.
		3 Post the SMS-R unit in the ISTb condition.
		4 Identify the problems with the posted SMS-R unit.
		5 Busy and test the posted SMS-R unit.
		6 Return to service the posted SMS-R unit.
Major (Continued)	A defective DS30 link	Proceed as follows:
		1 Silence the alarm.
		2 Identify the SMS-R unit in the ISTb condition.
		3 Post the SMS-R unit in the ISTb condition.
		4 Identify the problems with the posted SMS-R unit.
		5 Busy and test the posted SMS-R unit.
		6 Return to service the posted SMS-R unit.
—continued—		

Clearing an SMS-R alarm (continued)

Alarm condition	Possible cause	Action
Major (Continued)	Unified Processor fault	Proceed as follows:
		1 Silence the alarm.
		2 Identify the SMS-R unit in the ISTb condition.
		3 Post the SMS-R unit in the ISTb condition.
		4 Identify the problems with the posted SMS-R unit.
		5 Busy and test the posted SMS-R unit.
		6 Return to service the posted SMS-R unit.
Minor	Defective cards	Proceed as follows:
		1 Silence the alarm.
		2 Identify the SMS-R unit in the ISTb condition.
		3 Post the SMS-R unit in the ISTb condition.
		4 Identify the problems with the posted SMS-R unit.
		5 Busy and test the posted SMS-R unit.
		6 Return to service the posted SMS-R unit.
	—end—	

RCS

When faults occur in a Remote Concentrator SLC-96 (RCS) the system generates an alarm. The system sends these alarms to the log subsystem as PM128 logs at the MAP terminal. The PM128 logs contain the reasons for the alarms and actions to follow to clear the alarm. Refer to section SMS–R related logs for more information.

Advanced troubleshooting procedures

This section describes the XMS-based peripheral module (XPM) footprint tool. This section also describes the subscriber carrier module-100S remote (SMSR) power-up and power down procedures used in advanced troubleshooting.

Advanced trouble locating procedures

Under normal conditions, operating company personnel busies and tests a defective component. As a result of this testing, the MAP terminal displays a list of cards. The card at the top of the list is often the cause of the component problem. Operating company personnel replaces the problem card and tests the originally defective component again. If the component passes this test, operating company personnel returns the component to service and the troubleshooting procedure is complete.

If normal troubleshooting procedures do not restore a component to service, the problem requires advanced troubleshooting procedures. Operating company personnel with experience use MAP display responses from failed troubleshooting attempts to formulate a maintenance method. Operating company personnel can use advanced step action procedures to repair a component fault.

Using the XPM footprint tool

The XPM footprint tool collects data to determine the cause of failures when key events occur in the SMSR. The XPM tool stores the data in the buffers that maintain activity after all SMSR restarts, resets and program reloads. The data is available for retrieval after an SMSR outage. The memory buffers are a circular queue of events that contain information on different SMSR operations and the results. These buffers are in a hexadecimal format or in a form that is easier to read.

The XPM footprint tool has two buffers for event storage. These buffers are the active buffer and the holding buffer. Use of the event storage buffers avoids the overwrite of data saved from the previous outage. When an outage occurs, a swap of the active and holding buffers occurs. The swap locks the buffer that was active before the outage to prevent the overwrite of

the buffer. An overwrite occurs when the SMSR experiences multiple initializations.

Note: A swap does not lock active buffers when one buffer is locked already, or when planned SMSR outages occur.

An SMSR outage can include the following:

- manual warm activity switches (SWACTs)
- routine exercise (REX) tests
- busy (Bsy) operations

Data records critical events in the SMSR during normal operation. When the active buffer is full, the buffer wraps to the beginning of the data area. At the beginning of the data area, the active buffer begins to overwrite previously recorded data. This condition makes sure that a record of the latest events occurs in the footprint area. This wrap can also result in the loss of important data. The buffer groups events into classes to help avoid lost data. The type of events the footprint tool stores occurs in the following SMSR classes:

- maintenance
- synchronization
- activity
- diagnostics
- audits
- messaging
- patcher
- call processing
- PMDEBUG
- static data

The selection and omission of classes of events adjusts the data that the buffer collects. The selection and omission of classes avoids the entrance of data into the buffers that overflow. For example, if the suspected cause of an outage is a specified diagnostic, select one class and omit all other classes to focus data collection on the specified diagnostic.

Before the SMSR unit drops activity and initializes again, the buffer records the type and the cause of the failure. Also, the buffer saves specified system variables. Before the drop of activity, the active buffer locks or does not lock based on the following:

- If the drop request comes from the CC and the request is not a system request, the system locks the buffers.

- If an internal SMSR decision causes the drop request, the system locks the buffers.

A footprint information area is available. The information area indicates:

- the time that the buffer wraps to the beginning of the data

- the size of the footprint area

- the address of the last used buffer

The footprint information can be used when the SMSR tool cannot return to task level. When the SMSR tool cannot return to task, the read-only memory (ROM) firmware must perform a data dump.

An audit unlocks a buffer after 24 h to prevent the loss of data other SMSR outages cause. The system generates PM189 logs when the system locks or frees active buffers.

The following examples show the type of information that the buffer collects:

- The buffer stores every command entered from the PMDEBUG user interface. This information can determine if the installation of a dangerous command caused an SMSR outage.

- The buffer records the start and completion of a patch applied or removed. This information can determine if a wrong application or removal of a patch caused an SMSR outage.

Accessing the collected data

The PMDEBUG command selects of the classes of data to collect, and accesses the data that the XPM tool collects. Refer to *PMDEBUG User Guide Technical Assistance Manual*, TAM-1001-004. The BIGFOOT command allows access to other commands that select and display the data.

The Bigfoot utility stores information on tests that passed and failed.

The Bigfoot utility only maintains information on failed tests with the installation of the following features:

- AF5008

- XPM REX Control

- Trouble Notification Improvements

The use of this information improves efforts to debug the system.

The diagnostics code also maintains a graph of results for each set of tests. The results graph contains data on each diagnostic test in a diagnostic run. The results graph identifies a diagnostic as one of the following:

- passed

- failed

- not run

- test undefined

This section shows an example of the diagnostics graph.

The three main sublevels for these functions follow:

- selection menu: selects, deletes, and queries classes of events the utility captures.

- the HEX DUMP command: displays collected data in hexadecimal format. The system cannot decipher the data. This command quickly displays data. The command can be used for loads that do not have decoding routines.

- dump routine: displays formatted data. If a format for the data is not present, hexadecimal format appears.

The DISPLAY MEMORY command can also display data if the SMSR is at the ROM level.

The following table shows the commands for the PMDEBUG user interface to the SMSR footprint tool.

TSMS-R footprint commands

Command	Use
DISPLAY DATA	Displays formatted data. The system formats saved data only if a display routine is bound in.
DUMP DATA	Displays data that is not formatted. Data appears in hexadecimal format (16 bytes).
QUERY STATUS	Queries the state of the active and holding data areas. The type of information provided is in the SMSR footprint identification (ID) area.
CLASS	Enables, disables, and queries event classes. The state (enabled or disabled) appears for the queried (or ALL) classes.
SURVIVE	Enables, disables, and queries the ability of class settings to survive a restart.
CLEAR	Clears data areas and returns the areas to initial states. Sets the SMSR footprint ID area to its initial state.
LOCK	Locks the active or holding data area. Field personnel and technicians maintain collected data when the tool does not lock the buffers automatically with this command.
UNLOCK	Unlocks the active or holding data area. This command is useful if the collected data appeared or is not needed anymore.
HELP	Gives the syntax for the above commands.

The standard header for the output routines is as follows:

```
<nnn>        CLASS        EVENT   CC TIME OF EVENT
    MAINTENANCE (#xx)    #yy         01:13:19:12.52
```

where

nnn is the buffer number
xx   is the hexadecimal value for the given class
yy   is the event number of the given class

Maintenance class output

Examples of stored maintenance data follow:

- activity drop

```
<000>        CLASS    EVENT   CC TIME OF EVENT
   MAINTENANCE (#00)    #00     01:13:19:12.52


Dropped Activity.
Parml = SWACT_when_ready.
Drop source = cc_manual.
```

- jam

```
<000>        CLASS    EVENT   CC TIME OF EVENT
   MAINTENANCE (#00)    #03     01:13:19:12.52


Unit Has Received A Jam Inactive Message.
Jam Source = #CC.
Jam Result = mrs_ok.
Unit Is Jammed Inactive.
```

- pre-SwAct audit failed

```
<000>        CLASS    EVENT   CC TIME OF EVENT
   MAINTENANCE (#00)    #04     01:13:19:12.52


Pre-SwAct Audit Failed.
Failure Reasons Are:
The unit needs to be reloaded.
The unit is jammed inactive.
```

- pre-SwAct audit fail message received

```
<000>        CLASS    EVENT   CC TIME OF EVENT
   MAINTENANCE (#00)    #04     01:13:19:12.52


Pre-SWACT Audit Fail Message Received
```

- operational faults

    Examples of stored operational fault data follow:

    ```
      <003>         CLASS    EVENT   CC TIME OF EVENT
         MAINTENANCE (#00)    #08      01:13:19:12.52


     Operational Fault Data Continued.
     Rec_data 0 through 6": #00 #00 #00 #00 #00 #00


       <002>         CLASS    EVENT   CC TIME OF EVENT
          MAINTENANCE (#00)    #07      01:13:19:12.52


     Operational Fault Data Continued
     R_list  4 through 7": #0000 #0000 #0000 #0000


       <001>         CLASS    EVENT   CC TIME OF EVENT
          MAINTENANCE (#00)    #06      01:13:19:12.52


     Operational Fault Data Continued
     R_list  0 through 3": #0000  #0000 #0000 #0000


        <000>         CLASS    EVENT   CC TIME OF EVENT
           MAINTENANCE (#00)    #05      01:13:19:12.52


     An Operational Fault Message Has Been Received.
     Source = #D6.
     R_action=rr_localize-will only try to localize the fault.
     R_component = #D6.
     R_count = #00.
    ```

Activity class output
Examples of stored activity data follow:

```
  <000>         CLASS       EVENT   CC TIME OF EVENT
     MAINTENANCE (#01)    #00       01:13:19:12.52


Dropped Activity
Drop reason = dr request
Drop cid = #CC
Drop source = cc manual.
```

