

CMUX

Technical Handbook

ANR3.1 NB / FR2.1F BB

Ed 03

March 11, 2005



Status Released

Change Note

Short Title CMUX Tech Handbook

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Preface

There are two handbooks in the CMUX handbook set:

- ▶ *CMUX Technical Handbook.*
- ▶ *CMUX Housing, Racks and Cabling Handbook.*

The content of the CMUX handbooks is outlined in this Preface.

Note *The equipment described in this handbook is to be installed and maintained by service personnel unless otherwise noted.*

Note *This handbook describes all subracks, cards, and plugs supported by all current and previous releases of CMUX.*

Valid combinations depend on the CMUX release and the particular housing or rack at a location. The configuration tool is used to determine valid combinations.

Note *MiniMUX uses CMUX technology to provide ADSL services in RIM/C–RIM housings and racks.*

- *For details of MiniMUX refer to the MiniMUX Technical Handbook.*
- *For details of RIM and C–RIM housings and racks, refer to the RIM and C–RIM Technical Handbooks.*

CMUX Technical Handbook

This handbook contains details of CMUX hardware, including:

- ▶ General information.
- ▶ System overview.
- ▶ System architecture.
- ▶ ADSL architecture.
- ▶ Subrack descriptions.
- ▶ Card descriptions.
- ▶ Plugs.

CMUX Housing, Racks and Cabling Handbook

The *CMUX Housing, Racks and Cabling Handbook* contains details of the following hardware details of the CMUX:

- ▶ Descriptions and installation guidelines for:
 - NU Rack
 - Type 84 Rack Adaptor.
 - AU Customer Premises Rack (ACPA).
 - Above Ground Housing (AGHA).
 - Underground Housing (HUGA).
- ▶ Cable terminations.
- ▶ System cabling diagrams.
- ▶ Drawings.

Using the CMUX Technical Handbook

This handbook is the *CMUX Technical Handbook*. It provides detailed information about CMUX hardware other than housings, racks and cabling.

► General Information

Summarises how to handle the equipment, Card labelling, the Alcatel Part Numbering and Item Change Status (ICS) systems.

► System Overview

Gives a technical overview of the CMUX system from a hardware perspective.

► System Architecture

Describes the various Bus architectures operating within the CMUX system.

► ADSL Architecture

Describes the architecture of ADSL in CMUX.

► Subracks Chapter

Provides details of Subracks, their connectors and when and where each one is used.

► Cards Chapters

Describe Card functions, limitations, interfaces, LED function, switches, links, sockets and connectors.

- Card summary.
- Controller cards.
- Transport cards.
- Narrowband line cards.
- Broadband line cards.
- Auxiliary cards.

► **Plugs Chapter**

Describes Plug functions and connector pinouts.

► **Appendices**

The appendices in this handbook are:

- Abbreviations.
- Technical Specifications.
- CMUX Contract Items List.
- ADSL Customer Premises Filters.
- Setup – CMUX to AWS Communication.
- ADSL and HDSL Customer Premises Equipment.
- Telstra Line Tests.

1 General Information

The general information summarises identifying parts, and equipment handling precautions.

The content is presented in the following categories:

- ▶ Part identification.
 - Part Numbers.
 - Labels.
 - Item Change Status.
- ▶ Equipment handling precautions.
 - Static sensitive components.
 - Opto–electronic components.
 - Hazardous voltages.

1.1 Part Identification

1.1.1 Labels

CMUX hardware items, such as Cards, Plugs, and Subracks, carry labels with the following information:

- ▶ Barcode.
- ▶ Card Type.
- ▶ Alcatel Part Number.
- ▶ Serial Number.
- ▶ Item Change Status (ICS) of the item.



Figure 1-1 Typical Card Label

Locations of the labels are as follows:

Cards	Label located on front plate of card.
Subracks	Front of mounting flange at left hand side of subrack.
Plugs	Label on PBA.
Housings	Refer to the CMUX Housings, Racks and Cabling Handbook.
Racks	Refer to the CMUX Housings, Racks and Cabling Handbook.
Cables	Part number stamped on cable.

1.1.2 Alcatel Part Numbering System (APN)

Hardware and software items are identified with an Alcatel Part Number (APN).

Alcatel part numbers consist of 12 significant characters structured as shown in Figure 1–2. In this figure *n* represents numbers and *A* represents alpha characters. A typical part number is 3EC 40263 AAAA.

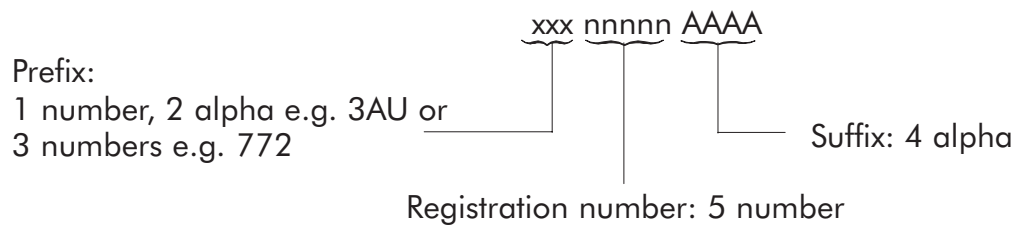


Figure 1–2 Alcatel Part Numbering System

► **Prefix.**

The prefix contains a single digit followed by two characters. The prefix generally denotes the place of origin of the item.

► **Registration Number.**

The Registration Number contains five digits. Together with the prefix it uniquely identifies the product.

► **Suffix.**

The four–character suffix describes the status of the part.

- The first two characters represent the Functional Variant (FV). Functional variants identify items with similar purposes but with variations in features or operation. As an example, a line card may have market–specific functional variants with different line characteristics for each market.
- The last two characters represent the Realisation Variant (RV). Items with the same FV and different RV have identical function but detailed construction variations.

1.1.3 Item Change Status (ICS)

The Item Change Status describes the evolution of items in ways that do not reflect a product Functional or Realisation Variant. The ICS is numbered sequentially starting from 01, with each ICS replacing all previous versions of that item.

1.2 Precautions

1.2.1 Handling Static Sensitive Equipment

The procedures given below should be followed when handling any equipment which is marked with a static sensitive device sticker as shown below.

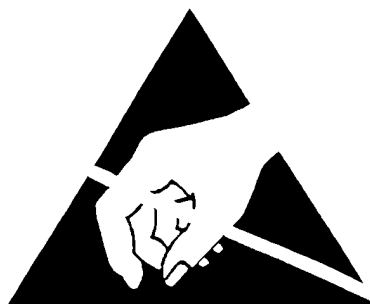


Figure 1–3 Warning Label—Static Sensitive Equipment



Equipment sensitive to static electricity

Possible permanent damage

The following precautions should be followed:

1. Pack all equipment which is to be transported into an anti-static bag and a suitable carton.
 2. Dissipate all electrostatic charge before handling the equipment.
 3. Minimize static build-up by wearing an anti-static wrist strap that is attached to the equipment rack when handling cards, plugs and subracks, and when connecting or disconnecting cables.
 4. Hold all Printed Board Assembly (PBA)s and Cards by the edge of the board, by the handle/s, or by the front plate.
-

1.2.2 Hazardous Opto–Electronic Components

The following precautions must be adhered to when dealing with cards containing opto–electrical components. These cards are marked with a label shown below.

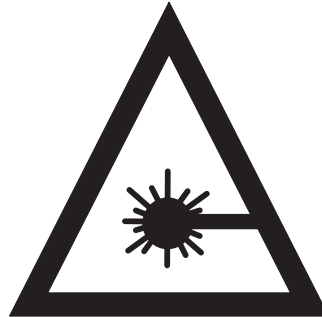


Figure 1–4 Warning Label–Opto–Electronic Components



Harmful laser beam light emissions

Possible temporary or permanent eye damage.

The following precautions should be followed:

1. *Do not look directly into the Optical Out (transmit) port as it may be harmful to the eye.*
2. *Keep the protective nylon caps on the optical connectors. This prevents dirt or dust particles from contaminating the connector front face.*
3. *Fit the protective caps onto the optical connectors whenever the optical station cabling is not connected.*
4. *Disconnect the optical station cabling before inserting or removing a card from its Rack.*

1.2.3 Hazardous Voltages

Some of the equipment contains hazardous voltages. This equipment is marked with a sticker as shown below.

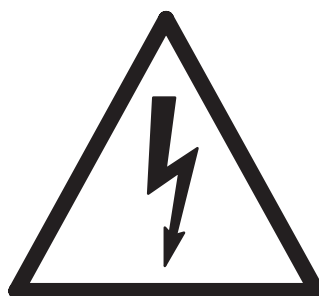


Figure 1–5 Warning Label—Hazardous Voltages



Hazardous equipment voltage and current levels

Contact with conductors carrying AC power or ring signals may cause possible temporary or permanent harm or **death**.

The following precautions should be followed:

1. Do not touch any live voltage areas when handling cards, particularly if a ring, meter, or test card is on an extender card.
 2. Unplug cards from the backplane and their front connectors and leave them for several minutes before handling. This allows any stored charge to dissipate.
 3. Be **cautious** when working inside the Power Compartment in housings as many components are connected directly to the incoming mains **AC** power supply.
-

1.2.4 Manual Handling



Manual handling precautions

Housings, racks, batteries, panels, subracks, and other items may be heavy. The precautions in this section should be followed if it is required to manually handle any items:



Manual handling above shoulder height.

Equipment at the top of NURA and ACPA racks may be above the shoulder height of installation or maintenance personnel when standing on the floor.

A risk assessment may indicate the need for a safe and stable ladder or platform to elevate persons working on such equipment.

- 1** A manual handling activity is any activity that requires the use of force exerted by a person to lift, lower, push, pull, carry or otherwise move, hold or restrain any animate or inanimate object.
- 2** All manual handling activities shall be managed following the requirements of any relevant Occupational Health and Safety legislation, regulations and other statutory requirements.
- 3** A risk assessment shall be carried out in consultation with employees prior to a manual handling activity taking place. The risk assessment will assess foreseeable hazards associated with the job and identify reasonable control measures to be implemented.
- 4** The redesign of the manual handling task followed by training in manual handling techniques should be the preferred option in eliminating or controlling the risk.

- 5** If re—design of the manual handling activity is not workable or as a temporary measures, the following control measures should be established, in order of preference:

 - provide mechanical aids, and/or
 - provide protective equipment and/or
 - arrange for team lifting, and/or
 - provide training in manual handling techniques and in the correct use of mechanical aids and equipment.
- 6** To assist in the assessment of risk, the weight of the items should be checked by either referring to the label on the packaging or section 1.2.5 of this manual or, for cards, in the *Cards Summary* chapter in the *CMUX Technical Handbook*.
- 7** Typical manual handling activities involve, but are not limited, to the following:

 - Lifting and maneuvering housing, racks, batteries, subracks and other equipment.
 - Stretching above shoulder to install or remove equipment at the top of racks.
 - Bending below knee to install or remove equipment at the bottom of racks.
- 8** Appendix G contains an example of a procedure for installing CMUX subracks. That appendix is a guideline for a risk assessment.

1.2.5 Weights – Major Assemblies

Item		Weight
Subrack – MLS–hb	Empty	9 kg
	Equipped (typical)	25.2 kg
	Equipped (maximum)	31.5 kg
Subrack – MLS–hbe	Empty	9 kg
	Equipped (typical)	27.8 kg
	Equipped (maximum)	30.2 kg
NURA	Fitted with fan trays, internal cabling and APDP. Subracks and cards not equipped.	65 kg
	Fully equipped	150 kg
ACPA	Fitted with internal cabling, CPP and fan trays. Subracks, cards and batteries not equipped.	110 kg
	Fully equipped	250 kg
AGH (AGHA or AGHB)	Unequipped	250 kg
	Fully equipped	400 kg
Cards	See <i>Cards Summary</i> chapter in the <i>CMUX Technical Handbook</i> .	
Transformer Panels	ACTP (in ACPA)	18 kg
	PSP (in AGH)	18 kg
Fan Trays	Fan Tray NU Rack	2 kg
	Fan Tray ACPA Rack	2 kg
	Fan Tray AGH External	2 kg
	Fan Tray AGH Internal	2 kg
	Fan Tray AGH Extension	2 kg
APDP	APDP	4.2 kg
CMUX Power Panel (CPP)	Fully equipped	4.6 kg
Battery (AGH)	Each battery (12V, 100Ah) (Fiamm)	42 kg
	One string, four batteries per string	168 kg
Battery (ACPA)	Each battery (12V, 38Ah) (Century Yuasa)	17 kg
	One string, eight batteries per string	136 kg

1.2.6 Beryllium Copper Hazard

This section is based on Telstra Standard CSD26004: *NDC Reference – SDH – SMA Cards Beryllium Copper Hazard*.

This section adapts the procedures in that Standard to CMUX cards, plugs, and blanking plates. In the event of a discrepancy between the standard and this section, the standard shall prevail.

(1) General Information

CMUX cards, plugs, and blanking plates contain metal spring clips provided for EMC protection. The springs are made from a Beryllium Copper Aluminium alloy. The springs are located along the edge of the face—plates of each card, plug, and blanking plate.

The Beryllium Copper contained within the alloy is hazardous if it is heated, welded, drilled, ground or the surface or structure is abraded. UNDER NO circumstances should any modification be performed to these items. You must avoid creating any fine particles.

This material can be handled safely by staff by observing these and basic personal hygiene precautions – ie: make sure you wash your hands before drinking, eating or smoking if you handle these items.

(2) Disposal of Damaged Cards, Plugs or Blanking Plates

Cards, plugs or blanking plates with damaged EMC fingers are to be placed in a container, for example a static bag, and clearly labelled:

“BERYLLIUM/BERYLLIUM OXIDE IN THIS CONTAINER”

and returned to Alcatel for replacement.

(3) Disposal of Blanking Plates.

Whenever new cards or plugs are added to an existing CMUX subrack, blanking plates are removed. These may be returned to Alcatel.

- ▶ Pack the blanking plates in a box one of the new cards came in.
- ▶ Return them to Alcatel marked ‘Spare Blanking Plates’.

2 System Overview

2.1 Introduction

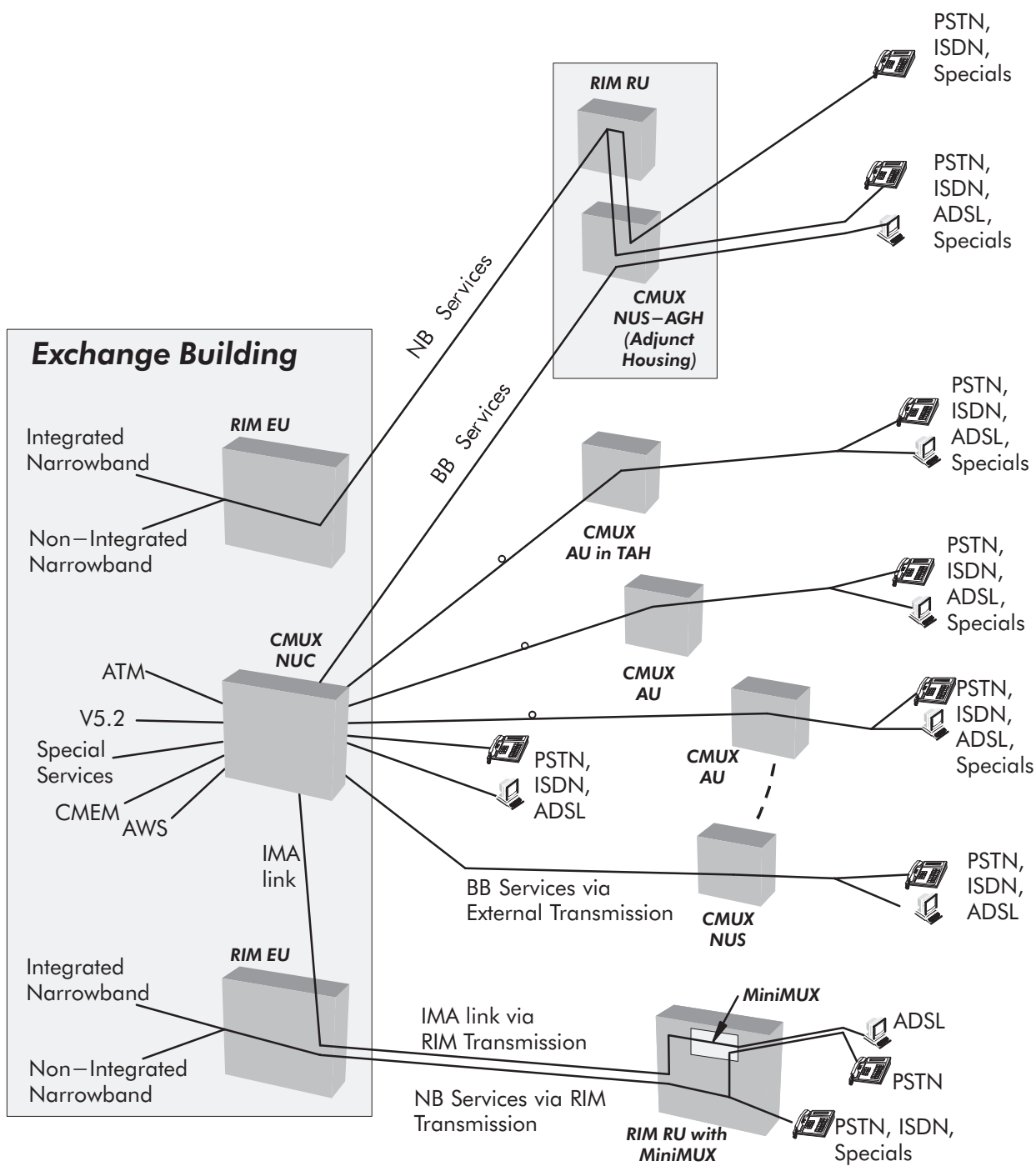


Figure 2-1 CMUX and MiniMUX – Typical Topologies

2.1.1 Multi–Service Access

Alcatel's CMUX is an advanced access product that provides Multi–service and Multi–topology solutions for a wide range of network applications.

