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Part I

Introduction

This part contains the following chapters:

- Product overview (Chapter 1)
- Development summary (Chapter 2)

1 Product overview

This chapter outlines the Spectrum Peripheral Module (SPM) product as implemented on the DMS-100 MMP switch for the SP17.2 software release.

What's new

The following sections detail what's new in *International Spectrum Peripheral Module Program* for release 17.2

Features

There are no new features in this release.

Other changes

There are no other changes in this release.

SPM features for software releases up to and including SP17.2

The following features are supported on the SPM, depending upon core load and switch software installed on your system:

- Australian ISUP
- ETSI ISUP
- ETSI ISUP V1
- ETSI ISUP V2
- ETSI-ISUP v2 variant on SPM (Austrian ISUP)
- ETSI-ISUP v2 variant on SPM (Russian ISUP)
- ETSI-ISUP v2 variant on SPM (German ISUP)
- ETSI-ISUP v3 variant on SPM (UK ISUP)
- ETSI-ISUP variant on SPM (Italian ISUP) (59014220)
- ETSI-ISUP variant on SPM (Belgium ISUP) (59017760)
- French ISUP (SPRIOU)
- Israel ISUP
- Turkish ISUP

- ETSI-ISUP variant on SPM (Spanish ISUP) (59017644)
- MTX-ISUP White Book variant on SPM (Hong Kong ISUP)
- STM-1 Brazil ISUP (59017595)
- ETSI PRI
- French PRI VN4/VN6
- Italian PRI
- Spanish PRI
- Downloadable tones
- Australian tones
- Belgium tones
- French tones
- German tones
- Israel tones
- Italian tones
- Ireland tones
- Netherlands tones
- New Zealand tones
- Portugal tones
- Russian tones
- Spain tones
- Swiss tones
- Turkish tones
- STM-1 Italian and Spanish tones (59018949)
- STM-1 Brazilian tones (59018854)
- K1/K2 Bytes Support on STM1 (A59033790 and A59028555)
- Speconn (Special Connections) for ISUP monitoring
- French TUP (SSUTRR)
- C7 DTA for PRI protocol test
- IUP (formerly BTUP)
- IUP and ECAN Enhancements (59016306)
- STM-1 German Network Protection (59019615 & 59025550)
- KLM numbering (59017369)

- STM-1 SPM Carrier Maintenance (59008275)
- STM-1 Digital Test Access (59008275)

Ordering information

PEC codes

The PEC code for the Spectrum base frame assembly is NTLX91BA. The NTLX91BA frame can support two Spectrum Peripheral Modules.

The PEC code for the STM-1 Resource Module is NTLX99BA (optical interface).

Software optionality control

The SPM is optional equipment. The relevant order codes are:

- STM00001 - Basic Software
- STM00004 - ISUP and TUP protocols
- STM00010 - Echo Cancellation
- STM00003 - Network PRI
- STM00005 - K1/K2 Byte Support
- STM00006 - Speconn

Background

What is Spectrum?

Spectrum is a multi-application high-speed technology platform that provides a flexible, cost-effective and reliable architecture for future application development. Its hardware and software architecture allow it to interface easily with a wide variety of network traffic, and to perform signal-processing functions as well as handling routine call processing in conjunction with the DMS switch.

What is an SPM?

The first application of Spectrum technology in the *international* market is an SPM providing a 1+1 redundant STM-1 trunking interface for the DMS-100 MMP switch.

Note: Throughout this document, the Spectrum application ‘SPM STM-1 trunking for the DMS-100 MMP switch’ is referred to as the SPM system.

Scope of the SPM system in MMP releases

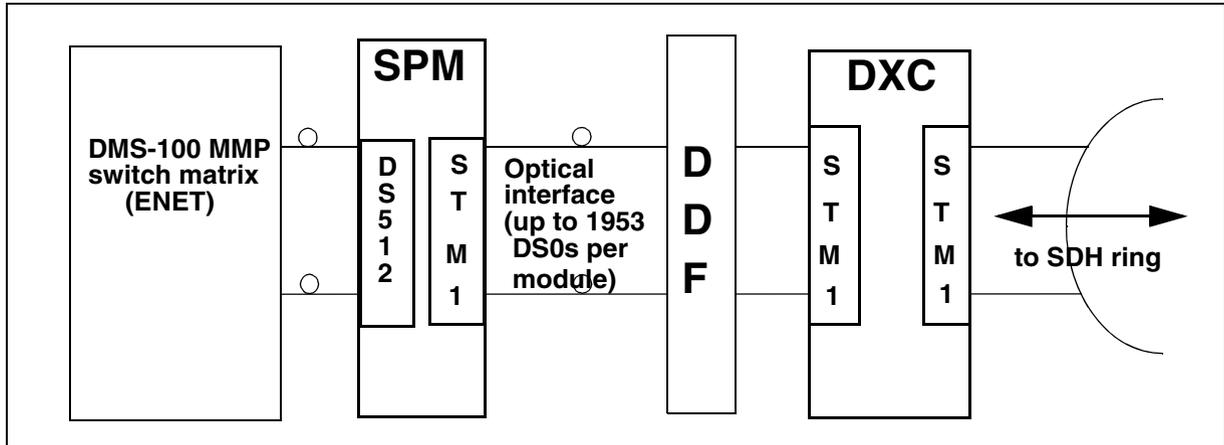
The SPM features and functionality described in this document are implemented through ISN04, ISN07 and MMP15 software releases.

SPM environment

SPM in the network

The SPM serves as a high-capacity feeder into the DMS-100 MMP switch, as shown in Figure 1-1.

Figure 1-1 SPM position in the network



The SPM system directly terminates an STM-1 carrier and feeds the individual DS0 traffic via DS512 from the carrier into the DMS-100 MMP switch. This configuration does not require external multiplexers to bring the carrier down to an E1 level, as is the case with PDTC trunk modules.

Network synchronization

The SPM system achieves SDH (Synchronous Digital Hierarchy) synchronization standards by loop timing to the SDH equipment to which it is connected, for example, a digital cross-connect (DXC). This means that to maintain SDH synchronization standards, the SPM must always be connected to equipment capable of providing an SDH quality clock (DXC or equivalent).

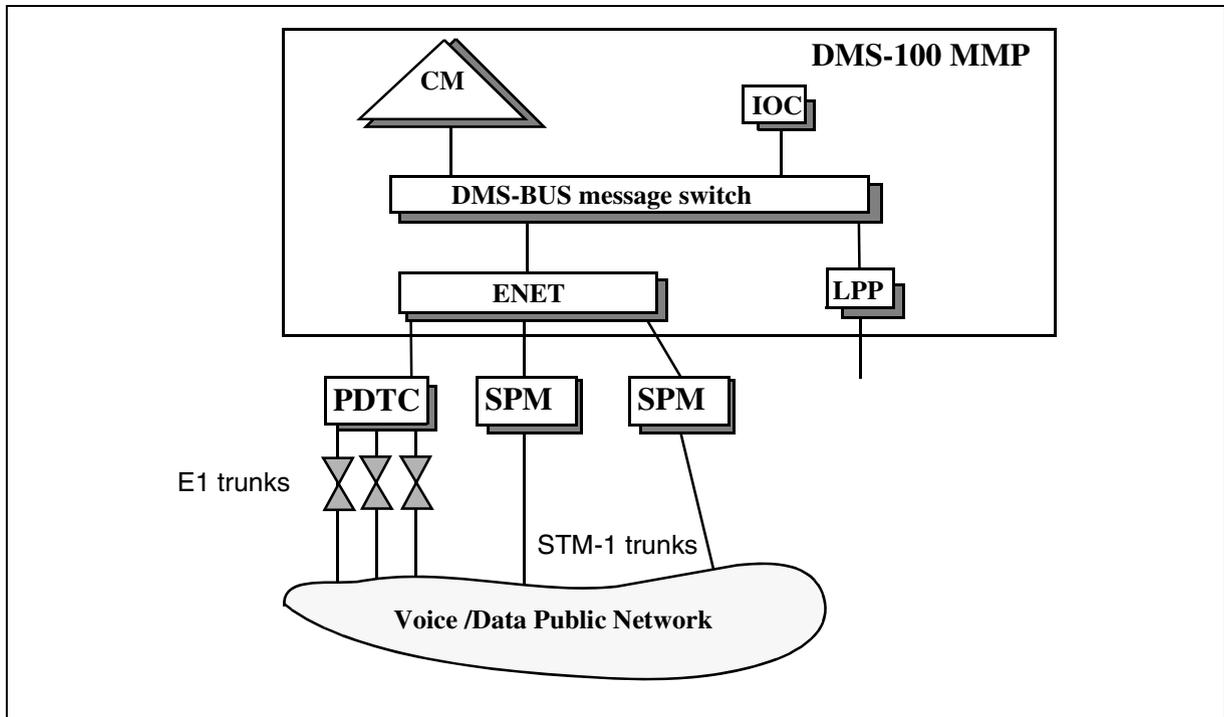
Back-to-back connection of two SPMs via STM-1 is a supported configuration.

Note: All the clocking (message switch, SPMs, DXCs and so on) must be derived from the same source.

SPM in the DMS-100 architecture

Figure 1-2 shows the position of both the new SPM and an existing PDTC within the DMS-100 MMP architecture.

Figure 1-2 SPM position within the DMS-100 MMP SuperNode

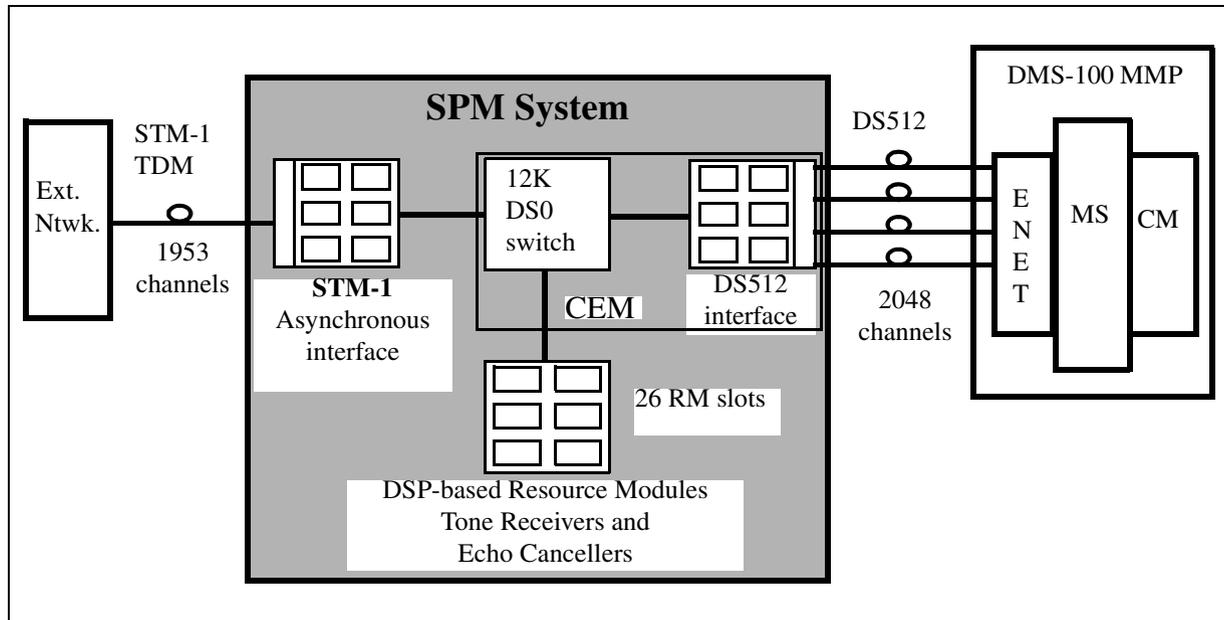


In the DMS-100 MMP architecture, the SPM occupies a similar position to the existing PDTC peripheral. However, instead of terminating E1 carriers, the SPM terminates a single STM-1 optical carrier, with four times as many trunks as a single PDTC. The SPM can also perform echo cancellation without external equipment on its terminating trunks.

SPM interface to the DMS-100 MMP switch

Figure 1-3 shows a high-level view of the internal signal routing within the SPM system.

Figure 1-3 SPM interface connections



The SPM system provides a redundant 1+1 STM-1 optical interface directly to the DMS-100 MMP switch. This interface supports asynchronous VC12 mapping.

The incoming STM-1 TDM signal is broken into its composite DS0 time slots for routing to the internal 12K port timeswitch within the Common Equipment Module (CEM). The DS0 time slots can be used in the following ways:

- routed to any of the other resource modules on the SPM shelf for bit-stream processing
- sent directly to the ENET for call processing routing through the DS512 host links provided by the CEM card

The DS512 links provide a full 2048 channels of bandwidth to the ENET, and allow for a full STM-1 payload (1953 channels) plus messaging between the SPM and the CM without a bandwidth bottleneck.

Product features

The SPM system has the following characteristics as an STM-1 trunking peripheral:

- coexists and interworks with DTCO and DTCOi
- supports ISUP and IUP (formerly BTUP) call processing in the DMS-100 MMP environment
- supports integrated echo cancellation with redundancy features
- supports an open interface to allow integrated echo canceller modules developed by licensed third parties
- supports current requirements for tone reception and COT testing
- supports ESTR capability for IN and other re-origination functionality

Benefits

The SPM system provides the following physical and operational benefits:

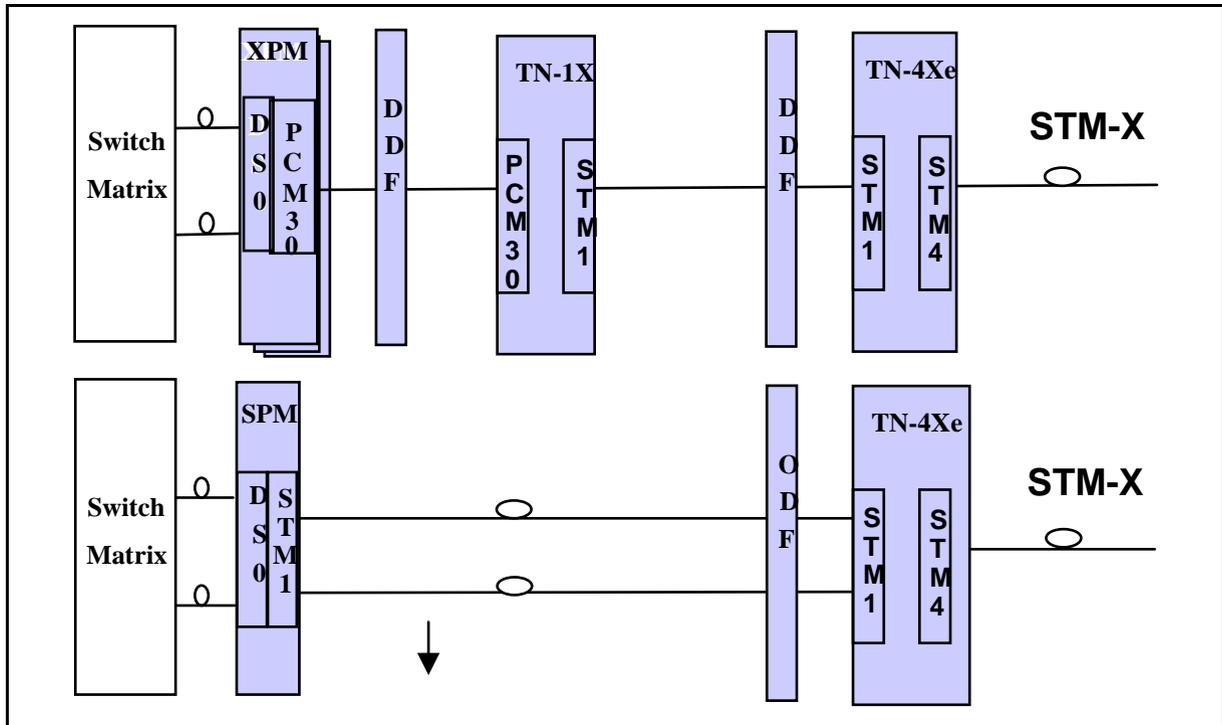
- reduction in central office physical plant
- reduced power consumption
- simplified switching/transmission boundary
- (optional) integrated echo cancellation
- integrated tone detection and tone generation
- use of existing OAM&P

The following paragraphs give details of these benefits.

Reduction in central office physical plant

Figure 1-4 shows how the SPM system achieves floor space savings by providing an STM-1 trunk interface directly to the DMS-100E switch.

Figure 1-4 Captive office equipment replaced by the SPM



A single SPM ANSI-sized frame supports two fully redundant STM-1 trunks (3906 DS0 payload trunking channels). This is the equivalent of 3.94 digital trunk controller (DTC) frames (3906/992). The SPM system also eliminates or significantly reduces the space required for MUX and external echo cancellers. This reduces the size of the wire centre and eliminates some cable congestion.

An accurate view of the achievable physical benefits requires detailed analysis on a per office basis. However, a guideline average figure is a five times reduction in the peripheral footprint (one SPM, instead of four DTCO frames and an E1/STM-1 MUX frame). This would also lead to a five times reduction in the power consumption for peripheral equipment.

Note: This power saving was evaluated in a comparative study of DTCO power measurements and SPM data. Nortel Networks Systems Engineering confirms the SPM model used as typical for UK customers: non-ECAN and 2+1 DSP per SPM.

Simplified switching/transmission boundary

The SPM system simplifies the network and switch interface. It also provides the operating company with cost-of-ownership benefits over existing solutions through the reduction of transmission equipment, and the elimination of copper interfaces and external echo cancellation equipment.

Note: Although the SPM significantly reduces equipment in the wire centre, it is not intended that the SPM incorporates all transmission functions. The SPM should be viewed as a simplified interface between the DMS switch and SDH, incorporating some of the functional advantages of SDH equipment.

Integrated echo cancellation

The SPM system provides an optional echo cancellation facility, using integrated resource modules called Voice Services Processors (VSP). The VSPs are plug-in modules and can be provisioned for 100% port coverage or pooled coverage (where only a percentage of the total number of speech time slots can use echo cancellation at one time). If less than 100% of the traffic requires echo cancellation, the SPM requires fewer VSP modules, thus providing a more economical deployment of the echo cancellation function.

Nortel Networks also provides an interface specification to enable licensed third-party echo canceller vendors to design and supply integrated echo cancellers for the SPM system. These units will be fully compatible with all SPM physical, logical, and software support systems.

Integrated tone detection and tone generation

The SPM system provides integrated tone detection and tone generation using the Digital Signal Processing Resource Module (DSP RM). The DSP RM is a plug-in module and can be provisioned for 100% trunk coverage or pooled coverage. Its functionality is equivalent to the Special Tone Receiver (STR) and Universal Tone Receiver (UTR) used in the XPM peripherals. It can also be used for both short and long duration tone detection.

Use of existing OAM&P

Because the SPM system is an integral subsystem of the DMS-100 MMP switch, it uses the existing switch-based operations, administration, maintenance and provisioning (OAM&P) facilities, via the Maintenance and Administration Position (MAP). This method of network management requires minimal retraining of operating company personnel.

2 Development summary

This chapter outlines the hardware and software development for the SPM STM-1 trunking application.

Functionality deliverables

For a complete list of available features that are available on the SPM, (depending on core software and switch software loads) please see "SPM features for software releases up to and including SP17.2" on page 1-1 of this document.

Hardware development

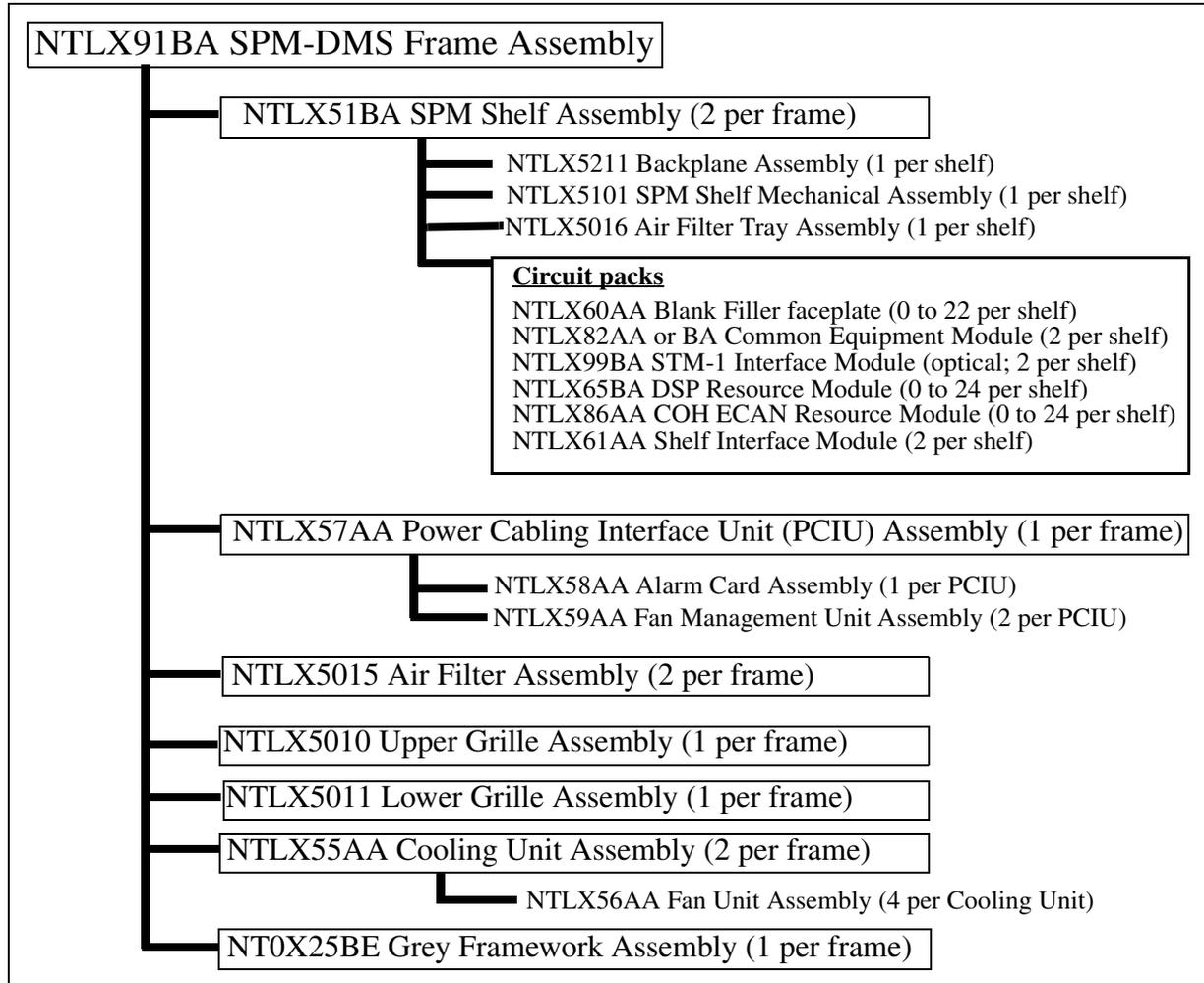
The Spectrum technology platform represents an entirely new set of mechanical shelving and circuit pack designs. All circuit packs share common features and plug into a double-height shelf with a single backplane designed to fit an ANSI rack. (SPM configured in an ETSI rack is not currently available.) The design is compatible with Model B lineups.