Diagnostic class output

An example of stored diagnostic data follows:

```
 <000>         CLASS         EVENT   CC TIME OF EVENT
     MAINTENANCE (#02)    #00         00:00:03:20.84


Diag_id = did_tone_diag{#B5} – Tone Diagnostic.
Loc_msw = #0011.
Loc_lsw = #001F.
Expected = #48.
Received = #41.
Qualifier = #12.
```

Patcher class output

An example of stored patcher data follows:

```
 <000>         CLASS         EVENT   CC TIME OF EVENT
     MAINTENANCE (#08)    #00         01:12:03:20.84


Patch Action Started.
Patchid = XAN13X31
Patch action = remove.
Patch result = mrs_ok.
```

PMDEBUG class output

An example of stored PMDEBUG data follows:

```
 <000>         CLASS         EVENT   CC TIME OF EVENT
     MAINTENANCE (#0B)    #00         01:12:03:20.84


Directory:  bigfoot Command:  class
```

Diagnostics results graph output

An example of the diagnostics results graph display output follows:

```
 <001>         CLASS         EVENT   CC TIME OF EVENT
     DIAG GRAPH (#0F)  #00   00:00:06:34:58


Diag_id =did_cmr_diag(#7) – CMR Card Diagnostics.
res_num=FF(P=Pass,F=Fail,N=Not Run|Test Undefined,O=Other)
Diag Results Graph: PFNNNNNNNNNNNNNNNNNN
```

Static data class output
An example of stored static data follows:

```
 <000>        CLASS       EVENT   CC TIME OF EVENT
     MAINTENANCE (#0C)    #00        01:12:03:20.84


Number of data bytes = 4.
Fiat byte = #02.
Oper byte = updtuple.
Sol byte = #08.
Tblid byte = #1F.
Data bytes 0 to 4 are:  F0 03 07 00 01
```

Limits

The loss of data that the SMSR footprint tool collects occurs under the following conditions:

- The SMSR utility experiences outages that power loss causes.

- The data is not accessed in the 24 h after the system locks the buffer.

- The SMSR initialized again because a system action such as a REX test, a manual SwAct, or a BSY operation occurred.

- The footprint tool data area changes dimensions. This change occurs if the technician reloads the SMSR unit with a load different from the load that captured the data. For example, a BCSn load drops activity seconds after the BCSn begins service again. To retrieve the data, operating company personnel loads a BCSn-1 in the SMSR unit. The footprint tool data area in the BCSn-1 load must be as large as, or larger than, the data area in the BCSn load. If the data area is smaller, the operating system overwrites some data when the technician reloads the SMSR. The data cannot be read if the system overwrites it.

- A card is pulled from the shelf of the SMSR unit that dropped activity.

The power-up of the SMSR unit

The SMSR unit is part of the host office. The power-up procedure for the SMSR unit appears in the general host office power-up procedure as follows:

1 **>POST SMS-R no**

2 Set the switch on the power converter to the ON position.

3 Hold the reset button in on the power converter and flip up the correct circuit breaker (CB), but do not hold it up. If power goes to the SMSR unit, the CB remains in the ON position. If a problem with the power occurs, the CB moves to the OFF position.

   a. Repeat steps 2 and 3 for the other SMSR unit.

   b. Busy both SMSR units.

4 List the PM LOADS command at the input or output device to be used to return to service (RTS) the units.   Perform this action if the action is not performed during the power-up procedure. Type:

>DSKUT;LISTVOL volume name ALL
where

volume name is the volume in which the PMLOADS are found.

For example:

>DSKUT;LISTVOL DOOOXPM ALL
Note: The list of the PMLOADS command is only necessary one time.

5 **>LOADPM UNIT unit no CC**

6 **>RTS UNIT unit no**

7 Perform a SWACT.

8 **>RTS UNIT unit no**

9 Use the NEXT command to assign an RTS to the next SMSR unit. Continue to perform this action until all SMSRs are returned to service.

Note: Because the SLC-96 is an AT&T product, refer to the correct AT&T documentation for SLC-96 power-up procedures.

Powering down the SMSR unit

As discussed before, the SMSR unit is part of the host office. The general host office power down procedure powers down the SMSR as follows:

1 Enter the PM level at the MAP terminal.

2 **>POST SMS-R no**

3 **>BSY PM**

4 **>TRNSL C**

5   Enter the network level and busy the port assigned to the link or links noted in step 4.

    a.   **>NET**

    b.   **>LINKS pair**

    where

    pair   is the network #

    c.   **>BSY plane link**

6   Enter the PM level again and use the POST command to RTS the SMSR indicated in step 2. To perform this action, type:

    >TRNSL C

    Note: Note the state of the link that is busy.

7   Busy the SMSR unit indicated in step 2.

8   Set the switch of the power converter to OFF to remove power from the SMSR unit that is busy. The power down procedure of the SMSR unit is complete. Repeat this procedure for all other SMSR units that apply.

    Note: When the power down procedure of the SMSR unit occurs, subscriber service for the associated SLC-96 is lost. Since the SLC-96 is an AT&T product, refer to AT&T documentation for SLC-96 power down procedures.

Common procedures

Common procedures does not apply to this product for this batch change supplement (BCS).

SMS-R routine maintenance procedures

This chapter contains routine procedures for the Subscriber Carrier Module-100S Remote (SMS-R). These procedures cover preventive tasks that maintenance engineering and field maintenance personnel must perform at normal intervals.

Inspecting cooling unit filters
SMS-R

Application

Use this procedure to inspect cooling unit filters in frame cooling units.

Interval

Perform this procedure in two week intervals.

Common procedures

There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Inspecting cooling unit filters
SMS-R (continued)

Summary of Inspecting cooling unit filters

Set FAN
ALARM
OVERRIDE on

↓

Remove air
intake grille and
filter

↓

Clean grille

↓

Clean or
replace filter

↓

Install grille
again and filter
assembly

↓

Set FAN
ALARM
OVERRIDE off

This flowchart summarizes the
procedure.

Use the instructions that follow
this flowchart to perform the
procedure.
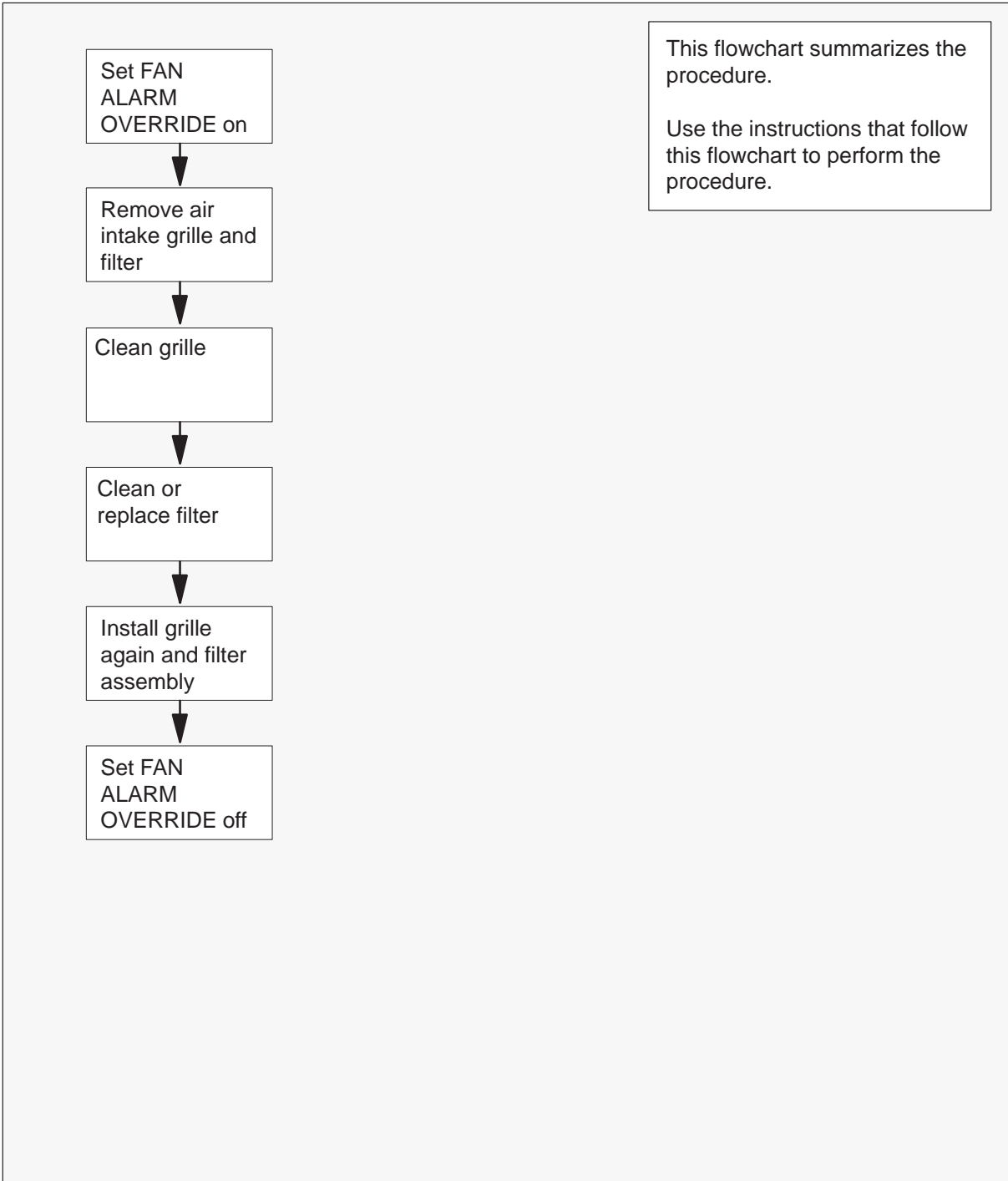
Inspecting cooling unit filters
SMS-R (continued)

Inspecting cooling unit filters

At your current location

1

> **DANGER**
> **Rotating fan blades**
> Do not reach in more than 6 in. beyond the upper lip of the air-intake grille. If you reach in beyond 6 in., your fingers can touch the rotating blades of the cooling unit fans.

On the frame supervisory panel (FSP), set the FAN ALARM OVERRIDE switch to ON.