- ▶ CMUX offers broadband and narrowband switched and leased lines services to both residential and business users. CMUX is installed in CMUX housings and racks.
- ▶ MiniMUX uses CMUX technology to provide ADSL services in RIM/C–RIM housings and racks. MiniMUX is described in the MiniMUX Technical handbook.
- ▶ NUS–AGH is a special application of CMUX as an Adjunct Housing. In this application, an AGHB equipped only with broadband services is co–located with a RIM or C–RIM housing.
 - Broadband cards are located in the CMUX.
 - Narrowband cards are located in the RIM/C–RIM.
 - Customer lines are terminated at the CMUX CCF.
 - Narrowband services from the RIM are interconnected to the CMUX CCF via a tie cable.

2.1.2 Integrated Broadband and Narrowband

CMUX provides a single multi–service access platform for deployment of both narrowband and broadband services.

- ▶ Traditional narrowband services, such as POTS, ISDN and Leased Lines.
- ▶ Broadband and data services, such as ATM and IP over xDSL.

The wide range of services, technologies and topologies from the same equipment is made possible by the subracks (MLS–hb, MLS–hbe and the MiniMUX MLS–sm–T9).

Subracks are the hosts for the narrowband and broadband line cards, transmission cards, and controller cards.

CMUX can also be configured with specialised controllers or interfaces that are focused on high capacity business applications such as fibre in the loop system.

2.1.3 Common Building Blocks

The CMUX family is built on a range of common building blocks, such as subracks, controller cards, line cards, server cards, transmission cards, and auxiliary cards.

The same components can be used in different combinations to meet a wide range of network applications.

CMUX supports a wide range of traditional narrowband interfaces and services for residential and small business customers. It exhibits its real strength in its support of broadband services such as Multimedia and Fast Internet Access and other new and rapidly growing interactive data communication services.

2.1.4 Scalability

The CMUX architecture cost-effectively deploys systems from very small sizes up to 1448 POTS lines per NE (NUC, NUS or AU).

- ▶ At a NUC or NUS the maximum is 1448 POTS lines. This assumes the use of four narrowband subracks, each of which is a MLS-hb.
- ▶ An AU in an AGH housing (AGHA or AGHB) has a maximum of 2 MLS-hb subracks (one NB MLS-hb and one BB/special services MLS-hb) and 420 POTS lines can be equipped.
- ▶ An AU in a single ACPA rack can have a maximum of 2 MLS-hb narrowband subracks, with up to 720 POTS lines.

2.1.5 CMUX CRAFT Terminal

CMEM and AWS provide Network Management for CMUX, including configuration and alarms. A NB CRAFT Terminal is not provided for current CMUX releases.

If a BB controller card has not been configured AWS may not be able to communicate with the BB controller card. Appendix D contains a procedure to establish communication from AWS to CMUX. It uses a PC running terminal software.

2.1.6 Network Management

CMUX Network Elements (NE) are managed by the CMUX Element Manager (CMEM) and ADSL Workstation (AWS).

CMUX NU (Network Units: NUC or NUS) and CMUX Access Units (AU) are separate NEs. CMEM manages each NE as a separate element. The NU provides the signalling channel to the AUs.

AWS, CMEM and other EMLs interface to the Access Domain Manager (ADM) as shown in Figure 2–2.

- ▶ The ADM interfaces directly to CMEM.
- ▶ A TL1 gateway is a standalone application which runs on the same computer as AWS. The ADM interfaces to the TL1 gateway, which in turn interfaces to AWS.

Note CMEM, AWS and ADM are described in separate handbooks.

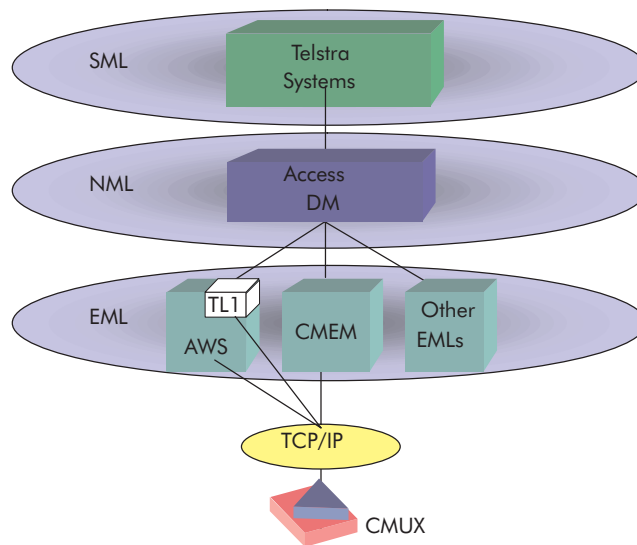


Figure 2–2 Network Management Layers

2.2 CMUX Features

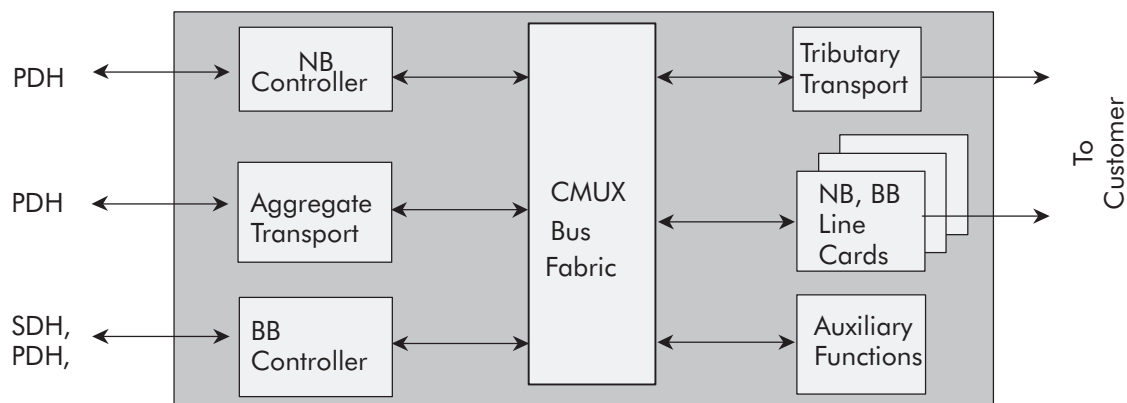


Figure 2-3 CMUX NU Reference Diagram

CMUX consists of Network Units (NU) and Access Units (AU). A NU may be a Central NU (NUC) or a Subtended NU (NUS).

- ▶ A NUC provides:
 - Interfaces towards the backbone or switch network.
 - Interfaces for AU and/or NUS.
 - Line circuits for customers connected directly to the NUC.
- ▶ Each AU or NUS provides:
 - Interfaces towards the NUC.
 - Line circuits for customers connected to the NUS or AU.
- ▶ A MiniMUX functions similarly to a NUS.
 - MiniMUX broadband (BB) services are subtended from a NUC via RIM/C–RIM transmission.
 - Narrowband (NB) services associated with MiniMUX are provided by the co-located RIM/C–RIM equipment.
- ▶ A NUS–AGH is an NUS in an AGHB housing.
 - An AGHB with Adjunct Cabling Kit is co-located with a RIM/C–RIM housing.
 - Customer lines (BB+NB and NB) are terminated at the CCF in the CMUX housing.
 - BB cards are located in the CMUX housing. BB services are subtended from a NUC via CMUX transmission.
 - NB services are provided by the co-located RIM/C–RIM, subtended from a RIM/C–RIM EU via RIM transmission.
 - A NB tie cable interconnects the CMUX housing and the RIM/C–RIM housing.

This multi-level architecture can be reduced to a single-level architecture by only utilising a NUC with customer interfaces as shown in Figure 2-3.

2.2.1 General Capabilities

CMUX is a distributed multiplexer which supports a full range of narrowband and broadband line cards. Support is provided for services at the NU (NUC or NUS) and AU such as:

- ▶ POTS, including metering.
- ▶ ISDN.
- ▶ ADSL.
- ▶ Securitel.
- ▶ 4/6 wire.
- ▶ Special services.

CMUX provides extensive capabilities for the flexible and efficient management of bandwidth and customer services. This includes:

- ▶ NU and AU concentration for up to a total of 1448 POTS lines at each NU or AU.
 - To provide the maximum of 1448 POTS lines, four MLS–hb subracks supporting narrowband services are required at an NU or AU.
 - Where an AU is located in an AGH (AGHA or AGHB) up to 420 POTS lines are supported.
 - Where an AU is located in an ACPA up to 720 POTS lines are supported.
- ▶ "Grooming" or selective routing of switched and data traffic
- ▶ Multiplexing of ATM and TDM traffic

CMUX is scalable both in terms of capacity and services. In addition, it can be equipped with the following services and interfaces:

- ▶ Narrowband–only.
- ▶ Broadband–only.
- ▶ Mixed narrowband–broadband services and interfaces.

The architecture is designed to ensure that no service interruptions occur during service or system configuration. Software download is completely in the background. Software can then be activated at the appropriate time to bring new functionality on–line.

2.2.2 Network Interfaces

(1) Network Interfaces at NUC and NUS

The NUC and NUS interface to Telstra's backbone data or switching networks using open protocols and interfaces.

Standard interfaces between the CMUX NUC and NUS and the Telstra networks are:

- ▶ V5.2.
- ▶ ATM on STM-1.
- ▶ ATM on IMA.
- ▶ 2 Mbit/s G.703

(2) Network Interfaces – AU

The AU interfaces to Telstra's networks via the NUC using the following interfaces.

- ▶ V5.2

V5.2 bearers are carried by optical or electrical transport from the NUC to the AU.

At the NUC, V5.2 bearers from the AU are electrically connected to the exchange.

- ▶ ATM on IMA

ATM from the AU is multiplexed onto IMA links. These are transported optically to the NUC.

At the NUC, ATM from the AU is multiplexed with ATM from ADSL line cards at the NUC, and then interfaced to Telstra's data network via STM-1 (AANC or ASCC-S) or IMA (AICC).

- ▶ 2 Mbit/s G.703

(3) Network Interfaces – NUS-AGH (Adjunct Housing)

The NUS-AGH is installed in an AGHB cabled as an Adjunct Housing.

- ▶ The network interface for initial installations is ATM on IMA as used in the AU. The IMA links use optical transport via EOTCA cards.
- ▶ Future installations may use alternative controllers with different network connections.

2.2.3 NUC–AU Transmission

Transmission between the NUC and the AU is provided using PDH over either optical transmission or external transmission.

2.2.4 Housings and Racks

CMUX NUC, NUS and AU equipment may be installed indoors in racks (NUC, NUS or AU), or outdoors in housings (AU only).

Housings and racks available are:

- ▶ NUC or NUS.
 - NU Rack (NURA).
 - Type 84 Rack Adaptor Kit (T84).
 - NUS–AGH. A NUS located in a BB–only AGHB co–located with a RIM/C–RIM.
- ▶ AU.
 - AU Customer Premises Rack (ACPA).
 - Above Ground Housing (AGH). AGH may be AGHA or AGHB.
 - AU in Telstra Access Housing (AU in TAH)
- ▶ MiniMUX
 - MiniMUX equipment is installed in RIM/C–RIM housings and racks.

Note *For details of CMUX housings and racks, refer to the CMUX Housings, Racks and Cabling Handbook.*

Note *For details of MiniMUX in RIM/C–RIM housings and racks refer to the MiniMUX Technical Handbook.*

2.3 CMUX Applications

CMUX/MiniMUX provides customers with high quality services quickly and efficiently. At the same time they significantly reducing operational costs. Some typical applications are described below.

Note *CMUX/MiniMUX system topology for broadband and narrowband services at NUC, NUS, AU and MiniMUX is shown in Figure 2–1.*

2.3.1 Narrowband Services

CMUX supports narrowband services at the NUC, NUS and AU:

- ▶ Most NB services are provided via V5.2 links from the exchange.
 - NUC or NUS in exchange:
V5.2 links are direct from exchange to NU.
 - AU
V5.2 links are provided indirectly via the NUC, with optical transmission or external transmission between the NUC and AU.
 - NUS–AGH
NB services are provided by RIM/C–RIM.
 - MiniMUX
NB services are provided by RIM/C–RIM.
- ▶ A customer line may have ADSL in addition to POTS. In this configuration the ADSL is multiplexed with the POTS at the CMUX/MiniMUX and at the customer premises.
- ▶ CMUX also supports mirror (non–integrated) special services.

2.3.2 Broadband (ADSL) Services

CMUX/MiniMUX supports ADSL and other BB services at NUC, NUS, AU and MiniMUX. ADSL and POTS services are multiplexed onto customer lines.

- ▶ ADSL services originate from LTAC (LTAC–A, LTAC–C, or LTAC–D) cards in the CMUX NUC, NUS, AU, or MiniMUX.
- ▶ POTS lines originate as follows:
 - From POTS line cards at the exchange (NUC or NUS).
 - From POTS line cards in a NUC, NUS and/or AU.
 - From RIM/C–RIM POTS cards (MiniMUX or NUS–AGH).

- ▶ POTS and ADSL services are multiplexed at the CMUX/MiniMUX.
- ▶ ADSL and POTS services are multiplexed and demultiplexed by:
 - NACC (NACC–A or NACC–C cards, or NACC–D daughterboard on an LTAC–D) at the CMUX/MiniMUX.
 - ADSL filters at the customer premises

2.3.3 Main Cable Relief

Continued growth in demand for services can lead to the situation where the capacity of the existing cable plant will be exceeded. Additionally, the age or condition of existing cable plant can be unsuitable for the deployment of new high-speed services to customers.

CMUX can be rapidly deployed to provide the required cable relief. As well as addressing the immediate problem of insufficient capacity, or poor service quality, deployment of the CMUX provides the platform for delivery of a range of new services.

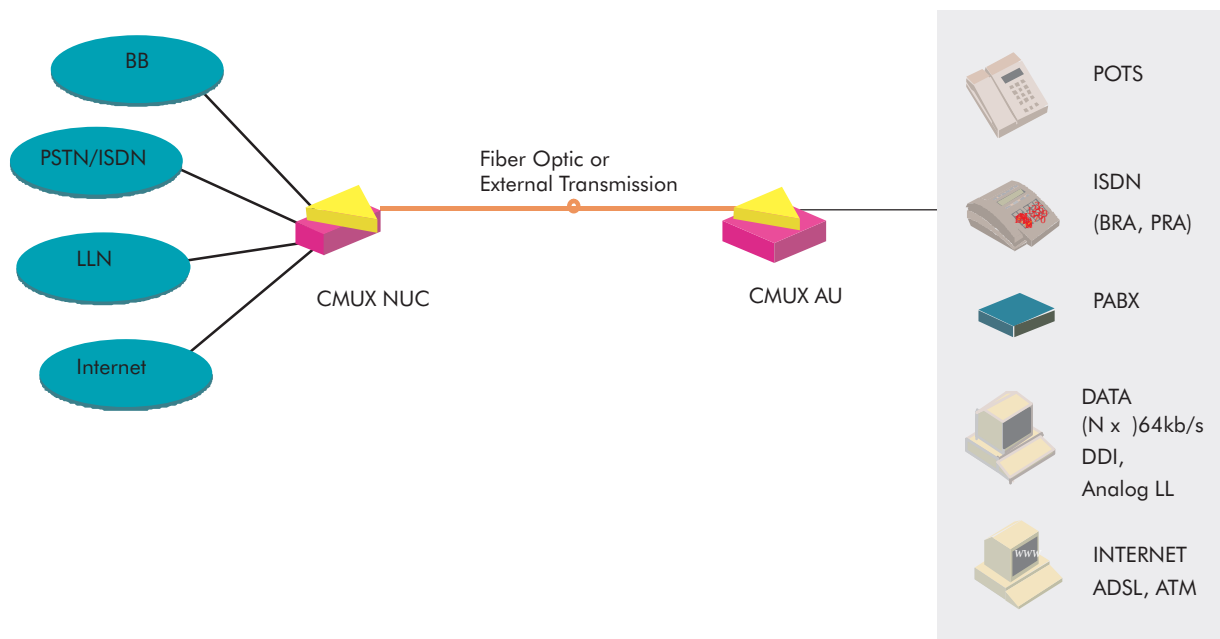


Figure 2–4 Cable Relief: Point to Point Configuration

The use of fibre to position the CMUX AU close to the customer provides the benefits of higher quality of transmission and typically higher data rates for analogue modems.

Fully integrated V5.2 and ADSL services can be provided in areas where it may not have been previously possible.

2.3.4 Housing Estates & Technology Parks

Many developments create significant demands for services which can be met by CMUX. Typical developments include:

- ▶ Urban redevelopment frequently sees existing buildings redeveloped to provide medium density housing of many tens or sometimes hundreds of dwellings.
- ▶ Technology and Business Parks are being established in areas which were previously largely residential.