Product structure

The Spectrum product structure is designed to support multiple Spectrum technology applications by building applications on the base frame assembly, NTLX91BA. This base assembly contains all the components, other than the circuit packs, that are common to any Spectrum-based application. The circuit packs are documented in the Modular Structure (MS) document, according to Modular Documentation System (MDS) rules. This documentation method assumes that all Spectrum technology customers use the current SPM-designed backpanel and frame mechanicals.

Figure 2-1 shows the main elements of a DMS-sized rack containing two STM-1 SPM systems. A single DMS-sized rack is always provisioned with two SPM system shelves.

Figure 2-1 STM-1 SPM product structure



The 'circuit packs' box shows the circuit packs required to turn the base frame into an STM-1 SPM. For documentation of these circuit packs and the frame assembly components, see the *DMS-SPM Hardware Maintenance Reference Manual*, 297-1771-550.

Dependencies

Deployment of the SPM STM-1 trunking peripheral on the DMS-100 MMP switch is dependent on the presence of ENET on the switch.

On the ENET, the DS512 links are terminated by NT9X40DA cards.

Software development

The software required to support the SPM system resides in several nodes within the SuperNode office. The loads delivered to the customer are:

- SuperNode core software load including the SPM configuration, central maintenance and call processing interfaces; this is the DMS-100 MMP load
- software in the ENET to support the new ENET paddleboard and link maintenance for the SPM-ENET links
- SPM system-resident software including the CEM load, DSP RM load, VSP RM load and STM-1 RM load
- COH RM load

Part II

Functional description

This part contains the following chapters:

- Functional overview (Chapter 3)
- Limitations and restrictions (Chapter 4)

3 Functional overview

This chapter describes how the SPM STM-1 trunking application is implemented on the DMS-100 MMP switch, in the following sections:

- STM-1 interface
- ISUP protocol
- IUP (formerly BTUP) protocol
- Echo cancellation
- Tones
- Continuity testing
- Intelligent Networks
- OAM&P
- Carrier maintenance
- Companding and bit inversion
- Error handling
- Network Protection
- Digital Test Access

STM-1 interface

The STM-1 interface provides the following:

- STM-1 optical interface compliant with G.703
- STM-1 1+1 unidirectional non-revertive multiplexer section protection
- STM-1 1+1 bidirectional and revertive are optional
- Automatic Protection Switching (APS) within 50 milliseconds as per G.841
- full fill capacity(1953 DS0s)
- asynchronous mapping of 63 E1s to 63 VC12s

- SDH alarm support
- interface to two SPM common equipment modules (CEM; active and inactive) via nine SPM serial links to each CEM

Protection switching

A particular carrier level may be defined as a protection group, where one carrier is the active carrier and the other carrier is inactive. If a problem occurs on the active carrier, traffic can then be switched to the inactive carrier. This is known as a 'protection switch'. For the SPM system, carrier protection operates at the multiplexer level and thus carrier protection switching is applicable only to multiplexor section (STM1M) carriers.

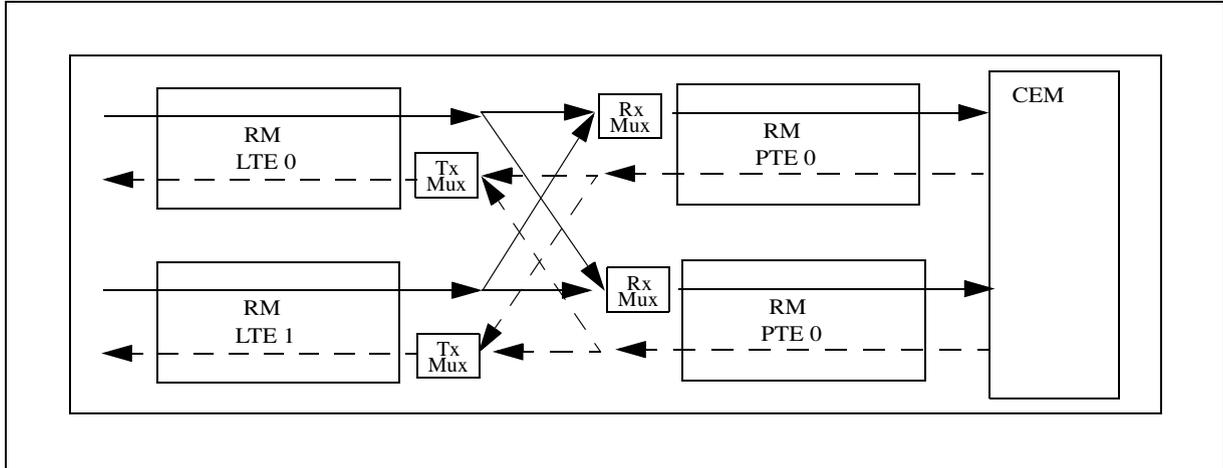
Multiplexer Section Protection (MSP), together with the RM Protection, provides a 1+1 unidirectional non-revertive Automatic Protection Switching (APS) for STM-1:

- 1+1: There is one working unit and one protection unit. Data is transmitted by both units. Data is recovered from the working unit.
- unidirectional: Only the affected direction (Tx or Rx) is switched.
- non-revertive: Once a protection switch has occurred, service stays with the protection unit (which is now the active unit) even after the condition that caused the switch has been cleared.
- APS: On detection of a service-affecting condition, the system automatically performs a protection switch, without operator intervention.
- For bidirectional and revertive, protection switching is optional

The SDH hierarchy contains Regenerator Section, Multiplexer Section and Path layers. Multiplexer Section Protection switching involves switching between the working and protection units at the Multiplexer Section level.

Figure 3-1 shows the STM-1 implementation of MSP, Transmit data is sourced from the active Path Terminating Equipment (PTE) to both the active and inactive Line Terminating Equipment (LTE). Receive data on a selected LTE is replicated to both the active and inactive PTE. The BWA-S at the CEM selects the receive data on the active path. With this arrangement, the MSP path compensates for a failure of the physical carrier, interface circuitry or Regenerator Section hardware.

Figure 3-1 STM-1 implementation of MSP



Protection functionality can be summarized as follows:

- APS is completed within 50 ms (as per ITU G.841) when:
 - Signal Fail (SF) is detected in the active LTE, and the mate unit is in the No Fault or Signal Degrade (SD) state.
 - Signal Degrade is detected in the active LTE, and the mate unit is in the No Fault state.

Note: SF is defined as LOS and LOF detected in the Regenerator Section, and EXC and AIS detected in the Multiplexer section. SD is detected at the Multiplexer section.

- The system supports protection mode and independent (simplex) mode. In simplex mode, crossover capability is disabled.
- During an APS or a manual sparing action, the active LTE and the active PTE switch together, so that the active RM always has the active line. This arrangement is known as welded sparing.

The SPM manual protection switching command is also available at the STM-1 PM MAP level. This allows operating company personnel to spare from an active device to an inactive device. Welded sparing causes the LTE and the PTE to switch together.

Automatic SYSB recovery process

When the SPM goes into simplex mode from inactive (that is, initially both CEMs are in the MANB state, and both STM-1 RMs are in the CBSY state), the active STM-1 RM behaves in the following way. When one of the CEMs returns to service (RTS) from a MANB state, the active STM-1 RM changes to SYSB, then changes to INSV. The CEM then changes to INSV in the normal way.

Note: This process of recovery through the SYSB state is built into the design of the new RM data synchronization manager which the STM-1 RM uses. The automatic SYSB recovery process carries out the actions needed to go INSV. Therefore any forcing of the STM-1 RM into an in-service state (INSV or HOLD) causes a SYSB request.

Synchronization

The SPM system supports a loop timing mode, where the synchronization is derived from the currently active STM-1 signal entering the SPM.

The DMS switch typically receives its synchronization reference via a PDTC. The PDTC measures the phase difference between the received reference and the message switch (MS) clock, and sends to the MS a message containing this difference. Based on the phase difference, the MS updates the frequency of its oscillators to match the frequency of the reference. The resolution of the phase comparator and the rate at which phase samples are sent to the MS result in a phase error between the reference and the MS, thus putting the DMS switch outside the SDH synchronization specification. Derivation of synchronization from the MS clocked externally is also of insufficient accuracy to meet the SDH specification.

Customers can achieve SDH standard synchronization by provisioning the SPM to receive its synchronization from the SDH equipment (for example, a DXC) to which it is connected. This means that the SPM system must always be connected to equipment capable of providing a clock which meets the SDH specification. This synchronization method is known as loop timing the SPM off the DXC. For loop timing to operate within the CCITT specification, the MS and the DXC to which the SPM is loop timed must both derive their timing from the same source.

Note: Although back-to-back connection of two SPMs via the STM-1 interface is a supported configuration, the connection does not conform to the ITU synchronization standard.

ISUP protocol

Trunk signaling and call processing services

The SPM does not directly participate in ISUP signaling termination. That function is handled by the link peripheral processor (LPP).

For a list of supported SPM trunk signalling types and call processing services see "SPM features for software releases up to and including SP17.2" on page 1-1 of this document.

Interworking

Interworking to existing protocols on PDTCs and DTCIs is supported. A single trunk group can be assigned across both SPM and PDTC. For a list of call interworkings see the *DMS-100 Base Product Description*.

IUP (formerly BTUP) protocol

Trunk signaling

IUP trunk signaling conforms to the following specifications:

- DMS-100E Compliance to IUP Sections 2 and 3

The SPM does not directly participate in IUP signaling termination. That function is handled by the link peripheral processor (LPP).

Call processing services

The IUP public network features available are as follows:

- Malicious Call Identification (MCI)
- Operator Override (OOR) /Network Barge-in
- Emergency Calls
- Dynamic Routing Control (DRC)
- Caller Confidentiality (141 service)
- Automatic Recall (1471 service)
- Call Back When Free
- Integrated echo cancellation using ETSI ISUP (V1 and V2 plus variants) and IUP on STM-1

Interworking

Interworking to existing protocols on PDTCs and DTCIs is supported. For a list of call interworkings, see the *DMS-100 Base Product Description*.

Echo cancellation

Echo cancellation is necessary when the echo from voice travelling time becomes significant, for example, international calls and mobile telephone

calls. Echo cancellation is provided by the VSP or COH (Voice Service Processor) Resource Module. The VSP or COH provides a shared resource pool of echo cancellers that are assigned to a trunk as required, and then removed from the trunk and put back into the resource pool when the call is completed. Echo cancellers are provisioned by selecting the percentage of trunk coverage required (0% to 100%) based on traffic engineering rules for the particular office. The customer then purchases enough VSP or COH modules to handle the coverage requirement and the SPM manages the resource allocation automatically.

The VSP or COH RM provides a network echo canceller which handles multiple echoes per channel (sparse impulse response coverage). Coverage is provided in 2-ms 'chunks'. Capacity estimates are based on an average of 6 ms echo coverage per channel. The maximum tail delay is selectable in 16 ms steps from 16 ms to 128 ms. If the echo canceller encounters conditions such as a tail delay greater than the selected maximum, it reports its failure to converge.

The application includes a tone disabler selectable for G.164 or G.165 mode operation. The disabler also activates on 2010 Hz CCIS tone. When disabled, the echo canceller is bit-transparent, allowing support for a 56 kbit/s data service.

MMP SPM echo cancellation provides similar functionality to the extended peripheral module (XPM) platform (see *MMP Translations Guide*, 297-9051-350). The implementation is compatible with continued and unchanged operation of XPM-based echo cancellers and with interworking between SPMs and XPMs on the same switch.

Echo cancellation devices are integrated with carrier access equipment which are accessed on a per trunk/per call basis from a resource pool. The size of the resource pool is dependent on the number and types of voice signal processing (VSP or COH) modules available.

Tones

Tone detection

The SPM provides a resource pool of the DTMF and MF receivers that are required for tone detection functionality in international trunking applications. STR (Specialized Tone Receiver) and UTR (Universal Tone Receiver) XPM equivalency is supported, although blue box fraud is not supported.

Tone generation

Tonesets are downloadable. For a list of supported tonesets, see "SPM features for software releases up to and including SP17.2" on page 1-1 of this document.

Note: Downloadable tones are available for the SPM. New tonesets must be tested before deployment.

Continuity testing

Continuity tone testing is available to support CCS7 signaling where required. This facility is necessary because the CCS7 signaling and voice paths are separate, so that a successful signaling interaction does not guarantee that a functional voice path has been established. COT tests involve transmission and reception of special tones over the voice circuit before the call is established. COT tests are not required on every call setup, and for operational savings can be achieved by provisioning COT tests to occur every n^{th} call on a given trunk.

High-level control of COT tests is performed by the switch core; the SPM provides the necessary transceivers to generate and detect the COT tones. This is accomplished using the Digital Signal Processor (DSP) Resource Module in the SPM. The continuity tone transmitter/receiver handles complete COT tests for 2W and 4W circuits. It is selectable as outgoing or incoming mode, and may be configured for variations in test frequencies/levels and protocols.

Intelligent Networks

The Intelligent Networks (IN) functionality in the SPM is fully compliant with the *ITU Intelligent Networks System Guide*. The following paragraphs provide details.

On the DMS-100 switch, Intelligent Networks (IN) call processing is implemented mainly in the CM. The peripheral (XPM) contains no specific IN code. However, the peripheral handles re-supervision on calls that become IN calls.

The re-supervision is a standard message sent from the CM to the peripheral. The IN re-supervision message contains no IN-specific supervision elements. Re-supervision has the following aims. The peripheral:

- reports to the CM, rather than bouncing messages for call interworking
- sends specific information to the CM, that is, ISUP RELs rather than CLFs

For an IN EDP8 call, the digit collection resource is checked before sending the STR supervision element to the peripheral to start digit collection. In the SPM, the DTMF resource in the DSP card provides the digit collection resource. (In the XPM, the STR card provides this resource.)

OAM&P

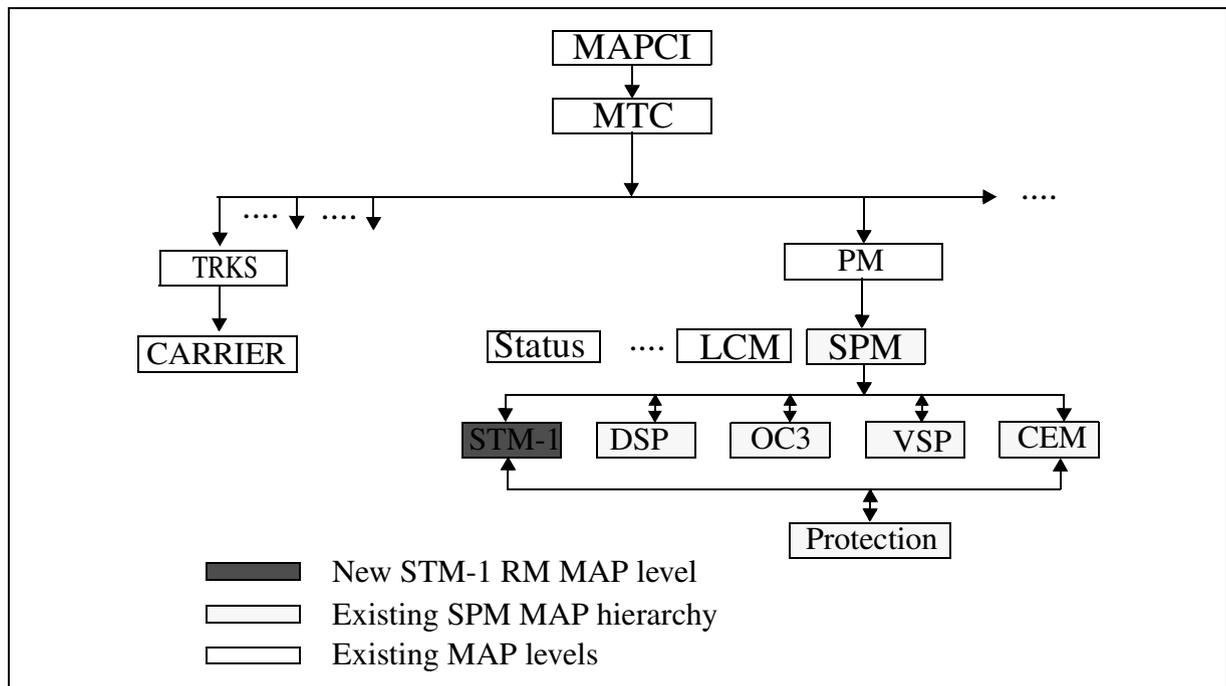
The SPM system has a switch-based local/remote MAP interface. The system contains new functionality for provisioning and hierarchical carrier maintenance, and provisioning software to introduce the new RM device to the Computing Module (CM).

After a new device is datafilled, it can be posted via the MAP Command Interpreter (CI) interface, for manual intervention such as maintenance activities and queries.

MAP interface enhancements

The STM-1 RM MAP structure conforms to the standard MAP interface used for the existing OC-3, DSP, and VSP RM. The SPM user interface is based on the DMS MAPCI interface. Figure 3-2 shows the SPM MAP hierarchy, including the STM-1 RM MAP level. The Peripheral Module (PM) MAP level is an existing sublevel of the MTC MAP, giving access to various DMS-SuperNode peripheral groups.

Figure 3-2 SPM MAP user interface hierarchy



The MAP display supports KLM numbering with VC12P and E1P carriers on POST CARRIER level.

Figure 3-3 shows the SPM screen, which gives a summary of an entire SPM. It shows all the modules in an SPM, their slot numbers, activity status (A (active) or I (inactive)) and service state (Insv etc.).

Figure 3-3 SPM summary screen

```

CM      MSN      IOD      Net      PM      CCS      Trks      Ext      APPL
.      .      .      .      .      .      .      .      .

SPM
0 Quit
2 Post_
3 Listset
4 ListRes
5 Trns1
6
7
8
9
10
11 Disp_
12 Next
13 Select_
14 QueryPM
15 ListAlm_
16
17
18

          SysB  ManB  OffL  CBsy  ISTb  InSv
          0    0    2    0    0    27
          SPM  0    0    1    0    0    20

SPM  32  InSv  Loc: Site HOST Floor 1 Row P  FrPos  2

Shlf1 S1 A Stat  Shlf1 S1 A Stat  Shlf2 S1 A Stat  Shlf2 S1 A Stat
DSP 2 1 A Insv  CEM 1 8 I Insv  VSP 2 1 A Insv  --- - 8 - ----
DSP 4 2 A Insv  STM 0 9 A Insv  --- - 2 - ----  VSP 6 9 A Insv
--- - 3 I Insv  STM 1 10 I Insv  --- - 3 - ----  --- - 10 - ----
--- - 4 I Insv  --- - 11 - ----  --- - 4 - ----  --- - 11 - ----
--- - 5 - ----  --- - 12 - ----  --- - 5 - ----  --- - 12 - ----
--- - 6 - ----  VSP 4 13 A Insv  --- - 6 - ----  --- - 13 - ----
CEM 0 7 A Insv  VSP 4 14 A Insv  --- - 7 - ----  --- - 14 - ----

CMAPO
Time 14:12 >

```

From the SPM screen, the user can select one or more devices (CEM, DSP, VSP, or STM). Figure 3-4 shows the screen layout for displaying the new STM-1 RM in the SPM node MAP display.

Figure 3-4 STM-1 MAP screen

```

      CM      MSN      IOD      Net      PM      CCS      Trks      Ext      APPL
      .        .        .        .        .        .        .        .        .

STM
0 Quit
2
3 ListSet
4
5
6 Tst_      SPM 32      STM 0
7 Bsy
8 RTS      Loc: Row P FrPos 2 ShPos 40" Sh 0 Slot 9      Prot grp: 1
9 OffL     Load: STM01      Prot Role: Working
10 LoadMod POST:
11          STM0:
12 Next
13 Select_
14 QueryMod
15 ListAlm
16 Prot
17
18

CMAPO
Time 14:12 >

```

The screen layout (see Figure 3-5) of the STM-1 carriers includes the following information:

- Carrier class (CLASS)
- Host site (SITE)
- Node number (SPM)
- Payload positions (STMIR, STM1M, VC4P, VC12P, E1P)
- Circuit number (CKT)
- Carrier service state (STATE)
- Transmit and receive indicators (TR)
- Maintenance and alarm state indicator (MA)

Figure 3-5 STM1R POST screen

```

CM      MS      IOD      Net      PM      CCS      Trks      Ext      APPL
.      12SBPT  .      RExByp  2 SPM   .      30 CC    2Crit   .
                *C*                *C*                *C*

POST
0 Quit      TRUNKS    ML  OS  ALARM  SYSB  MANB  UNEQ  OFFL  CBSY  PBSY  INSV
2 Post_    REMOTE    1  0    5      0      0      0      0      4      32    29
3          TIMING    1  0    2      0      0      0      0      2      0      0
4          PROTLN   0  0    0      0      0      0      0      0      0      2
5 Loop_    HSCARR    0  0    0      0      0      0     131    0      0      0
6 Tst_
7 Bsy_
8 RTS_
9 OffL_
10
11 Disp_
12 Next
13
14 Detail_
15 ListAlm_
16
17 PerfMon_
18

      CLASS  SITE  SPM      RM  STM1R  CKT  STATE  TR  MA
0  HSCARR  HOST  10      0      0      1  OFFL  --  --
1  HSCARR  HOST  10      1      0      2  OFFL  --  --

CMAPO
Time 14:12
>

```

For a more detailed description of the MAP levels, see the *DMS-SPM Commands Reference Manual*, 297-1771-819.