If frame trim panels	Do
overlap side edges of intake grille	step 2
do not overlap side edges of intake grille	step 4

2 Remove the frame trim panels.

3 Grip both sides of the grille. Pull the grille toward you to remove the grille from the magnetic catches.

Go to step 5.

4 Pry in a gentle manner the upper half of the grille from the frame to remove the grille.

5 Go to a work area outside the room that holds the switching system. Use a dust cloth or a vacuum cleaner to clean the grille.

If filter surfaces	Do
appear dirty	step 9
appear clean	step 6

Inspecting cooling unit filters
SMS-R (continued)

6   Shine a trouble light through the filter.

If light	Do
is visible through the filter	step 7
is not visible through the filter	step 9

7   Install the filter in the grille again.

8   Install the filter again and grille assembly in the frame.

Go to step 19.

9   Refer to the following table:

If filter part number	Do
is A0344437	step 10
is P0558302	step 13
is P0623539	step 16

10   Get replacement filter material.

11   Trim a new filter to fit around the magnetic latches. Use the old filter as a guide.

12   Install the filter and grille on the frame.

Go to step 19.

13   In an area outside the room that holds the switching system, vacuum the filter.

14   Install the filter and grille on the frame.

Go to step 19.

15   At an area outside the room that holds the switching system, remove the excess dirt and lint. Tap dirty side down, or vacuum to remove the excess dirt and lint.

16   Wash the filter in soap and water.

17   Rinse the filter. Allow the filter to dry.

Inspecting cooling unit filters
SMS-R (end)

18 Install the filter and grille on the frame.

Go to step 19.

19 On the front of the FSP, set the FAN ALARM OVERRIDE switch to OFF.

20 The procedure is complete.

Replacing cooling unit filters
SMS-R

Application

Use this procedure to replace cooling unit filters in frame cooling units.

Interval

Perform this procedure at intervals of three months.
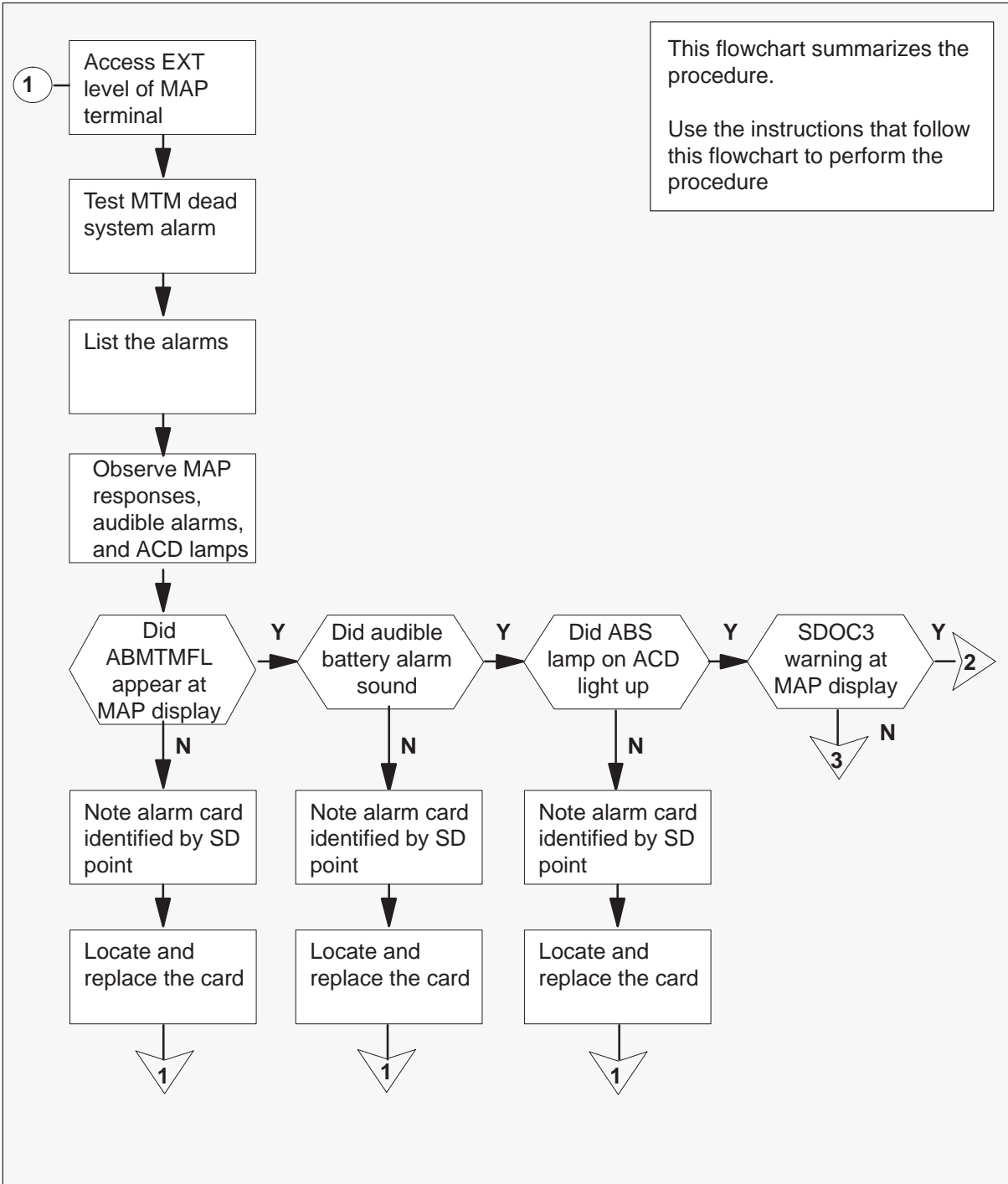
Common procedures

There are no common procedures.

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.
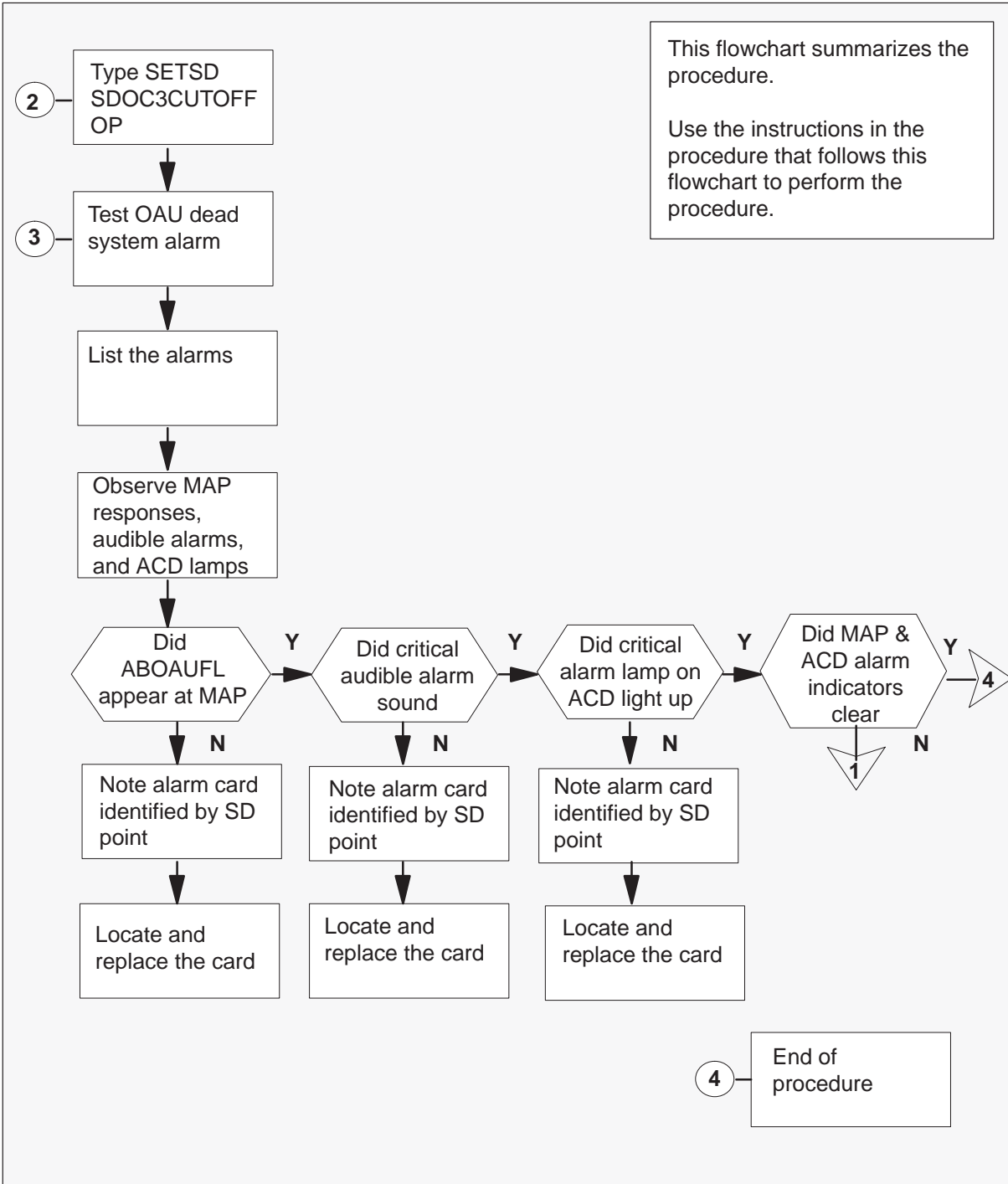
Replacing cooling unit filters
SMS-R (continued)