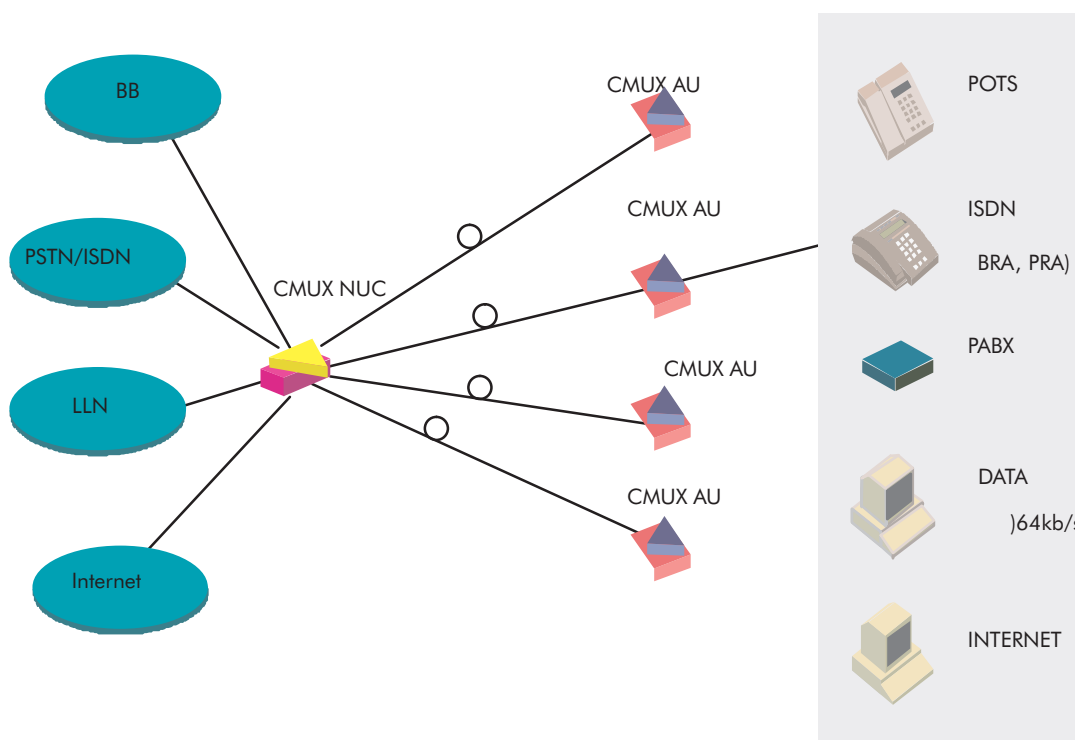


Figure 2–5 Technology Park Deployment

CMUX AU can be located:

- ▶ In outdoor housings (AGHA or AGHB).
- ▶ Rack-mounted within buildings (ACPA).

2.4 CMUX Equipment Overview

CMUX architecture is designed for 'in-the-field' evolution based upon card compatibility and re-useability. A key part of this strategy are the subracks (MLS-hb and MLS-hbe) which support the full range of access node functions.

- ▶ Subracks have slots for:
 - Narrowband controller cards
 - Broadband controller cards
 - Transport cards
 - Line cards
 - Auxiliary cards.
- ▶ Up to twelve subracks can be interconnected in a group to form an NUC, NUS or AU.
- ▶ CMUX equipment may be located in racks (NUC, NUS or AU), or outdoor housings (AU or NUS-AGH). AU may also be housed in Telstra Access Housings (TAH) .

Subracks provide broadband and narrowband busses to each line card slot. Total bandwidth provided by these busses is in excess of 10 Gbit/s.

Together, the shared busses provide a flexible distributed switching environment for narrowband and broadband access technologies.

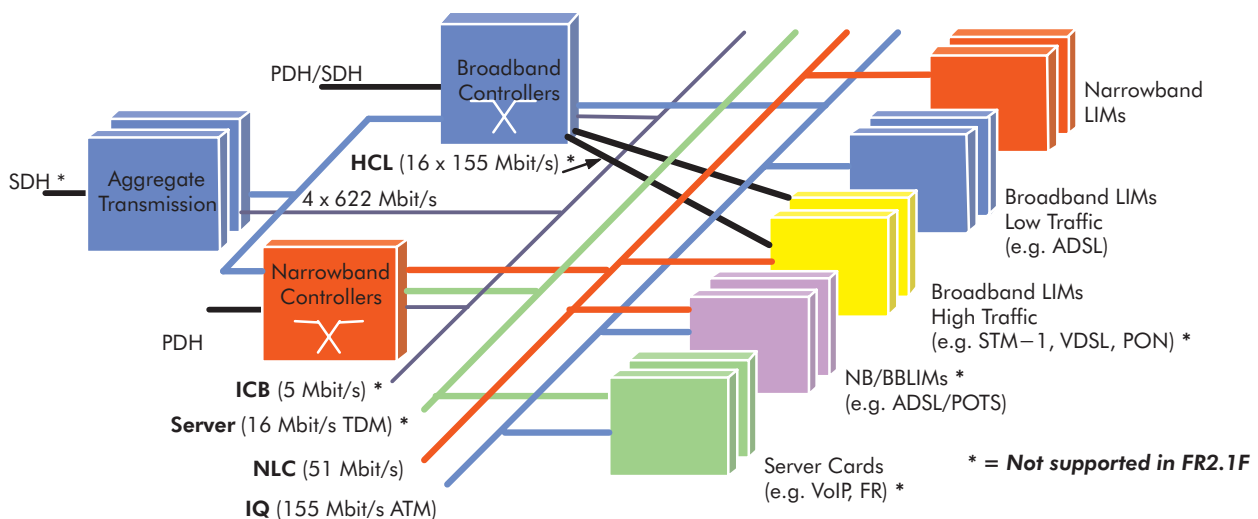


Figure 2-6 CMUX Bus Architecture

2.5 Typical Topologies

This section provides some possible CMUX deployment topologies for narrowband (NB) and/or broadband (BB) applications.

2.5.1 NUC Only

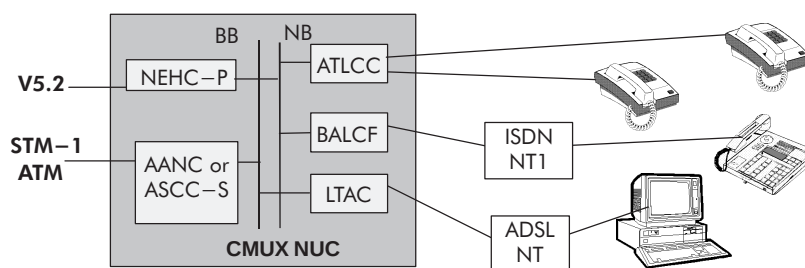


Figure 2–7 NUC only configuration

A CMUX NUC may consist of up to twelve subracks which are linked together by bus extension cables and extension controllers.

- ▶ The NSEC NB extension card supports up to three extension subracks in an NUC or NUS. An AU in an AGH (AGHA or AGHB) or ACPA can have one extension subrack which supports NB services.
- ▶ The BSEC BB extension card supports up to eleven extension subracks in an NUC or NUS. An AU in an ACPA can have one extension subrack which supports BB services.

The available services in subracks in a NUC are:

- ▶ Three subracks may be NB and/or BB.
- ▶ One subrack may be NB or BB, but not NB and BB.
- ▶ The remaining eight subracks are BB only.

CMUX may be deployed in an NUC-only arrangement, with V5.2 (POTS and ISDN) and ADSL based services from the NUC.

Up to sixteen 2 Mbit/s G.703 links from the NEHC-P are used for providing one or more V5.2 interfaces, which can be connected to one or more exchanges. The V5.2 services include POTS and ISDN services from their respective line cards (ATLCC and BALCF).

ATM network termination is provided by an AANC or ASCC-S (STM-1 optical interface) or an AICC (4 x 2 Mbit/s IMA interface).

- ▶ ATM traffic from ADSL line cards (LTAC) is multiplexed via the IQ bus and passed to the ATM network.
- ▶ POTS services associated with ADSL may be provided by a CMUX POTS card, or POTS line from an exchange.

2.5.2 NUC and Single AU

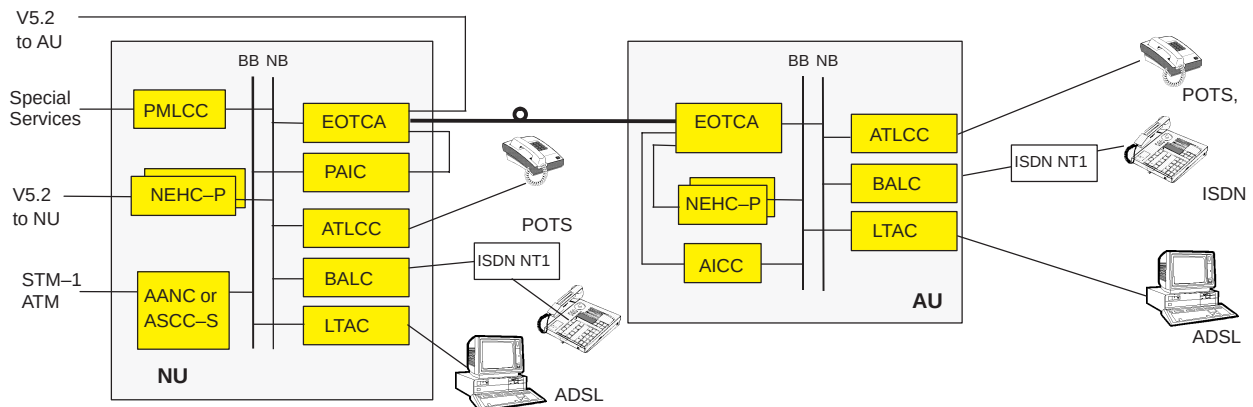


Figure 2–8 NUC and Single AU – PDH Transport

A CMUX configuration may use a NUC/AU pair to support services at a remote location, typically with the AU in an above-ground housing.

The NUC and AU are connected by a PDH-based optical bearer providing 16 x 2 Mbit/s links. The optical transport card (EOTCA) is mounted in line card slots at the NUC and the AU.

Each of the 2 Mbit/s links may be used to carry one of the following types of traffic.

- ▶ V5.2.
- ▶ Mirror Service.
- ▶ ATM over IMA.

Note Multiple AU can be subtended from an NUC. For details refer to Section 2.5.3.

(1) Services at NUC

Services at the NUC in a NUC/AU pair are the same as the services provided at the NUC in a NUC-only CMUX system. These are detailed in Section 2.5.1.

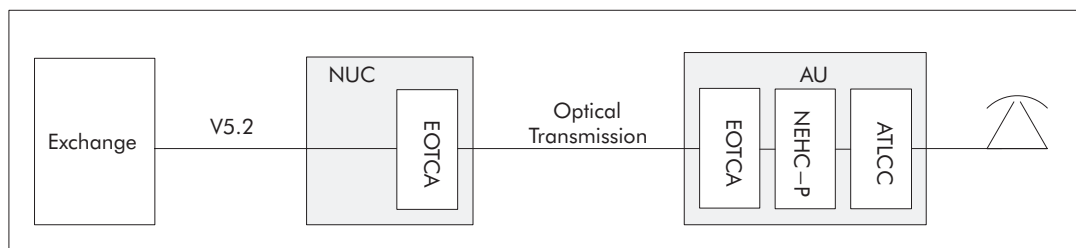
(2) Services at AU**V5.2 at AU**

Figure 2–9 Block Diagram – POTS at AU (V5.2)

A CMUX AU supporting POTS lines would typically use four of the available 16 x 2 Mbit/s links to form a multi-link V5.2 interface.

- ▶ At the AU, the links are cabled from the NEHP plug below the NEHC–P to the EOTP plug below the EOTCA optical card.
- ▶ At the NU, the links are accessed via the EOTP below the EOTCA and routed via the exchange DDF to the exchange V5.2 interface.
- ▶ Services supported via V5.2 include POTS, ISDN and payphone.

Mirror Service – AU to NUC

Special services are supported using mirror (non-integrated) mode. They are carried by one or more 2 Mbit/s links which are dedicated to mirror services.

- ▶ At the AU, the service from the line card is routed via the NEHC–P, cabled to the EOTCA, and carried via a separate 2 Mbit/s link to the NU.
- ▶ At the NUC, the services carried by the mirror link are routed via the narrowband bus to the line card supporting the special service.

Note Typical configurations of cards for mirror services are shown in Chapter 5 – Customer Interface.

Mirror services include:

- ▶ 6W Tie Line.
Connects two PABXs. Uses an ALLC at the NU and AU.
- ▶ Analogue PABX Indial.
Uses an ATLCC at NU and a PMLCC at AU.
- ▶ PABX Outdoor Extension (ODX).
Uses an ATLCC at the NU and a PMLCC at the AU.
- ▶ Securitel.
Uses a PMLCC at NU and an ATLCC at the AU.
STU is connected to the line at customers premises.
- ▶ DDN 2Mbit/s or Nx64.
Carried by a 2 Mbit/s tributary of the EOTCA between the NU and AU. At the AU this is cabled from the EOTCA to an HDSL line card (HLTCA). The customer interface is provided by an HDSL NT. ISDN PRA can also be supported similarly.

ATM at AU

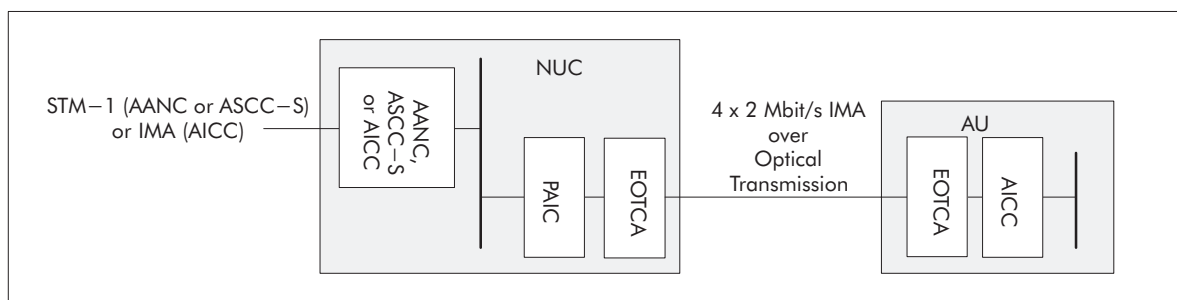
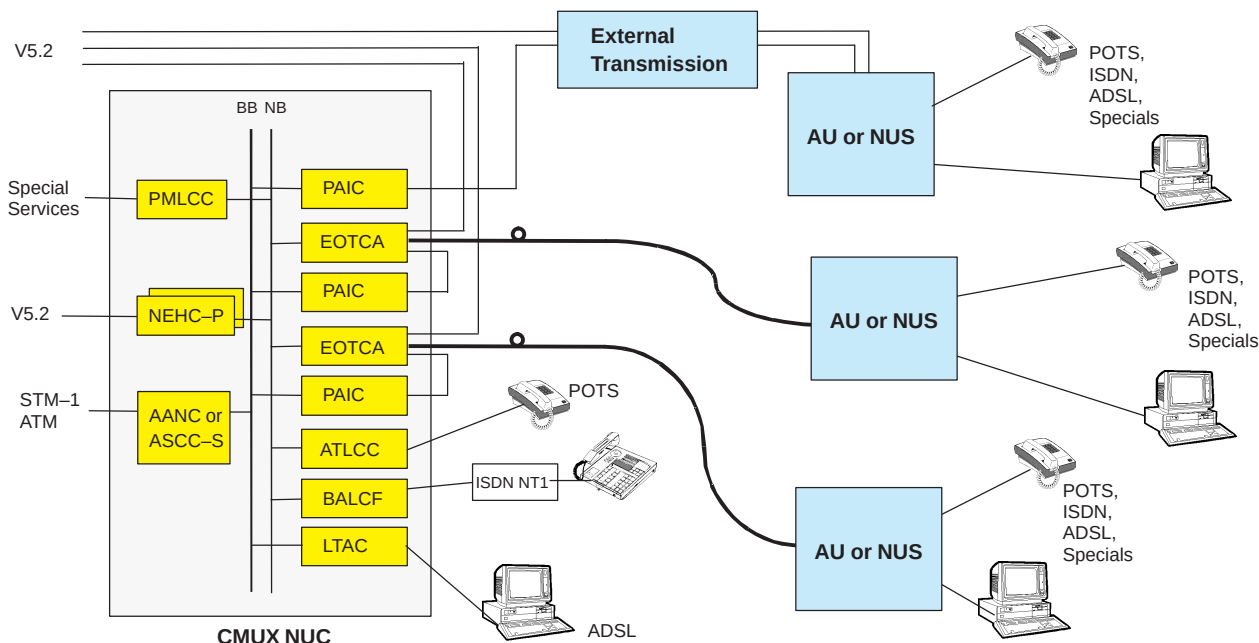


Figure 2–10 Block Diagram – ATM at AU

ATM traffic is carried between the NUC and the AU using Inverse Multiplexing (IMA) using four of the available 16 x 2 Mbit/s links.

- ▶ At the AU:
 - ATM traffic from ADSL line cards (LTAC–C or LTAC–D) is multiplexed by the AICC via the broadband bus.
 - The 4 x 2 Mbit/s IMA links are cabled from the NEHP below the AICC to the EOTP below the EOTCA.
- ▶ At the NUC:
 - The 4 x 2 Mbit/s IMA links are cabled from the EOTP below the EOTCA to the PAIP below the PAIC.
 - The PAIC converts the IMA interface to a single ATM stream which is multiplexed with other ATM traffic via the broadband bus.

2.5.3 NUC with Multiple AU and NUS



Note: LTAC may be LTAC-A, LTAC-C, or LTAC-D

Figure 2–11 NUC with Multiple AU or NUS

This configuration, as shown in Figure 2–11, is a combination of the previous configurations.

Multiple AU and/or NUS are connected to a NUC in a star topology using multiple PDH optical point-to-point bearers.

- If CMUX optical transmission is used and there are ADSL services at an AU or NUS:
 - An EOTCA and a PAIC are required at the NUC for each AU or NUS.
 - An EOTCA and a AICC are required at each AU or NUS.
- If external transmission is used and there are ADSL services at an AU or NUS:
 - A PAIC is required at the NUC for each NUS or AU.
 - The 2 Mbit/s links from the NUC to each NUS or AU are carried by external transmission.
 - An AICC is required at each NUS or AU.