STM-1 RM command descriptions

The following commands are provided:

- METRPP - aligns the transmit and receive power.
- Quit - quit out of the current MAP level.
- Tst - run manually in-service (InSv) and out-of-service (OOS) diagnostics on the selected device.
- Bsy (Busy) - manually place the selected device into a manual OOS (MOOS) state.
- Rts (Return to Service) - manually bring the selected device from an OOS state (MOOS or SOOS) back to a ready or InSv state.
- OffL - set the selected device into an OFF LINE state.
- LoadMod - manually download a specific load file to the selected device.
- QueryMod - manually query local/CM information on the selected device.
- Prot - carry out a manual protection switch.

Additional commands which do not interface with IDM are as follows:

- ListSet - provides a list of the posted entities in a post set.
- Next - selects the 'next' RM in the post set. If there are no more RMs in the posted set, then the system displays a message and control returns to the SPM level.
- Select - selects another device of any type configured to this SPM node.
- ListAlm - lists all alarms that are set against the posted RM. If no alarms are set, the system indicates this for each possible alarm severity.

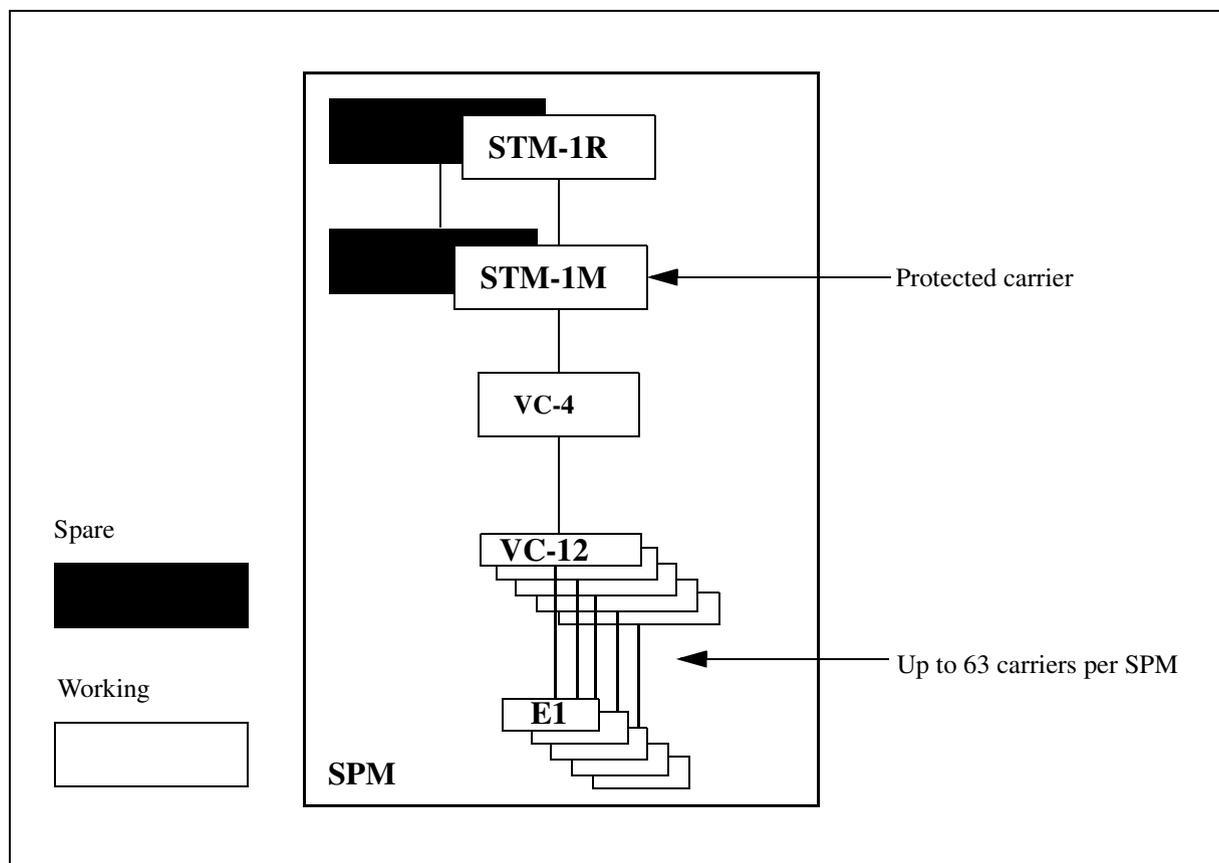
The hidden commands for the STM-1 MAP level are as follows:

- ResetMod - resets the selected STM-1 circuit pack.
- Wait - turns on/off/query wait mode.

Carrier maintenance

Figure 3-6 summarizes the STM-1 carrier hierarchy which may be provisioned using table MNHSCARR.

Figure 3-6 STM-1 carrier hierarchy



Each E1 contains up to 31 bearer channels which are available to trunk maintenance.

A maximum of two regenerator section (STM1R) carriers per SPM can be defined, one on the WORKING STM RM circuit pack and one on the SPARE STM RM circuit pack. A maximum of two Multiplexor section (STM1M) carriers per SPM can be defined, one on the WORKING STM circuit pack and one on the SPARE STM circuit pack. The two STM1R and STM1M carriers form the protection switching mechanism described on page 3-2.

A VC4P carrier must be datafilled against the WORKING STM1M carrier. There can only be one VC4P carrier per STM1M protection group, which means that there can only be one VC4P carrier defined per SPM. A maximum of 63 VC12P carriers can be defined per VC4P carrier (which means a maximum of 63 VC12P carriers per SPM). Only one E1P carrier can be defined per VC12P carrier (which means a maximum of 63 E1P carriers per SPM).

Guidelines for VC12 carrier datafill

VC12P carrier names support the inclusion of KLM numbering. The KLM numbering system is used for the international market to represent VC12 carrier names on VC4P. c.p. with the previous section (*E1 payload positions and KLM numbers*). Such a naming scheme helps to locate VC12P/E1P carriers in SDH (Synchronous Digital Hierarchy) when troubleshooting. For example, suppose that a problem occurs with a far-end E1 with KLM number 1,1,3 connecting to SPM1. The carrier name contains all this information and operating company personnel know immediately that the carrier to check is SPM_1_VC12P_113.

STM-1 is a high speed digital carrier contained in SDH. SDH uses a set of standards that are used by the international market.

The KLM numbering scheme uses a three digit (k, l, m) coordinate to represent the carrier position of VC12P within VC4P. E1P is also represented by KLM numbering since VC12P has a one-to-one mapping with E1P carriers. The relationship between the KLM numbering and the tributary unit group (TUG) is shown below:

TUG3 = K = values 1 to 3

TUG2 = L = values 1 to 7

TVC12 = M = values 1 to 3

The following CI commands use payload positions, and can also use KLM co-ordinates, as inputs and outputs:

- SETCARR
- GETHIST
- LISTHIST

For example, the SETCARR command:

```
SETCARR VC4P 1 VC12P 112
```

could be used with a KLM of 112.

Alarms

The supported list of carrier defects is as follows:

- STM1R - LOS, LOF
- STM1M - AIS, RFI, EXC, SD
- VC4P - AIS, RFI, LOP, TIM, SLM, LOM, UNEQ

- VC12P - AIS, RFI, LOP, TIM, SLM, UNEQ
- E1P - AIS, CRE, LLCMA, LOF, RAI, BER

For each defect the user can provision (by datafill) an alarm severity of Critical, Major, Minor, or No Alarm. The alarm severities are printed as part of the carrier log. There is no functional consequence of allocating a particular severity to an alarm.

The system raises an alarm if the defect persists for 2.5 seconds. The system clears the alarm if the defect is not evident for 10 seconds.

Note: These threshold parameters are not datafillable.

Performance Monitoring parameters

The supported Performance Monitoring parameters are as follows:

- STM1R - ES, SES, UAS, BBE, LBC, OPT, OPR
- STM1M - ES, SES, UAS, BBE, PSC
- VC4P - ES, SES, UAS, BBE
- VC12P - ES, SES, UAS, BBE
- E1P - ES, SES, UAS, BBE, CSS, CRC4

For each performance parameter, the user can provision a 15-minute and 24-hour performance parameter threshold and an alarm severity of Critical, Major, Minor, or No Alarm.

Note: The performance parameters are supported for near end (NE) only.

Performance Monitoring archival

The ITU specification G.784 requires terminal equipment to maintain performance monitoring historical data, for both the 15-minute and 24-hour registers. The DMS switch fulfills this requirement by storing the performance data gathered by the SPM in disk files on the CM. The user can then display the performance data, and use it to find fault locations within the transmission system.

The following table shows which performance parameters are archived.

Carrier type	Performance Monitoring parameters collected									
	UAS	ES	SES	BBE	PSC	CSS	CRC4	LBC	OPT	OPR
STM1R	NE	NE	NE	NE				NE	NE	NE
STM1M	NE	NE	NE	NE	NE					

Carrier type	Performance Monitoring parameters collected									
	UAS	ES	SES	BBE	PSC	CSS	CRC4	LBC	OPT	OPR
VC4P	NE	NE	NE	NE						
VC12P	NE	NE	NE	NE						
E1P	NE	NE	NE	NE		NE	NE			

MAPCI

Support for the new STM-1 carriers (STM1R, STM1M, VC12P, VC4P, and E1P) includes changes to the existing Post and Detail commands at the CARRIER level.

The POST command is available, at the CARRIER level of MAPCI, which can be accessed by typing the following command at the command interface:

```
MAPCI ; MTC ; TRKS ; CARRIER
```

The user can use the Post command to specify a set of all the carriers on a SPM of a given state (removing the previous restriction of specifying either the SPM node number or the carrier state). For example, to display all the InSv carriers on SPM 1, the user can enter the command POST SPM 1 INSV.

The user can use the Detail command to display additional details about the posted carrier.

Idle bit pattern

ITU specifies a number of set bit patterns that must be sent when a trunk is in the idle state (that is, not involved in call processing but available for call processing) to the trunk connected at the far end. For the E1 market, the DMS-100 MMP switch supports two such bit patterns:

- G.714 - 11010101 (hex D5)
- Q.503 - 01010100 (hex 54)

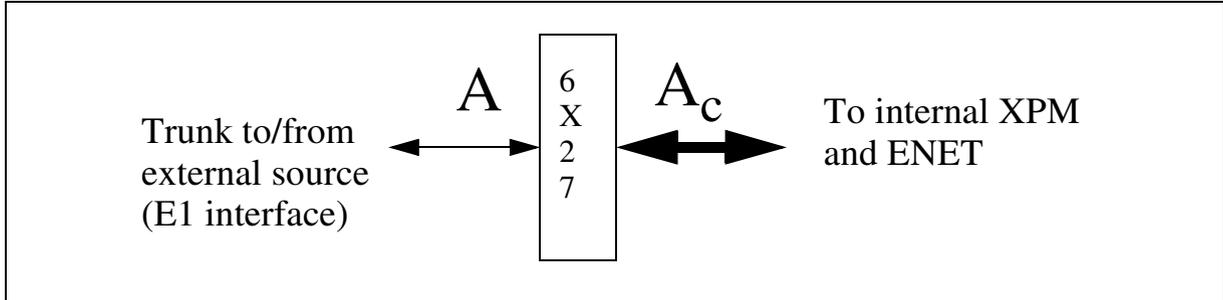
The user can select the required bit pattern by datafilling an entry in the E1P tuple of table MNHSCARR.

Companding and bit inversion

Any byte stream, carried over a trunk which is incoming to the DMS switch and which carries voice, in the E1 market is encoded using A-law companding. ITU specification G.711 specifies that this bit stream must also be even bit inverted (EBI). This E1 companding is called A-law companding plus EBI, denoted 'A'.

The trunk interface card (NT6X27) on a PDTC even bit inverts all bit streams as they pass through the card into the XPM. This means that the internal XPM format is A-law companding without EBI. This is called pure A-law companding, denoted 'Ac'. Figure 3-7 shows this process.

Figure 3-7 Even bit inversion on a PDTC

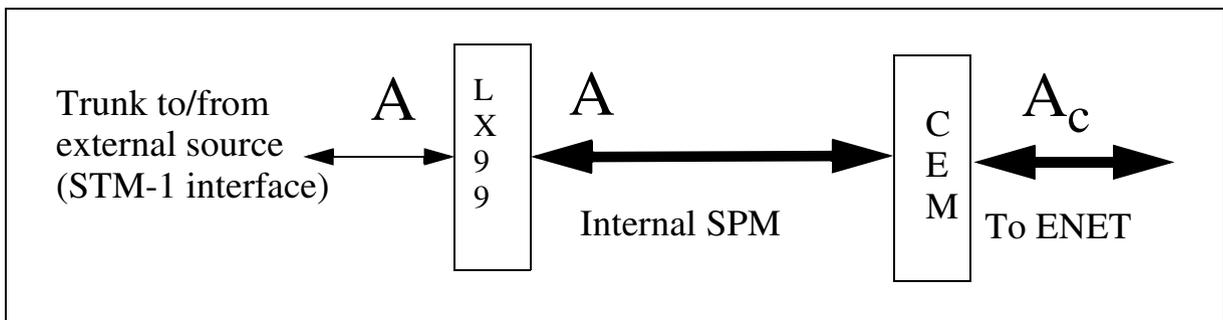


For a data call, the bit stream must be clear (no bit inversion or companding). This is called data clear, denoted 'D'.

The voice trunks incoming to the STM-1 interface are A-law companding plus EBI, just as on a PDTC. However, unlike the NT6X27 on the PDTC, the STM-1 interface card (NTLX99BA) does not perform any bit inversion on the bit stream. Therefore the internal format of the bit stream on an E1 SPM is A-law companding plus EBI. This means that all Resource Modules are hard-coded to accept bit streams with A-law plus EBI companding.

The ENET requires the bit stream to be pure A-law, therefore all payload bit streams must be EBIEd at the SPM/ENET interface. There is provision within the SPM to perform a global EBI at the DS512 interface. Figure 3-8 shows this process.

Figure 3-8 Even bit inversion at the SPM/ENET interface



International standards require trunks to be A-law. No A-law to μ -law conversion is required in Europe (or Australia).

The SPM interface provides a global even bit inversion between the CEM and the DS512 interface, that is, EBI is performed on every payload time slot. All data calls are EBId as they enter and exit the ENET. This results in a net effect of no bit inversion and is consistent with what happens currently on the PDTC to ENET interface.

Error handling

Device logs

Existing SPM logs are used to report on the condition of an STM-1 RM device (the same logs report the condition of the DSP, VSP and CEM RMs). The logs defined for alarm reporting are as follows:

- SPM300, SPM310, SPM311, SPM313, SPM331, SPM334, SPM335, SPM336, SPM337, SPM338, SPM339, SPM340, SPM350 - fault report logs
- SPM500, SPM501, SPM502, SPM503, SPM504, SPM510, SPM600, SPM630, SPM637, SPM638 - state change logs
- SPM650, SPM651, SPM660, SPM661 - loading logs
- SPM700, SPM701, SPM702, SPM703, SPM704, SPM705, SPM706, SPM707, SPM708, SPM709, SPM710 - DDM audit logs

Carrier maintenance logs

The SPM carrier maintenance logs report changes in the level of service integrity provided by an SPM node. The carrier maintenance logs are as follows:

- CARR300, CARR310 - carrier failure event logs
- CARR340, CARR341 - carrier protection logs
- CARR500, CARR501, CARR510, CARR511, CARR512 - carrier state change logs
- CARR800, CARR810, CARR811 - threshold-crossing event logs

The payload position is converted to KLM co-ordinates.

Network Protection

Priority calls

This is a regulatory feature required by the German market. It provides Priority Class of Service (PCoS), which is used to prioritize specific types of calls. If the feature is activated, then under certain predefined conditions only, those calls marked as priority are passed on through the network to the SPM.

If a Timed Break Recall (TBR) is used on Digitone (DGT) telephones a feature can be used reliably. An office parameter, `ENABLE_TBR_ON_DGT`, can be used to enable or disable the collection of dial pulse digits after a DGT telephone has initiated a feature.

Note: When ENABLE_TBR_ON_DGT is set to 'Y', features requiring TBR are not supported on dial pulse telephones using DGT lines. To support features requiring TBR on dial pulse telephones, the DGT option must be removed from the lines.

A PCoS allows prioritized users to have privileged access to the telephone system during catastrophic situations. So for emergency situations, PCoS gives priority ISDN BRI and PRI calls (for example, police, fire and ambulance) priority treatment. There are two levels of PCoS:

- ESP (Essential Service Protection)

When ESP is set to 'ON' messages from priority accesses are given priority. Priority accesses are ELN line option users and ISDN PRI users with the PCoS option provisioned.

- NETPROT

When NETPROT (Network Protection) is set to 'ON', only priority accesses are allowed to use the network.

There are no specific German emergency call (110, 112 or 115) handling. They are treated as priority calls. The dialed emergency number is specifically translated to the real number of the nearest emergency bureau and routed.

Digital Test Access

The Digital Test Application provides a mechanism to monitor individual CCS7 (Common Channel Signaling) links and digital voice trunks.

Monitoring refers to accessing a trunk that has a trunk-to-trunk call connected.

The following four commands allow various forms of trunk monitoring:

- MONPOST provides the connection between the incoming path of the posted trunk and the outgoing path of the digital jack ended trunk.
- MONLINK provides the connection between the incoming path of the linked trunk and the outgoing path of the digital jack ended trunk.
- MONBOTH enables the user to listen to incoming transmission of the posted trunk and incoming transmission of the linked trunk.
- MONTALK establishes a 3-party conference circuit connection between the posted trunk, the linked trunk and the headset of the TTP. This command is only available for analog monitoring.

4 Limitations and restrictions

This chapter discusses the following limitations and restrictions applying to the SPM STM-1 trunking application:

- operational limitations
- memory utilization
- table size

The following sections give details.

Operational limitations

The SPM STM-1 trunking application has the following operational limitations:

- To maintain SDH synchronization standards, the STM-1 SPM must always be connected to equipment capable of providing an SDH quality clock (DXC or equivalent).
- Although back-to-back connection of two SPMs via STM-1 is a supported configuration, the connection does not conform to the ITU synchronization standard.
- ECAN is provided for IUP and ETSI ISUP V1 and V2 protocols, German ISUP, UK ISUP, Italian ISUP, Spanish ISUP, Belgian ISUP, Brazilian ISUP, Austrian ISUP, Russian ISUP and Hong Kong ISUP subject to the following notes:
 - In end offices/local exchanges where lines are interworking to ETSI ISUP, compliance is 100%.
 - In transit nodes where previous nodes have not inserted echo cancellation, the SPM inserts the echo canceller on the incoming trunk. Specifications and present DMS behavior insert the echo canceller on the outgoing trunk. From an end-user perspective, there is no discernible difference.
 - Reverse Connection is functional with the use of the FAREC boolean in table SPMECAN. However, the echo canceller is applied on the

incorrect trunk. From an end-user perspective, there is no discernible difference.

- The MMP SPM echo cancellation implementation provides equivalent functionality to that currently available via the extended peripheral module (XPM) platform. In addition, the implementation is compatible with continued and unchanged operation of XPM-based echo cancellers and with interworking between SPMs and XPMs on the same switch.
- Echo cancellation is provided by either the VSP RM or the COH RM.
- The DTMF and MF receivers provided for tone detection functionality do not support blue box fraud.
- The only supported implementation of the MTP router is internal routing (external routing is not currently a requirement in the E1 market).
- The STM-1 RM does not support the following features:
 - E1 path protection
 - full-featured multiplexing and mapping (the STM-1 RM supports asynchronous E1 to STM-1 mapping only)
- For the performance archival facility, only the near-end Performance Monitoring parameters are supported.
- The SPM system does not support Specconn. If non-channelized access is used, the physical carriers for the bearer and signaling channels must be separated so that the two components enter the DMS-100 MMP switch as follows:
 - Only the bearer channels enter via the SPM.
 - The signaling channels enter using an E1 connection to the LIU via a MUX.

Table size

The size of the tables which support the SPM STM-1 trunking application (that is, the tables in the datafill sequence) are as follows:

Table	Maximum size
ENCDINV	592 tuples
LOGCLASS	512 tuples
MNCKTPAK	1662 tuples
MNHSCARR	8384 tuples
MNLINK	64 tuples

Table	Maximum size
MNNODE	64 tuples
MNPRTGRP	1792 tuples
MNSHELF	128 tuples
PMLOADS	255 tuples
TRKMEM	16 000 000 tuples

Part III Interactions

This part contains the following chapter:

- Feature interactions (Chapter 5)

5 Feature interactions

The SPM system has no feature interactions.

Note: Although the SPM interacts with other features, it does not change their functionality.

Part IV

Planning and engineering

This part contains the following chapters:

- Planning for installation (Chapter 6)
- Hardware requirements (Chapter 7)
- Software description (Chapter 8)
- System engineering (Chapter 9)
- Signaling requirements (Chapter 10)
- Capacity information (Chapter 11)

6 Planning for installation

The following manual describes the procedures to be followed in preparation for installing an SPM:

- IM24-6750 (basic SPM and STM-1 specific procedures)

Note: All installation procedures are carried out by Nortel staff.

Planning

Planning of the SPM system covers the following topics:

- hints on getting ready to install an SPM
- physical aspects
- organizational aspects
- overview/road map of the planning and provisioning sections of the SIG
- cross-references to NA installation procedures manual

Installation

Installation of the SPM system covers the following topics:

- alarms
- power and grounding
- cabling
- accessibility
- floor loading
- mounting hardware
- seismic considerations
- ventilation
- thermal loading
- tool requirements
- floor plan restrictions

7 Hardware requirements

This chapter outlines the hardware required to support the SPM STM-1 trunking application.

Description

The STM-1 Resource Module (STM-1 RM; card NTLX99BA) is an SDH STM-1 carrier interface module for the Spectrum Peripheral Module (SPM). It allows the SPM to terminate SDH STM-1 transmission systems carrying asynchronous E1 payloads, and it also maps the DS0s in those payloads to the internal format of the SPM.