Summary of Replacing cooling unit filters

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Set FAN ALARM OVERRIDE on

↓

Remove air intake grille and filter

↓

Replace filter

↓

Install grille and filter assembly again

↓

Set FAN ALARM OVERRIDE off
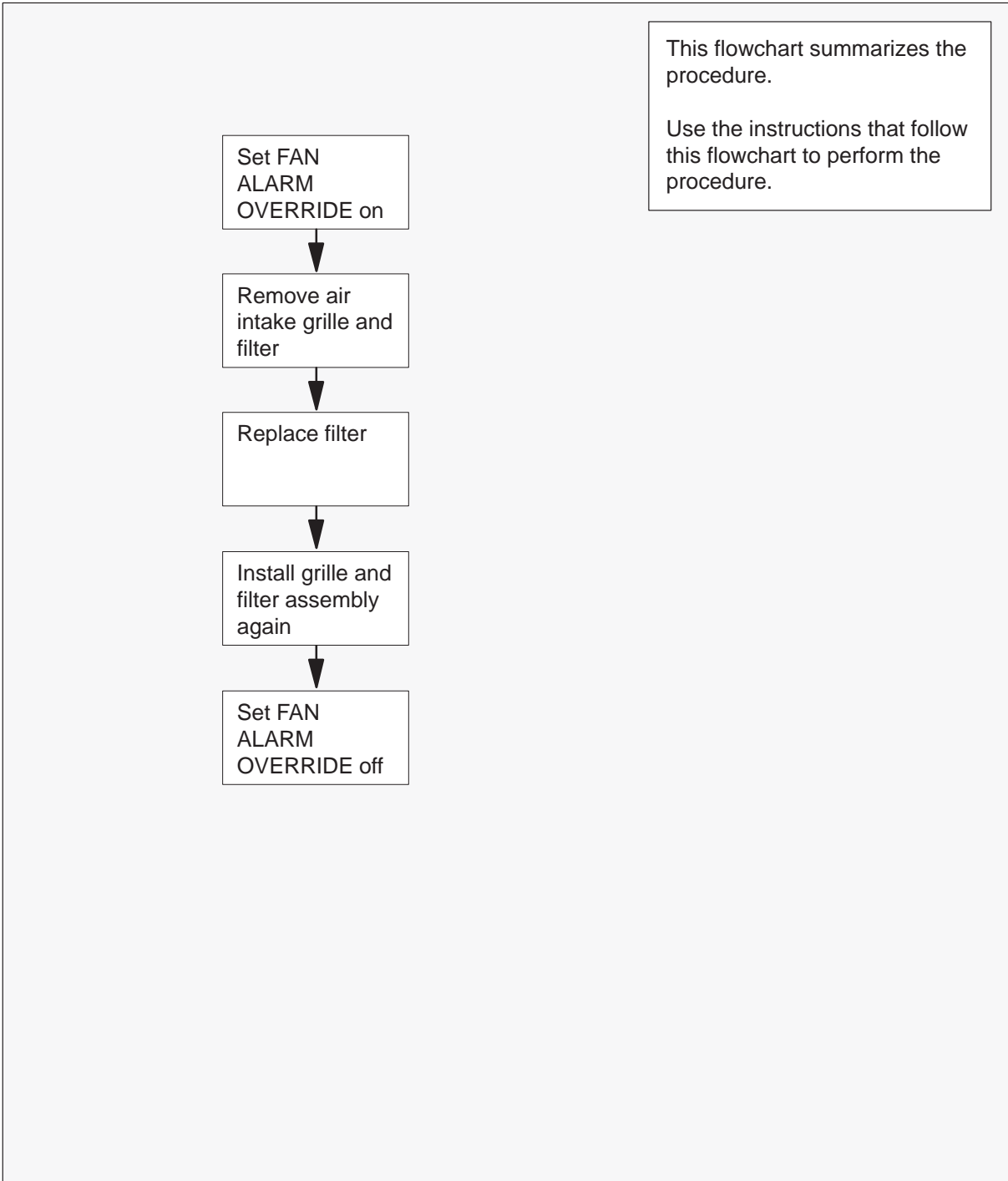
Replacing cooling unit filters
SMS-R (end)

Replacing cooling unit filters

At your Current Location

1

> ### DANGER
> **Rotating fan blades**
> Do not reach in more than 6 in. beyond the upper lip of the air-intake grille. If you reach beyond 6 in., your fingers can contact the rotating blades of the cooling unit fans.

On the frame supervisory panel (FSP), set the FAN ALARM OVERRIDE switch to ON.

If frame trim panels	Do
overlap side edges of intake grille	step 2
do not overlap side edges of intake grille	step 4

2 Remove the frame trim panels.

3 Grip the two sides of the grille. Pull the grille toward you to remove the grille from the magnetic catches.

Go to step 5.

4 Carefully pry upper half of the grille away from the frame to remove the grille.

5 Go to a work area outside the room that contains the switching system. Remove the filter from the grille.

6 Use the old filter as a pattern to trim the new filter to fit around the magnetic latches.

7 Install the grille and new filter on the cooling unit.

8 On the front of the FSP, set the FAN ALARM OVERRIDE switch to OFF.

9 The procedure is complete.

Testing the dead system alarm
SMS-R

Application

Use this procedure to verify that the dead system alarm is operating correctly.

Interval

Perform this procedure one time each month.

Common procedures

There are no common procedures

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing the dead system alarm
SMS-R (continued)

Summary of Testing the dead system alarm

① — Access EXT level of MAP terminal

↓

Test MTM dead system alarm

↓

List the alarms

↓

Observe MAP responses, audible alarms, and ACD lamps

↓

Did ABMTMFL appear at MAP display —**Y**→ Did audible battery alarm sound —**Y**→ Did ABS lamp on ACD light up —**Y**→ SDOC3 warning at MAP display —**Y**→ ②

N↓   **N**↓   **N**↓   **N**↓ ③

Note alarm card identified by SD point   Note alarm card identified by SD point   Note alarm card identified by SD point

↓   ↓   ↓

Locate and replace the card   Locate and replace the card   Locate and replace the card

↓①   ↓①   ↓①

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure

Testing the dead system alarm
SMS-R (continued)

Summary of Testing the dead system alarm (continued)

```
(2)── Type SETSD
       SDOC3CUTOFF
       OP
          │
          ▼
(3)── Test OAU dead
       system alarm
          │
          ▼
       List the alarms
          │
          ▼
       Observe MAP
       responses,
       audible alarms,
       and ACD lamps
          │
          ▼
     Did                Y    Did critical        Y    Did critical        Y    Did MAP &         Y
     ABOAUFL ─────────────▶  audible alarm ─────────▶  alarm lamp on ────────▶  ACD alarm ──────────▶ (4)
     appear at MAP          sound                     ACD light up             indicators
          │ N                   │ N                       │ N                  clear
          ▼                     ▼                         ▼                     │ N
     Note alarm card       Note alarm card           Note alarm card           ▼
     identified by SD      identified by SD          identified by SD         (1)
     point                 point                     point
          │                     │                         │
          ▼                     ▼                         ▼
     Locate and            Locate and                Locate and
     replace the card      replace the card          replace the card
```

This flowchart summarizes the procedure.

Use the instructions in the procedure that follows this flowchart to perform the procedure.

```
(4)── End of
       procedure
```

Testing the dead system alarm
SMS-R (continued)

Testing the dead system alarm

At your Current Location

1   In offices equipped with NT0X63 alarm control and display panels (ACD),
    ensure that the AUDIBLE ALARM DISABLE switch is set downward.

2   To access the EXT level of the MAP display, type

    >MAPCI;MTC;EXT
    and press the Enter key.

3   To test the dead system alarm, type

    >TSTDSALM MTMFAIL 12
    and press the Enter key.

4   Wait 15 seconds. To get a list of alarms, type

    >LIST MAJ;LIST MIN
    and press the Enter key.

5   Observe the responses on the MAP display, listen for audible alarms, and
    examine the lamps on alarm and control display panel.

If	Do
ABMTMFL was *not* displayed at MAP screen	step 6
audible battery alarm did *not* sound	step 6
ABS lamp on ACD panel did *not* activate	step 6
the system did not display WARNING —SDOC3 SENT ON DEAD SYSTEM at MAP screen	step 18
you did not observe any of the above indications	step 19

6   Note the alarm card identified by one of the following SD points:

    ● MTMFAIL
    ● OAUFAIL
    ● CRALMAUD
    ● CRALMVIS
    Proceed to step 7 to locate the card.

Testing the dead system alarm
SMS-R (continued)

7   To access system table ALMSD, type

   >TABLE ALMSD
   and press the Enter key.

8   To position on the field bearing the name of the SD group, type

   >POS sd_group
   and press the Enter key.

   where

   sd_group is the SD group name identified in step 6, for example MTMFAIL

9   To list the table, type

   >LIST
   and pressing the Enter key.

10   Note the entry under SDGROUP.

11   To exit from the table, type

   >QUIT
   and press the Enter key.

12   To access system table ALMSDGRP, type

   >TABLE ALMSDGRP
   and press the Enter key.

13   To position on the field noted in step 10, type

   >POS sd_group
   and press the Enter key.

   where

   sd_group is the SD group noted in step 10

14   To list the entries, type

   >LIST
   and press the Enter key.

15   Note the entries under TMTYPE, TMNO and CARDCODE. This information
   identifies the location of the card.

16   To exit the table, type

   >QUIT
   and press the Enter key.

17   Replace the card. Return to step 1 of this procedure.

Testing the dead system alarm
SMS-R (continued)

18   To tespond to the warning, type

>   **>SETSD SDOC3CUTOFF OP**
>   and press the Enter key.

19   To test the dead system alarm, type

>   **>TSTDSALM OAUFAIL 12**
>   and press the Enter key.

20   Wait 15 seconds, To get a list of alarms, type

>   **>LIST MAJ;LIST MIN**
>   and press the Enter key.

21   Observe the responses on the MAP display, listen for audible alarms, and examine the lamps on alarm and control display panel.

If	Do
ABOAUFL was *not* displayed at MAP screen	step 6
critical audible alarm did *not* sound	step 6
critical alarm lamp on ACD panel did *not* activate	step 6
you observed none of the above indications	step 22

22   Wait 60 seconds. Note any changes on the MAP display and the ACD panel. The following changes should occur:

- On the MAP terminal, the alarm under the Ext header disappears.
- On the ACD panel, the critical alarm lamp turns off.
- On the MAP terminal, the ACD lamp turns off.

If above changes	Do
occur	step 24
do not occur	step 23

23   It is possible you missed a indication. Return to step 1 and repeat this procedure.

Testing the dead system alarm
SMS-R (end)

24 The dead system alarm is correct. The procedure is complete.

Testing power converter voltages SMS-R

Application

Use this procedure to test power converter voltages for all power converters in the subscriber carrier equipment (SME) frame.

Interval

Perform this procedure every six months.