Note PAIC and AICC are not required for narrowband-only systems.

(1) V5.2

Each AU or NUS has one or more separate V5.2 interface(s).

If internal CMUX optical transmission is used, the V5.2 interface links from each AU or NUS are accessed at the NUC via the EOTP below the corresponding EOTCA and routed via the DDF to the exchange V5.2 interface.

V5.2 based services hosted directly by the NUC are supported by separate V5.2 interfaces at the NUC. The links of this interface are accessed via the NEHP below the NEHC–P at the NUC.

(2) Mirror

Special services from each AU or NUS are routed via the narrowband bus of the NUC to the line card supporting the special service. The services are then cross–connected to the appropriate special services network MDF.

(3) ATM

The ATM traffic from each AU or NUS is carried to the NUC in IMA format and converted back to the internal ATM format by a PAIC. The traffic is then multiplexed by the AANC or ASCC–S via the broadband bus.

ATM traffic from ADSL lines hosted directly by the NUC is multiplexed with traffic received from the AUs and/or NUSs.

2.5.4 Multiple Subtended NUS and AU

CMUX can be used to create complex systems which share a single STM-1 connection to the data network. In these complex systems there are:

- ▶ A single Central Network Unit (NUC).
- ▶ One or more Subtended Network Units (NUS).
- ▶ One or more AU.

A typical configuration for broadband services is shown in Figure 2–12. This diagram does not show narrowband connections.

- ▶ In initial CMUX installations all narrowband services will originate from POTS line cards at exchange equipment.
- ▶ Later CMUX installations will use ATLCC (CMUX POTS line cards) to originate POTS services.

ADSL Triplets (one NACC–A plus two LTAC–A), ADSL Twins (one NACC–C plus one LTAC–C), or a LTAC–D/NACC–D combine POTS and ADSL services at NU. ADSL twins or LTAC–D/NACC–D are used in AU.

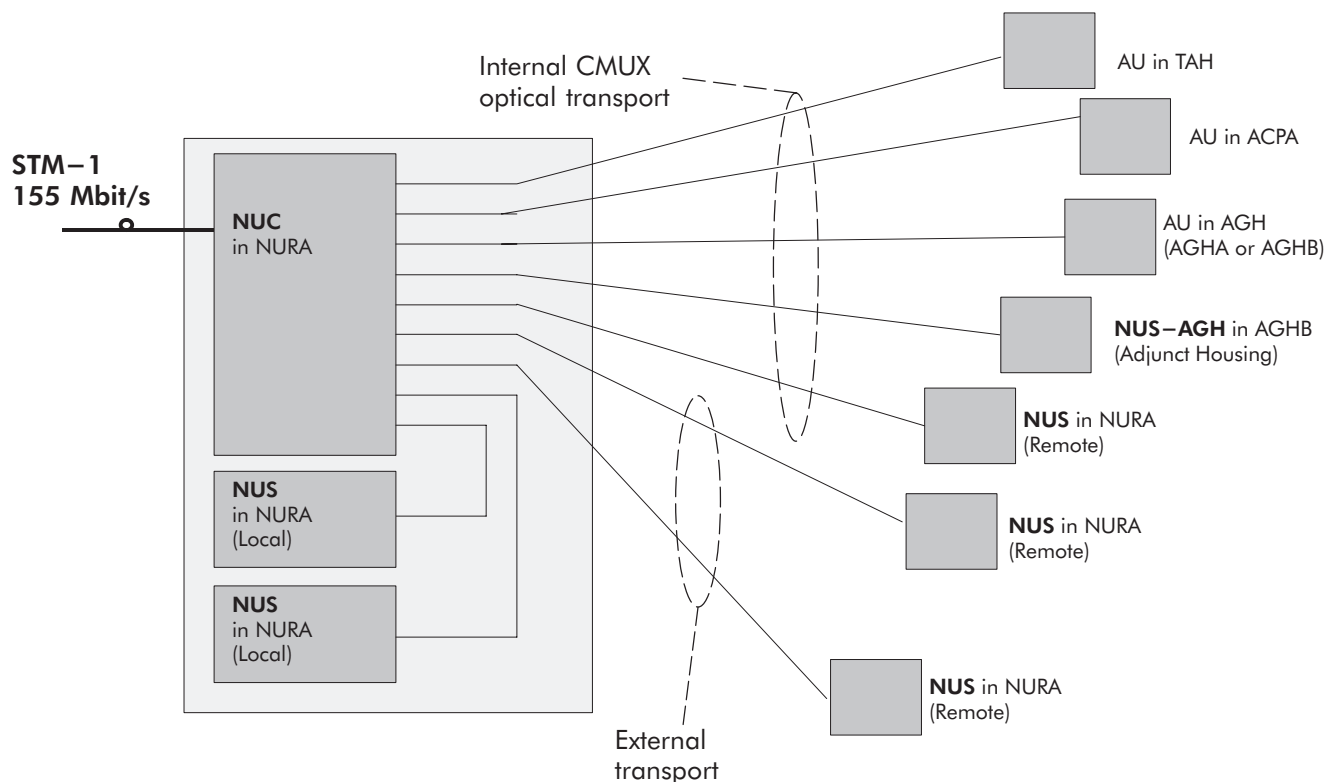


Figure 2–12 Multiple Subtended NU and AU.

(1) NUC

The NUC is located in a NURA in an exchange. The NUC may parent several subtended NUS and/or AU.

NUS may be local (in the same building as the NUC) or remote (in a building at another location).

- ▶ The NUC is fitted with one PAIC for each NUS or AU.
An AICC is fitted to each NUS or AU.
- ▶ An IMA link using up to four 2 Mbit/s links is used to connect each PAIC at the NUC to its associated AICC at a NUS or AU.
 - IMA links may be carried over external transmission.
 - Alternatively they may be carried over CMUX optical transmission using EOTCA cards at each end of the link.

Connection from the NUC to the network is via an STM–1 optical connection (AANC or ASCC–S) or an IMA link (AICC).

(2) NUS (Local)

Local NUS are located in the same Telstra building as the NUC.

- ▶ An IMA link connects the NUS to the parenting NUC. The IMA link is carried over copper via the DDF.
- ▶ A PAIC is required at the NUC for each NUS (local).
- ▶ An AICC is required at each NUS (local).

(3) NUS (Remote)

NUS (Remote) are located in a different Telstra building to the one containing the NUC.

- ▶ An IMA link (up to 4 x 2 Mbit/s) connects the NUC and NUS (remote). This link is carried over CMUX optical transmission.
- ▶ A PAIC is required at the NUS for the IMA link to each subtended NUS (remote).
- ▶ An AICC is required at each NUS (remote) for the IMA link from the NUC.

(4) NUS–AGH

NUS–AGH are located in a AGHB housing equipped as an Adjunct Housing co–located with a RIM/C–RIM containing the NUC.

- ▶ An IMA link (up to 4 x 2 Mbit/s) connects the NUC and NUS–AGH. This link is carried over CMUX optical transmission.
- ▶ A PAIC is required at the NUS for the IMA link to each subtended NUS–AGH.
- ▶ An AICC is required at each NUS–AGH for the IMA link from the NUC.

(5) AU

AU are located in:

- ▶ Above Ground Housings (AGHA or AGHB), or
- ▶ AU Customer Premises Racks (ACPA), or
- ▶ Telstra Access Housings (TAH).

The IMA link between the NUC and the AU is carried via a PAIC/AICC combination and CMUX optical transmission.

2.6 Release Summary

2.6.1 CMUX ANR2.0 NU

(1) CMUX ANR2.0 Phase 1 (BB only)

Initial deliveries were known as CMUX ANR2.0 Phase 1. These were deployed from July 2000.

CMUX ANR2.0 Phase 1 provided internal support for broadband (BB) services only. Within the CMUX the BB services were combined with narrowband services from the exchange.

CMUX ANR2.0 Phase 1 supported the Network Unit Rack (NURA). In CMUX ANR2.0 Phase 1 each NU contained a single MLS–hb.

Items supported in this release are:

- ▶ Subracks
 - MLS–hb
- ▶ Cards
 - AANC
 - AICC
 - LTAC–A
 - NACC–A
 - PAIC
- ▶ Plugs
 - AUXP
 - MBTPB
 - NEHPG
 - PAIP
 - POWP
 - TSPP–A
- ▶ Rack
 - NU Rack

(2) CMUX ANR2.0 Phase 1B (BB only)

CMUX ANR2.0 Phase 1B was deployed in the fourth quarter of 2000. It provided internal support for BB services only. Within the CMUX the BB services were combined with NB services from the exchange. Additional features in CMUX ANR2.0 Phase 1B are:

- ▶ Up to 12 subracks in a CMUX NE (NUC or NUS).
- ▶ BSEC. A BB controller (AICC or AANC) is located in the first subrack. A BSEC is located in each of the other subracks (up to eleven subracks) to extend the BB busses from the previous subrack.

(3) CMUX ANR2.0 Phase 2 (BB and NB)

CMUX ANR2.0 Phase 2 was deployed in the first half of 2002.

The main additional feature in CMUX ANR2.0 Phase 2 is internal support for narrowband (NB) services:

- ▶ CMUX ANR2.0 Phase 2 supports up to 12 subracks in a NE (NUC or NUS).
 - Up to four of these subracks may support NB services.
 - Up to twelve subracks can support BB services.
 - The first three subracks are NB and/or BB.
 - Subracks four to twelve are either NB or BB. They cannot be hybrid (NB and BB).
- ▶ New cards:
 - NEHC–P
 - EOTCA
 - ALLC
 - ATLCC
 - BALCF
 - HLTCA
 - NSEC
 - PMLCC
 - DURCC
 - TACCB
 - TARCB

- ▶ Additional plugs
 - AUXPA
 - AUXPB
 - DURP
 - EOTP
 - LFSPB
 - NEHP
 - PRCPB
 - TARP
- ▶ Internal support for NB services.
 The NB services from CMUX NB line cards are multiplexed with BB services from CMUX BB (ADSL) line cards.

2.6.2 CMUX ANR2.0 AU

CMUX ANR2.0 AU was released in 2002. The main new features in this release is support for the AU, including support for customer premises racks and outdoor housings.

The new items supported are:

- ▶ Access Units
- ▶ Additional housings and racks:
 - ACPA (AU Customer Premises Rack)
 - AGHA (Above Ground Housing).
- ▶ Type 84 Rack Adaptor.

Note *In CMUX systems where ANR2.0 AU was used for Narrowband services, ANR3.2.1 continued to be used for Broadband services.*

2.6.3 CMUX ANR3.2.1 (BB)

CMUX ANR3.2.1 was released in 2002. It was initially deployed in conjunction with the ANR 2.0 narrowband release.

The main new feature in this release is support for high density ADSL cards.

The new items supported are:

- ▶ Subracks
 - MLS–hbe for BB use only.
- ▶ New Cards
 - Long–haul AANC.
 - LTAC–C
12 line ADSL LT card.
 - NACC–C
12 line ADSL filter.
- ▶ New plug
 - DSPP–B:
Dual Slot Position Plug for LTAC–C and NACC–C.
- ▶ New functionality
 - Broadband Controller redundancy (AANC)

Note *In CMUX systems where ANR3.2.1 is used for Broadband services, ANR2.0 Phase 2 continues to be used for Narrowband services.*

2.6.4 MiniMUX

MiniMUX was deployed in early 2003.

MiniMUX uses CMUX technology to provide ADSL services in RIM/C–RIM housings and racks.

- ▶ MiniMUX uses a new subrack, the MLS–sm–T9. This has similar functionality to the MLS–hb, with the following variations:
 - The external dimensions and mechanical practice are similar to RIM/C–RIM Access Panel so it can be installed in a RIM/C–RIM housing or rack.
 - The number of card slots is 5:
 - On controller card slot for the AICC broadband controller.
 - Four line card slots for two ADSL Twins, each of which has one LTAC–C and one NACC–C.
 - New plugs are located in a plug area to the left of the card area.
- ▶ MiniMUX uses the following CMUX cards:
 - AICC
 - LTAC–C
 - NACC–C
- ▶ NGAWS provides BB management
- ▶ Fan alarms are reported to COMNET via the RIM/C–RIM external alarm input.

Note *MiniMUX is described in document 3AU 48730 AAAA TQZZA – MiniMUX Technical Handbook. The AICC, LTAC–C and NACC–C are described in this handbook.*

2.6.5 CMUX ANR3.1 NB

CMUX ANR3.1 NB was released in 2003.

ANR3.1 NB is a narrowband release, deployed in conjunction with the ANR3.2.1 BB release. It builds upon the functionality of ANR 2.0 NB to provide additional narrowband features.

The main new features in this release are:

- ▶ Performance management:
Performance monitoring of ISDN–BRA user ports.
- ▶ Support for narrowband cards in the CMUX Extension (MLS–hbe) subrack.
- ▶ Additional line testing functionality.
- ▶ Batch and scheduled software download.
- ▶ Support for external G.703 transport.

2.6.6 DSAP Plug

The DSAP plug was released in late 2003.

The DSAP is used at an AU to attenuate the ADSL signal to the same level as would be seen on a cable connection from the exchange to the vicinity of the AU. There are five versions of the DSAP with attenuations from 7dB to 35dB.

Features of the DSAP are:

- ▶ Interconnects one LTAC–C and one NACC–C to form an ADSL twin.
- ▶ Pinouts are similar to the DSPP–B
- ▶ Offers ADSL attenuation
- ▶ Is not fitted with bypass relays.

2.6.7 AU in TAH

Support for an AU in a Telstra Access Housing (TAH) was introduced in late 2003.

- ▶ The AU in TAH uses a single NU Rack in a TAH.
- ▶ Two subracks are supported, a Main Subrack (MLS–hb) and an Extension Subrack (MLS–hb or MLS–hbe).
- ▶ An internal cabling harness links POTS and ADSL services.

2.6.8 HBEP and HBMP Plugs

HBEP and HBMP plugs were released in early 2004

These plugs replace the NEHP plugs in new CMUX installations.

2.6.9 FR2.1F BB

The FR2.1F BB release of CMUX was deployed in mid 2004. It builds upon the functions provided in ANR 3.2.1.

The major new features of FR2.1F BB are:

- ▶ Ultra Density ADSL equipment
 - 24 line ADSL line card (LTAC–D)
 - TSCP plug
- ▶ Second generation Broadband Controller (ASCC)
 - Featuring flexible network interface architecture and greater ATM capacity
 - STM–1 Network Interface (ASCC–S) with Long Haul and Short Haul variants.
- ▶ Service Features
 - Extended QoS Capabilities to include VBR and GFR ATM Service Categories
 - Independent setting of QoS for each VC on the same DSL port
- ▶ Service Assurance Features
 - Standards based ATM OAM functions using F4/F5, including inband loopback functions for localising ATM connection faults
 - ATM Layer performance measurements for monitoring ATM traffic and ATM policing functions

2.6.10 AGHB Housing and Adjunct Housing

The AGHB Housing was introduced in early 2005. It is based on the AGHA.

The AGHB may be equipped with either a Standard Cabling Kit or an Adjunct Cabling Kit.

1 AGHB with Standard Cabling Kit

When equipped with the Standard Cabling Kit, the CMUX in the AGHB is an AU. It supports narrowband and broadband services. It is cabled and equipped similarly to the AGHA.

2 AGHB with Adjunct Cabling Kit

When equipped with the Adjunct Cabling Kit, the CMUX in the AGHB is a NUS–AGH.

- A housing equipped with the Adjunct Cabling Kit is known as an Adjunct Housing.
- The Adjunct Housing is co–located with an existing RIM or C–RIM housing.
- All line cards are LTAC–D.
- Narrowband services are provided by a co–located RIM/C–RIM.
- Narrowband line cards are not installed in the CMUX Adjunct Housing.

3 Architecture

3.1 CMUX Overview

3.1.1 Introduction

CMUX is a flexible access platform for providing a wide range of customer services, including switched and non-switched narrowband services, as well as broadband services.

- ▶ Initial deliveries of CMUX ANR2.0 were for accelerated deployment of ADSL. These deliveries are known as CMUX ANR2.0 Phase 1.

CMUX ANR2.0 Phase 1 internally only supports ADSL services. It does not internally support any narrowband services, however it does multiplex ADSL originating from CMUX ADSL cards with narrowband services originating from other equipment.

- ▶ CMUX ANR2.0 Phase 1B was deployed in the fourth quarter of 2000. Phase 1B introduced the BSEC, allowing a single CMUX NE (NUS or NUC) to have up to 12 subracks.
- ▶ Later deliveries of CMUX ANR2.0 have internal support for both narrowband services and broadband services. These deliveries are known as CMUX ANR2.0 Phase 2.
- ▶ CMUX ANR3.2.1 was released in the first half of 2002. Main new items introduced include:
 - High density ADSL cards (LTAC-C and NACC-C)
 - DSPP-B
 - Long haul AANC
 - MLS-hbe.
 - Redundant AANC-A broadband controller.
- ▶ MiniMUX was released in early 2003. It provides ADSL services in RIM/C-RIM housings and racks. New items introduced were:
 - MLS-sm-T9 subrack
 - T9IPA controller plug
 - T9APA access plug.

- ▶ CMUX ANR3.1 was introduced in mid 2003. This is a narrowband release, deployed in conjunction with the CMUX ANR3.2.1 broadband release. New features include:
 - Performance management: Performance monitoring of ISDN–BRA user ports.
 - Support for narrowband cards in the CMUX Extension (MLS–hbe) subrack.
 - Additional line testing functionality.
 - Batch and scheduled software download.
 - Support for external G.703 transport.