The features of the STM-1 RM are as follows:

- single uni-directional STM-1 line interface (two Resource Modules are required for carrier protection), bidirectional switching is available as an option
- hardware support for 1+1 protection switching (non-revertive), revertive protection switching is available as an option
- STM-1 optical interface compliant with G.957
- on-board Local Processing Complex for
 - low level maintenance functions
 - Performance Monitoring data collection
- terminates up to 1953 DS0s mapped to a maximum of 63 asynchronous (PDH) E1s
- Channel Associated Signaling supported by hardware on a per E1 basis
- jitter performance as per G.825
- translation of link payload to and from the internal SPM S-Link protocol
- on-board diagnostics, self-test and JTAG capability
- timing recovery from incoming STM-1 for distribution to SPM CEM
- QUICC-baseRM compliant

Unsupported features

The STM-1 RM does not support the following features:

- Routing of STM-1 section and regenerator DCC to QUICC SCC ports.
- E1 path protection - this feature is not currently planned for the STM-1 RM.
- Full-featured multiplexing and mapping - the STM-1 RM supports asynchronous E1 to STM1 mapping only.

Location

The NTLX99BA STM-1 Resource Module is located in the DMS-Spectrum Peripheral Module (SPM) frame.

Functions

The principal functions of the STM-1 RM are as follows:

- STM-1 optical interface, including data and clock recovery
- SDH STM-1 interface termination including frame generation, alarm detection and generation, and error detection hardware
- termination of asynchronous E1 payloads
- overhead support at all multiplexing levels
- STM-1 and E1 transmit clock generation
- SDH alarm support
- mapping of DS0s and overhead to nine SPM S-link interfaces to each SPM CEM
- interfaces to two SPM CEMs (active and inactive) via nine SPM serial links to each CEM; messaging and payload data is passed over one link and the remaining links are used for payload data

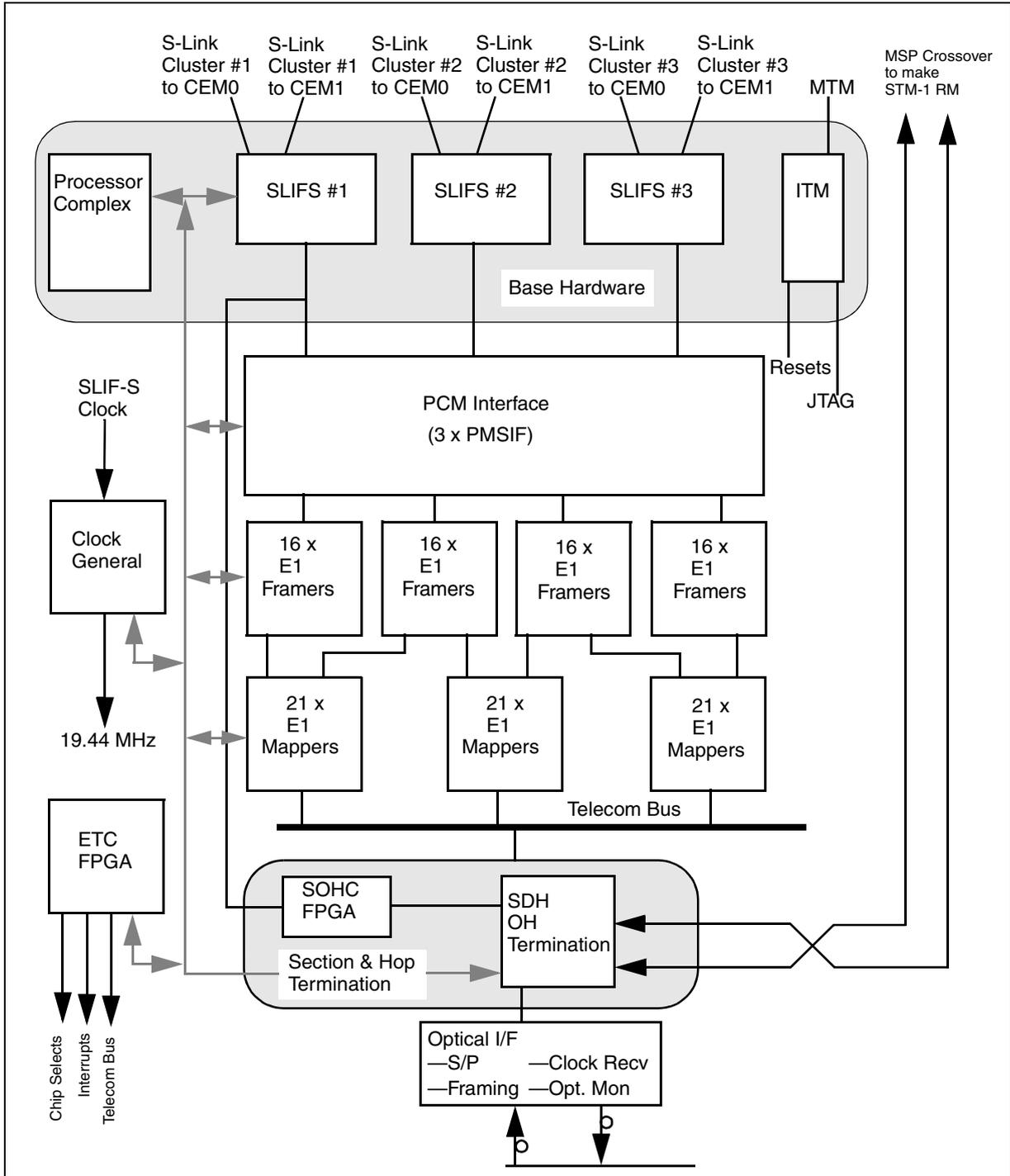
Functional blocks

The STM-1 RM is composed of the following functional blocks:

- optical and section/line interface
- E1 mapping and multiplexing
- E1 framing
- PCM interface
- base hardware
- clock generation
- ETC

Figure 7-1 shows the DSLX99BA STM-1 RM functional block diagram.

Figure 7-1 DSLX99BA STM-1 RM block diagram



Optical and section/line interface

The DSLX99BA STM-1 resource module provides a short-reach and an intermediate-reach STM-1 optical transceiver (155.52 Mbyte/s). The STM-1 RM terminates the section and line portions of the overhead and exchanges SDH AU4 streams with mate to support protected link operation. The electro-optical (E/O) modules are separate receiver and transmitter units that provide short-reach and intermediate-reach capabilities.

The laser output of the transmit E/O modules can be disabled for safety during diagnostics. In addition, it is monitored for laser bias and optical output power output. The receive module provides low light and received power indications.

Overhead termination is provided by a transport overhead transceiver device that is serviced by the local processor. The transport overhead transceiver detects line defects, performance related overhead, protection switching and alarms.

The transport overhead transceiver has the highest interrupt priority of all devices on the optical, line and section termination board. The highest priority ensures that an immediate protection switch can be performed if a link fault occurs. The E/O module and clock/data recovery sections monitor for loss of light and signal and report these error conditions through the transport overhead transceiver. The transport overhead transceiver provides a special B2 error monitor that monitors B2 errors over programmable periods of time. If the error rate during a period exceeds a programmable limit, an interrupt is generated and software determines if a protection switch is required.

STM-1 section and high order path hardware handles both the section and high order path overhead. The hardware handles overhead in one of three ways:

- terminates the overhead directly in hardware
- extracts the overhead and makes it available to the STM-1 RM local processor
- extracts the overhead and passes it to the Common Equipment Module (CEM) through the SDH OverHead Controller (SOHC) FPGA.

The principal components of the SDH section and high order path termination block are the transport overhead transceiver and the path terminating transceiver.

The APA FPGA provides and controls the Multiplexor Section Protection (MSP) path between the two STM-1 RMs in the Spectrum shelf.

Table 7-1 shows the optical interface specifications for the STM-1 RM.

Table 7-1 STM-1 RM optical interface specifications

STM-1 RM optical interface circuit pack specifications		
Parameter	short reach	intermediate reach
Connector type	SC	SC
General fiber type	Single mode	Single mode
Device type	MLM	MLM
Central wavelength	1310 nm	1310 nm
Spectral width	7.7 nm	7.7 nm
Central wavelength range	1261 - 1360 nm	1261 - 1360 nm
Line rate	STM-1 (155.52 Mb/s)	STM-1 (155.52 Mb/s)
Extinction ratio	8.2 dB	8.2 dB
Guaranteed launch power	-15 dBm	-15 dBm
Maximum launch power	-8 dBm	-8 dBm
Mean output power	-15 to -8 dBm	-15 to -8 dBm
Supply voltage	4.7 - 5.5 Volts	4.7 - 5.5 Volts
Case temperature	-4.0 to 79 degrees C	-4.0 to 79 degrees C

Table 7-2 shows the optical interface receiver specifications for the STM-1 RM.

Table 7-2 STM-1 receiver specifications

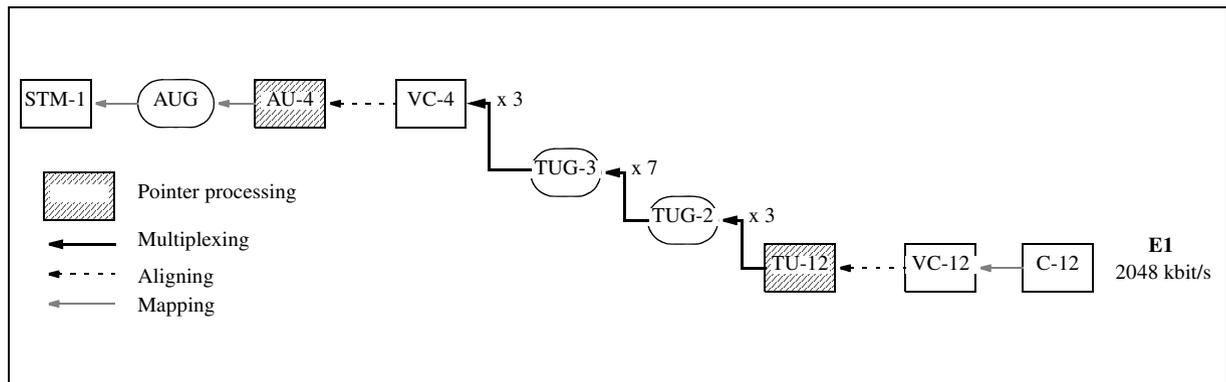
STM-1 RM optical interface receiver specifications		
Parameter	1310 nm short reach	1310 nm intermediate reach
Central wavelength	1261-1360 nm	1261-1360 nm
Line rate	STM-1 (155.52 Mb/s)	STM-1 (155.52 Mb/s)
Overload level	-5 dBm	-5 dBm
Guaranteed receiver sensitivity	-37 dBm	-37 dBm
Supply Voltage	4.7 - 5.5 Volts	4.7 - 5.5 Volts
Case Temperature	-4.0 to 79 degrees C	-4.0 to 79 degrees C

E1 mapping and multiplexing

The E1 mapping and multiplexing block maps sixty three E1 payloads into sixty three VC-12 containers. The VC-12 containers are multiplexed up to three TUG-3s. The E1 mapping and multiplexing function is performed by 3 SXT6251, 21 E1 Mapper devices from Level 1 communications.

Figure 7-2 shows the multiplexing structure. A 2048 kbit/s framed E1, Container 12 (C-12), is converted into a VC-12 by adding VC-12 path overhead (POH). The VC-12 is placed into a TU-12 where a pointer is added. The rest of the mapping involves byte-interleaved multiplexing of TU-12s into TUG-2s and TUG-2s into TUG-3s.

Figure 7-2 SDH multiplexing/mapping scheme supported by STM-1 RM



E1 framing

In the receive direction the framing process completes the following tasks:

- locates the start-of-frame in an incoming stream of bits
- converts the bit stream to a synchronous payload byte stream
- detects alarms and extracts signalling information

In the transmit direction the framing process encapsulates synchronous payload and signalling byte streams in a frame structure and sends them off as a stream of bits.

The STM-1 RM framers support slip buffers on the receive side to absorb the phase and frequency differences between the received E1 stream and the PCM interface block.

STM-1 RM supports sixty four independent E1 framers. One framer is not used.

PCM interface

The PCM interface provides a glue-logic function between the synchronous PCM interface of the three SLIF-S devices and the E1 framers.

Base hardware

The STM-1 RM base hardware supports the following features:

- Motorola MC68EN360 QUICC micro-controller, memory and support circuitry
- Spectrum S-Link interface to the CEM supported by three SLIF-S ASICs
- module test, reset and maintenance supported by the ITM ASIC
- point of use power supply (PUPS) providing both +5V and +3.3V

Clock generation

The STM-1 RM uses five separate clock structures:

- processor clock
- SLIF-S clock
- E1 clock
- transmit line rate clock
- receive line rate clock

The processor clock is a 25 MHz clock generated by a 3.3V crystal oscillator.

The SLIF-S clock is a 24.576 MHz clock selected from the active common equipment module (CEM). The SLIF-S device generates the SLIF-S clock and

the associated framing signals, and generates the 6.144 MHz byte clock used by the PCM interface block (PMSIF)

The E1 clock is a 2.048 MHz clock generated by the PMSIF FPGA by dividing down the SLIF-S clock.

The transmit line rate clock is a 19.44 MHz clock generated from the selected S-Link Interface clock through an on board phase-locked loop.

The receive line rate clock is a 155.52 MHz clock and a 19.44 MHz clock extracted from the receive data by the LIU. The clocks clock data into the STXC.

ETC

The ETC is a Field Programmable Gate Array (FPGA) that supports glue logic functions on the STM-1 RM. The ETC generates chip select, consolidates interrupt, and controls the Telecom Bus.

Signaling

Table 7-3 shows the DSLX99BA STM-1 RM connector P18 (1U) - power pinouts.

Table 7-3 P18 (1U) connector

Pin number	A	B	C	D	E
2	-48B	-48B	-48B	-48B	-48B
3	NC	NC	NC	NC	NC
4	NC	NC	NC	NC	NC
5	RTN	RTN	RTN	RTN	RTN
6	NC	NC	NC	NC	NC
7	NC	NC	NC	NC	NC
8	-48A	-48A	-48A	-48A	-48A

Table 7-4 shows the DSLX99BA STM-1 RM connector P14 (2U) - S-Link cluster #1 and MTM bus.

Table 7-4 P14 (2U) connector

Pin number	A	B	C	D	E
2	SYNC_ToCEM0	LGND	LGND	LGND	SYNC_FrOC30
3	SYNC_ToCEM1	.NC.	LGND	.NC.	SYNC_FrOC31
4	LGND	LGND	LGND	LGND	LGND
5	.NC.	.NC.	LGND	.NC.	.NC.
6	.NC.	.NC.	LGND	.NC.	.NC.
7	ToCEM0_D2	ToCEM0_D1	LGND	ToCEM1_D1	ToCEM1_D2
8	ToCEM0_D3	ToCEM0_CK	LGND	ToCEM1_CK	ToCEM1_D3
9	FrCEM0_D2	FrCEM0_D1	LGND	FrCEM1_D1	FrCEM1_D2
10	FrCEM0_D3	FrCEM0_CK	LGND	FrCEM1_CK	FrCEM1_D3
11	LGND	LGND	LGND	LGND	LGND
12	.NC.	.NC.	LGND	.NC.	.NC.
13	.NC.	.NC.	LGND	.NC.	.NC.
14	.NC.	.NC.	LGND	.NC.	.NC.
15	.NC.	.NC.	LGND	.NC.	.NC.
16	SLOT_ID4	SLOT_ID3	MCTL	SLOT_ID1	SLOT_ID0
17	LGND	MPR	SLOT_ID2	MCLK	LGND
18	MMD	LGND	LGND	LGND	MSD

Table 7-5 shows the DSLX99BA STM-1 RM connector P12 (2U) - S-Link cluster #2 and #3.

Table 7-5 P12 (2U) connector

Pin number	A	B	C	D	E
2	LGND	LGND	LGND	LGND	LGND
3	MXPXOver08	MXPXOver09	LGND	MXPXOver10	MXPXOver11
4	MXPXOver12	MXPXOver13	LGND	MXPXOver14	MXPXOver15
5	.NC.	.NC.	LGND	.NC.	.NC.
6	LGND	LGND	LGND	LGND	LGND
7	LGND	LGND	LGND	LGND	LGND
8	LGND	LGND	LGND	LGND	LGND
9	ToCEM0_D8	ToCEM0_D7	LGND	ToCEM1_D7	ToCEM1_D8
10	ToCEM0_D9	ToCEM0_CK3	LGND	ToCEM1_CK3	ToCEM1_D9
11	FrCEM0_D8	FrCEM0_D7	LGND	FrCEM1_D7	FrCEM1_D8
12	FrCEM0_D9	FrCEM0_CK3	LGND	FrCEM1_CK3	FrCEM1_D9
13	LGND	.LGND	LGND	LGND	LGND
14	ToCEM0_D5	ToCEM0_D4	LGND	ToCEM1_D4	ToCEM1_D5
15	ToCEM0_D6	ToCEM0_CK2	LGND	ToCEM1_CK2	ToCEM1_D6
16	FrCEM0_D5	FrCEM0_D4	LGND	FrCEM1_D4	FrCEM1_D5
17	FrCEM0_D6	FrCEM0_CK2	LGND	FrCEM1_CK2	FrCEM1_D6
18	LGND	LGND	LGND	LGND	LGND

Table 7-6 shows the DSLX99BA STM-1 RM P11 (2U) cross connector.

Table 7-6 P11 (2U) connector

No	A	B	C	D	E
2	LGND	LGND	LGND	LGND	LGND
3	Add0Data_TD_0	Add0Data_TD_1	Drop0Data_TD_4	Drop0Data_TD_1	Drop0Data_TD_0
4	Add0Data_TD_2	Add0Data_TD_3	Add0Data_TD_4	Drop0Data_TD_3	Drop0Data_TD_2
5	Add0Data_TD_5	Add0Data_TD_6	LGND	Drop0Data_TD_6	Drop0Data_TD_5
6	Add0Data_TD_7	Add1Data_ROut_0	LGND	Drop1Data_ROut_0	Drop0Data_TD_7
7	Add1Data_ROut_1	Add1Data_ROut_2	LGND	Drop1Data_ROut_2	Drop1Data_ROut_1
8	Add1Data_ROut_3	LGND	LGND	LGND	Drop1Data_ROut_3
9	LGND	Add1Data_ROut_4	LGND	Drop1Data_ROut_4	LGND
10	Add1Data_ROut_5	Add1Data_ROut_6	Drop0Parity_TD	Drop1Data_ROut_6	Drop1Data_ROut_5
11	Add1Data_ROut_7	Add0C1k_TIC1k	Add0Parity_TD	Drop0C1k_TIC1k	Drop1Data_ROut_7
12	Add0C1J1_PFOut	.NC.	LGND	.NC.	Drop0C1J1_PFOut
13	Add1Parity_ROut	Add1C1k_RIC1k	LGND	Drop1C1k_RIC1k	Drop1Parity_ROut
14	Add1C1J1_ROFP	.NC.	LGND	.NC.	Drop1C1J1_ROFP
15	LGND	LGND	LGND	LGND	LGND
16	MSPXOver00	MSPXOver01	LGND	MSPXOver02	MSPXOver03
17	MSPXOver04	MSPXOver05	LGND	MSPXOver06	MSPXOver07
18	LGND	LGND	LGND	LGND	LGND

The NTLX99BA STM-1 interface card is located in the DMS-Spectrum Peripheral Module (SPM) frame. Table 7-7 shows the naming convention, functions and type of signals presented to an NTLX99BA STM-1 RM in a shelf.

Table 7-7 STM-1 RM backplane pin descriptions

No	Signal	Function	IO type	Description
J1	-48B	Power		-48V battery feed B
J1	RET	Power		Battery return
J1	-48A	Power		-48V Battery Feed A
J2	FrCEMnCKm	Input	3.3V CMOS SLIF-S	S-Link clock lines from common equipment (n=0 CEM0, n=1 CEM1)
J2	FrCEMnDm	Input	3.3V CMOS SLIF-S	S-Link data lines from common equipment (n=0 CEM0, n=1 CEM1) n=1,2,3 on J2
J2	ToCEMnCKm	Output	3.3V CMOS SLIF-S	S-Link clock lines to common equipment (n=0 CEM0, n=1 CEM1)
J2	ToCEMnDm	Output	3.3V CMOS SLIF-S	S-Link data lines to common equipment (n=0 CEM0, n=1 CEM1) n=1,2,3 on J2
J2	SYNC_ToCEM0 SYNC_ToCEM0 SYNC_FrOC3 SYNC_FrOC3	Output	3.3V TTL (74LVT16244)	STM-1 recovered frame pulse, used by CEM, or clock RM for synchronization
J2	MMD	Input	3.3V CMOS ITM	JTAG 1149.5 bus master data
J2	MSD	Input/Output Open Drain	3.3V CMOS ITM	JTAG 1149.5 bus slave data
J2	MCLK	Input	3.3V CMOS ITM	JTAG 1149.5 bus clock
J2	MPR	Input/Output Open Drain	3.3V CMOS ITM	JTAG 1149.5 bus request
J2	MCTL	Input	3.3V CMOS ITM	JTAG 1149.5 bus control
J2	LGND	Power		logic ground of the PCP/BACKPLANE

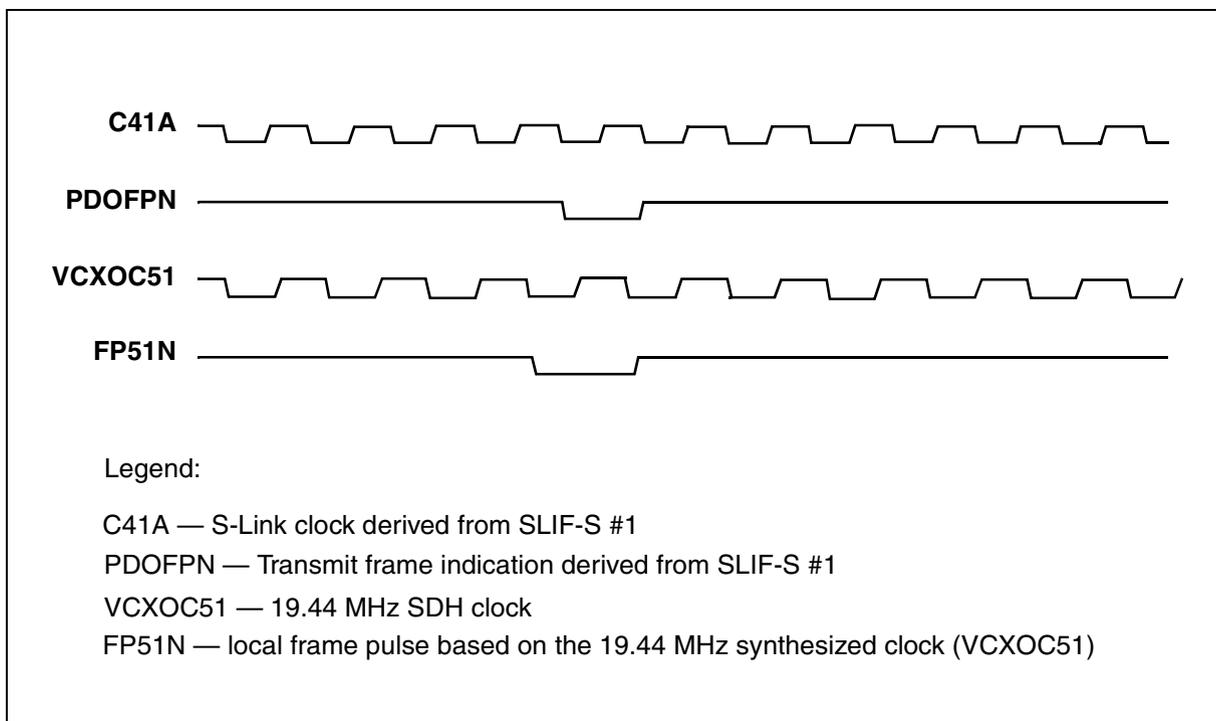
Table 7-7 STM-1 RM backplane pin descriptions (Continued)

No	Signal	Function	IO type	Description
J3	FrCEMnCKm	Input	3.3V CMOS SLIF-S	S-Link clock lines from common equipment (n=0 CEM0, n=1 CEM1) m=2,3 on J3
J3	FrCEMnDm	Input	3.3V CMOS SLIF-S	S-Link data lines from common equipment (n=0 CEM0, n=1 CEM1) n=4,5,6,7,8,9 on J3
J3	ToCEMnCKm	Output	3.3V CMOS SLIF-S	S-Link clock lines to common equipment (n=0 CEM0, n=1 CEM1) m=2,3 on J3
J3	ToCEMnDm	Output	3.3V CMOS SLIF-S	S-Link data lines to common equipment (n=0 CEM0, n=1 CEM1) n=4,5,6,7,8,9 on J3
J3	LGND	Power		logic ground of the PCP/BACKPLANE
J4	Drop0Datan Drop0C1J1 Drop0PL Drop0PAR	Output	3.3V TTL (74LVT16244)	Inter STM-1 resource module telecom bus Drop0Datan ranges from n=0 to n=7
J4	Add0Datan Add0C1J1 Add0PL Drop0PAR	Input	3.3V TTL (74LVT16244)	Inter STM-1 resource module telecom bus Add0Datan ranges from n=0 to n=7
J4	LGND	Power		logic ground of the PCP/BACKPLANE

Timing

Figure 7-3 shows the clock phase relationships for the DSLX99BA STM-1 RM.