Common procedures

There are no common procedures

Action

This procedure contains a summary flowchart and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing power converter voltages
SMS-R (continued)

Summary of Testing power converter voltages

```
        Obtain dc
        voltmeter
            |
            v
        Measure
        voltages at face
        plate test points
            |
            v
      Are voltages      Y      End of
    within 2 % of face -----> procedure
      plate values
            |
            | N
            v
        Replace card
            |
            v
        End of
        procedure
```

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.
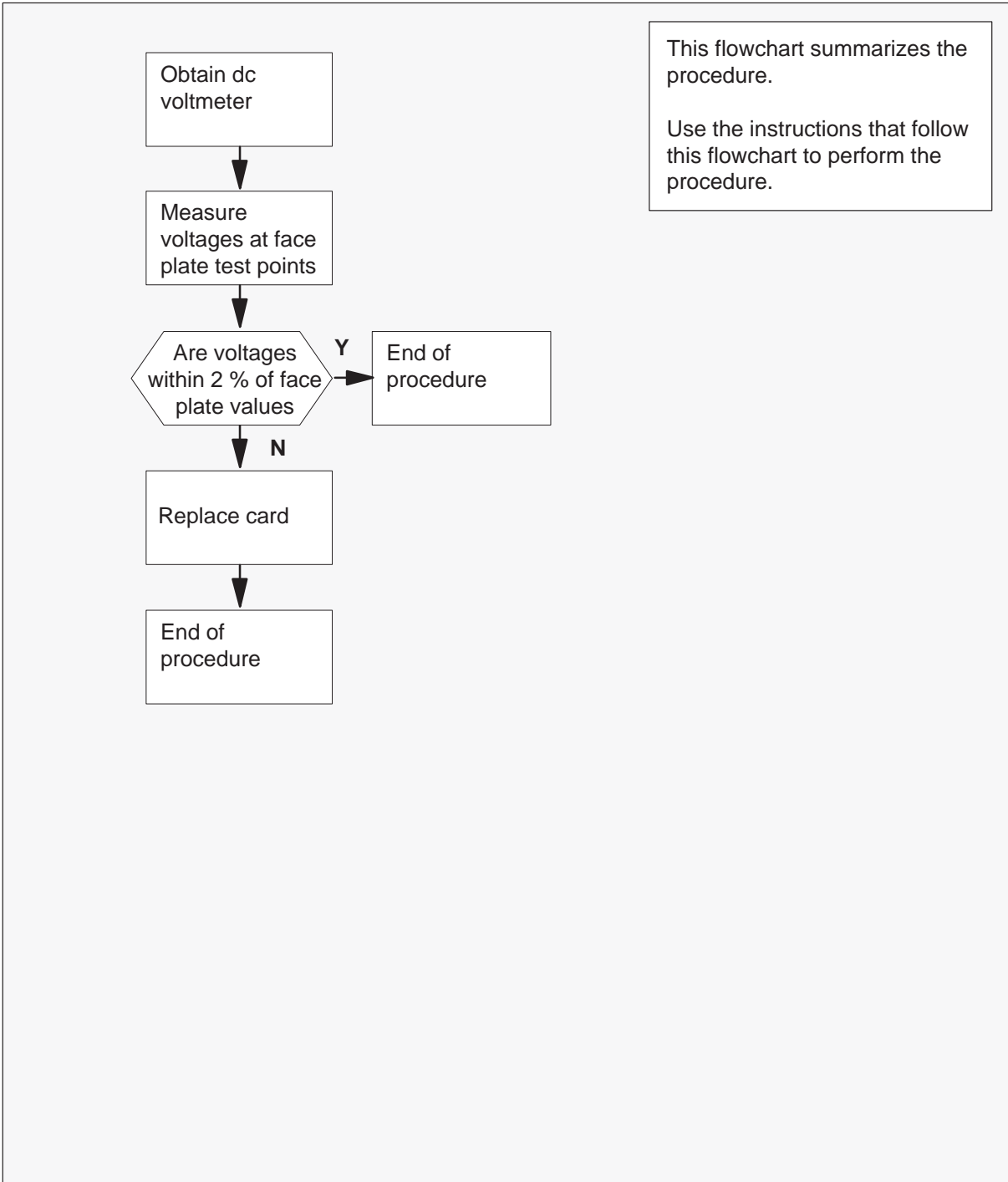
Testing power converter voltages
SMS-R (end)

Testing power converter voltages

At your Current Location

1 Obtain a dc voltmeter.

2 Measure the voltage at the test points on the faceplates of all NT2X70 power converters in the SME frame.

3 The voltages must be within 2 % of the nominal values printed on the NT2X70 face plate. Compare the voltages measured in step 2 with the acceptable voltage ranges given below.

Test point voltage	Acceptable range
+12 V	+11.76 V to +12.24 V
−12 V	−12.24 V to −11.76 V
+ 5 V	+4.9 V to +5.1 V
− 5 V	−5.1 V to −4.9 V

If test point voltages are	Do
within acceptable range	step 5
not within acceptable range	step 4

4 Replace the NT2X70 power converter as directed in *Card Replacement Procedures*. When you return to this procedure, go to step 5.

5 The procedure is complete

Testing wrist strap grounding cords
SMS-R

Application

Use this procedure to verify wrist strap grounding cord resistance. The resistance must be low enough to allow static electricity to discharge from the person. Resistance must be high enough to prevent electrocution if the equipment develops a short-circuit while the person wears the wrist strap

Interval

Perform this procedure in one month intervals.

Common procedures

There are no common procedures.

Action

This procedure contains a summary flowchart and and a list of steps. Use the flowchart to review the procedure. Follow the steps to perform the procedure.

Testing wrist strap grounding cords
SMS-R (continued)

Summary of Testing wrist strap grounding cords

This flowchart summarizes the procedure.

Use the instructions that follow this flowchart to perform the procedure.

Obtain ohmmeter

Detach cord from wrist strap

Measure resistance between ends

Is resistance between 800 and 1200 kohms

Y → Attach cord to wrist strap → End of procedure

N

Discard wrist strap

End of procedure
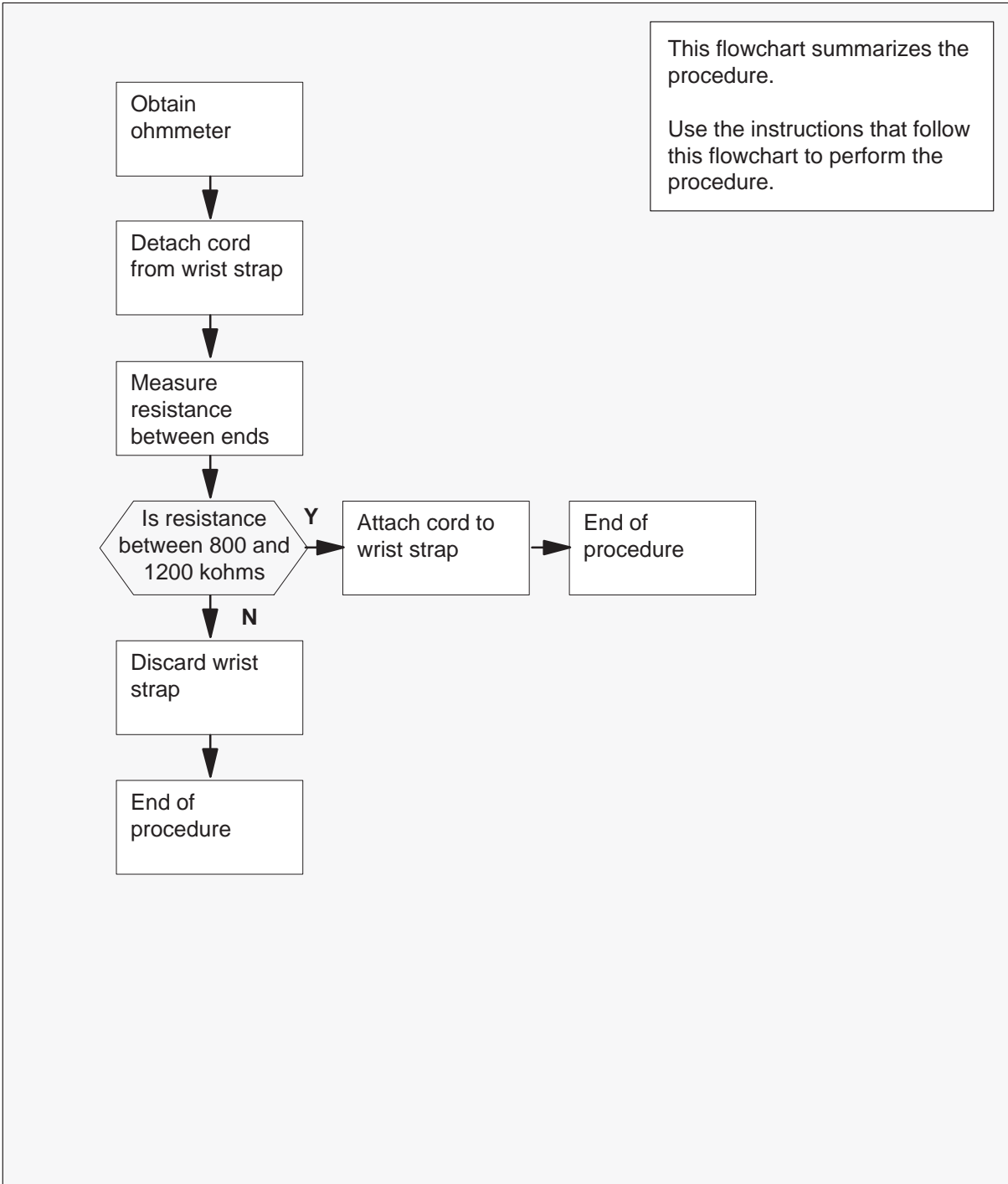
Testing wrist strap grounding cords
SMS-R (continued)

Testing wrist strap grounding cords

At your current location

1 Obtain an ohmmeter.

2 Detach the grounding cord from the wrist strap.

3 Measure the resistance between opposite ends of the grounding cord with the ohmmeter.

If resistance	Do
is between 800 kohms and 1200 kohms	step 4
is not between 800 kohms and 1200 kohms	step 5

4 Use the in process grounding cord and wrist strap assembly. Assemble the wrist strap to the grounding cord.

Go to step 6.

5

DANGER
Risk of electrocution
The grounding cord is safe to use if the resistance measures higher than 800 kohms. A lower resistance exposes the user to the risk of electrocution if equipment short-circuits while the person wears the wrist strap.