- ▶ The DSAP plug was released in late 2003.
 The DSAP is used at AU to attenuate the ADSL signal to the same level as would be seen on a cable connection from the exchange to the vicinity of the AU. There are five versions of the DSAP with attenuations from 7dB to 35dB.
 - It is used with one LTAC–C and one NACC–C to form an ADSL twin.
 - It has similar pinouts to the DSPP–B
 - Offers ADSL attenuation
 - Is not fitted with bypass relays.

- ▶ AU in TAH
 Support for an AU in a Telstra Access Housing (TAH) was introduced in late 2003.
 - The AU in TAH uses a single NU Rack in a TAH.
 - Two subracks are supported, a Main Subrack (MLS–hb) and an Extension Subrack (MLS–hb or MLS–hbe).
 - An internal cabling harness links POTS and ADSL services.

► FR2.1F

FR2.1F BB was introduced in Mid 2004.

New features include:

- LTAC–D
 - The LTAC–D supports 24 ADSL lines.
 - The LTAC–D is a double width card.
 - External connections are via a TSCP plug in ACPA and AGHA, and via PRCPB plug in NURA.
- The ASCC–S broadband controller card was introduced with the LTAC–D.

► AGHB Housing and Adjunct Housing

The AGHB Housing and Adjunct Housing were introduced in early 2005.

- The AGHB housing is based on the AGHA with modified cabling to support the additional broadband services in the Main Subrack.
- The Adjunct Housing utilises an AGHB. The Adjunct Housing is co–located with an existing RIM or C–RIM housing.
 - All line cards are LTAC–D.
 - Narrowband services are provided by the RIM/C–RIM. Narrowband line cards are not installed in the Adjunct Housing.

Note *This chapter outlines the broadband and narrowband architecture for:*

- *All broadband releases up to FR2.1F*
- *All narrowband releases up to ANR3.1.*
- *For additional details about ADSL see Chapter 4 – ADSL Architecture.*

3.1.2 CMUX Network Architecture

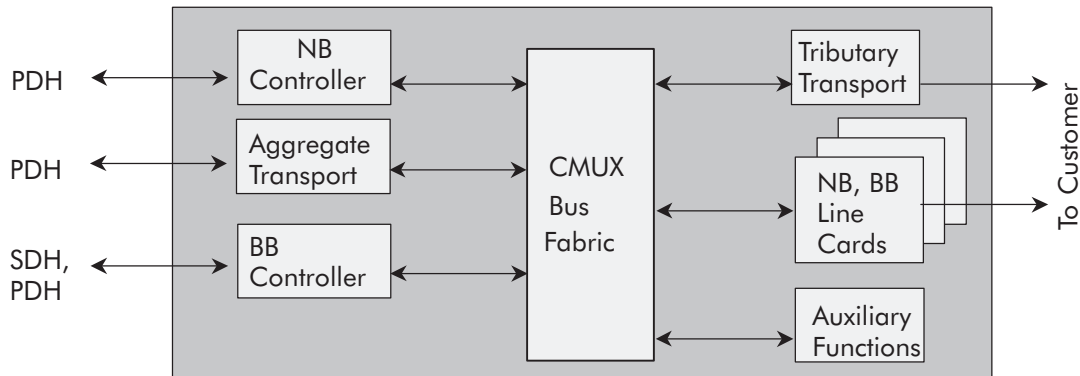


Figure 3–1 CMUX NU Reference Diagram

The basic deployable entity of CMUX is a single Network Element (NE) which provides a range of NB and BB services. A CMUX NE has from one to twelve subracks.

A CMUX NE has line cards for customer services, plus a range of network interfaces and transport options.

Groups of CMUX NEs can be deployed. The CMUX network architecture has a star topology (Figure 3–2).

- ▶ The NUC is located in exchange premises. It provides connections to the various core network interfaces.
- ▶ Multiple AU, MiniMUX and/or NUS can be connected to each NUC via individual point to point connections.
- ▶ AU equipment can be installed in exchanges and housings.
- ▶ NUS are located in exchange premises and parented by NUC.
- ▶ NUS–AGH are installed in an AGHB housing co–located with a RIM or C–RIM.
- ▶ MiniMUX functions similarly to a NUS. MiniMUX is installed in RIM/C–RIM housings and racks.
- ▶ Transmission between a NUC and AUs or NUSs consists of 16 x 2 Mbit/s connections for all services.
 - NUC to AU links and NUC to NUS–AGH links are via CMUX optical transmission.
 - Links from NUC to NUS are via external transmission.
 - NUC to MiniMUX links use RIM/C–RIM transmission.
- ▶ Auxiliary functions include ringing, line testing and external alarm collection.

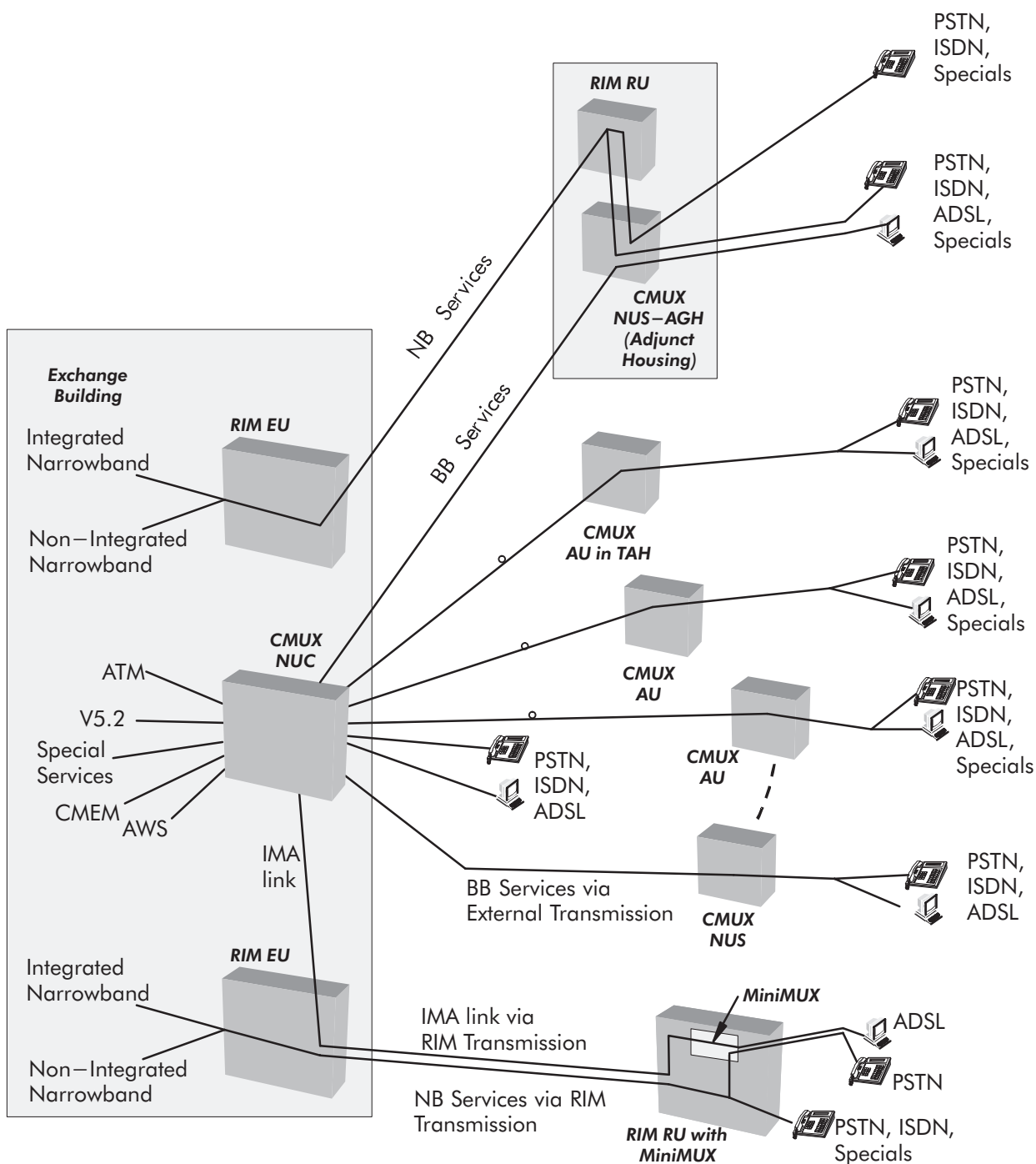


Figure 3-2 CMUX and MiniMUX – Typical Topologies

- Note** *CMUX ANR3.1 supports subtended NB services at the AU.*
- MiniMUX provides ADSL services in RIM/C–RIM housings and uses RIM/C–RIM transmission.*
- AU in TAH provides CMUX NB and/or BB services in a Telstra Access Housing (TAH)*
- NUS–AGH in Adjunct Housing (AGHB with Adjunct Cabling Kit) is co–located with a RIM/C–RIM. BB cards are located in the CMUX housing, NB cards in the RIM/C–RIM housing.*
- A CMUX in an Adjunct Housing is co–located with a RIM/C–RIM.*
- *NB services are provided by the RIM/C–RIM*
 - *BB services are provided by the CMUX.*

3.1.3 CMUX Bus Architecture

The backplane of subracks incorporate a number of busses to facilitate communication between the various plug-in cards. The bus architecture is shown in Figure 3–3, and a description of each bus is provided below.

Note Some bus functions are not used in current CMUX releases, however the subracks will support the use of these bus functions in a future release of CMUX.

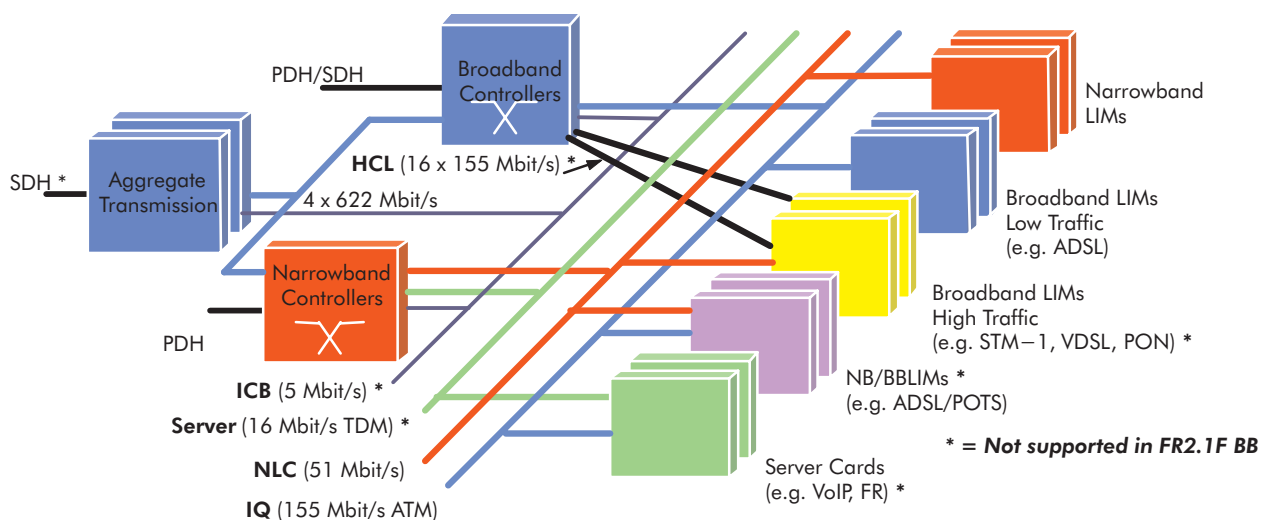


Figure 3–3 CMUX Bus Architecture

(1) Narrowband Bus (NLC)

Narrowband services use the NLC bus. This is a bi-directional, point to multi-point time division multiplex bus operating at 51 Mbit/s. It has 810 timeslots for providing connections between cards which can be used for traffic, signalling or OA&M as required.

Basic communication between the Narrowband Controller (NEHC-P) and other cards is achieved by a multi-point HDLC based channel carried via a single timeslot. The NLC bus is part of a distributed cross-connection matrix.

The NEHC-P allocates timeslots for connections between itself and other cards. When a cross-connection is required, the NEHC-P communicates the selected timeslot to the relevant card, and the connection is then established. Each card has access to all timeslots.

A bus extension facility can extend the bus from the first subrack at an NE (NU or AU) to the other subracks in the same NE.

The speed and capacity of the bus is unchanged with the system functioning as a single logical Network Element (NE) spread over multiple physical subracks. The first subrack in the NE is accessed via the NEHP or HBMP/HBEP. Each subsequent subrack in the NE is equipped with an NSEC to control the NLC bus within the subrack.

(2) Broadband Bus (IQ)

For broadband applications, a shared cell based 155Mbit/s ATM bus is provided to each universal line card slot. This bidirectional point to multi-point broadband bus is known as the IQ bus.

Multiple priorities are supported on the IQ bus to guarantee QoS for different services.

The IQ bus is extended from the first subrack to the other subracks in a NU or AU.

- ▶ A broadband controller card (AANC, ASCC-S, or AICC) is required in the broadband controller card slot in the first subrack in an NU or AU.
- ▶ A BSEC is required in the broadband controller slot in each of the other subracks in the NU or AU.
- ▶ The IQ bus extension is accessed via the NEHP or HBMP/HBEP.

(3) High Capacity Links (HCL)

When using shared TDM and ATM busses the total bandwidth could become a bottleneck for heavy broadband users. A dedicated HCL bus is provided to make the CMUX 'future-safe'.

The HCL bus provides multiple point to point connections from the Broadband Controller card to each of the universal line card slots. Each of the HCL links is bidirectional operating at 155 Mbit/s providing up to 155 Mbit/s throughput for each line card.

The HCL bus is not used in current CMUX releases.

(4) Server Bus

The server bus is a special purpose bus which is available in the first four universal line card slots. This bus provides an additional 16 Mbit/s bandwidth for TDM server pool applications, such as Voice over IP (VoIP), Securitel and Frame Relay (FR).

The server bus is not used in current CMUX releases.

(5) Line Test Bus

The Line Test Bus provides a connection between the line test card (TACCB) and the customer line to be tested. Separate connections are provided for outwards tests (towards the customer) and inwards tests (towards the line circuit).

Line cards are equipped with test relays for providing the connections between the line under test and the line test bus. The line test bus is extended between subracks so that a single test card can access all lines of a system.

The line test bus is extended from the main subrack to NB extension subracks via the AUXPA and AUXPB and interconnecting cables

(6) Inventory Access Bus (IAB)

The Inventory Access Bus (IAB) is used by the Narrowband Controller (NEHC-P) to access the remote inventory data stored in RI memory of each card that it manages. A separate IAB is used for collecting RI and alarm status from external equipment such as the power equipment of a remote housing.

(7) Hardware Management Wires (HWM)

The Hardware Management Wires (HWM) form a bus which is used by controller cards to detect the presence of cards to be managed and to execute hardware control functions.

Card detection is used to provide auto-discovery of new cards in a subrack.

A controller card is able to use HWM to individually reset a card it is managing. This completely resets that card's hardware.

The Hardware Management Wires are extended between subracks as part of NLC and IQ extension.

(8) Ring Bus

The Ring Bus distributes the ring voltage from the ringer generator (DURCC) to POTS line cards. Each line card requiring ring applies it to the customer's line by a ring relay.

Ring Bus extension is provided by the AUXP.

(9) Internal Control Bus (ICB)

The ICB is an internal management bus between the narrowband controller (NEHC-P), the broadband controller (AANC, ASCC-S, or AICC) and aggregate transport. The bus supports a half-duplex multipoint-to-multipoint transmission, at up to 5 Mbit/s.

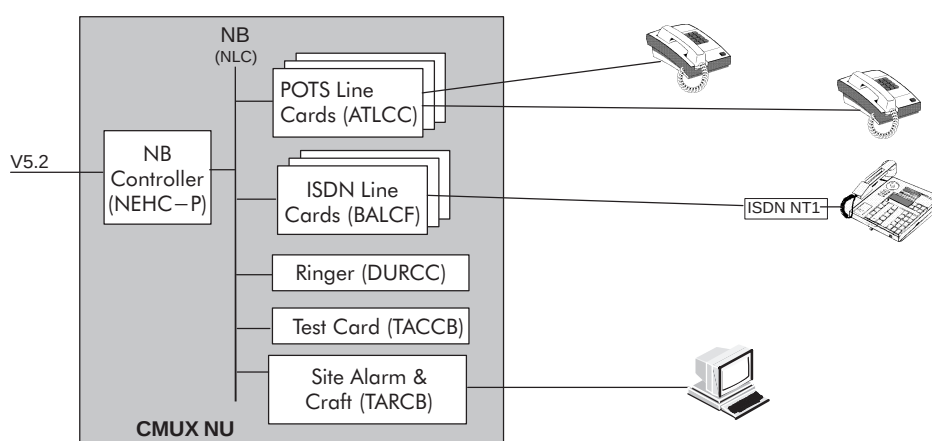
The ICB is not used in current CMUX releases.

3.1.4 Narrowband Architecture

(1) NU Based Services

A CMUX can be used as a single Network Element (NE) to provide a range of V5.2 switched narrowband services directly from an exchange, as shown in the figure below.

The Narrowband Controller (NEHC–P) is the main processor card within the system, providing all management functions as well as up to sixteen V5.2 interfaces towards the LE.



Note: Ring Bus and Line
Test Bus not shown

Figure 3–4 Typical Narrowband Services from an NU

POTS and ISDN customer services are supported by their respective line cards (ATLCC and BALCF), which support 30 and 16 lines respectively.

Line cards are responsible for low level functions. The NEHC–P handles high level functions. For example, when an ATLCC detects an off–hook state, the event is passed to the NEHC–P, which establishes a connection between it and the ATLCC via the NLC bus, and passes the appropriate V5 message to the LE.

Ring signal and line test functions are provided by separate cards - DURCC and TACCB respectively. Separate busses are provided for distributing ring signal to line cards, and for providing access for line testing.