Figure 7-3 DSLX99BA STM-1 RM clock phase relationships



Power Requirements

Table 7-8 shows the DSLX99BA STM-1 RM general power requirements.

Table 7-8 STM-1 RM general power requirements

Parameter	Minimum	Maximum	Units
Supply voltage	39.0	053.0	V
Supply noise		100.0	mv
Supply current		001.0	A

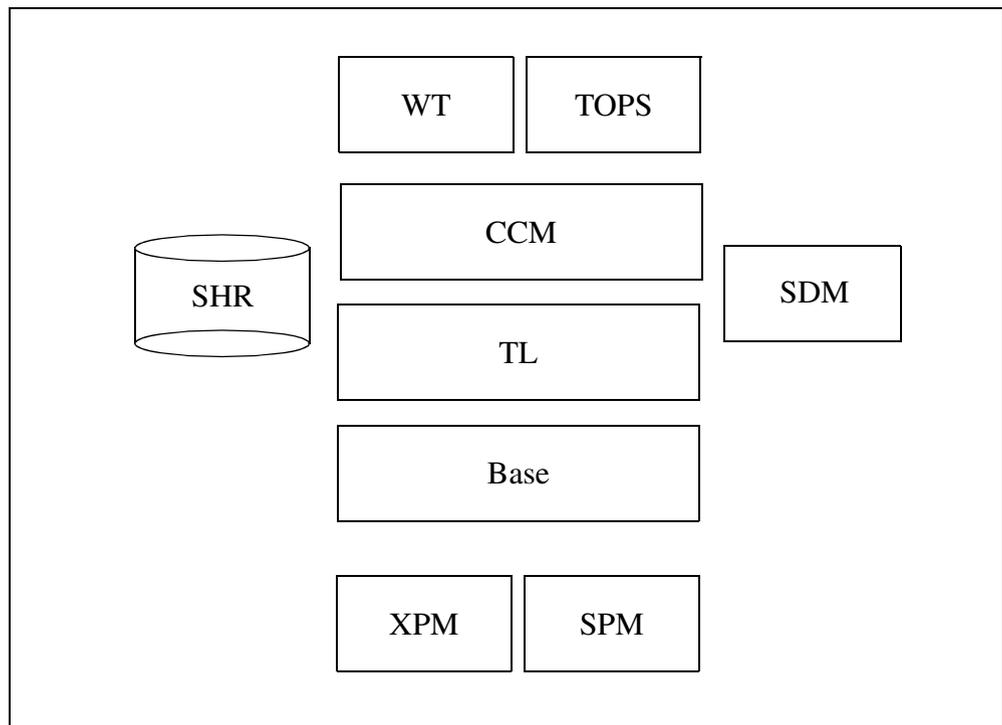
8 Software description

Software architecture

The software required for the SPM STM-1 application affects the DMS-100 MMP Core Processor (CM), the SPM Common Equipment Module (CEM) and the STM-1 Resource Module.

Figure 8-1 shows the general architecture of the DMS-100 MMP software.

Figure 8-1 DMS-100 MMP software architecture



The following table shows the architecture and functionality of the STM-1 application software.

Functionality	Software layers affected
Additional ISUP country variants	SPM
STM-1 sparing enhancements and KLM numbering	SHR
IUP and ECAN Enhancements	TL, SHR, CNA, WT
German Network Protection (PCOS)	SHR, WT, SPM

9 Capacity and Performance Engineering

Collection of performance data

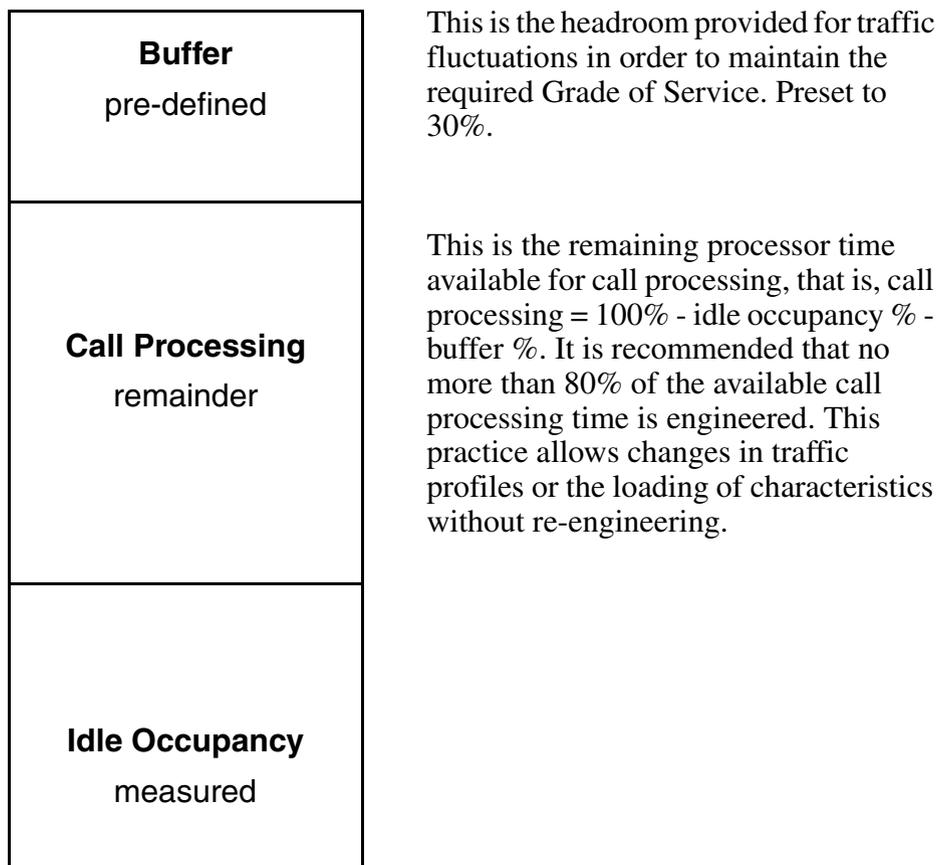
Call processing capacity data make it possible to give a supported level of performance while maintaining the required grade of service. Data collected for the STM-1 SPM give a per release indication of the change in call processing capacity.

SPM capacity data in the SPM are collected using the sperform tool which resides in the SPM and provides an indication of the number of calls running in the SPM. A further tool, resmon, displays the CPU occupancy. These tools allow the measurement of CPU occupancy at different traffic levels.

Processor real time allocations

Figure 9-1 shows the way in which processor real time is allocated to call processing and other processes.

Figure 9-1 Processor allocations



Trunk provisioning rules

The STM-1 bearer supports 63 VC12 containers, equivalent to a total of 1953 trunks (63 x 31 channels).

The DMS-100 MMP switch is limited to supporting 58,000 ISUP trunks, the equivalent of 30 SPMs, unless external routers are deployed.

Echo cancellation is available for ETSI ISUP V1 and V2, German ISUP, UK ISUP, and IUP (formerly BTUP).

C-side connectivity

The unit is connected to the switch by up to four DS512 links providing enough bandwidth to the ENET to allow for a full STM-1 payload plus messaging between the SPM and CM, without blocking.

Calculating DSP and VSP RM requirements

One of the main advantages of SPM over XPM is its flexibility. This flexibility is achieved by the number (up to 26) and diversity of optional resource modules (RMs). Each RM has a finite capacity; therefore the ability of an SPM to meet the performance expectations is affected by the RM profile, that is, the mix of RMs plugged into the SPM.

The SPM provides several types of service using the DSP and VSP Resource Modules:

- tone synthesizers - DSP
- continuity tone receivers (CoT) - DSP
- DTMF tone receivers with dial tone generation (DTMF) - DSP
- echo cancellation (ECAN) - VSP and COH

Each DSP resource module provides nine DSP islands, each capable of supporting one of the following:

- 255 circuits with tone synthesizers
- 80 circuits with continuity tone receivers
- 64 circuits with DTMF receivers

Each VSP resource module provides ten turbo DSP islands, each supporting a maximum of 26 channels for echo cancellation.

Note: The ECM does not require a fixed number of DSPs per customer per market.

To calculate the number of circuits required for each service, and hence the number of islands, the user must calculate the expected amount of traffic using each service, and then adjust the figures to achieve a specified Grade of Service.

There are different methods for calculating the traffic presented for each service. The calculations must be made for each trunk type:

- Tone synthesizers

$$\text{Traffic} = (\% \text{incoming calls requiring call progress tones} \times \text{SHTp} + \% \text{incoming calls requiring audible ringing} \times \text{SHTr}) \times \# \text{trks} \times \text{trk.occ.} \times \% \text{calls incoming} \div \text{CHT}$$

where SHTx is the service hold time for the appropriate service.

- Continuity tone receivers

$$\text{Traffic} = \% \text{outgoing calls requiring CoT} \times \# \text{trks} \times \text{trk.occ.} \times \% \text{calls outgoing} \times \text{SHTc} \div \text{CHT}$$

- DTMF

$$\text{Traffic} = (\% \text{DTMF calls with DTMF for part of call} \times \text{SHTd} + \% \text{DTMF calls with DTMF for whole call} \times \text{CHT}) \times \# \text{trks} \times \text{trk.occ.} \times \% \text{calls incoming}$$

- Echo Cancellation

For ECAN, an island can support 26 circuits. Therefore the following calculation, rounded up, gives the ECAN value:

$$\% \text{trks with ECAN} \times \# \text{trks} \div 26$$

Example

This example shows how to calculate the number of DSP islands required for the following configuration:

Characteristic	Value
Number of trunks	1920
Average call hold time	120 second
Trunk occupancy	0.8
Incoming calls	60%
Incoming calls requiring call progress tones	20% (5-second hold time)
Calls requiring audible ringing	80% (20-second hold time)
Trunks requiring DTMF	60% (20-second hold time)
Outgoing calls requiring COT	10% (5-second hold time)
Trunks with ECAN	10% (60 tests per trunk per hour)
Grade of Service	0.001

Tone synthesizers:

$$\begin{aligned} \text{Traffic} &= (5s \times 20\% + 20s \times 80\%) \times 1920 \times 0.8 \times 60\% / 120s \\ &= 130.56 \text{ Erlangs} \\ &\text{which requires 165 circuits for 0.001 GoS} \\ &= 1 \text{ DSP island.} \end{aligned}$$

Continuity tone receivers:

$$\text{Traffic} = 5s \times 10\% \times 1920 \times 0.8 \times 40\% \div 120s$$

= **2.56 Erlangs**
which requires 10 circuits for 0.001 GoS
 = 1 DSP island.

DTMF:

Traffic = $(20s \times 10\% + 120s \times 90\%) \times 1920 \times 60\% \times 0.8 \times 60\% \div 120s$
 = 506.88 Erlangs
which requires 562 circuits for 0.001 GoS
 = 9 DSP islands.

ECAN:

= $1920 \times 10\% \div 26 = 7.38$
 = 8 islands

Total number of islands:

= $17 \text{ DSPi} \times (2 + 1 \text{ spare DSP RMs}) + 8 \text{ tDSPi} \times (1 + 1 \text{ spare VSP RM})$

The provisioning of individual DSP islands onboard each VSP and DSP RM is left up to the operating company's customer, since the trunk signalling service mix must be matched to the needs of the individual tandem office. The following example shows how the DSP islands can be provisioned.

DSP RM	TONESYN	DTMF + DT	COT	Total islands
1	1 island 255 ccts.	5 islands 320 ccts.	0 islands 0 ccts.	9
2	0	4 islands 256 ccts.	1 island 80 ccts.	8
3 (spare)	0	0	0	0
Totals: (unspared)	1 island 255 ccts.	9 islands 576 ccts.	1 island 80 ccts.	17
VSP RM	ECAN			
1	8 islands			8

Other performance variables

One of the main advantages of SPM over XPM is its flexibility. This flexibility is achieved by the number (up to 26) and diversity of optional resource modules (RM). Each RM has a finite capacity; therefore the ability of an SPM

to meet the performance expectations is affected by the RM profile, that is, the mix of RMs plugged into the SPM.

To test degradation, a standard configuration is needed. This will enable the percentage capacity degradation per release to be accurately measured. The recommended standard configuration is as follows:

- 10% ECAN (that is, 10% of measured calls have ECAN switched on; requires two VSPs)
- 10% COT, 10% DTMF (requires three DSPs)

Testing is required on 100% ISUP, 100% IUP and 50% ISUP/IUP.

10 Signaling requirements

The SPM system supports the following types of signaling:

- CCS7 signaling via channelized and non-channelized access
- CCS7 MTP routing using internal routers
- associated and quasi-associated signaling
- digit processing using enbloc or overlap signaling

Support is now provided to enhance GSM ETSI ISUP version 2 variants on the Spectrum Peripheral Module (SPM) to use version 3 parameters. This ensures parameter and message compatibility between different ISUP versions and ensures all the current GSM v2 variants remain compliant with the earlier ISUP versions now supported.

These variants will not send v3 parameters, only pass them through when they are present. Affected v2 national protocol variants are: China, Israel, ETSI ISUP, and German. Additionally, UK ISUP, originally implemented as a v3 variant, will be restructured to make use of the new global GSM specific functions.

This feature only supports existing v3 parameters: SCF ID, Correlation ID (CORR), Call diversion treatment indicators, Call offering treatment indicators in IAM message and Conference Treatment Indicators in IAM, ACM, ANM, CPG, CON messages.

CCS7 signaling

The CCS7 link interface unit (LIU7) provides the hardware interface between a DMS-100 switch and a CCS7 network. It allows signaling information to pass between the switch and the CCS7 network. Prior to channelized access, the regular DS0 LIU7s connected via a channel bank (MUX) to gain access to a PCM30 span. Channelized access introduced a new interface card, the Network Interface Unit (NIU). The NIU allows signaling information to reach the LIU7 without the need for an external MUX. The SPM system operates with both channelized and non-channelized access.

Specconn

The SPM supports Specconn. If non-channelized access is used, the physical carriers for the bearer and signaling channels must be separated so that the two components enter the DMS-100 MMP switch as follows:

- only the bearer channels enter via the SPM
- the signaling channels enter using an E1 connection to the LIU via a MUX

Monitoring CCS7 links

The Digital Test Application provides a mechanism to monitor individual CCS7 (Common Channel Signaling) links and digital voice trunks. Monitoring refers to accessing a trunk that has a trunk-to-trunk call connected.

Digital monitoring is controlled through an existing DMS MAP screen and requires a PDTC (PCM30 Digital Trunk Controller) equipped with a NT6X55 PEC (Product Equipment Code) connected via a jack trunk. Monitoring occurs by tapping into the link between the two trunks at the ENET. Monitoring of the trunk is performed via Digital Test Equipment (DTE).

The following four commands allow various forms of trunk monitoring:

- MONPOST provides the connection between the incoming path of the posted trunk and the outgoing path of the digital jack ended trunk.
- MONLINK provides the connection between the incoming path of the linked trunk and the outgoing path of the digital jack ended trunk.
- MONBOTH enables the user to listen to incoming transmission of the posted trunk and incoming transmission of the linked trunk.
- MONTALK establishes a 3-party conference circuit connection between the posted trunk, the linked trunk and the headset of the TTP. This command is only available for analog monitoring.

CCS7 MTP routing

There are currently two implementations of the MTP router on the DMS switch: internal routing and external routing (although the switch cannot support both implementations at the same time). The DMS-100 MMP switch currently supports only internal routing. The SPM system also supports MTP routing using internal routers.

Note: External routing is used in the high-capacity IEC switches in North America and is not currently a requirement in the E1 market.

Associated and quasi-associated signaling

Associated signaling occurs where the same physical topology carries both the traffic and the related signaling information. Quasi-associated signaling occurs where there is no direct physical connection between two CCS7 signaling points (SP). The physical connection is made via one or more signaling transfer points (STP). The SPM system supports associated signaling and quasi-associated signaling.

Digit processing

The SPM system supports both enbloc and overlap signaling on ETSI ISUP and IUP (formerly BTUP). This includes full overlap functionality.

11 Capacity information

See Chapter 9 for all capacity information and performance data.

Part V Provisioning

This part contains the following chapters:

- Provisioning overview (Chapter 12)
- Data schema (Chapter 13)
- Service order procedures (Chapter 14)
- Datafill procedures (Chapter 15)
- Translations and routing (Chapter 16)

12 Provisioning overview

This chapter provides for the SPM as implemented on the DMS-100 MMP switch.

Base STM-1 trunking system

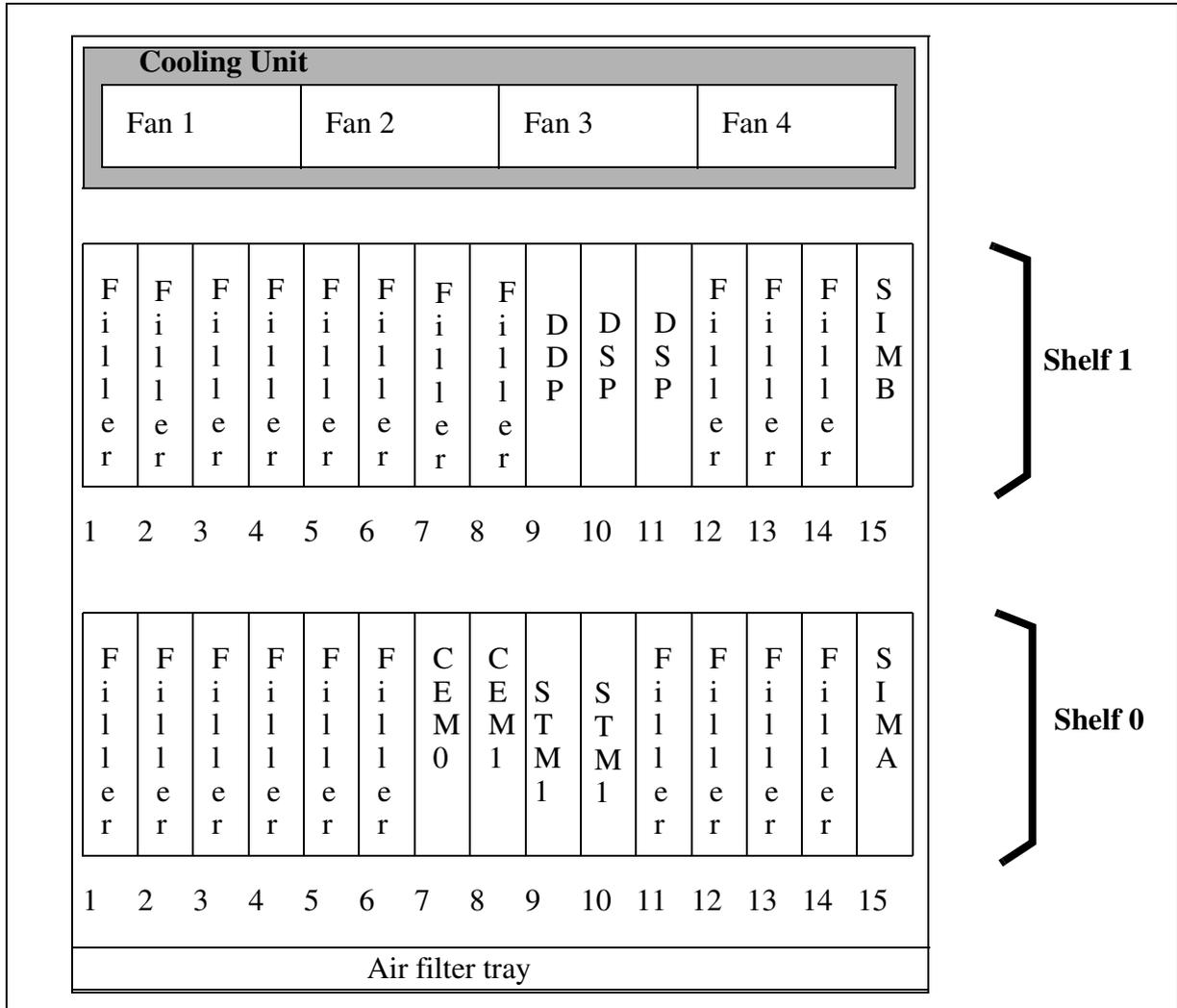
For details of the slots in which the cards should be provisioned, see the *DMS-SPM Hardware Maintenance Reference Manual*, 297-1771-550.