WARNING
Damage to electronic equipment
A grounding cord that has a resistance higher than 1200 kohms cannot conduct enough static charges to ground. A grounding cord with this high resistance will not protect sensitive electronic equipment against build-ups of static charges that can damage.

Discard the complete assembly. DO NOT ATTEMPT TO USE IT.

Testing wrist strap grounding cords
SMS-R (end)

6   The procedure is complete.

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A - Appendix

SMS unequipped lines troubleshooting

This section provides the user with the necessary information and tools to verify if the SMS lines in the Line Maintenance Busy (LMB) state are in that state because of a valid unequipped line condition in the Mode 1 SLC-96.

Note: In order to use the troubleshooting steps provided in this document, the user must have access to the PMDEBUG utility. Access to the PMDEBUG utility is enabled through password activation at the TOOLSUP level.

In order to effectively troubleshoot an unequipped line condition in the SMS, it is necessary to understand how the Unequipped Line Detection feature works in the SMS. The Unequipped Line Detection feature runs only on SLC-96 remote terminals (RT) that are configured in the MODE 1 configuration. The SMS interfaces to the SLC-96 RT through DS-1 links that are connected to the Line Interface Units (LIU) in the SLC-96 RT. Each DS-1 link connects to an LIU card on each shelf of the RT. These shelves are referred to as the A, B, C, and D shelves.

Each shelf in the RT can have a maximum of 24 lines installed. Since the DS-1 link has 24 DS0 timeslots, there is a one-to-one association between physical line location and a DS0 timeslot. This association between line association and DS0 timeslot is as follows:

Table 1 DS0 to SLC Line Circuit Translation

SLC-96 Line Circuit to DMS LEN and DS0 Timeslot Translation																							
Line (DMS LEN)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
DS0 Channel	0	2	4	6	8	10	12	14	16	18	20	22	1	3	5	7	9	11	13	15	17	19	21	23
SLC Circuit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
SLC Card Slot	1		2		3		4		5		6		7		8		9		10		11		12	

When there is no physical line card installed in the SLC-96 RT, the SLC-96 RT sends an unequipped AB-bit pattern (A-bit = 1, B-bit = 1) to the SMS in the DS0 timeslot associated with that line. If a line is inserted into the SLC-96, then the appropriate AB-bit pattern is sent with the associated DS0 timeslot for that specific line location; for a POTS line, this is usually IDLE code (A-bit = 0, B-bit = 0). The SMS makes use of this behaviour to scan each DS0 channel for the unequipped AB-bit pattern. If it detects the unequipped AB-bit pattern in any DS0 channel that is associated to a datafilled line in the DMS (directory number assigned), then the SMS reports this line as unequipped to the Control Module (CM) of the DMS. This results in the line being placed in the LMB state. The line remains in the LMB state until the SMS detects the appropriate IDLE AB-bit patter in the associated DS0 timeslot. Once the IDLE pattern is received, the SMS notifies the CM that the line is now equipped, and the line state changes to idle (IDL).

The SMS uses an internal software audit to report the unequipped line condition. This audit runs every 15 seconds and sequences through each possible RT on the SMS. Since each SMS can support a maximum configuration of six RTs, it takes 90 seconds (6 x 15) for the SMS to sequence through all the RTs. This results in a maximum delay of 90 seconds for an unequipped/equipped line to change states in the CM from the instant that it is removed or inserted into the RT.

Troubleshooting Walk-through

This section is made up of a walk-through of the process for determining the status of unequipped SMS lines.

Post up the line in question. This procedure uses the first two lines off the SLC-96. The following displays shows the data for a line in the IDLE state.

```
> mapci nodisp;mtc;lns;ltp

>mapci nodisp;mtc;lns;ltp
MAPCI:
MTC:
LNS:
LTP:

> post l ercs 0 0 0 0 print
CKT TYPE            LEN                DN          STATE  FAIL   EqPEC


==================================================================
1MR          ERCS 00 0 00 00      619 351 1234 IDL           SCD203
Number of entities in the posted set: 1
>
> post l ercs 0 0 0 1 print
CKT TYPE            LEN DN STATE   FAIL    EqPEC
==================================================================
OWT          ERCS 00 0 00 01 619 516 1212       IDL SCD203

 Number of entities in the posted set: 1
```

The next step is to query the Line Equipment Number (LEN) in order to obtain the code number and line number. Note that the line number is the terminal number minus 1 (ERCS 0 0 0 0 is terminal 1 but line number 0).

```
> qlen ercs 0 0 0 0


-----------------------------------------------------------------
LEN:     ERCS  00 0 00 00
TYPE: SINGLE PARTY LINE
SNPA: 619


DIRECTORY NUMBER:     3511234
LINE CLASS CODE:       1MR
SIGNALLING TYPE:  DIGITONE
LINE TREATMENT GROUP:     0
LINE ATTRIBUTE INDEX:     1
CARDCODE:  SCD203    GND: N  PADGRP: STDLN  BNV: NL MNO: N
PM NODE NUMBER     :    235
PM TERMINAL NUMBER :    1
OPTIONS:
DGT
-----------------------------------------------------------------

> qlen ercs 0 0 0 1
```

```
----------------------------------------------------------------
LEN:      ERCS  00 0 00 01
TYPE: SINGLE PARTY LINE
SNPA: 619
DIRECTORY NUMBER:       5161212
LINE CLASS CODE:  OWT **
SIGNALLING TYPE:  DIGITONE
LINE TREATMENT GROUP:     0
LINE ATTRIBUTE INDEX:     7
CARDCODE:  SCD203    GND: N  PADGRP: STDLN  BNV: NL MNO: N
PM NODE NUMBER      :    235
PM TERMINAL NUMBER  :    2
OPTIONS:
DGT
----------------------------------------------------------------
```

The next step is to post up the RCS at the PM level of the MAP in order to verify which SMS links are associated with which SLC-96 shelf.

```
>pm;post rcs ercs 0 0

MTC:
PM:
POST:


> querypm

 PM Type: RCS  Int. No.: 22  Node_No: 235
  Site Flr RPos Bay_id  Shf Description    Slot     EqPEC
  ERCS  01  G03  RTS 000   65  RCS  00 0
 >
```

From the following translation information, we can determine that the A shelf of the RT is connected to SMS 0 link 0, the B shelf of the RT is connected to SMS 0 link 1, the C shelf of the RT is connected to SMS 0 link 6, and the D shelf of the RT is connected to SMS 0 link 7.

```
>trnsl

Link 0: SMS    0  0;Cap:MS;Status:OK       ;MsgCond:OPN
Link 1: SMS    0  1;Cap:MS;Status:OK       ;MsgCond:OPN
Link 2: SMS    0  6;Cap:MS;Status:OK       ;MsgCond:OPN
Link 3: SMS    0  7;Cap:MS;Status:OK       ;MsgCond:OPN
>
```

Now we can go into PMDEBUG on the active unit of the SMS and check the status.

```
>pmdebug sms 0

PMDEBUG MODE - CONNECTING TO SMS 0 UNIT 1
WARNING: You now have access to the PM monitor...proceed with
caution
```

We now go through the CHNLS, PROT, and NODE levels and dump out the node table information in the SMS. This is required in order to get the internal RT number that the SMS associates with the particular SLC-96 with which we are working.

```
LTCUP>

c

UP:Chnls>

Prot, Unprot, Rlcm_intra

UP:Chnls> p

Node,Port,Spec,H_l_mux,Utr,NX,PRt_ps,Audt,Xlat,Msgnode,ND_hash
,MCh,Cs_map, PS_map,Iu_map,Ring,ST_cd,RCc_ltc.

UP:Prot> n

----------------------------------------------------------------
NODE TABLE

----------------------------------------------------------------
Node     | Description |  Msg  |  Port   | Trmnl  |  Info

----------------------------------------------------------------

|               |         |               |       | R I M      NT

|               |         |               |       | C P o Netl oh

Int External Host|  Node      PM|Protocol|# Start End|Start    #|
T M d Thrd dr

dec hex    #|  Type      Type|Relation| | |   L e Type ed
----------------------------------------------------------------
1  143 08F 1 LTC:0B  SMS:17 ds30:1 S 16 0  15 1  641  0 F P   cc  1

2  235 0EB 1 RCS:13  RCS:20  nil:0 M  4 16  19 642 98  0 F P  rcs  6

3  236 0EC 1 RCS:13  RCS:20  nil:0 M  4 20  23 740 98  1 F P  rcs  6

4  249 0F9 1 RCS:13  RCS:20  nil:0 M  4 24  27 838 98  2 F P  rcs  6

----------------------------------------------------------------

UP:Prot>
```

If we look under the "Info" heading of the node table, we see that the first entry in this field is the RCT heading. This heading is read vertically and has been bolded to make identification easier in this document. This RCT is the RT index number that we require. The qlen information that we obtained on the

line indicated that our line was on node number 235. If we find the entry for Node 235, we see that it is Internal code number 2 in the table, external code number 235, and its RCT number is 0. In order to get the RT index number for this SMS, we must add 1 to the RCT number. Therefore our RT index for the SLC-96 is 1 (0 + 1) for this SMS.

```
Node,Port,Spec,H_l_mux,Utr,NX,PRt_ps,Audt,Xlat,Msgnode,ND_hash
,MCh,Cs_map,PS_map,Iu_map,Ring,ST_cd,RCc_ltc.
```

UP:Prot> *
UP:Chnls> *
LTCUP> *

```
TIme,TAsk,Load,Xprompt,CHEaptmr,DAtadump,Uspace,Debug,BPMonito
r,Swerr,C++monitor,Ipc,Verreg,Patches,Flq,Msg6x69,UArtimc,Newm
sging,NWmsgtrc,MSGTr,Chnls,CDm,DYnamic,MTc,Rcvrmon,SChnls,CSm,
DS1,CMr,UTr,OMUnsol,DIagnose,IMage,
Audit,MAtediag,CAudit,PRfm,PErcall,Bigfoot,PARaudt,CP,CNd,Trmt
rc,SMsm,SMSS,LTst.
```

LTCUP> sm

```
Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config
Disp ln config status, disp ln config Image
cHnl aud, send Cfield msg, Line, sMsr, *
```

Now we dump the config status. This information is used to determine if the SLS thinks the line is unequipped or equipped. We are looking at the first two lines on the SLC-96. They show up in the location for Shelf A, Slot 1. Each line has a value of 1, which means equipped. This is the expected state for a line in the IDL state.