(2) NU and AU

As well as providing narrowband services directly from an NU, they can be provided from a subtended AU, as shown in Figure 3–5.

Each AU provides a separate V5.2 interface which is transported to the NU, where the V5.2 links are connected directly to the V5.2 interface of the LE. If required, multiple V5.2 interfaces may be provisioned within an AU, transported to the NU and connected to separate V5.2 exchange interfaces.

Customer services are associated with a particular V5.2 interface to provide number portability or to access required supplementary services.

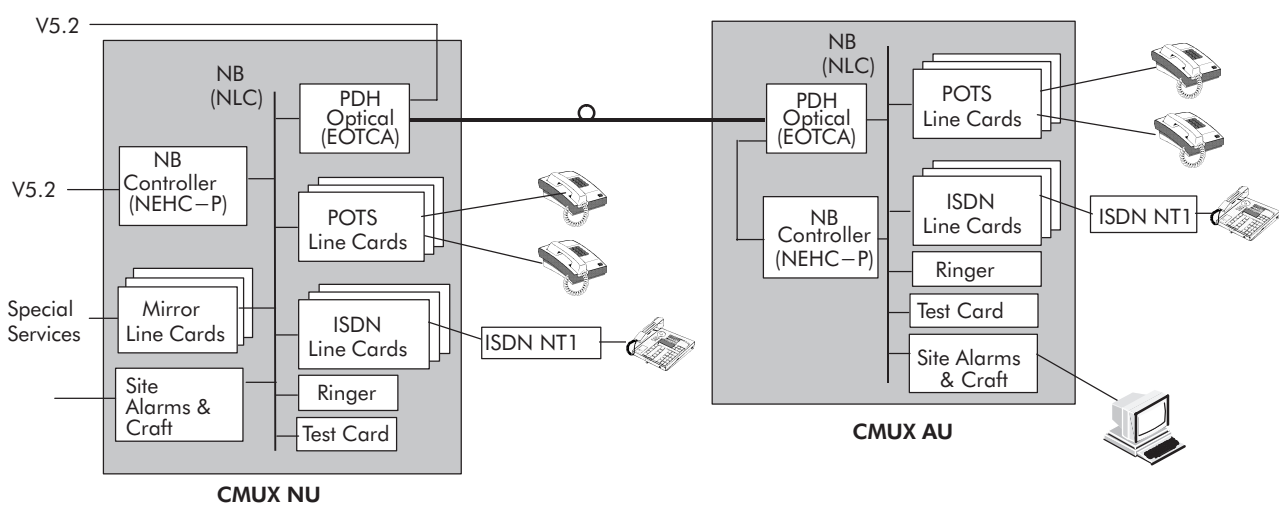


Figure 3–5 Typical Narrowband Services from NU and AU

Special services can be supported in mirror (non-integrated) mode between AU and the NU using separate 2 Mbit/s links.

In the NU, mirror services are passed from the optical transport card (EOTCA) via cabling to the NEHC-P, and then via the NLC bus to the appropriate mirror line card.

Note CMUX ANR2.0 NU and later support subtended BB services. Support for subtended NB services at an AU are provided by CMUX ANR3.1 AU.

3.1.5 Broadband Architecture

In addition to supporting an extensive range of narrowband services, CMUX also supports broadband services, incorporating the functions of a DSLAM.

ADSL services are typically carried over a customer line which is also used for providing a POTS service. The POTS service may be provided by a POTS card of CMUX or from a co-located narrowband switch.

Figure 3–6 below shows the basic modules for supporting an ADSL service with the associated POTS service being provided by an external NB switch.

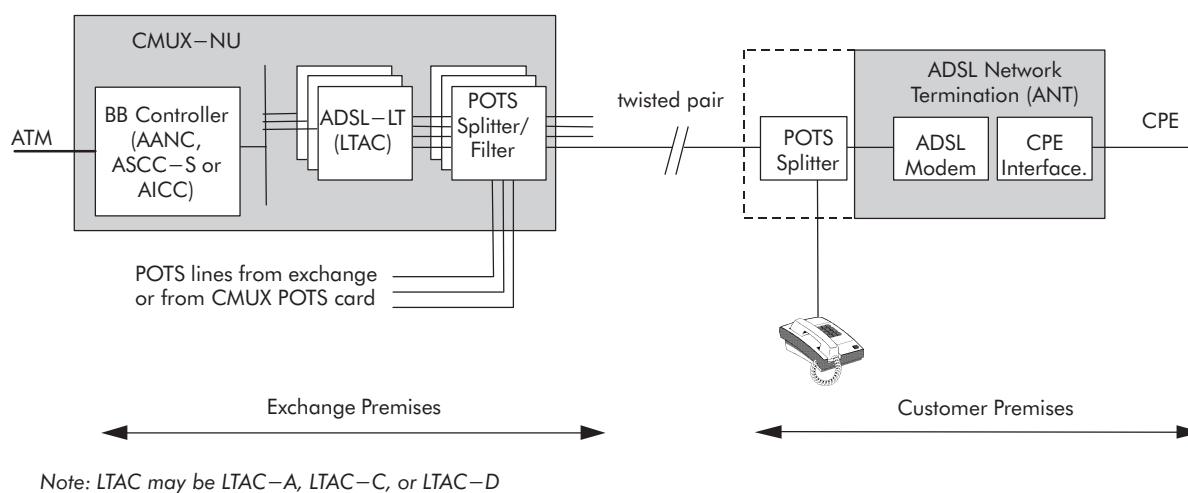


Figure 3–6 Functional Reference – ADSL Services at NU

(1) POTS Splitting

Spectral discrimination between the POTS and ADSL frequency ranges is performed in CMUX by the POTS Splitter (NACC) and the Line Termination ADSL Card (LTAC).

- ▶ The NACC (NACC-A, NACC-C) or the splitter daughterboard on the LTAC-D has a low-pass filter which passes POTS signals and blocks ADSL.
- ▶ The LTAC (LTAC-A, LTAC-C, or LTAC-D) has a high-pass filter which blocks POTS and passes ADSL data.

(2) Line Termination of the ADSL Customer Lines

LTAC cards are connected to the IQ bus.

- ▶ LTAC–A cards support four lines.
- ▶ LTAC–C cards support twelve lines.
- ▶ LTAC–D cards support 24 lines.

(3) Concentration/Multiplexing to ATM Backbone

The concentration function is implicitly realised by the access mechanism to the IQ bus. The IQ bus runs at a physical speed of 155.52 Mbit/s in each direction. The ATM cell format complies with ITU and ATMF standards.

A sophisticated Quality of Service (QoS) aware multiplexing scheme governs the CMUX IQ bus. This enables the combination of a high concentration factor with the guarantee of safeguarding the individually negotiated QoS requirements in a complex mix of traffic and QoS profiles.

The IQ bus architecture is able to accommodate all relevant QoS classes currently defined by the ATM Forum Traffic Management specifications. The QoS architecture of CMUX also allows generic support of QoS classes beyond the current set.

(4) Broadband Controller (BBCC)

Network adaptation is performed by the broadband controller, such as the AANC, ASCC–S, or AICC.

IQ bus modularity enables the termination of a wide range of different physical interfaces towards the ATM backbone by equipping the appropriate controller card.

The Network Termination forms the interface between the CMUX and a broadband backbone network. It terminates the transport system and ATM layer handling. It also concentrates management information of all the connected ADSL LTs and ADSL NTs.

(5) Network Interfaces

Network interfaces supported by CMUX are:

- ▶ STM-1
 - short haul optical
 - AANC variant AAxx
 - ASCC-S variant SBAA
 - long haul optical
 - AANC variant ACxx
 - ASCC-S variant SAAA
- ▶ 4 x E1 using ATM Forum IMA standard (AICC).
- ▶ SDH. A future release will use the SYNTH card (compact SDH Add/Drop Multiplexer) and PRCC card to transport IMA links to the AU or NUS. The broadband controller is the AICC.

(6) Subtending Architecture

CMUX supports ADSL directly from a NUC. It's subtending architecture also provides ADSL services from NUS and AU.

ATM traffic from each AU or NUS is carried to a NUC over multiple 2 Mbit/s streams using Inverse Multiplexing (IMA). This allows PDH or external transport to conveniently carry NB and BB services.

PAICs in the NUC bridge IMA streams and the IQ bus. ATM traffic from multiple NUS and AU is multiplexed via the IQ bus with traffic from LTACs in the NUC, and then forwarded to the ATM network via the NT (AANC, ASCC-S or AICC).

IMA Link – External Transmission

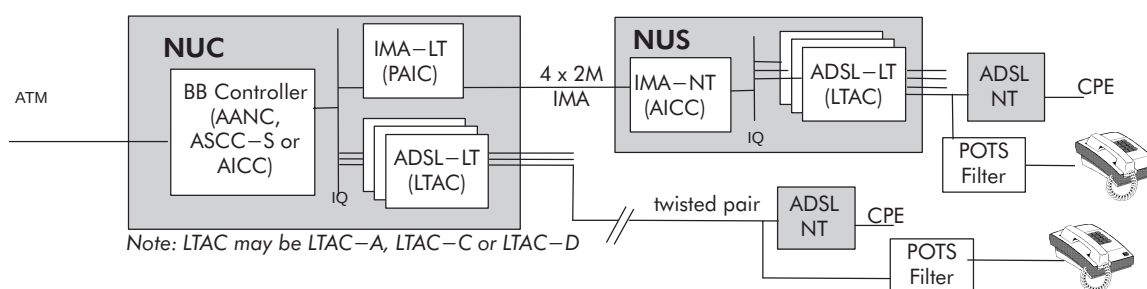


Figure 3-7 Subtending Architecture – NUC to NUS

- ▶ IMA links from a NUC to a NUS in the same building are carried over direct electrical connections via the DDF.
- ▶ IMA links from a NUC to a NUS in a different building are carried over external transmission.

IMA links from a NUC to an AU use optical transmission.

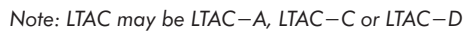


Figure 3–8 Subtending Architecture – NUC to AU

3.2 Subracks, Cards, and Plugs

This section outlines the subracks and cards that comprise the CMUX system.

- ▶ Detailed descriptions of subracks are given in Chapter 6 – *Subracks*.
- ▶ Individual cards are described in the various cards chapters.
- ▶ MiniMUX uses CMUX cards, together with new subracks and plugs. For details see the *MiniMUX Technical Handbook*.

3.2.1 Subracks

There are two types of subracks which can be used at either the NU or AU to support the full range of functions.

These are:

- ▶ MLS–hb.
In previous releases the MLS–hb was named CMUX Main Panel.
- ▶ MLS–hbe.
In previous releases the MLS–hbe was named CMUX Extension Panel.

A CMUX NU or AU can be an assembly of up to twelve subracks. The assembly of twelve subracks behaves as a single NU or AU.

The broadband and narrowband busses are extended from the first subrack in the assembly to the subsequent subracks in the assembly.

- ▶ The main subrack (first subrack in a CMUX NU or AU) is always a MLS–hb.
- ▶ Other subracks in a CMUX NU or AU are extension subracks. These may be either MLS–hbe, or alternatively may be MLS–hb equipped with extension controllers.
- ▶ Up to four subracks in an NU or AU may be narrowband and/or broadband. The other subracks are broadband only.

Note *For details of subrack types, usage and terminology, refer to Chapter 6 – Subracks of this handbook. That chapter also defines the permitted sequencing of MLS–hb and MLS–hbe.*

3.2.2 Controller Cards

(1) AANC – STM–1 NT Broadband Controller

The AANC is a broadband network termination card which provides an STM–1 interface towards the network, as well as managing the configuration and supervision of the broadband line cards.

The AANC multiplexes ATM traffic from ADSL line cards onto a single STM–1 interface to the ATM network. The AANC is typically located at the CMUX NU.

There are two versions of the AANC. These have differing optical interfaces to provide different ranges. Otherwise they have the same functionality.

- ▶ The Short Haul AANC is supported by CMUX ANR2.0 Phase 1 and later releases.
- ▶ The Long Haul AANC is supported by ANR3.2.1 and later releases.

(2) AICC – ATM Inverse Mux Broadband Controller

The AICC is a broadband controller card. It uses multiple 2 Mbit/s interfaces to carry ATM traffic. The card also manages the configuration and supervision of ADSL line cards.

Inverse Multiplexing according to ATMF IMA specification carries ATM over 4 x 2 Mbit/s interfaces towards the network.

Management information is transported to the network through inband ATM signalling.

The AICC is supported by CMUX ANR2.0 Phase 1 and later releases.

(3) ASCC–S

The ASCC–S is a broadband network termination card which provides an STM–1 interface towards the network, as well as managing the configuration and supervision of the broadband line cards.

The ASCC–S multiplexes ATM traffic from ADSL line cards onto a single STM–1 interface to the ATM network. The ASCC–S is typically located at the CMUX NU.

There are two versions of the ASCC–S. These have differing optical interfaces to provide different ranges. Otherwise they have the same functionality.

The ASCC–S is supported by Release FR2.1F and later releases.

(4) BSEC – Broadband Shelf Extender Card

The BSEC extends broadband functions from the first subrack at a NU or AU to the second and subsequent subracks in the same NE.

The BSEC receives the IQ Bus extension from the previous subrack via the NEHP or HBMP/HBEP, and acts as the master of the IQ bus within the subrack in which it is located. It also provides control of cards via the Hardware Management Wires (HMW) and collects the Remote Inventory (RI) data of broadband cards within the subrack.

The BSEC is supported by CMUX ANR2.0 Phase 1B and later releases.

(5) NEHC–P – Narrowband Controller

The NEHC–P is the narrowband system controller. It provides the management functionality for the narrowband, transport and auxiliary cards in the subrack, including fault, configuration and software management.

The NEHC–P also provides the narrowband signal processing, V5.2 signalling termination, traffic routing and clock distribution functions.

The NEHC–P is supported by CMUX ANR2.0 Phase 2 and later releases.

(6) NSEC – Narrowband Shelf Extender Card

The NSEC extends narrowband functions from the first subrack in the NU or AU to the second and subsequent narrowband subracks in the same NE.

The NSEC receives the NLC Bus extension from the previous subrack via the NEHP or HBMP/HBEP, and acts as the master of the NLC bus within the subrack in which it is located. It also provides control of cards via the Hardware Management Wires (HMW) and collects the Remote Inventory data of narrowband cards within the subrack.

The NSEC is supported by CMUX ANR2.0 Phase 2 and later releases.

3.2.3 Transport Cards

(1) EOTCA – PDH Optical Transport

The EOTCA is an optical transport card for carrying 16 x 2 Mbit/s between the CMUX NUC and AU, and between CMUX NUC and NUS–AGH.

It uses a standard PDH multiplexing hierarchy over an optical interface. An overhead OA&M channel is provided for transporting management information over the optical link using spare bits in the optical line code.

The EOTCA is supported by CMUX ANR2.0 Phase 2 and later releases.

3.2.4 Narrowband Line Cards

Narrowband cards are supported by CMUX ANR2.0 Phase 2 and later releases.

(1) ALLC – Analogue Leased Line Card (2W/4W (+ E&M))

The ALLC supports various types of Leased Line services. It provides 8 customer lines which may be 2W or 4W VF, with or without E&M signalling. The ALLC is typically used to provide 6W Tie Lines between PABXs. The ALLC card is equipped in any LIM slot at an NU or AU.

Customer interfaces are physically accessed via the LFSPB plug located below the ALLC in the plug area of the subrack.

(2) ATLCC – 30 Line POTS Card

The ATLCC is a 30 line POTS line card which provides 2–wire VF interfaces for customer lines.

Customer lines are physically accessed via the LFSPB in the plug area of the subrack.

(3) BALCF – ISDN BA line card

The BALCF provides the interface for connection to an ISDN Basic Access NT. Each BALCF provides 16 customer lines. These are physically accessed via the LFSPB in the plug area of the subrack.

(4) HLTCA – HDSL line card

The HLTCA is an HDSL–LT and provides the interface for connection to an HDSL–NT. Each HLTCA has line pairs for HDSL based services. These can provide either four single–pair customer interfaces, or two customer interfaces which use two pairs each.

External connections on the HLTCA are physically accessed via an PRCP located below the HLTCA in the plug area of the subrack.

(5) PMLCC – POTS mirror line card

The POTS Mirror Line Card (PMLCC) supports mirror mode (non–integrated) POTS, reverse POTS and Indial services. The card is equipped in LIM slots in an NU or AU.

Each PMLCC provides 16 line circuits. These are physically accessed via the LFSPB in the plug area of the subrack.

3.2.5 Broadband Cards

(1) LTAC–A – ADSL Line Termination Card

The LTAC–A is a broadband line card that provides Line Termination (LT) functions for four ADSL lines.

Each of these LTs allows bidirectional access to an ADSL Network Termination over conventional twisted pair cable, which may already be in use for POTS service.

ADSL traffic from the subscriber lines is transported between the LTAC–A and the broadband controller (AICC, AANC, or ASCC–S) via the IQ bus of the subrack. The broadband controller provides the connection to the ATM network.

The LTAC–A extracts and inserts ATM cells from and to the IQ bus. By using a DMT (Discrete Multi Tone) approach it converts these cells to a bandpass signal that can be sent over a subscriber line. On this subscriber line the DMT modulated ATM cells are frequency multiplexed with the analogue POTS service.

Two LTAC–A cards are used in conjunction with one NACC–A. This is because each LTAC–A supports four lines, while the NACC–A is an 8 line card.

The NACC–A removes the ADSL signals from the subscriber line towards the POTS line circuit. The TSPP–A plug is used to provide inter–connections between the LTAC–A cards, the NACC–A, the POTS line card and the customer lines.

The LTAC–A is supported by CMUX ANR2.0 Phase 1 and later releases.