Support for NWK (Networking) Trunks for MTX CDMA networks with the SPM STM-1 interface has been added.

CDMA to CDMA hard handoff is performed when the mobile station is transitioned between different frequency assignments or between different systems using the same frequency. Two types of CDMA to CDMA Hard Handoffs; Intrasytem and Intersystem handoffs, are supported. An intrasytem hard handoff occurs when the mobile changes from one CMDA frequency to another CDMA frequency within a system. CDMA to CDMA Intersystem hard handoff is a handoff between a CDMA cell of one system to a CDMA cell in another system. NWK trunks are only used in Intersystem handoffs.

Figure 12-1 shows a simplified view of an SPM STM-1 shelf configuration provisioned for ISUP signaling on a DMS-100 MMP switch.

Figure 12-1 Shelf provisioning for STM-1 trunking



The following modules must always be provisioned on an STM-1 SPM shelf:

- fan units 1 to 4 (housed in the cooling unit)
- CEM 0 and CEM 1, always located in slots 7 and 8 of shelf 0
- STM-1 RMs, always located in slots 9 and 10 of shelf 0
- SIM A and SIM B, always located in the 15th slot of each shelf

DSP Resource Modules are required to provide ISUP and IUP (formerly BTUP) signaling support. In this configuration, two DSPs are used to provide these services, and one DSP RM acts as a spare.

The DSP RMs provide the following services:

- tone synthesizers (TONESYN)
- continuity tone receivers (COT)
- DTMF tone receivers with dial tone generation (DTMF+DT)

All unused slots must be equipped with filler modules to maintain EMI integrity and shelf airflow patterns.

Each DSP RM provides nine DSP islands. Table 12-1 shows the number of DS0 channels that can be serviced simultaneously per island for any given function.

Table 12-1 DSP RM capacities

Application (function)	Quantity per DSPI
Tone synthesizer	255
Continuity tone transceiver	80
DTMF receiver	64

Table 12-2 shows how the DSP services are distributed amongst the DSP RMs. The numbers in brackets indicate the numbers of DSP islands on the indicated DSP RM assigned to each function.

Note: These numbers are for guidance only and are based on traffic pattern approximations. Customers must choose suitable values for each office.

Table 12-2 DSP services

DSP RM	TONESYN	DTMF + DT	COT	Total islands
1	(1) = 255	(5) = 320	(1) = 80	7
2	1	(5) = 256	(1) = 80	7
3 (spare)	0	0	0	0
Totals: (unspared)	255	576	80	14

The service provisioning requirements are derived from card sparing considerations, taking into account the assumptions regarding traffic characteristics shown in Table 12-3.

Table 12-3 Traffic characteristics

Call attempt rate	16 CA/s	(margin)
Average call holding time	120 s	
Traffic density	1920 Erlang	(53 CCS)
Percent origination	60%	
Origins requiring call progress tones	20%	5 s hold
Calls requiring audible ringing	80%	20 s hold
Calls requiring DTMF	10%	20 s hold
Outgoing calls requiring COT	10%	5 s hold

Table 12-4 shows the DSP resources required, calculated using the traffic characteristics and formulae/tables published in Engineering Change Memorandums 590 and 597.

Note: Customers who offer Intelligent Networks capability (IN) may require more than a 2+1 DSP configuration. This is because re-origination capability requires a DTMF resource for the whole duration of the call. The following table shows how many DSP RMs are required given the percentage of IN calls which require re-origination capability for the whole duration of the call.

Table 12-4 DSP requirements

Percentage of calls requiring re-origination for 100% of the call	Total number of DSPs required
30%	2+1
60%	2+1
100%	3+1

Echo canceller provisioning

Echo cancellers are provisionable from 0% to 100% of trunks. An operating company's customers can decide which provisioning model works best for each office. The echo cancellation function is provided by equipping VSP resource modules.

Each VSP RM provides ten turbo DSP islands (tDSPi). 26 DS0 channels can be serviced simultaneously per tDSPi for the echo cancellation (ECAN) function.

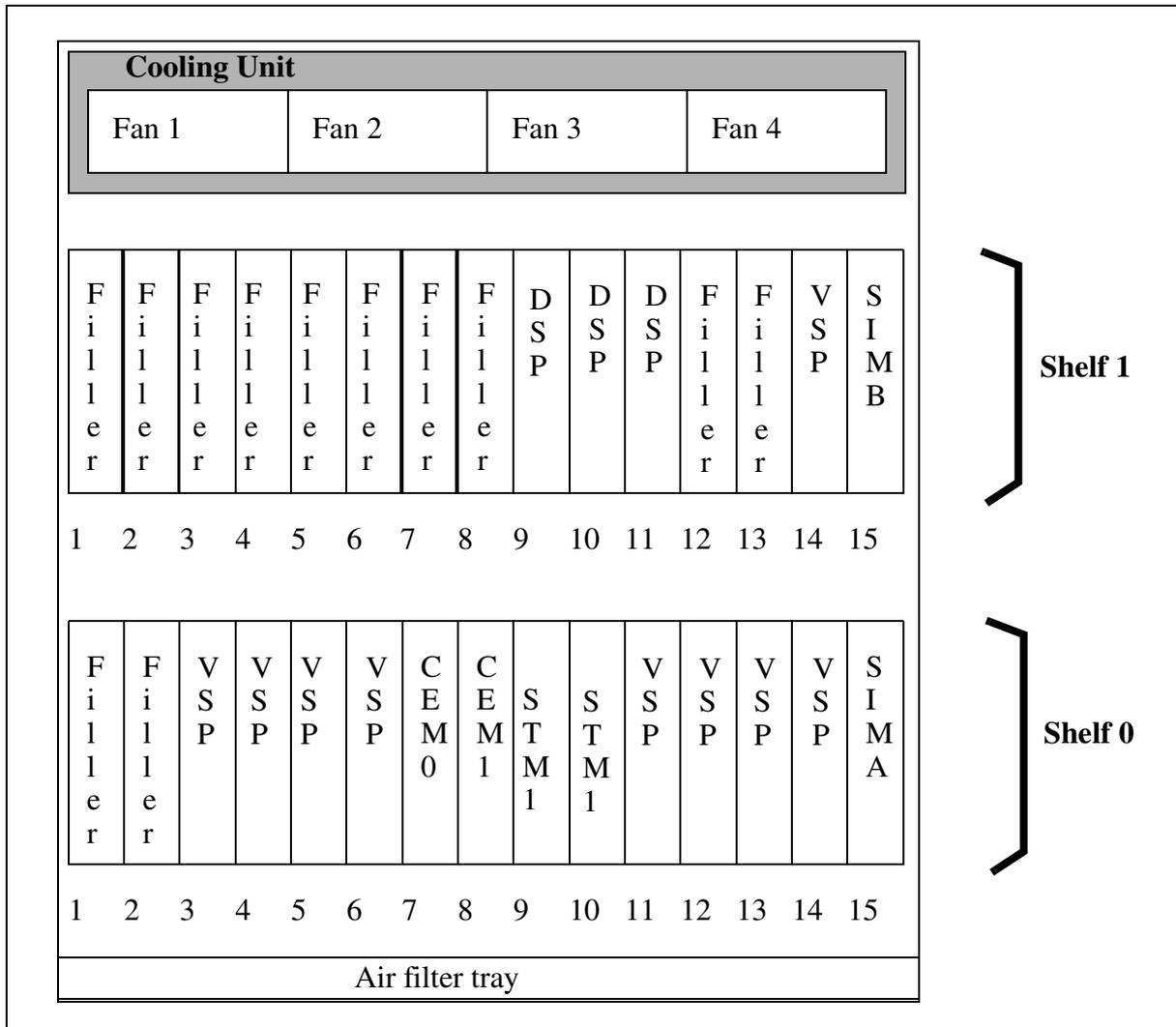
Table 12-5 shows the possible VSP provisioning levels. The sparing ratio is shown in brackets.

Table 12-5 VSP provisioning levels

VSP RMs	Maximum ECANs	% of 1953
2 (1:1)	260	13.3%
3 (2:1)	520	26.6%
4 (3:1)	780	39.9%
5 (4:1)	1040	52%
6 (5:1)	1300	66.6%
7 (6:1)	1560	79.9%
8 (7:1)	1820	93.2%
9 (8:1)	2080	100%

Figure 12-2 shows a view of an STM-1 trunking SPM equipped with 100% echo cancellation.

Figure 12-2 STM-1 SPM shelf layout with 100% echo cancellation, 100% DTMF, 0% PTS



The configuration shows that eight VSP RMs are required to provide 1953-channel coverage plus one spare for 8:1 redundancy provisioning. The provisioning of individual DSP islands onboard each VSP and DSP RM is left up to the operating company’s customer, since the trunk signaling service mix must be matched to the needs of the individual tandem office.

Table 12-6 COH ECAN provisioning levels

VSP RMs	Maximum ECANs	% of 1953
2 (1:1)	336	13.3%
3 (2:1)	672	26.6%
4 (3:1)	1008	39.9%
5 (4:1)	1344	52%
6 (5:1)	1680	66.6%
7 (6:1)	2016	79.9%

Datafill

Datafill tables are modified to allow for STM-1 carriers and trunks. For details of the changes, see Chapter 13, Data schema. For details of how to datafill the tables, see the *MMP Customer Data Schema*, 297-9051-351.

13 Data schema

This chapter lists the tables that have changed at MMP15 and SP17.2. For more details about datafill changes, see *MMP Data Schema*, 297-9051-351. Note that feature numbers for changed features are in brackets.

- LTDATA
- LTDEF
- MNCKTPAK
- MNHSCARR
- MNPRTGRP
- OFCENG
- SPMECAN
- TRKSGRP

For details of how to datafill the tables, see Chapter 15, Datafill procedures.

Table LTDATA

- German Network Protection (59019615 and 59025550)
Priority ISDN PRI accesses are provisioned with the PCOS option.

Table LTDEF

- German Network Protection (59019615 and 59025550)
Priority ISDN BRI accesses use the existing ELN option. The provisioning of ELN against the LTID (Logical Terminal Identifier) is introduced in table LTDEF. The setting for the ELN option in table LTDEF supersedes

the setting of the ELN option in table KSETLINE if they both apply to the same LTID.

Table MNCKTPAK

- Italian, Spanish, Russian and Austrian tones (59018949)

Table MNCKTPAK is modified to allow the datafill of all the tonesets supported on SPM for this release.

Table MNHSCARR

- Carrier maintenance (59008275)

Table MNHSCARR is modified to allow for provisioning of five new STM-1 carrier types (STM1R, STM1M, VC4P, VC12P, and E1P) within the Synchronous Digital Hierarchy (SDH).

- KLM numbering (59017369)

Table MNHSCARR is modified to allow for KLM numbering within the VC12P and E1P carriers. Payload positions are automatically converted to KLM co-ordinates.

Table MNPRTGRP

- KLM numbering (59017369)

Table MNPRTGRP is modified to allow definition of protection groups for STM1M carriers.

- Carrier maintenance (59008275)

Table MNPRTGRP is modified to support carrier protection switching for STM-1. A new protection group type, CARR_GRP, has been defined. CARR_GRP only supports a 1 + 1, non revertive, unidirectional protection group.

- K1/K2 Bytes Support on STM1 (A59033790 and A59028555)- Table MNPRTGRP is modified to allow revertive, nonrevertive, bidirectional and unidirectional operation.

Table OFCENG

- German Network Protection (59019615 and 59025550)

A new office parameter, ENABLE_TBR_ON_DGT, is added. When datafilled with 'N', the Extended Peripheral Module (XPM) accepts dial

pulse and Digitone digits on any DGT line. When datafilled with 'Y', the XPM stops collecting dial pulse digits after it has received a Timed Break Recall (TBR) signal.

Table SPMECAN

- Echo canceller (59016306)

SPMECAN is modified to allow an algorithm to activate echo cancellers, and to allow the echo control information (ECI) to be delivered via the appropriate common channel signaling messages.

SPMECAN contains the detailed information required to configure echo cancellers on the SPM. The Coherent ECAN RM (NTLX86AA) is supported by table SPMECAN.

Table TRKSGRP

- Echo canceller (59016306)

TRKSGRP is modified to allow an algorithm to activate echo cancellers, and to allow the echo control information (ECI) to be delivered via the appropriate common channel signaling messages.

TRKSGRP contains the SPMECIDX option. SPMECIDX has a sub-field, EC_IDX, which contains a numeric value which identifies a valid record in table SPMECAN.

14 Service order procedures

The SPM system does not use service orders.

15 Datafill procedures

For details of the datafill procedures for tables relevant to the SPM, see the *MMP Customer Data Schema*, 297-9051-351. This includes the following tables:

- ENIMLAST
- FEATCNTL
- LTDATA
- LTDEF
- MNATMCON
- MNCKTPAK
- MNHSCARR
- MNLINK
- MNNODE
- MNPRIID
- MNPRTGRP
- MNSHELF
- OFCENG
- SPMECAN
- SPMCHAST
- SPMTIDMP
- TRKMEM
- TRKSGRP

16 Translations and routing

The SPM system does not affect translations.

Part VI Billing

This part contains the following chapters:

- Billing structures and modules (Chapter 17)

17 Billing structures and modules

The SPM system does not affect any billing functionality (AMA, CDR, or SMDR).

Part VII OA&M

This part contains the following chapter:

- Translation verification tool (Chapter 18)
- CI commands (Chapter 19)
- Operational measurements (Chapter 20)
- Administrative log reports (Chapter 21)
- Maintenance (Chapter 22)

18 Translation verification tool

The SPM system does not affect the translation verification tool.

19 CI commands

The command interpreter (CI) commands that are new or changed are listed below. (The bracketed numbers relate to the feature number associated with the change.)

- CARRIER directory
 - Detail (59008275)
 - POST level (59008275 and 59017369)
- CARRUTIL directory
 - Help (59008275)
 - DumpHist (59008275)
 - ListHist (59008275 and 59017369)
 - SetCarr (59008275 and 59017369)
 - GetHist (59017369)
- NETPROT (59019615 and 59025550)

An alarm is generated when NETPROT is switched ON, and is turned off when NETPROT is switched OFF
- METRPP

For details of CI commands relevant to the SPM, see the *DMS-SPM Commands Reference Manual*, 297-1771-819. The following sections summarize the CI facilities available.

SPM screen

The SPM MAP screen gives a summary of an entire SPM. It shows all the modules in the selected SPM, together with their slot numbers, activity status and service state. From the SPM screen, the user can select one or more devices (for example, CEM, DSP, STM, or VSP). The individual MAP screens display the characteristics of the selected device, and the commands available for controlling the device.

The full list of SPM commands, with their function, is as follows:

- Bsy (busy) - puts the selected device into a manual out-of-service state
- Disp - displays all carriers that correspond to a given condition
- ListAlm - displays detailed alarm information
- ListRes - displays the resources provided by the specified device (DSP)
- ListSet - lists the items in the Post set
- LoadMod - manually downloads a specific load file to the selected device
- METRPP - aligns transmit and receive power
- Next - selects the next RM in the Post set
- OffL - puts the selected device into an offline state
- Post - displays carriers based on a condition or a peripheral type
- Prot - carries out a manual protection switch
- QueryMod - manually queries local/CM information on the selected device
- QueryPM - displays miscellaneous information about the SPM
- Quit - quits the current MAP level
- Rts (return to service) - manually brings the selected device from an out-of-service state to in-service
- Select - selects a specified module (circuit pack)
- Tst - runs manual in-service and out-of-service diagnostics on the selected device
- Trnsl - displays the C-side link information for the selected device

The following sections list the commands available for controlling the individual devices.

SPM commands (SPMDIR directory)

The SPM level commands are as follows:

- Disp
- ListAlm
- ListRes
- ListSet
- Next
- Post
- QueryPM

- Quit
- Select
- Trnsl

CEM commands (SPMCEMDIR directory)

The CEM level commands are as follows:

- Bsy
- ListAlm
- ListSet
- LoadMod
- Next
- OffL
- Prot
- QueryMod
- Quit
- Rts
- Select
- Tst
- Trnsl

Note: If the RTS command is used when both the CEMs are in the MANB state, the STM-1 RM is subject to the automatic SYSB recovery process (see Chapter 3).

DSP commands (SPMDSPDIR directory)

The DSP level commands are as follows:

- Bsy
- ListAlm
- ListRes
- ListSet
- LoadMod
- Next
- OffL
- Prot
- QueryMod

- Quit
- Rts
- Select
- Tst

STM-1 commands

The STM-1 level commands are as follows:

- Bsy
- ListAlm
- ListSet
- LoadMod
- Next
- OffL
- Prot
- QueryMod
- Quit
- Rts
- Select
- Tst

VSP commands (SPMVSP directory)

The VSP level commands are as follows:

- Bsy
- ListAlm
- ListRes
- ListSet
- LoadMod
- Next
- OffL
- Prot
- QueryMod
- Quit
- Rts

- Select
- Tst

Carrier commands (CARRIER directory)

The CARRIER screen displays carrier information. The screen has two levels: POST level and DISPLAY level.

The POST level allows the user to display carriers based on a condition or a peripheral type. The POST level commands are as follows:

- Bsy (busy) - puts the selected device into a manual out-of-service state
- Detail - displays additional details of one of the posted carriers
- Disp - displays all carriers that correspond to a given condition.
- ListAlm - displays detailed alarm information
- Loop - puts the specified carrier in a given loopback state
- Next - selects the next RM in the Post set
- OffL - puts the selected device into an offline state
- Perfmon - displays the performance monitoring screen
- Post - displays carriers based on a condition or a peripheral type
- Quit - quits the current MAP level
- Rts (return to service) - manually brings the selected device from an out-of-service state to in-service
- Tst - runs manual in-service and out-of-service diagnostics on the selected device

The DISPLAY level allows the user to display all carriers in a specified state. The DISPLAY level commands are as follows:

- Disp - displays all carriers that correspond to a given condition
- Next - selects the next RM in the Post set
- Post - displays carriers based on a condition or a peripheral type
- Quit - quits the current MAP level

Carrier maintenance commands (CARRUTIL directory)

The CARRUTIL level gives the user access to a number of carrier monitoring utilities. The commands are non-menu and support Spectrum carriers only.

The CARRUTIL level commands are as follows:

- DumpHist - retrieves and displays the historical data for all carriers or for a selected carrier
- GetHist - retrieves historical performance monitoring data
- Help - provides information about the CARRUTIL commands
- ListHist - displays the historical data retrieved by the GetHist command
- Quit - quits the CARRUTIL MAP level
- SetCarr - specifies the carrier to be monitored (placed in context)

Trunk maintenance commands (SPMTKCNV directory)

The MAP display at the SPMTKCNV level now accommodates seven extra time slots in both display positions. This modification is to allow display of the 31 time slots of a PCM30 carrier on the SPM.

Figure 19-1 shows an example MAP display at the SPMTKCNV level for trunk DTC 0 17.

Figure 19-1 Example MAP display: SPMTKCNV level

```

CKT TYPE      PM NO.  COM LANG      STA S R  DOT TE  RESULT
2W S7 S7     DTC 0 17 24 SPMIC 0  IDL
 0 Quit
 2 Post
 3
 4
 5 Bsy
 6 Rts
 7           CARR1: DTC 0 17   (3 trk)           CARR2 SPM 1 4   (30 slot)
 9           1234567890123456789012345678901 -> 1234567890123456789012345678901
10           **-*-----XXXXXXXXX *-----
11 Hold
12 Next
13 ...
    
```

Internally, changes to the CONVERT command allow for the conversion of trunks to and from PCM30 carriers. The SPMTKCNV MAP level can handle the following conversion types:

- PDTC PCM30 carrier to and from SPM PCM30 carrier.
- PDTC PCM30 carrier to and from SPM DS1 carrier.

The SPMTKCNV level commands are as follows:

- Bsy (busy) - busies the circuit in the control position
- Convert - converts the posted trunk to the trunk member specified by the command parameters.

- CvCarr - moves trunks from the origination carrier into free slots in the same position on the destination carrier
- Display - displays information about time slot occupancy on a given carrier
- Hold - holds the posted trunk
- Next - selects the next RM in the Post set
- Post - posts one or more circuits for maintenance
- Quit - quits the current MAP level
- Rts (return to service) - returns to service the circuit in the control position
- Swap - reverses the direction of the displayed arrow and exchanges the origination and destination information
- Undo - reverses the action of the last Convert or CvCarr command

20 Operational measurements

The SPM system uses operational measurements (OM) to describe the peripheral.

For details of OMs relevant to the SPM, see the *MMP Operational Measurements Reference Manual*, 297-9051-814. This includes the following OMs:

- DSPRMAN

The use of tone synthesizer BRATONE (59018854) is recorded in group DSPRMAN.

- ECANRMAN

21 Administrative log reports

For details about log reports and operational measurements which report failure events in the SPM system, see the *MMP Log Reports Reference Manual*, 297-9051-840.

22 Maintenance

For additional details about other maintenance procedures, see the following documents:

- *DMS-SPM Hardware Maintenance Reference Manual, 297-1771-550*
- *MMP Alarm Clearing and Performance Monitoring Procedures, 297-9051-543*
- *DMS-100 MMP Trouble Locating and Clearing Procedures, 297-9051-544*
- *DMS-100 MMP Recovery Procedures, 297-9051-545*
- *DMS-100 MMP Routine Maintenance Procedures, 297-9051-546*
- *MMP Card Replacement Procedures, 297-9051-547*

Replacing NTLX99BA STM-1 interface cards

Application

Use this procedure to replace an NTLX99BA STM-1 interface card. The STM-1 cards are located in the DMS-Spectrum Peripheral Module (SPM) frame.