UP:SMsm> d 1

```
SHELF       SLOTS: 1| 2| 3| 4| 5| 6| 7| 8| 9| A| B| C|

A              11|11|11|11|11|11|11|11|11|11|11|11|
B              11|11|11|11|11|11|11|11|11|11|11|11|
C              11|11|11|11|11|11|11|11|11|11|11|11|
D              11|11|11|11|11|11|11|11|11|11|11|11|

Value of 0 = unequipped line, Value of 1 = equipped line

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *

UP:SMsm>
```

Now we check what the SMS is receiving from the SLC-96. We do this by reading the AB-bit information from the SMS timeswitch. We know from the data dumped earlier that the A shelf of this SLC-96 is connected to SMS 0 link

0. We also know from our line to DS0 associated that line 0 signaling information should be in timeslot (chnl) 0 and that line 1 signaling information should be in chnl 2 location. Reference Table 1). Both lines are reporting onhook, which is expected for an IDLE equipped line. Note: Be very careful here in that the port number entered ranges from 0 to 19 and is entered as a HEX value (port 19 would be entered as 13).

```
LTCUP> smss

A/bdata, Ddldata, Tsw, Psport, Rtstat, psW, Cmb, Mtc, aLms, *

UP:SMSS> a

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS> b 0

Chnl 00   on hook              Chnl 0C   on hook
Chnl 01   on hook              Chnl 0D   unequipped
Chnl 02   on hook              Chnl 0E   on hook
Chnl 03   on hook              Chnl 0F   unequipped
Chnl 04   on hook              Chnl 10   on hook
Chnl 05   on hook              Chnl 11   on hook
Chnl 06   on hook              Chnl 12   on hook
Chnl 07   on hook              Chnl 13   unequipped
Chnl 08   unequiped            Chnl 14   on hook
Chnl 09   on hook              Chnl 15   on hook
Chnl 0A   unequiped            Chnl 16   on hook
Chnl 0B   on hook              Chnl 17   on hook
Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS>
```

Now we check to see what the SMS is expecting to see from the SLC-96. For an IDLE line, we are scanning for an offhook signaling pattern. Note: The port number ranges from 0 to 19 and the port number ranges from 0 to 23. Both values are entered as the HEX equivalent values.

```
Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS c 0 0

mode: scan off-hook        flash option: false

timer blk not attached

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS c 0 2
```

```
mode: scan off-hook        flash option: false

timer blk not attached

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *
```

UP:SMSS> *

```
A/bdata, Ddldata, Tsw, Psport, Rtstat, psW, Cmb, Mtc, aLms, *
```

UP:SMSS> *
LTCUP> quit

```
NOTE: PMDEBUG will terminate when last request is complete
PMDEBUG TERMINATES
```

We have now removed the first line card in the A shelf of the SLC-96. If we
post the lines at the MAP, we see that these lines are now in the LMB state.

>lns;ltc

```
MTC:
LNS:
LTP:
```

>post l ercs 0 0 0 0 print

```
CKT TYPE          LEN               DN          STATE  FAIL  EqPEC



==================================================================
 1MR       ERCS 00 0 00 00      619 351 1234 LMB            SCD203

 Number of entities in the posted set: 1
```

> post l ercs 0 0 0 1 print

```
CKT TYPE          LEN               DN          STATE  FAIL  EqPEC



==================================================================
OWT        ERCS 00 0 00 01      619 516 1212 LMB            SCD203

 Number of entities in the posted set: 1
```

>pmdebug sms 0

```
PMDEBUG MODE - CONNECTING TO SMS 0 UNIT 1
```

```
 WARNING: You now have access to the PM monitor...proceed with
caution
LTCUP>
TIme,TAsk,Load,Xprompt,CHEaptmr,DAtadump,Uspace,Debug,BPMonito
r,Swerr,C++monitor,Ipc,Verreg,Patches,Flq,Msg6x69,UArtimc,Newm
sging,NWmsgtrc,MSGTr,Chnls,CDm,DYnamic,MTc,Rcvrmon,SChnls,CSm,
DS1,CMr,UTr,OMUnsol,DIagnose,IMage,Audit,MAtediag,CAudit,PRfm,
PErcall,Bigfoot,PARaudt,CP,CNd,Trmtrc,SMsm,SMSS,LTst.
```

From the SMsm level, we now dump the line config status. We now see that
the first two lines of the A shelf are set to a value of 0. This indicates that the
lines are not equipped in the SLC-96.

LTCUP> sm

```
Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config
Disp ln config status, disp ln config Image
cHnl aud, send Cfield msg, Line, sMsr, *
```

UP:SMsm> d 1

```
SHELF       SLOTS: 1| 2| 3| 4| 5| 6| 7| 8| 9| A| B| C|
A              00|11|11|11|11|11|11|11|11|11|11|11|

B              11|11|11|11|11|11|11|11|11|11|11|11|

C              11|11|11|11|11|11|11|11|11|11|11|11|

D              11|11|11|11|11|11|11|11|11|11|11|11|
```

Value of 0 = unequipped line, Value of 1 = equipped line

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *

UP:SMsm> *

```
LTCUP>
```

We can now go to the SMSS level and dump the AB-bit information that is
being received from the SLC-96. This verifies that we are actually receiving
the unequipped AB-bit pattern in the appropriate channels. Once again, we
check PORT 0 CHNL 0 and CHNL 2 for line 0 and line 1 respectively. We now
see that both Chnl 0 and Chnl 2 contain the unequipped AB-bit pattern.

```
TIme,TAsk,Load,Xprompt,CHEaptmr,DAtadump,Uspace,Debug,BPMonito
r,Swerr,C++monitor,Ipc,Verreg,Patches,Flq,Msg6x69,UArtimc,Newm
sging,NWmsgtrc,MSGTr,Chnls,CDm,DYnamic,MTc,Rcvrmon,SChnls,CSm,
DS1,CMr,UTr,OMUnsol,DIagnose,IMage,Audit,MAtediag,CAudit,PRfm,
PErcall,Bigfoot,PARaudt,CP,CNd,Trmtrc,SMsm,SMSS,LTst.
```

>LTCUP> smss

```
A/bdata, Ddldata, Tsw, Psport, Rtstat, psW, Cmb, Mtc, aLms, *

UP:SMSS> a

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS> b 0

Chnl 00   unequiped              Chnl 0C   on hook
Chnl 01   on hook                Chnl 0D   unequipped
Chnl 02   unequiped              Chnl 0E   on hook
Chnl 03   on hook                Chnl 0F   unequipped
Chnl 04   on hook                Chnl 10   on hook
Chnl 05   on hook                Chnl 11   on hook
Chnl 06   on hook                Chnl 12   on hook
Chnl 07   on hook                Chnl 13   unequipped
Chnl 08   unequiped              Chnl 14   on hook
Chnl 09   on hook                Chnl 15   on hook
Chnl 0A   unequiped              Chnl 16   on hook
Chnl 0B   on hook                Chnl 17   on hook

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

 UP:SMSS>
```

If we now check to see what the SMS is looking for, we see that it is looking
for the onhook pattern to occur, in order to progress out of the unequipped
state. Remember that when the card is plugged in, it sends the onhook pattern
first.

```
Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS> c 0 0

mode: scan onhook from unequip       flash option: false

timer blk not attached

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS> c 0 2

mode: scan onhook from unequip       flash option: false

timer blk not attached

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *
```

It is important to note that although CHNL 0D in the bits display on page 9 is
reporting the unequipped AB-bit patter that the SMS indicates that it is not
scanning this line at the channel block level.The Bits level reports what the
incoming AB-bits are for all 24 DS0 timeslots. Even though the SLC-96
reports appropriate AB-bit information to the SMS, the SMS does not evaluate
that information unless the line is datafilled in the DMS (has a directory

number). The SMS does not tie up resources scanning lines that cannot make telephone calls.

```
UP:SMSS> c 0 d
```

```
 mode: no scan        flash option: false
```

```
timer blk not attached
```

```
LTCUP> quit
```

```
NOTE: PMDEBUG will terminate when last request is complete
PMDEBUG TERMINATES
```

We now insert the first line card into the A-shelf of the SLC-96. The line state now changes to IDL.

```
> post l ercs 0 0 0 0 print
```

```
CKT TYPE           LEN               DN        STATE  FAIL  EqPEC


================================================================
1MR        ERCS 00 0 00 00      619 351 1234 IDL           SCD203

 Number of entities in the posted set: 1
```

```
> post l ercs 0 0 0 1 print
```

```
CKT TYPE           LEN               DN        STATE  FAIL  EqPEC


================================================================
OWT        ERCS 00 0 00 01      619 516 1212 IDL           SCD203

 Number of entities in the posted set: 1
```

We have forced a mismatch between the CM and the SMS to show the state information that occurs when the SMS is incorrectly reporting an unequipped line. This is a condition that does not normally occur, but can be used for reference in gaining troubleshooting knowledge.

This first thing to note is that the lines in question are datafilled as an SCD203 card type. This card type has two line circuits per line card. As both lines that we are positing are on the same physical line card, it is very unlikely that one circuit would be IDL and the other circuit LMB. This condition raises suspicion that further evaluation is necessary.

```
> post l ercs 0 0 0 0 print
```

```
CKT TYPE          LEN              DN        STATE  FAIL   EqPEC



==================================================================
1MR       ERCS 00 0 00 00       619 351 1234 IDL          SCD203

Number of entities in the posted set: 1
```

> post l ercs 0 0 0 1 print

```
CKT TYPE          LEN              DN        STATE  FAIL   EqPEC



==================================================================
OWT       ERCS 00 0 00 01       619 516 1212 LMB          SCD203

Number of entities in the posted set: 1
```

> pmdebug sms 0

```
PMDEBUG MODE - CONNECTING TO SMS 0 UNIT 1

 WARNING: You now have access to the PM monitor...proceed with
caution
LTCUP>
TIme,TAsk,Load,Xprompt,CHEaptmr,DAtadump,Uspace,Debug,BPMonito
r,Swerr,C++monitor,Ipc,Verreg,Patches,Flq,Msg6x69,UArtimc,Newm
sging,NWmsgtrc,MSGTr,Chnls,CDm,DYnamic,MTc,Rcvrmon,SChnls,CSm,
DS1,CMr,UTr,OMUnsol,DIagnose,IMage,Audit,MAtediag,CAudit,PRfm,
PErcall,Bigfoot,PARaudt,CP,CNd,Trmtrc,SMsm,SMSS,LTst.
```

We can now dump the line config status from PMDEBUG for RT 1. This is
ERCS0 0 which is the same SLC on which we have been working. This can be
verified by matching the node number of 235. We see that the SMS is reporting
that line 0 on the A shelf is equipped and line 1 on the A shelf is unequipped.
This agrees with what the CM shows when posting the line.