(2) LTAC–C – ADSL Line Termination Card

The LTAC–C is a broadband line card that provides Line Termination (LT) functions for twelve ADSL lines.

Each of these LTs allows bidirectional access to an ADSL Network Termination over conventional twisted pair cable, which may already be in use for POTS service.

ADSL traffic from the subscriber lines is transported between the LTAC–C and the broadband controller (AICC, AANC or ASCC–S) via the IQ bus of the subrack. The broadband controller provides the connection to the ATM network.

The LTAC–C extracts and inserts ATM cells from and to the IQ bus. By using a DMT (Discrete Multi Tone) approach it converts these cells to a bandpass signal that can be sent over a subscriber line. On this subscriber line the DMT modulated ATM cells are frequency multiplexed with the analogue POTS service.

One LTAC–C is used in conjunction with a NACC–C as the NACC–C is also a twelve line card.

The NACC–C removes the ADSL signals from the subscriber line towards the POTS line circuit. A DSPP–B or a DSAP plug is used to provide inter–connections between the LTAC–C, the NACC–C, the POTS line card and the customer lines.

The LTAC–C is supported by CMUX ANR3.2.1 and later releases.

(3) LTAC–D – ADSL Line Termination Card

The LTAC–D is a broadband line card that provides Line Termination (LT) functions for 24 ADSL lines. It is two slots wide.

Each of these LTs allows bidirectional access to an ADSL Network Termination over conventional twisted pair cable, which may already be in use for POTS service.

ADSL traffic from the subscriber lines is transported between the LTAC–D and the broadband controller (AICC, AANC, or ASCC–S) via the IQ bus of the subrack. The broadband controller provides the connection to the ATM network.

The LTAC–D extracts and inserts ATM cells from and to the IQ bus. By using a DMT (Discrete Multi Tone) approach it converts these cells to a bandpass signal that can be sent over a subscriber line. On this subscriber line the DMT modulated ATM cells are frequency multiplexed with the analogue POTS service.

A splitter daughterboard is mounted on the LTAC–D mainboard. This removes the ADSL signals from the subscriber line towards the POTS line circuit. A TSCP or a PRCPB plug is used to provide connections for the LTAC–D and the splitter for the POTS line card and the customer lines.

The LTAC–D is supported by Release FR2.1F BB and later releases.

(4) NACC–A – Narrowband ADSL Combiner Card

The NACC–A, in conjunction with a TSPP–A plug and two LTAC–A cards, is used to combine a POTS service and an ADSL service on a single line. Each NACC–A supports up to 8 POTS lines.

The primary function of the NACC–A is to filter the ADSL signals from the customer line so that a pure POTS signal can be created. The pure POTS signal is presented to the TSPP–A for connection to narrowband line termination equipment.

The NACC–A provides the following interface via the TSPP–A located in the plug area of the subrack:

- ▶ Eight subscriber lines physically connected via the TSPP–A (TN12 impedance matched). The subscriber lines contain both POTS and ADSL signals frequency division multiplexed together.
- ▶ Eight POTS only lines for connection to an MDF or a CMUX narrowband line card.

The NACC–A is supported by CMUX ANR2.0 Phase 1 and later releases.

(5) NACC–C – Narrowband ADSL Combiner Card

The NACC–C, in conjunction with a DSPP–B plug or a DSAP plug and a LTAC–C, is used to combine a POTS service and an ADSL service on a single line. Each NACC–C supports up to twelve POTS lines.

The primary function of the NACC–C is to filter the ADSL signals from the customer line so that a pure POTS signal can be created. The pure POTS signal is presented to the DSPP–B or DSAP for connection to narrowband line termination equipment.

The NACC–C provides the following interface via the DSPP–B or DSAP located in the plug area of the subrack:

- ▶ Twelve subscriber lines physically connected via the DSPP–B or DSAP (TN12 impedance matched). The subscriber lines contain both POTS and ADSL signals frequency division multiplexed together.
- ▶ Twelve POTS only lines for connection to an MDF or a CMUX narrowband line card.

The NACC–C is supported by CMUX ANR3.2.1 and later releases.

(6) PAIC – ATM Inverse Mux Line Termination

The Primary rate ATM Interface Card (PAIC) performs Line Termination function using multiple 2 Mbit/s IMA interfaces for carrying ATM traffic. Inverse Multiplexing is used to carry ATM over 4 x 2 Mbit/s links.

The PAIC extends ATM traffic from an NUC to an AU or NUS via a PDH interface, such as an EOTCA or external transmission. The PAIC is paired with an AICC located in the AU or NUS.

The PAIC is supported by CMUX ANR2.0 Phase1 and later releases.

3.2.6 Auxiliary Cards

(1) DURCC – Dual Ring Generator

The DURCC generates the necessary sine-wave ring voltage to be superimposed on the POTS lines. The DURCC can be mounted in any LIM slot of a subrack, and occupies two slots.

The DURCC has on-board 1 + 1 redundancy, with two separate and independent ring generators each providing ring.

The DURCC is supported by CMUX ANR2.0 Phase 2 and later releases.

For further information on the DURCC, refer to Section 12.1. That section also describes the valid DURC locations in an NU or AU.

(2) TACCB – Test Access Control Card

The TACCB provides detection and diagnosis of faults on customer's lines, customer's equipment and line circuits of the subrack.

Separate test busses are provided for inward tests (towards equipment) and outward tests (towards customer line). These pass via the subrack backplane to each line slot. Each line card which supports line testing is equipped with test relays for connecting the line under test with the test bus.

The TACCB is supported by CMUX ANR2.0 Phase 2.

(3) TARCB – Alarm Card

The TARCB collects alarms raised by internal or external equipment, including the CMUX Housings.

Urgent (U), Non-Urgent (NU) and Attended (ARA) system alarms are indicated via LEDs on the front of the TARCB. These are also provided as alarm outputs to drive rack alarms, and can be physically accessed via the TARP, which is located below the TARCB in the front access section of the subrack.

The TARCB provides for up to eight external alarm inputs, accessed via the TARP.

The TARCB is supported by CMUX ANR2.0 Phase 2.

3.2.7 Plugs

External electrical access to CMUX equipment is via the plug area at the bottom of the subrack. All plug slots are equipped with Metral style connectors in the subrack backplane.

Plugs are inserted into the connectors on the subrack backplanes. The plugs provide physical access to the backplane and, where required, adaption of the backplane signal. Front connectors on the plugs provide correct pinouts for external cables.

The plugs on the left hand side below the controllers are Common Plugs while those located below the LIM slots are LIM plugs.

Each LIM plug is generally used to provide electrical access to the card above it. Multislot LIM plugs such as the TSPP–A are used to provide interconnections between adjacent line cards as required.

Connections provided by common plugs are grouped by function rather than which controller provides the function. Each common plug generally connects via the backplane to multiple cards.

Detailed descriptions of plugs are found in the following:

- ▶ The MBTPB (Main Bus Termination Plug) is described in Section 6.11.
- ▶ Other plugs are described in detail in Chapter 13 – *Plugs*.
- ▶ MiniMUX plugs are described in the *MiniMUX Technical Handbook*.

(1) Common Plugs

The four left plug slots are used to mount the common plugs. This section is box-like in shape and has a bottom and side plates, and card rails for the plugs. The common plugs extend to the front of the subrack.

The Common Plugs are:

- ▶ AXP.
- ▶ POWP.
- ▶ NEHP.
- ▶ HBMP.
- ▶ HBEP.

AUXP - Auxiliary Plug

The AUXP provides access to a variety of busses and interfaces which do not carry traffic. Different versions of the AUXP are used in the first subrack in a NE (NU or AU) and in the second and subsequent subracks in a NE. Each version provides different connections.

- ▶ The AUXPA is used in the first subrack.
The AUXPA used in CMUX has an Ethernet management interface. The AUXPA also extends certain busses to an AUXPB in the second subrack at the NE.
- ▶ The AUXPB is used in the second and subsequent subracks in an NE.
It connects certain busses upwards to a higher subrack in the NE, and connects busses downwards to the next subrack in the NE.

HBMP/HBEP - High Band Main and Extension Plugs

HBMP and HBEP plugs were introduced in late 2003. They provide traffic connections to the narrowband and broadband controllers, and some interconnections between subracks.

- HBMP: The High Band Main Plug is used in the Main subrack, which is always a MLS-hb.
- HBEP: The High Band Extension Plug is used in Extension subracks, which may be either MLS-hb or MLS-hbe.

NEHP - Network Element Handler Plug

The NEHP provides the traffic connections to the narrowband and broadband controllers. There are two variants of the NEHP:

NEHPG: This variant is used in the Main subrack and in broadband-only extension subracks.

NEHPGE: This variant offers enhanced EMC performance on the NLC bus. It is used in extension narrowband subracks and in extension combo (NB+BB) subracks.

Note *HBMP and HBEP plugs were introduced in late 2003. In some new installations they are used instead of NEHP plugs for the traffic connections to the CMUX and for interconnections between subracks. HBMP and HBEP plugs use different cabling to NEHP plugs.*

POWP - Power Plug

The POWP connects one or two incoming 48V (nominal) battery supplies to the equipment. The connectors at the front of the plug are D-type connectors with three thick pins. The POWP provides filtering of battery leads for improved EMC performance.

(2) Transport Plugs

Transport plugs provide access to the transport cards. They are much shorter than the common plugs. The transport plugs are:

- ▶ EOTP.

EOTP

The EOTP is a single slot flat plug with straight through connections for the 16 x 2 Mbit/s G.703 signals from the EOTCA. The EOTP is situated below the EOTCA in the subrack, and contains capacitors for improved EMC performance.

(3) CMUX LIM Plugs

LIM plugs (Line Interface Module Plugs) are located below the LIM slots to provide access to the line cards. They are much shorter than the common plugs. The LIM plugs are:

- ▶ DSAP.
- ▶ DSPP—B.
- ▶ DURPB.
- ▶ LFSPB.
- ▶ PRCP.
- ▶ PAIP.
- ▶ TARP.B.
- ▶ TSCP
- ▶ TSPP—A.

DSAP - Dual Slot Attenuator Plug

The DSAP is used to provide physical access to an ADSL twin (1 x LTAC—C and 1 x NACC—C). It is a double—width plug with Metral connectors on the front for connecting to customer lines and to POTS line interfaces (CMUX POTS line cards or exchange line cards).

Customer lines carrying both POTS and ADSL signals are connected by the DSAP to both an LTAC—C line and a NACC—C line. After filtering by the NACC—C the line returns to the DSAP and is connected to the POTS interface.

The DSAP provides attenuation of the ADSL signal to the level of a direct connection from the exchange to the vicinity of the AU. There are five variants of the DSAP with attenuations from 7dB to 35dB.

The DSAP has the same pinouts as a DSPP-B. The DSAP does not have bypass relays.

DSPP-B - Dual Slot Position Plug

The DSPP-B is used to provide physical access to an ADSL twin (1 x LTAC-C and 1 x NACC-C). It is a double-width plug with Metral connectors on the front for connecting to customer lines and to POTS line interfaces (CMUX POTS line cards or exchange line cards).

Customer lines carrying both POTS and ADSL signals are connected by the DSPP-B to both an LTAC-C line and a NACC-C line. After filtering by the NACC-C the line returns to the DSPP-B and is connected to the POTS interface.

DURPB

The DURPB is a single slot, flat plug. There are two plug slots below the double slot width DURCC. The DURPB is installed in the left slot of these two plugs.

The DURPB provides straight through connections for the DURCC alarm signals, as well as providing connections to the backplane to allow reading of the DURCC remote inventory.

LFSPB - Line Filtering Single Plug

The LFSPB is a single slot straight through plug providing 30 pairs for connecting to line cards including:

- ▶ ATLCC.
- ▶ BALCF.
- ▶ PMLCC.
- ▶ ALLC.
- ▶ TACCB (revertive call).

The LFSPB includes filter capacitors to improve EMC performance.

PAIP

The PAIP is a single slot plug which provides connections for:

- ▶ PAIC.

PRCPB

The PRCPB is a single slot plug which provides connections for:

- ▶ HLTC.
- ▶ LTAC.

TARPB

The TARPB is a single slot plug with straight through connections for:

- ▶ External alarm inputs
- ▶ Alarms outputs for Urgent, Non–Urgent and Alarm Receiving Attention
- ▶ Command outputs (see Section 12.3.7).

The TARPB is situated below the TARCB in the subrack, and contains capacitors for improved EMC performance.

TSCP – Triple Slot Combiner Plug

The TSCP is a triple slot plug used in AU.

The TSCP:

- ▶ Interconnects an LTAC–D and the associated ATLCC in the slot immediately to the right of the LTAC–D. Via the TSCP, 24 POTS lines from the ATLCC are connected to the splitter daughterboard on the LTAC–D.
- ▶ Provides connections for 24 customer lines carrying ADSL and POTS services.
- ▶ Provides external connections for six POTS–only services.

TSPP–A - Triple Slot Position Plug

The TSPP–A is used to provide physical access to an ADSL triplet (LTAC–A + NACC–A + LTAC–A). It is a triple–width plug with Metral connectors on the front for connecting to customer lines and to POTS line interfaces (CMUX POTS line cards or exchange line cards).

Customer lines carrying both POTS and ADSL signals are connected by the TSPP–A to both an LTAC–A line and a NACC–A line. After filtering by the NACC–A the line returns to the TSPP–A and is connected to the POTS interface.

(4) MiniMUX Plugs

MiniMUX uses the MLS-sm-T9 subrack which has external dimensions similar to the RIM/C-RIM Access Panel. The plug and card areas are re-arranged to suit the available space, with the plug area having different dimensions of the plug area of the MLS-hb and MLS-hbe.

MiniMUX plugs are described in the MiniMUX Technical Handbook.

The MLS-sm-T9 uses three types of plug:

T9IPA

The T9IPA controller plug also has power and auxiliary functions.

T9APA

The T9APA line card plug supports 12 ADSL lines. It interconnects the LTAC-C and NACC-C in an ADSL twin similar to the DSPP-A, and provides connectors for external cabling.

T9APB

The T9APB is a line card plug which supports 24 ADSL lines. It connects the LTAC-D/NACC-D to external cabling.

3.3 Synchronisation

The narrowband and broadband parts of CMUX have independent processes for synchronisation and are not inherently synchronised to each other.

The narrowband and broadband controllers are responsible for controlling the synchronisation of each of the domains which they respectively manage.

3.3.1 Narrowband Synchronisation

The clock source which is used to generate system clocks for the narrowband part of CMUX is selected from the following list. The order of the list indicates the priority of the clock sources. The highest priority source is used for generating system clocks.

- ▶ External Clocks.
 - External 2.048 MHz clock 1.
 - External 2.048 MHz clock 2.
- ▶ Extracted Clocks.
 - Extracted clock source 1.
 - Extracted clock source 2.
- ▶ Internal Clock.
 - Internal clock.

Timing sources are always treated in the priority of External, Extracted and then Internal.

- ▶ Switches between clocks of the same priority is non—revertive. For example, the two extracted clocks are considered to be of the same priority, so a switchover between them is non—revertive.
- ▶ If a timing source fails and timing sources of the same or higher priority are not available, switchover to a source of lower priority will occur.
- ▶ Switchover to a source of higher priority will occur if such a source becomes available and the previously active source is of lower priority.

Extracted Clock sources are configured via CMEM. Other timing sources are fixed and cannot be configured.

3.3.2 Broadband Synchronisation

System clocks for the broadband part of CMUX are generated from a clock extracted from the network interface. This may be from STM-1 when using an AANC or ASCC-S, or from a 2 Mbit/s link when using the 4 x 2 Mbit/s IMA interface of an AICC.

In the latter case, the lowest numbered 2 Mbit/s link which is operational, is selected. If there is a complete failure of the network interface, an internal clock is used.

3.4 Operation, Administration and Maintenance

CMUX is remotely managed by its element managers, CMEM and AWS. OA&M functions are carried out via CMEM and AWS.

3.4.1 Management Interfaces

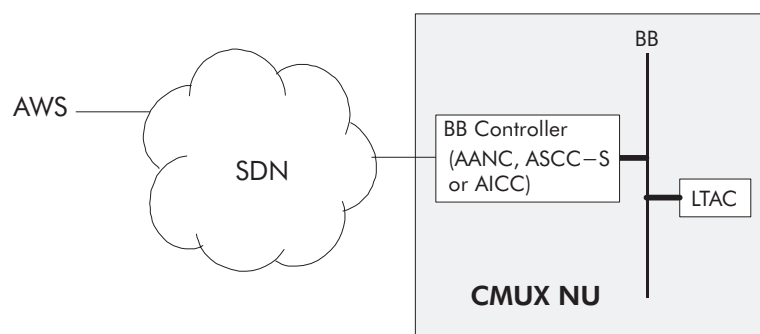
CMUX provides support for narrowband and broadband services with limited interaction between the plug-in cards supporting the narrowband and broadband services respectively.

Separate Element Managers are used for narrowband and broadband services requiring separate management interfaces between CMUX and the respective element managers.

(1) Broadband Management

The management interface between CMUX and its broadband element manager AWS is carried in-band via the ATM interface between the CMUX Broadband Termination (AANC or ASCC-S for STM-1 or AICC for 4 x 2 Mbit/s IMA) and the ATM network.

Installations using a subtending architecture carry broadband traffic between the NU and AUs using inverse multiplexing. Management traffic for AUs is carried between the NU and AU via in-band ATM.



Note: LTAC may be LTAC-A, LTAC-C, or LTAC-D

Figure 3-9 In-band ATM Management Interface

(2) Narrowband Management – In-band ATM

For CMUX installations supporting broadband and narrowband services, the narrowband management channel from the NEHC-P may be carried as in-band traffic.

The means by which the narrowband management channel is carried via in-band ATM is shown in Figures 3-10 and 3-11.