To identify the product engineering code (PEC) and release, or provisioned shelf or frame for the card you want to replace, refer to the following table.

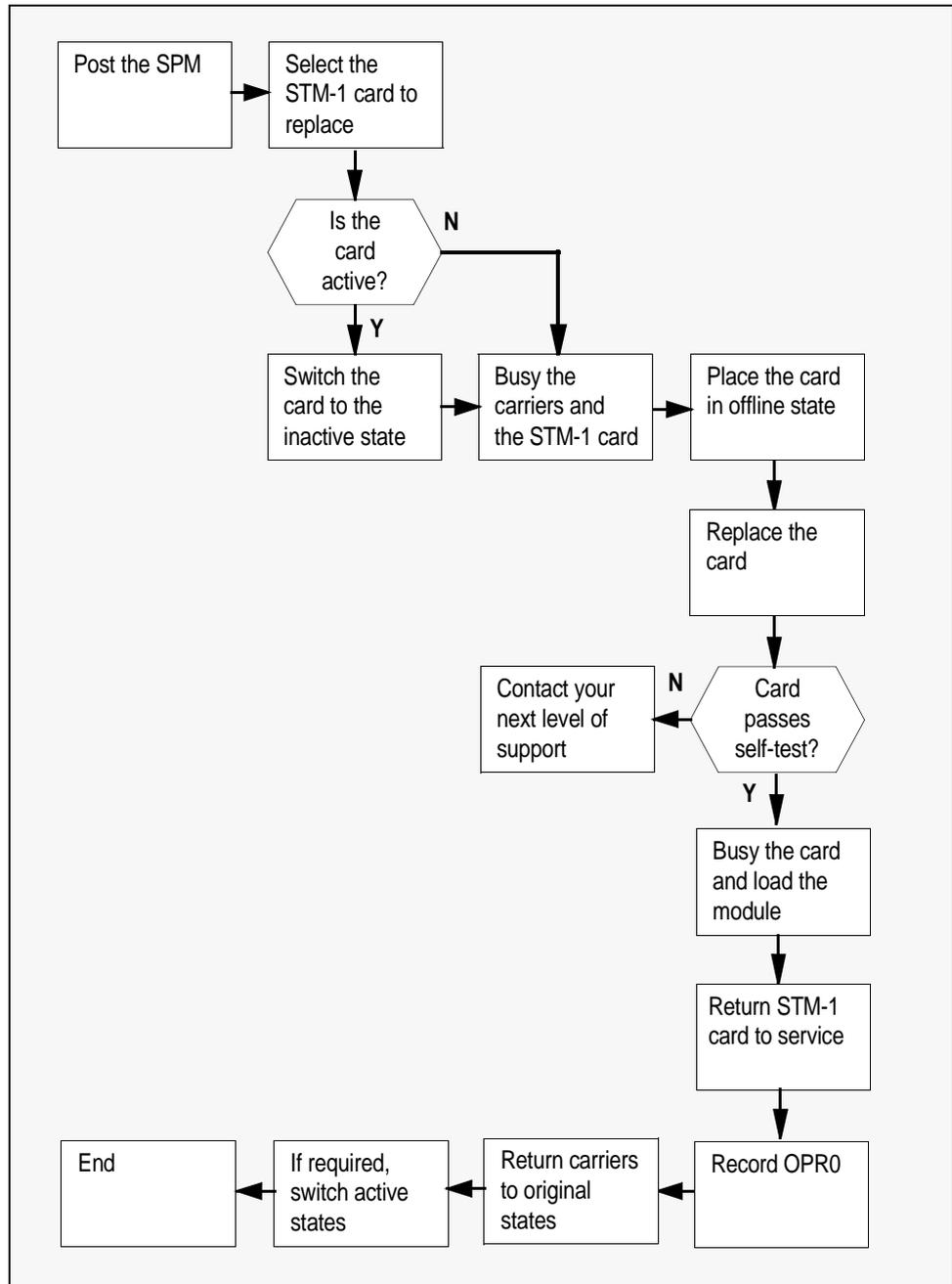
PEC	Release	Card name	Shelf or frame name
NTLX99	BA	STM-1 interface module	NTLX51AA dual-shelf assembly, NTLX50AA DMS frame assembly

To verify the PEC of the card being replaced, check the datafill in table MNCKTPAK.

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.

Figure 22-1 Summary of replacing the NTLX99BA STM-1 card



Procedure 22-1 Replacing the NTLX99BA SPM STM-1 card**At the MAP terminal**

- 1 Access the PM screen level of the MAP display by typing

```
>MAPCI;MTC;PM
```

and pressing the Enter key.

- 2 Access the SPM screen by typing

```
>POST SPM spm_no
```

and pressing the Enter key.

where

spm_no

is the number of the SPM (0 to 63)

This is an example of an SPM screen. This example may not reflect your SPM screen.

```

CM      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.      .      .      .      .      .      .      .      .      .
.
SPM
0 Quit          PM          SysB      ManB      OffL      CBsy      ISTb      InSv
2 Post_        SPM          0          0          0          0          0          1
3 ListSet
4 ListRes      SPM 11 INSV  Loc: Site HOST Floor 2 Row A FrPos 0
5 Trnsl
6
7 Shlf0 SL A Stat  Shlf0 SL A Stat  Shlf1 SL A Stat  Shlf1 SL A Stat
8 DSP 2 1 A Insv  CEM 1 8 I Insv  VSP 2 1 A Insv  --- - 8 - ----
9 DSP 0 2 A Insv  STM 0 9 A Insv  --- - 2 - ----  VSP 6 9 A Insv
10 DSP 1 3 I Insv  STM 1 10 I Insv --- - 3 - ----  --- - 10 - ----
11 --- - 5 - ----  --- - 11 - ----  --- - 4 - ----  --- - 11 - ----
12 Disp_        --- - 6 - ----  VSP 4 13 A Insv --- - 6 - ----  --- - 13 - ----
13 Next         CEM 0 7 A Insv  VSP 5 14 A Insv --- - 7 - ----  --- - 14 - ----
14 Select_
15 QueryPM
16 ListAIm_
17
18
14:12 >

```

- 3 Access the STM-1 card by typing

```
>SELECT stm stm_no
```

and pressing the Enter key.

where

stm_no

is the number of the STM-1 card (0 or 1)

This is an example of an STM-1 screen.

```

CM      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.      .      .      .      .      .      .      .      .      .
.
STM-1
0 Quit
2      PM      SysB      ManB      OffL      CBsy      ISTb      InSv
      0      0      0      0      0      0      1
3 ListSet
      SPM      0      0      0      0      0      1
4
      STM-1      0      0      0      0      0      2
5
      SPM 11      STM 0      Act      InSv
6 Tst
7 Bsy
8 RTS      Loc : Row A FrPos 0 ShPos 6 ShId 0 Slot 9      Prot Grp : 1
9 OffL      Default Load: STMLOAD      Prot Role: Working
10 LoadMod
11
12 Next
13 Select_
14 QueryMod
15 ListAlm
16 Prot
17
18

14:12 >

```

- 4 From the STM-1 screen, type
>PROT
and press the Enter key.
This is an example of a Protection screen.

```

CM      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.
.
.
Protectn
0 Quit      PM          SysB      ManB      OffL      CBsy      ISTb      InSv
2          SPM          0          0          0          0          0          1
3          STM-1      0          0          0          0          0          2
4
5          SPM  11  InSv
6          Prot Grp: STM_GRP 1      Mode: Non-revertive      Schema: one_plus_one
7 Force     Sh0 U R A Stat      Sh0 U R A Stat      Sh1 U R A Stat      Sh1 U R A Stat
8 Manual    1 - - - - -      8 - - - - -      1 - - - - -      8 - - - - -
9          2 - - - - -      9 0 W A InSv      2 - - - - -      9 - - - - -
10         3 - - - - -      10 1 S I InSv     3 - - - - -      10 - - - - -
11         4 - - - - -      11 - - - - -      4 - - - - -      11 - - - - -
12         5 - - - - -      12 - - - - -      5 - - - - -      12 - - - - -
13 Select_  6 - - - - -      13 - - - - -      6 - - - - -      13 - - - - -
14         7 - - - - -      14 - - - - -      7 - - - - -      14 - - - - -
15 ListAlm
16
17
18
14:10 >

```

- 5 At the Protection (PROT) screen, determine if the STM-1 being replaced is active (A) or inactive (I). If the card is active, set it to the inactive state by typing

>**MANUAL from_unit_no to_unit_no**

and pressing the Enter key.

where

from_unit_no

is the number of the active unit (0 or 1)

to_unit_no

is the number of the inactive unit (0 or 1)

Note: Protection switching an STM-1 normally requires protection switching of the network devices connected to the STM-1 on the external network. Refer to the appropriate manufacturer's documentation for the connected equipment.

- 6 Access the carrier maintenance screen and post the STM1M line carriers by typing

>**MAPCI;MTC;TRKS;CARRIER;POST SPM spm_no STM1M**

and pressing the Enter key.

where

spm_no

is the number of the SPM (0 to 63)

This is an example of the CARRIER screen showing posted STM1M carriers.

```

CM      MS      IOD      Net      PM      CCS      Lns      Trks      Ext      APPL
.
.
.
POST
0 Quit      TRUNKS    1      0      28      28      0      0      0      0      0      50
2 Post_    TIMING    0      0      0      0      0      0      0      0      0      2
3          HSCARR    0      0      0      1      3      0      1      0      0      180
4          STM1M
5 Loop_    N CLASS  SITE  SPM  STMRM  STM1R  STM1M  CKT  STATE  TR  MA
6 Tst_    0 HSCARR HOST  11    0      0      0      3 InSv  .S --
7 Bsy_    1 HSCARR HOST  11    1      0      0      4 InSv  -- --
8 RTS_    SIZE OF POSTED SET : 2
9 Offl_    MTC:
10         TRKS:
11 Disp_    CARRIER:
12 Next     POST:
13
14 Detail_
15 ListAlm_
16
17 Perfmon_
18

14:12 >

```

- 7 Record the STM1M line carrier number (listed under *N*) associated with the STM-1 card being replaced (listed under *STMRM*). Record the state of the carrier (listed under *STATE*).
 - 8 Manual busy (ManB) the STM1M line carrier by typing
>BSY carrier_no
 and pressing the Enter key.
where
carrier_no
 is the carrier identification (*N*) number (0 to 4)
 - 9 Post the SPM STM-1 section carriers by typing
>POST SPM spm_no STM1R
 and pressing the Enter key.
where
spm_no
 is the number of the SPM (0 to 63)
- Example of a MAP screen:*

```

CLASS      ML      OS ALRM  SYSB  MANB  UNEQ  OFFL  CBSY  PBSY  INSV
TRUNKS    1      0   28   28    0    0    0    0    0   50
TIMING    0      0    0    0    0    0    0    0    0    2
HSCARR    0      0    0    1    3    0    1    0    0  180
STM1R
N  CLASS  SITE  SPM  STMRM  STM1R  STM1M  CKT  STATE  TR  MA
0  HSCARR  HOST  11    0      0      -    1 InSv  .S  --
1  HSCARR  HOST  11    1      0      -    2 InSv  --  --
SIZE OF POSTED SET : 2
POST:

```

10 Record the STM-1R Section carrier number (listed under *N*) associated with the STM-1 card being replaced (listed under *STMRM*). Record the state of the carrier (listed under *STATE*).

11 Manual busy (ManB) the STM-1 Section carrier by typing

```
>BSY carrier_no
```

and pressing the Enter key.

where

carrier_no

is the carrier identification (*N*) number (0 to 4)

At the STM RM card level of the SPM

12 Take the STM-1 card to be replaced out-of-service by typing

```
>BSY
```

and pressing the Enter key.

13 Set the STM-1 card offline (OffL) by typing

```
>OFFL
```

and pressing the Enter key.

14 Return to the SPM screen and wait for the module to change state.

Note: The state change from ManB to OffL (offline) can take up to one minute to complete. After the state change completes, remove the STM-1 card.

15



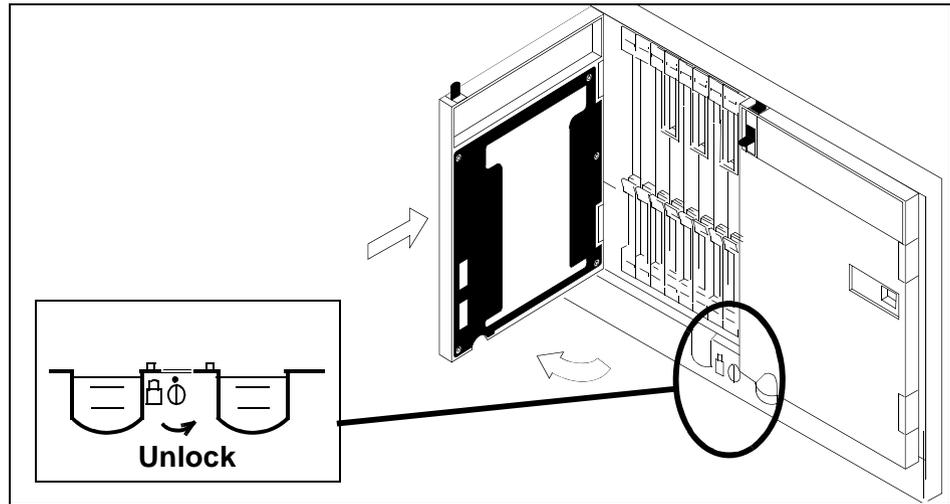
CAUTION

Static electricity damage

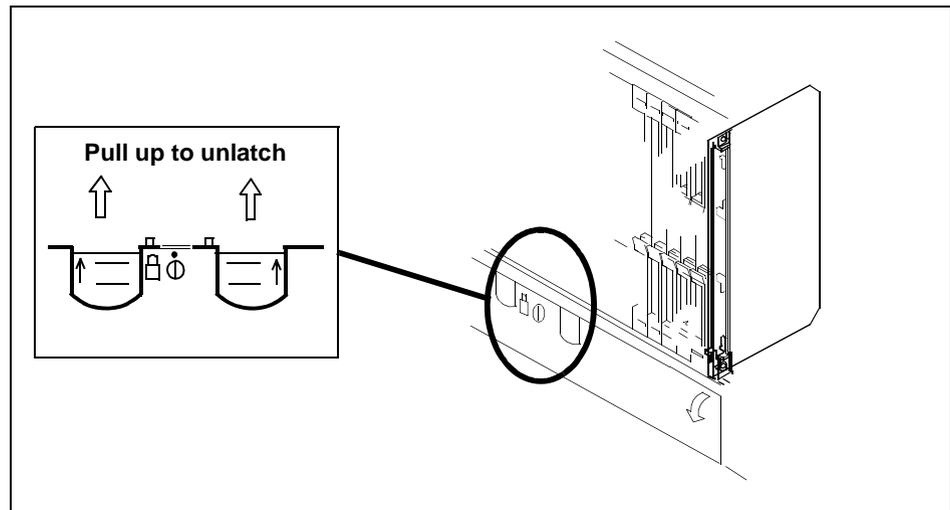
While handling circuit cards or cables, wear a wrist strap connected to the wrist-strap grounding point on the frame. This protects the cards against damage caused by static electricity.

As shown in the following figure, unlock the access doors to shelf 0 by turning the locking screw one quarter turn counter clockwise. The doors are unlocked when the slot in the locking screw is in the vertical position. Open the access

doors by carefully pulling down on the spring lock at the top of each door. At the same time, carefully pull each door toward you using the finger grip at the bottom of the door. Slide the doors back into the retracted position.



- 16 As shown in the following figure, unlatch the cable-trough door by grasping the thumb grips and pulling up. Rotate the cable-trough door to the open position.

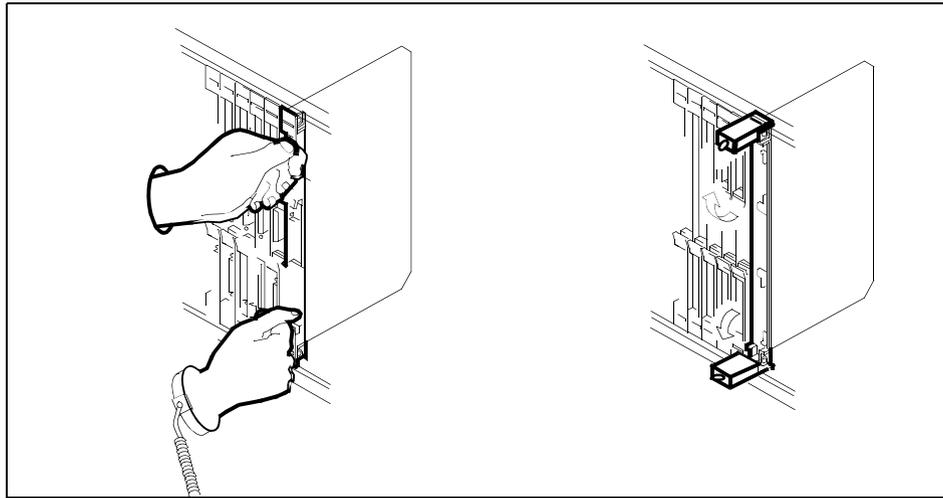


17

**CAUTION****Card lever breakage**

Holding a card by the levers only can result in lever breakage. Once the card has been pulled halfway out of the shelf, carefully grasp the card underneath for more secure support and continue to remove the card from the shelf. Avoid touching any wires or internal parts on the card.

As shown in the following figure, open the locking levers on the card to be replaced.



18

**CAUTION****Damage to fiber cables**

Take care when handling fiber cables. Do not crimp or bend fiber cables to a radius of less than 1 in. (25 mm).

Label each fiber cable. Use *transmit* for the top cable and *receive* for the bottom cable.

**DANGER****Laser radiation exposure**

The exposed ends of fiber optic cables can emit harmful laser radiation. Do not look at the ends of fiber optic cables unless protector caps are in place. Disconnect all laser sources when personnel are working with fiber-optic cables.

Determine which type of fiber optic adapter you have before disconnecting the cables from the faceplate of the card. The following three types of fiber optic adapters are used for securing the equipment:

- SC to SC fiber optic adapter
- FC fiber optic adapter
- ST fiber optic adapter

Refer to the following figures for each type of adapter.

Figure 22-2 SC to SC fiber optic adapter

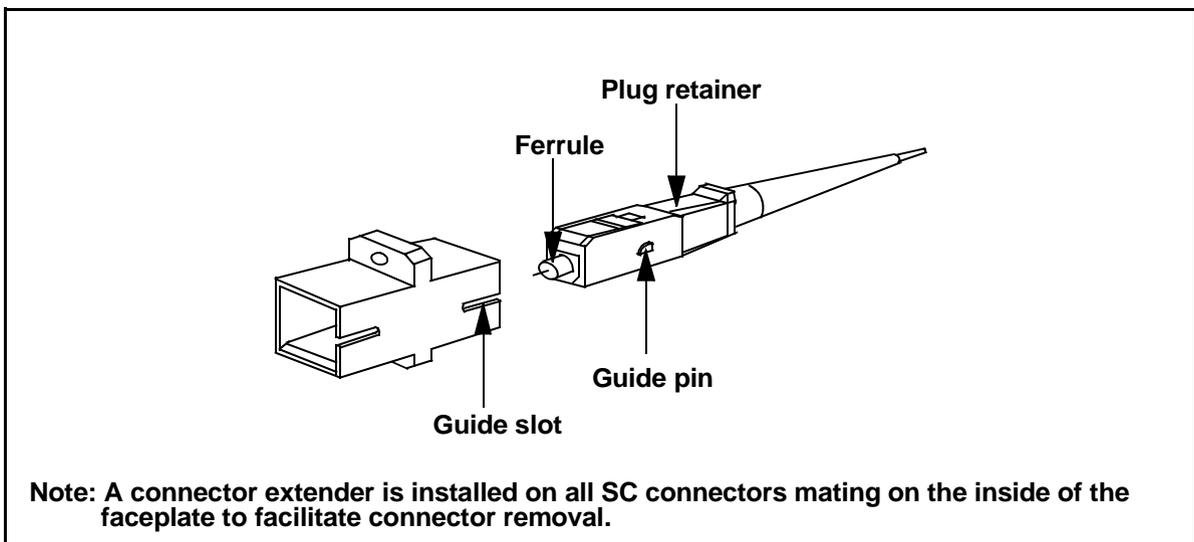


Figure 22-3 FC fiber optic adapter

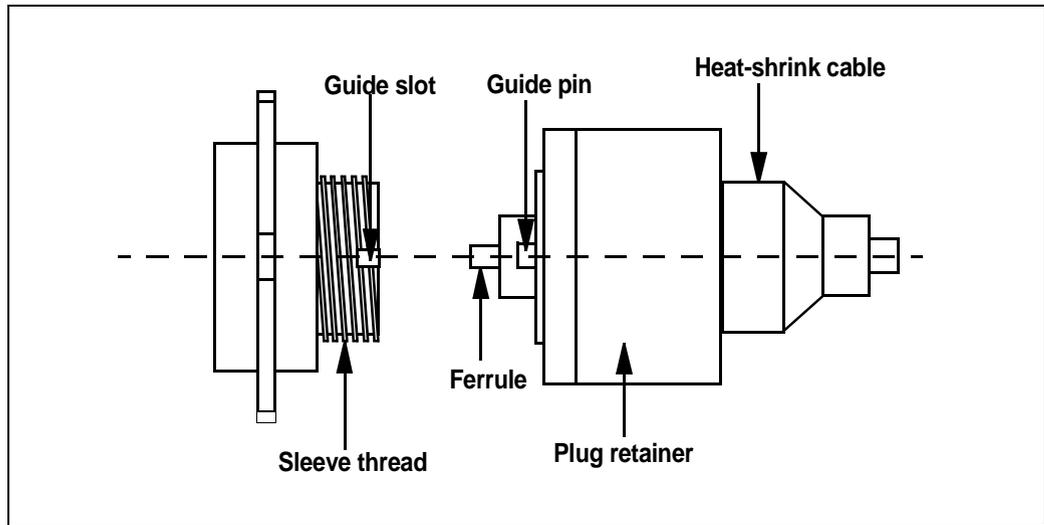
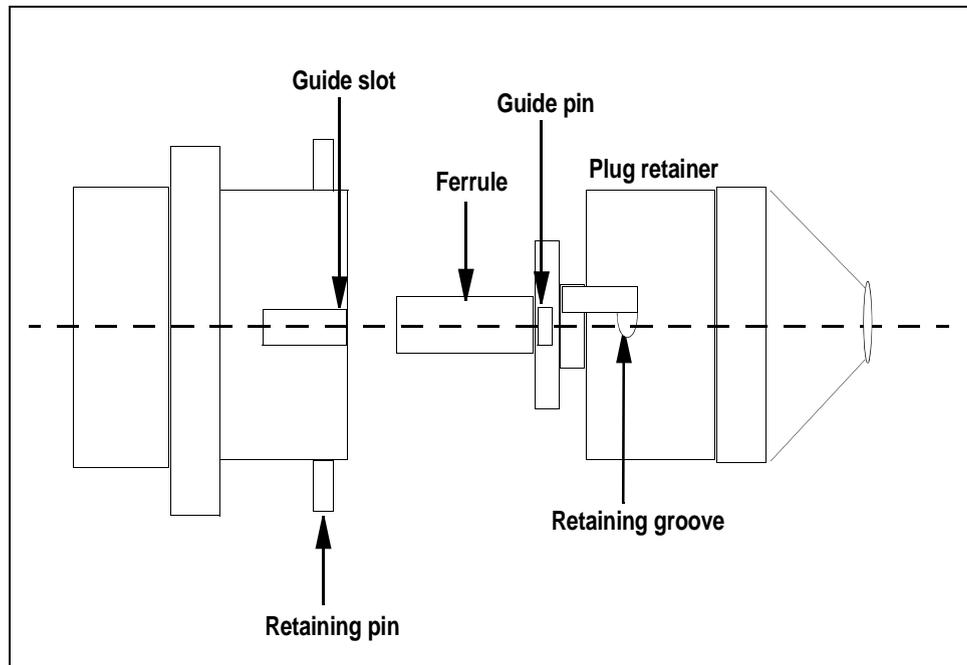