LTCUP> sm

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *

UP:SMsm> d 1

```
SHELF       SLOTS: 1| 2| 3| 4| 5| 6| 7| 8| 9| A| B| C|

A                 10|11|11|11|11|11|11|11|11|11|11|11|

B                 11|11|11|11|11|11|11|11|11|11|11|11|

C                 11|11|11|11|11|11|11|11|11|11|11|11|

D                 11|11|11|11|11|11|11|11|11|11|11|11|
```

Value of 0 = unequipped line, Value of 1 = equipped line

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *

UP:SMsm> *

```
LTCUP>
TIme,TAsk,Load,Xprompt,CHEaptmr,DAtadump,Uspace,Debug,BPMonito
r,Swerr,C++monitor,Ipc,Verreg,Patches,Flq,Msg6x69,UArtimc,Newm
sging,NWmsgtrc,MSGTr,Chnls,CDm,DYnamic,MTc,Rcvrmon,SChnls,CSm,
DS1,CMr,UTr,OMUnsol,DIagnose,IMage,Audit,MAtediag,CAudit,PRfm,
PErcall,Bigfoot,PARaudt,CP,CNd,Trmtrc,SMsm,SMSS,LTst.
```

We can verify if the line is equipped or not by looking at the AB-bit information being received from the SLC-96. Dumping the AB-bit information for link 0 indicates that we are receiving the onhook patter for line 0 (Chnl 0) and for line 1 (Chnl 2). This would indicate that the SMS is reporting an unequipped line that is actually installed in the SLC-96.

LTCUP> smss

A/bdata, Ddldata, Tsw, Psport, Rtstat, psW, Cmb, Mtc, aLms, *

UP:SMSS> a

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS> b 0

```
Chnl 00   on hook              Chnl 0C   on hook
Chnl 01   on hook              Chnl 0D   unequipped
Chnl 02   on hook              Chnl 0E   on hook
Chnl 03   on hook              Chnl 0F   unequipped
Chnl 04   on hook              Chnl 10   on hook
Chnl 05   on hook              Chnl 11   on hook
Chnl 06   on hook              Chnl 12   on hook
Chnl 07   on hook              Chnl 13   unequipped
Chnl 08   unequiped            Chnl 14   on hook
Chnl 09   on hook              Chnl 15   on hook
Chnl 0A   unequiped            Chnl 16   on hook
Chnl 0B   on hook              Chnl 17   on hook
```

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

Dumping the scan information for both lines now indicates that we are
scanning for the offhook condition.l If the line were actually unequipped, then
we would be scanning for the "onhook from unequip" condition. This
condition would definitely indicate that the SMS is not reporting a valid
unequipped line. This is because the SMS should never be scanning for the
offhook condition when the card is unplugged. When the card is removed, the
SLC sends the unequipped AB bit pattern to the SMS. The SMS would detect
the unequipped pattern and change the scan state to "onhook from
unequipped" instead of "offhook. In order for the SMS state machine to
change to scanning for "offhook" from the unequipped state, it must first
receive the onhook AB bit pattern from the SLC. This could happen only if the
line card was installed in the SLC system.

```
UP:SMSS> c 0 0

mode: scan off-hook       flash option: false

timer blk not attached

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS>

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS> c 0 2

mode: scan off-hook       flash option: false

timer blk not attached

Chnl blk, Image, port Map, Bits, sAn, Digit, Outg, Uneq scan, *

UP:SMSS> *

A/bdata, Ddldata, Tsw, Psport, Rtstat, psW, Cmb, Mtc, aLms, *
```

We now look at the line config status information again to verify that the SMS
is still reporting the line as unequipped. Remember that it takes the SMS up to
1.5 minutes after the line is inserted in the SLC-96 to update the information
is this table. We will see that line 1 is still marked as unequipped even after 1.5
minutes have passed, so we definitely have an invalid unequipped line.

```
LTCUP> sm

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *

UP:SMsm> d 1
```

```
SHELF       SLOTS: 1| 2| 3| 4| 5| 6| 7| 8| 9| A| B| C|

A                 10|11|11|11|11|11|11|11|11|11|11|11|

B                 11|11|11|11|11|11|11|11|11|11|11|11|

C                 11|11|11|11|11|11|11|11|11|11|11|11|

D                 11|11|11|11|11|11|11|11|11|11|11|11|

Value of 0 = unequipped line, Value of 1 = equipped line

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *
```

Since we know that the SMS is not receiving the unequipped AB-bit information from the SLC-96, and the SMS is actually scanning for offhook, we need to get the line config status to report the line as equipped. Changing the line config status from the "Set in Config" level of PMDEBUG can do this. This level asks us for the RT number on which we are working (our RT index is 1). This PMDEBUG level also prompts us for the line number on which to take action. From the qlen information, we know that our line number is 1. It finally prompts us for the value that we want to change to "0" or "1" - we want to change to equipped so we enter a value of 1.

UP:SMsm> s

rt #:

UP:SMsm> 1

line # (0..95):

UP:SMsm> 1

change to 0 or 1

UP:SMsm> 1

```
Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *
```

The line config information after the change now indicates that the line is equipped. It takes up to 1.5 minutes after the change for the CM to be notified of the new line status. Once this occurs, the line changes back to the IDL state.

UP:SMsm> d 1

```
SHELF        SLOTS: 1| 2| 3| 4| 5| 6| 7| 8| 9| A| B| C|

A                  11|11|11|11|11|11|11|11|11|11|11|11|

B                  11|11|11|11|11|11|11|11|11|11|11|11|

C                  11|11|11|11|11|11|11|11|11|11|11|11|

D                  11|11|11|11|11|11|11|11|11|11|11|11|


Value of 0 = unequipped line, Value of 1 = equipped line

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *
```

We can verify if the audit has detected the change and sent the information to
the CM by dumping the "line config image" information. The image
information is the status of the line the last time that the audit ran. If the
information in the "image" does not match the information in the "status", then
the audit has not yet detected the change. Once the "image" and "status" tables
match, we know that the audit has run on that RT.

```
Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *
```

UP:SMsm> i 1

```
SHELF        SLOTS: 1| 2| 3| 4| 5| 6| 7| 8| 9| A| B| C|

A                  10|11|11|11|11|11|11|11|11|11|11|11|

B                  11|11|11|11|11|11|11|11|11|11|11|11|

C                  11|11|11|11|11|11|11|11|11|11|11|11|


   D                  11|11|11|11|11|11|11|11|11|11|11|11|

Value of 0 = unequipped line, Value of 1 = equipped line

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *
```

UP:SMsm> i 1

```
SHELF       SLOTS: 1| 2| 3| 4| 5| 6| 7| 8| 9| A| B| C|

A                 11|11|11|11|11|11|11|11|11|11|11|11|

B                 11|11|11|11|11|11|11|11|11|11|11|11|

C                 11|11|11|11|11|11|11|11|11|11|11|11|

D                 11|11|11|11|11|11|11|11|11|11|11|11|

Value of 0 = unequipped line, Value of 1 = equipped line

Rt config, All chnl bsy, pWrk trc, aBbt, Set ln config

Disp ln config status, disp ln config Image

cHnl aud, send Cfield msg, Line, sMsr, *
```

UP:SMsm> *
LTCUP: quit

```
NOTE: PMDEBUG will terminate when last request is complete
PMDEBUG TERMINATES
```

> post l ercs 0 0 0 0 print

```
CKT TYPE          LEN              DN          STATE  FAIL  EqPEC


==================================================================
1MR       ERCS 00 0 00 00      619 351 1234 IDL           SCD203

 Number of entities in the posted set: 1
```

> post l ercs 0 0 0 1 print

```
post l ercs 0 0 0 1 print

  CKT TYPE          LEN              DN          STATE  FAIL  EqPEC


==================================================================
OWT       ERCS 00 0 00 01      619 516 1212 IDL           SCD203
Number of entities in the posted set: 1
```

We can get a history of what the unequipped line detection feature has reported by dumping the AUDT202 logs out of the DMS. This shows us when the line state changed from IDL to LMB and from LMB back to IDL.

```
>
> logutil
Current MODE setting is: EXTENDED

LOGUTIL:

> open audt
Done.
RTPE13BH      AUDT202 JAN31 14:57:45 2600 INFO LINE AUDIT
LINE_EQUIPMENT_NUMBER ERCS  00 0 00 01
FROM         LINE_LM_BUSY TO          LINE_IDLE


 > back

RTPE13BH      AUDT202 JAN31 14:54:45 7100 INFO LINE AUDIT
LINE_EQUIPMENT_NUMBER ERCS  00 0 00 00
FROM         LINE_LM_BUSY TO          LINE_IDLE
> ?
>back
RTPE13BH      AUDT202 JAN31 14:53:15 5400 INFO LINE AUDIT
LINE_EQUIPMENT_NUMBER ERCS  00 0 00 01
FROM           LINE_IDLE TO       LINE_LM_BUSY
> ?
>back
RTPE13BH      AUDT202 JAN31 14:53:15 5300 INFO LINE AUDIT
LINE_EQUIPMENT_NUMBER ERCS  00 0 00 00
FROM           LINE_IDLE TO       LINE_LM_BUSY
> ?
>back
RTPE13BH      AUDT202 JAN31 14:50:15 8700 INFO LINE AUDIT
LINE_EQUIPMENT_NUMBER ERCS  00 0 00 01
FROM         LINE_LM_BUSY TO          LINE_IDLE
> ?
>back
RTPE13BH      AUDT202 JAN31 14:50:15 8600 INFO LINE AUDIT
LINE_EQUIPMENT_NUMBER ERCS  00 0 00 00
FROM         LINE_LM_BUSY TO          LINE_IDLE
>
```

DMS-100 Family

Subscriber Carrier Module – 100S Remote

Maintenance Manual

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