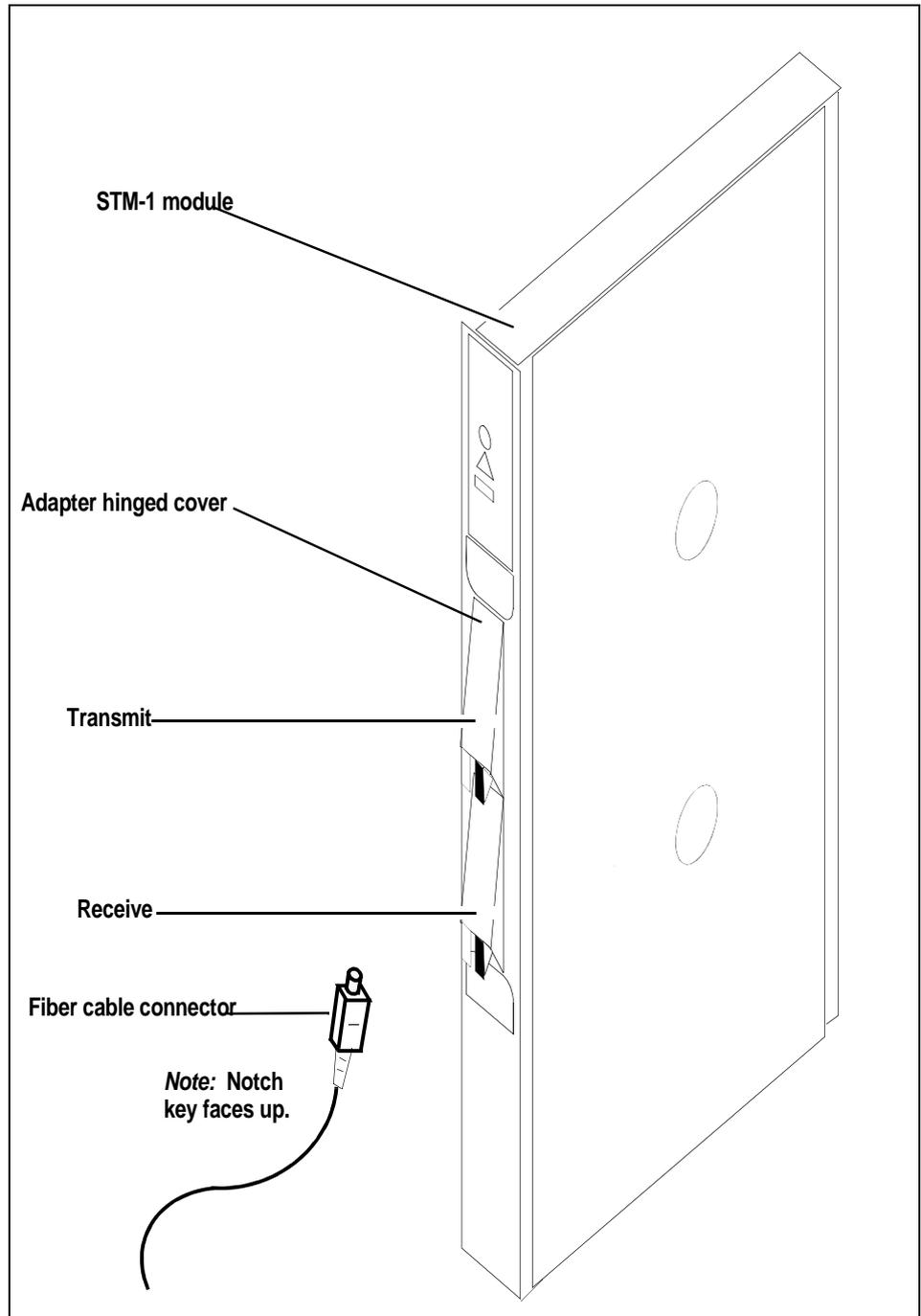
Figure 22-4 ST fiber optic adapter



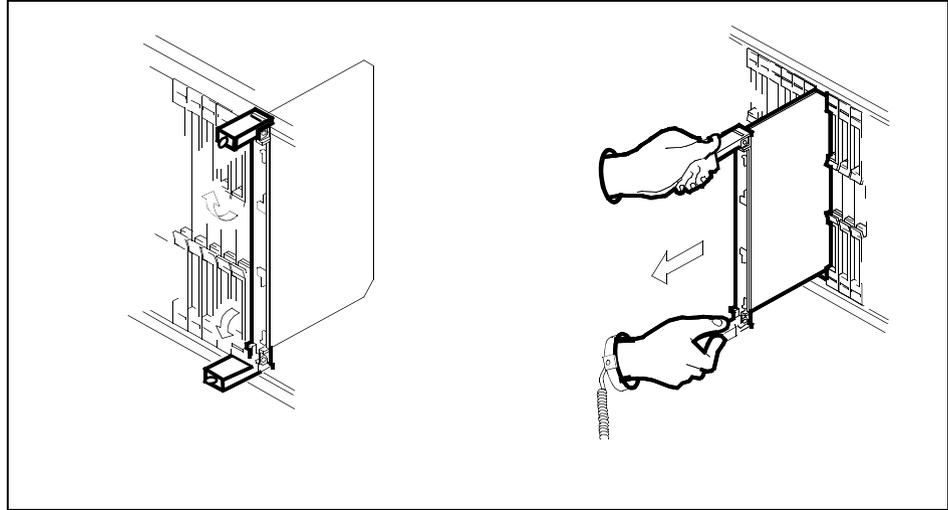
20 Disconnect the fiber cables from the faceplate of the card.

- 21** After the cables have been removed, cap the connectors on the module and the fiber cable. Store the cables in the cable trough.

Note: Before removing the STM-1 card, ensure that the fiber cables are stored below the bottom level of the card shelf to avoid cable damage when the card is removed.



- 22** As shown in the following figure, while grasping the locking levers, gently pull the card towards you until it protrudes about 2 in. (5.1 cm) from the equipment shelf.

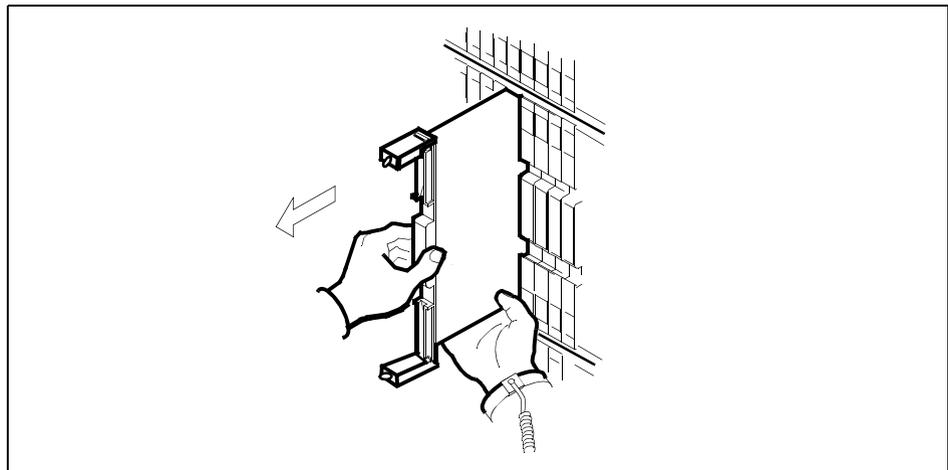


23

ATTENTION

Cards can weigh up to 9 lbs (4 kg).

As shown in the following figure, hold the card by the face plate with one hand while supporting the bottom edge with the other hand. Gently pull the card toward you until it clears the shelf.



24 Place the card you have removed in an electrostatic discharge (ESD) protective container.

25

**WARNING****Equipment malfunction**

Use a replacement card with the same PEC and release to avoid equipment malfunction. If the replacement card has a different PEC or release, change the datafill in Table MNCKTPAK to match the replacement card before inserting it in the slot.

Use a replacement card with the same PEC and the same release.

Note: Refer to the *Data Schema Reference Manual* or the data schema section of the *Translation Guide*, as appropriate, for information about Table MNCKTPAK.

26

ATTENTION

Examine the fiber connectors on the replacement NTLX99BA STM-1 card and connectors on the STM-1 fiber cables. To prevent eye damage, do not look directly into the end of the fiber cables. If the fiber connectors and the cable connectors do not mate, replace the fiber connectors on the replacement card. Each NTLX99BA replacement card is shipped with two pairs of spare fiber connectors. To select the correct fiber connectors, compare the spare fiber connectors with the fiber connectors on the card you removed. Also check the spare fiber connectors against the connectors on the STM-1 fiber cables. Do not connect the STM-1 fiber cables until instructed to do so.

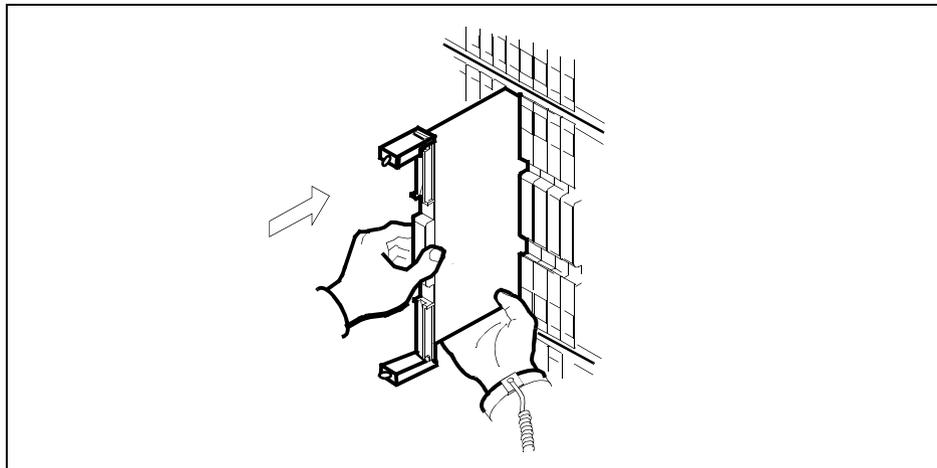
**CAUTION****Equipment damage due to empty slots**

Equip all unused slots on a powered shelf with NTLX60AA filler modules. Filler modules maintain electromagnetic interference (EMI) integrity, and they maintain shelf airflow patterns to ensure proper cooling.

Insert the replacement STM-1 card into the shelf. If a replacement card is not available, insert an NTLX60AA filler module in the slot until a replacement card is available.

27 Open the locking levers on the card.

28 As shown in the following figure, hold the card by the face plate with one hand while supporting the bottom edge with the other hand. Gently slide the card into the shelf.



29



CAUTION

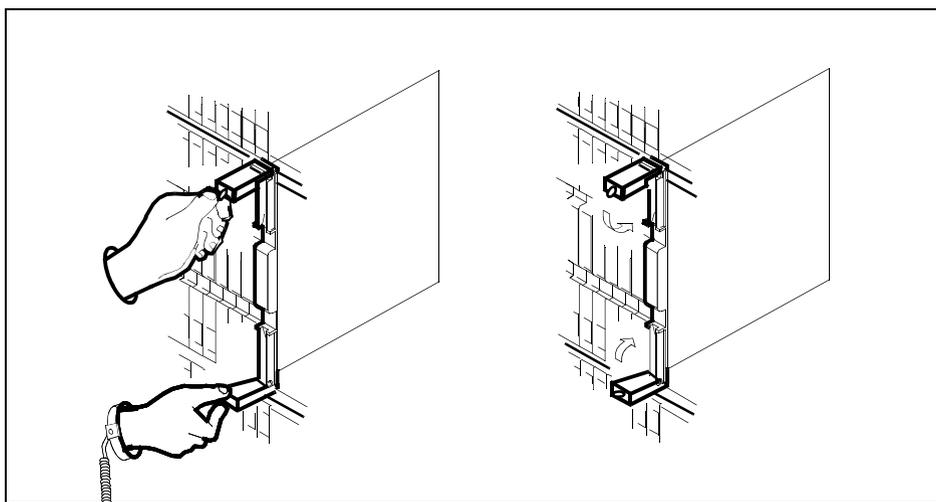
Damage to fiber cables

Take care when handling fiber cables. Do not crimp or bend fiber cables to a radius of less than 1 in. (25 mm).

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.

30

As shown in the following figure, close the locking levers to secure the card.



31

Wait until the card performs a self-test (less than one minute). The self test is complete when the green LED remains on and the red LED remains off. If

both LEDs stay on for an extended period of time, it means the replacement STM-1 card is defective; remove the card and replace it with another STM-1 replacement card. If both LEDs remain on with the second replacement card, contact your next level of support.

- 32 Determine which type of fiber optic adapter you have before reconnecting the cables from the faceplate of the card. Refer to figures under Step 19 for an illustration of different adapters.
- 33 Reconnect the cables from the faceplate of the card.
- 34 Close the cable trough door. Close and lock the card-access door.

At the MAP terminal

- 35 Return to the STM-1 screen and take the STM-1 card from the OffL state to ManB state by typing

>BSY

and pressing the Enter key.

- 36 Load the new STM-1 card with the default software load by typing

>LOADMOD

and pressing the Enter key.

Monitor the progress of the loading activity on the SPM line of the STM-1 screen.

- 37 Return the new STM-1 card to Insv state by typing

>RTS

and pressing the Enter key.

Note: The state change from ManB to Insv can take up to seven minutes to complete.

- 38 Access the performance monitoring (PERFMON) screen and post the STM-1 carrier by typing

>MTC;TRKS;CARRIER;POST SPM spm_no STM1R;PERFMON car_no

and pressing the Enter key.

where

spm_no

is the number of the SPM (0 to 63)

car_no

is the number of the STM-1R carrier (0 or 1)

Example of a MAP screen:

CLASS	ML	OS	ALRM	SYSB	MANB	UNEQ	OFFL	CBSY	PBSY	INSV
TRUNKS	1	0	28	28	0	0	0	0	0	50
TIMING	0	0	0	0	0	0	0	0	0	2
HSCARR	0	0	0	1	3	0	1	0	0	180

PERFMON 0 **SPM 11 STM-1RM 0 STM-1S 0**

Interval:

Status:

Parm	Count	M	D	Parm	Count	M	D	Parm	Count	M	D
SEFS-N	10			CV-N	35			ES-N	5		
SES-N	9			LBC-N	0			OPT-N	7		

OPR-N UNSET

PERFMON:

Note: The initial value of the optical power received (OPR) must be recorded for the STM-1 Section carrier terminating on the replacement STM-1. This initial reading is OPR0 (OPR zero). If the OPR0 value has not been recorded for the replacement STM-1 card, the count for the PERFMON parameter OPR-N appears as UNSET (see the previous example).

- 39 Record the value for OPR0 by typing

>METERPP RECORDOPR0

and pressing the Enter key.

where

RECORDOPR0

means Record OPR 0 (zero)

If an OPR0 value has already been recorded for the replacement STM-1 card, confirm the reset confirmation request by typing

>YES

and pressing the Enter key.

- 40 At the carrier screen, restore the STM-1R carrier and the STM1M carrier to their original state as recorded in Step 10 and Step 7. The STM-1R carrier should be restored first.
- 41 To ensure sparing capability of the new STM-1 RM, set the new STM-1 card to working (W). To do this, access the Protection (PROT) screen from the STM-1 screen and type

>MANUAL from_unit_no to_unit_no

and pressing the Enter key.

where

from_unit_no

is the number of the active unit (0 or 1)

to_unit_no

is the number of the inactive unit (0 or 1)

Note 1: Protection switching an STM-1 normally requires protection switching of the network devices connected to the STM-1 on the external network. Refer to the appropriate manufacturer's documentation for the connected equipment.

Note 2: The MANUAL command without options and the FORCE command can be used only with a CEM card.

- 42** To ensure that the new RM can release activity, repeat step 41.
- 43** You have completed this procedure. Return to the CI level of the MAP screen by typing
>QUIT ALL
and pressing the Enter key.

Part VIII Requirements

This part contains the following chapters:

- Product support (Chapter 23)
- Customer acceptance (Chapter 24)

23 Product support

Recovery

For details of the SPM recovery system, see the NTP *DMS-100 MMP Recovery Procedures*, 297-9051-545.

Support

Support for this product is supplied by Nortel Networks Global Customer Care Support (GCCS) group. Please refer to any specific Warranty and Enhanced Support Plan (ESP) agreements that exist between your company and Nortel Networks.

Training

If you need assistance or have questions regarding Nortel Networks training or products, please contact the Customer Information Authority at (44) 1628-434463 or (44) 1628-434670.

Documentation

The documentation provided to support the SPM system is listed in the About this Document and References sections of this document.

Part IX

Reference information

This part contains the following sections:

- List of terms
- References
- Index

List of terms

ANSI	American National Standards Institute
APS	automatic protection switching
ATM	asynchronous transfer mode
BRISC	B-type reduced instruction set computer
BTUP	British telephone user part
C7	see CCS7
CASE	computer aided software engineering
CCIS	common channel interoffice signalling
CCITT	Comite Consultatif International Telegraphique et Telephonique
CCS7	common channel signalling #7
CCTS	circuits
CE	Call Event

CEM	common equipment module
CHT	Call Holding Time
CI	command interpreter
CM	computing module
COT	continuity tone
CPU	central processor unit
CSP	common services platform
DMS	digital multiplex switch
DRC	dynamic routing control
DS0	digital signal level 0
DSP	digital signal processor or processing
DSPR	digital signal processing resource
DTC	digital trunk controller
DTCI	digital trunk controller (ISDN)
DTCO	digital trunk controller offshore
DTCOI	digital trunk controller offshore (ISDN)

DTMF	dual-tone multi-frequency
DXC	digital cross-connect
E1	2.048 Mbit/s rate used by European CEPT carriers
EBI	even bit inversion
ECAN	echo canceller
EMI	electromagnetic interference
ENET	enhanced network (component of DMS)
ESTR	[?]
ETSI	European Telecommunications Standards Institute
FAM	Final Address Message
GoS	Grade of Service
IAM	Initial Address Message
IEC	interLATA exchange carrier
IMT	inter-machine trunk
IN	intelligent network
ISDN	integrated services digital network

ISUP	ISDN signalling user part
ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
IUP	interconnect user part
KLM	payload position numbering scheme
LGC	line group controller
LIU	link interface unit
LIU7	link interface unit for CCS7
LPP	link peripheral processor
LTE	line terminating equipment
MAP	maintenance and administration position
MCCS	mechanized calling card service
MCI	malicious call identification
MDS	modular documentation system
MF	multi-frequency
MMP	multi-market platform

MS	message switch
MSP	message switch processor
MTP	message transfer part
MUX	multiplexer
OAM	operations, administration and maintenance
OAM&P	operations, administration, maintenance and provisioning
OC-3	optical carrier 3
OM	operational measurement
OOR	operator override
PCM	pulse-code modulation
PDTC	peripheral digital trunk controller
PEC	product equipment code
PM	peripheral module
PRI	primary rate interface
PTE	path terminating equipment
QUICC	quad integrated communications controller

RM	resource module, or resource maintenance
RTS	return to service
SAM	Subsequent Address Message
SD	signal degrade
SDH	synchronous digital hierarchy
SF	signal fail
SIM	shelf interface module
SOC	software optionality control
SONET	synchronous optical network
SPM	Spectrum peripheral module
STA	service test application
STM-1	synchronous transfer mode 1
STR	special tone receiver
SWACT	switch of activity
TDM	time division multiplexing
TONESYN	tone synthesizer

TU	tributary unit
UTR	universal tone receiver
VC12	virtual container level 12
VC4	virtual container level 4
VO	verification office
VSP	voice service processor
XPM	extended peripheral module

References

Base Product Description (BAS-PD-xxx)

DMS-SPM Hardware Maintenance Reference Manual (297-1771-550)

DMS-SPM Commands Reference Manual (297-1771-819)

MMP Product Documentation Directory (297-9051-001)

MMP Data Schema Reference Manual (297-9051-351)

MMP Alarm Clearing and Monitoring Procedures, 297-9051-543

DMS-100 MMP Trouble Locating and Clearing Procedures, 297-9051-544

DMS-100 MMP Recovery Procedures, 297-9051-545

DMS-100 MMP Routine Maintenance Procedures, 297-9051-546

MMP Card Replacement Procedures, 297-9051-547

DMS-100 MMP Operational Measurements Reference Manual (297-9051-814)

DMS-100 MMP Log Reports Reference Manual (297-9051-840)

ITU Intelligent Networks System Guide [doc no?]

STM-1 RM Applications Diagnostics [doc no?]

ToneSyn Application Functional Description [doc no?]

B-2 References

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International Spectrum Peripheral Module Program

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