The LAN management interface from the AUXP is connected to an ADSL modem, and then to a line of an LTAC. An assigned VP/VC is then used to carry the management traffic via the ATM network interface to CMEM. This VP/VC is separate from the one used for broadband management.

Note *In-band management may use a spare BB channel on any ADSL Triplet or ADSL Twin. Alternatively, a LTAC may be installed in Slot 7 of the Main Subrack to provide a suitable BB channel.*

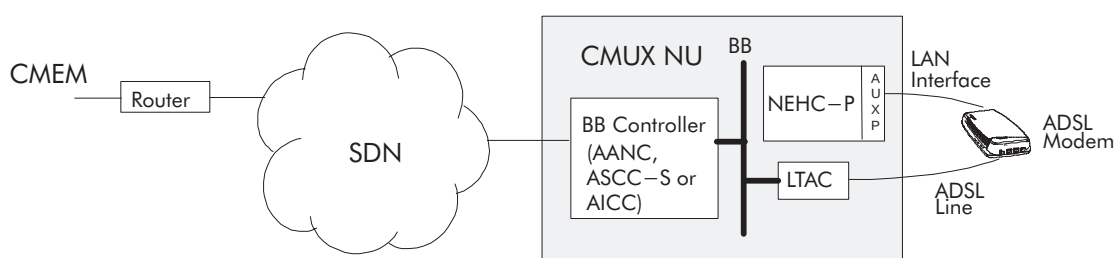


Figure 3-10 In-band ATM – NUC

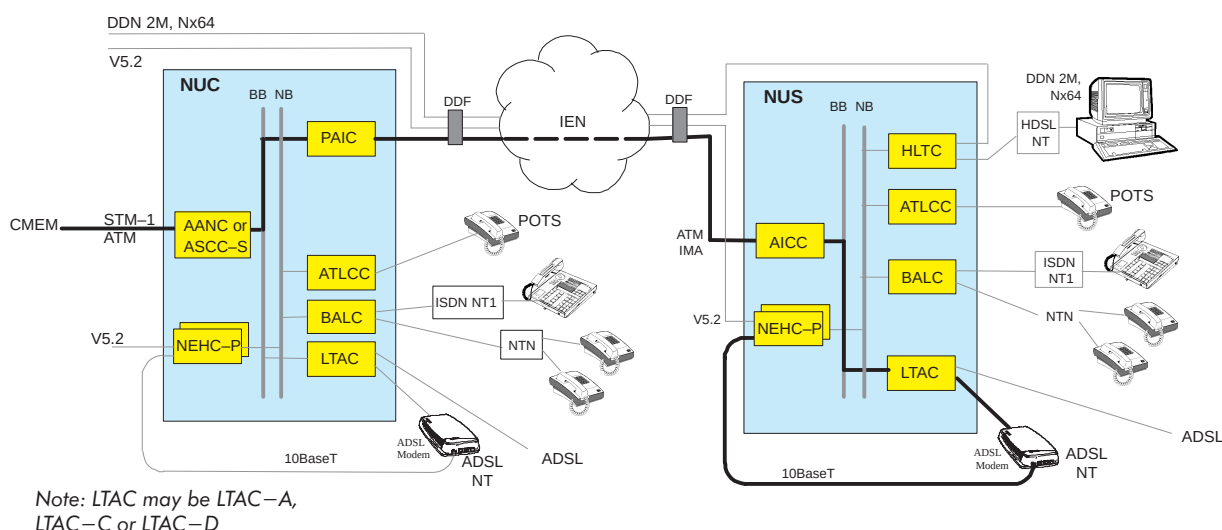


Figure 3-11 In-band ATM to NUS Via External Transport

(3) Narrowband Management – Optical Transmission

The NEHC–P supports a LAN management interface:

- LAN (CLNS1 in Q.811)

The interface is physically accessed via the AUXP.

Management traffic between an NUC and subtended AUs is carried via an out-of-band management channel which is supported by the EOTCA optical line card.

The NUC and each AU are separate network Elements (NE) each with its own network address (NSAP). The NU performs IS–IS routing as required to route management traffic between AUs and CMEM.

(4) Narrowband Management – External G.703 Transmission

External G.703 Transport may be used to connect an NUC to an AU. In Figure 3–12 the connection from the NUC to AU2 uses this connection.

If External G.703 Transport is used, the AU Management Channel is carried over an embedded 64kb/s timeslot (TS31) of a Leased Line Bearer, which is established between the NU and the first 2M Network Port of the AU.

Note *The management channel **cannot** be carried over a Mirror or V5.2 Bearer.*

If the management channel of the NUC is carried as in-band traffic (via a LAN connection), then the NUC may connect up to seven AUs. Each AU may be connected using either EOTC or via External G.703 Transmission, in any combination.

If the management channel of the NUC is carried over an out-of-band X.25 connection, then the NUC may connect up to two AUs. Each AU may be connected using either EOTC or via External G.703 Transmission, in any combination.

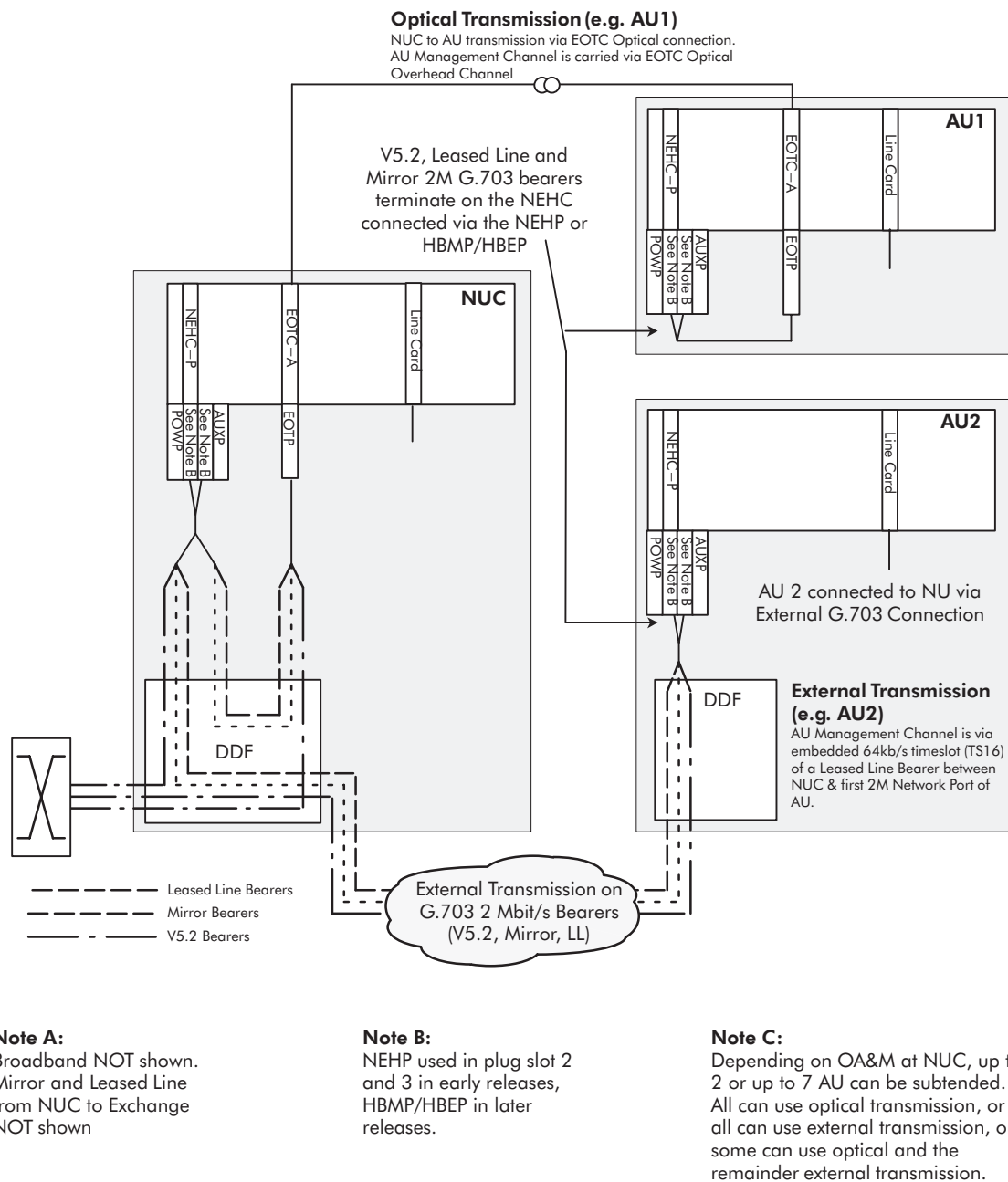


Figure 3–12 Optical and External G.703 Transport

3.4.2 Configuration Management

The NEHC–P is the narrowband controller, responsible for configuration management of the narrowband portion of CMUX.

The AANC, ASCC–S or AICC is the broadband controller, responsible for configuration management of the broadband part of CMUX.

NEHC–P, AANC, ASCC–S, and AICC are equipped with flash memory for permanent storage of configuration data.

When cards managed by the controllers restart, they are loaded with operational software and are then provided with configuration commands from the controller.

Changes to the persistent configuration data in the active controller are replicated to the persistent memory of the standby card. This ensures that the standby card has the correct configuration data if a changeover is required.

CMUX equipment can be configured via a GUI giving a physical representation of the equipment. This includes the declaration and provisioning of equipment racks and housings, subracks, and individual cards.

Other aspects that can be configured are transport, synchronisation and redundancy. The relevant network management interface configuration can also be performed including the interface type and NU/AU addressing.

CMUX network interfaces are also configurable. This includes both the V5.2 and ATM interfaces.

Finally, the V5.2, Mirror and ADSL user ports can also be configured on a line by line basis. Termination and hybrid impedances, gain levels and other user port information such as Securitell or ADSL Modem characteristics are configurable on the supported cards.

3.4.3 Software Management

Software management is the process by which various cards in a CMUX system are loaded with the correct versions of operational software.

Software management allows the replacement of one or more items of CMUX software with a newer version. The basic item which can be downloaded is the complete operational software of a card (except the card's boot code).

New software is transferred from the Element Manager (CME or AWS) to a CMUX as a background operation without affecting services. When the new software is activated, there is a short interruption to services.

Since the narrowband and broadband parts of CMUX are separate Network Elements, each have independent processes for software management.

(1) Broadband Software Management

The broadband controller (AANC, ASCC-S, or AICC) loads other broadband cards at startup and during software replacement. New software is received from AWS without affecting services. A brief service interruption occurs during software activation.

- ▶ If new controller software is downloaded the service interruption is approximately two minutes. This includes the time for the broadband controller to restart with the new software, load the LTACs (LTAC-A, LTAC-C, or LTAC-D) with software, and establish communication between the LTAC and CPE.
- ▶ If new line card software is downloaded the service interruption is approximately one minute. This includes the time for the broadband controller to load the LTACs with software, and establish communication between the LTAC and CPE.

The following CMUX broadband cards can receive downloaded software:

System	AANC, ASCC-S, AICC.
Line Cards	PAIC, LTAC (LTAC-A, LTAC-C or LTAC-D).

(2) Narrowband Software Management

The NEHC–P, as the narrowband system controller, is responsible for software management for all narrowband cards.

All cards managed by the NEHC–P which have a processor do not have permanent memory for downloaded software. They have a Boot ROM and RAM for receiving and executing operational software.

When a card restarts, it executes a self test and then requests for operational software from the NEHC–P. The NEHC–P has flash memory which is used to store the operational software for all processor equipped cards managed by the NEHC–P.

At system startup, cards of the same type are loaded with software in parallel using a broadcast to multiple cards. Since cards are always loaded at startup, a replaced card will always be loaded with the correct version of software.

When a system is loaded with a new release of software, the length of interruption to service will depend on the type of service, the existence of a redundant NEHC–P, and whether data conversion is required.

When a system is equipped with a redundant NEHC–P, the new software is received by the active card and passed to the standby card. The standby card then restarts and, if required, converts the data structures to the new format. When ready, a switchover occurs from the active card to the standby card, after which the new active card re-synchronises with the other cards in the system.

When a system is not equipped with a redundant NEHC–P, the new software is received by, and stored in, the active card. Service affecting time starts when the new software is activated. If data conversion is required, the service affecting time is lengthened.

The following CMUX narrowband cards can receive downloaded software:

System	NEHC–P.
NB Line cards	ALLC, ATLCC, BALCF, HLTCA, PMLCC.
Transport	EOTCA.
Auxiliary	DURCC, TACCB, TARCB.

(3) Batch and Scheduled Software Download

CMUX 3.1 introduced Batch and Scheduled Software Download for narrowband cards.

Software Download (SWD) allows an operator to modify the executable software operating on an NE. Software is downloaded to a second software bank on the NE, the new software is activated, then the new software is either committed or rolled back to the original software.

ANR 2.0 provided SWD functionality in CMUX. This functionality was provided on an NE by NE basis and accessed via the individual NE's Management windows. To perform a SWD to three NEs, three individual SWD operations were initiated via CMEM from three separate NE Management windows.

To make this process more efficient, ANR 3.1 introduced a SWD Manager Application. From this application an operator can schedule the various aspects of a SWD across multiple NEs. This is referred to as Batch and Scheduled SWD.

Batch SWD allows an operator to select a range of NEs before initiating any of the various operations of a SWD, i.e. download, activate, commit and roll-back.

For example, if an operator wishes to download the same software to 5 NEs, the operator may:

- ▶ select all 5 NEs
- ▶ via the SWD Manager Application, initiate a single download operation
- ▶ the download will then occur to all 5 NEs simultaneously.

Scheduled SWD introduces the capability for an operator to specify at what date and time the SWD operation should be performed. So, coupled with Batch SWD, an operator may select a range of NE's to download to and schedule the download to occur at a particular date and time.

- ▶ Batch SWD can download to a total of ten independent NEs simultaneously.
- ▶ Batch SWD can download to a maximum of four AUs from one NU.

The CMEM Operator's handbook describes, in more detail, how this feature works from the perspective of a CMEM Operator.

3.4.4 CRAFT Terminal

The CMUX supports narrowband and broadband CRAFT terminals which allows direct local access to the equipment for configuration and fault management. Separate craft terminal connections are provided for narrowband and broadband CRAFT terminals.

(1) Broadband Craft Terminal

The broadband craft terminal port uses a TL1 command line interface. It does not require a special CRAFT terminal application and can be used with any terminal emulation program such as the HyperTerminal application provided with Windows.

The broadband CRAFT terminal port is accessed via a DB-9 connector on the front of the broadband controller (AANC, ASCC-S or AICC).

The broadband CRAFT is normally only used to establish communications between AWS and a CMUX NU or AU. All subsequent broadband configuration is done by AWS.

Appendix D of this handbook details the process of establishing communications between AWS and a CMUX NE.

(2) Narrowband CRAFT Terminal

A narrowband CRAFT Terminal interface is provided as a DB9 connector on the front of the TARCB.

The narrowband CRAFT will not normally be used by Telstra personnel. Configuration and management of the narrowband parts of CMUX is done via CMEM.

3.4.5 Remote Inventory

Each CMUX card is equipped with remote inventory memory devices.

- ▶ RI data for narrowband and common cards is collected by the NEHC-P.
- ▶ RI data for broadband cards is collected by the broadband controller (AANC, ASCC-S, or AICC).

The items of RI data available from the respective element managers (CMEM and AWS) are as follows:

- ▶ Version.
This item has the following sub-fields:
 - Alcatel Part Number.
 - Variant.
 - Item Change Status (ICS).
- ▶ Serial Number.
- ▶ Vendor Name.

3.5 System Dimensioning

This section provides details regarding the dimensioning of various types of customer services.

- ▶ CMUX ANR2.0 Phase 1 and Phase 1B have internal support for ADSL broadband services and combines these with narrowband services from the exchange.
- ▶ CMUX ANR2.0 Phase 2 adds internal support for narrowband services.
- ▶ CMUX ANR3.2.1 adds support for broadband cards in the MLS–hbe, and for high density ADSL cards (LTAC–C, NACC–C, and associated DSPP–B plug or DSAP plug).
- ▶ CMUX ANR3.1 adds support for narrowband cards in the MLS–hbe.
- ▶ The LTAC–D was released in mid 2004. It supports 24 ADSL lines. The associated TSCP plug was also released in mid 2004. Also released was the ASCC–S broadband controller card.

The CMUX system can simultaneously support a wide range of services.

- ▶ Line card slots can be used for cards for various combinations of cards to support ADSL, POTS, ISDN, and other services.
- ▶ Line card slots may also be used for PAIC and EOTC cards which support communication between hub (NUC) and subtended (NUS or AU) systems.

Typical CMUX installations do not only support one type of service, and as an example a CMUX which only supports POTS would be very untypical.

As other types of cards, such as ADSL cards, are installed the maximum number of each type of service is reduced to a number which is fewer than the maximum number of cards and channels that can physically be installed.

- ▶ The maximum tested number of POTS services is 1410.
- ▶ The maximum tested number of ISDN services is 128.
- ▶ Note that these maximums cannot be simultaneously achieved as in total they would require more than the maximum number of line card slots.

3.5.1 Subrack Allocation

Each NE (NUC, AU or NUS) is equipped with one main subrack which is a MLS—hb. Up to eleven additional extension subracks can be connected to the first subrack in an NE to form a single assembly.

- ▶ Subracks R1/SR1 to R1/SR3 can support NB and/or BB.
- ▶ Other subracks can support either BB or NB services. They do not support a mixture of NB and BB cards.

(1) Central NU

The Central NU (NUC) is a CMUX NU located in an exchange and connected to the core narrowband and/or broadband networks. It may parent one or more NUS and/or AU.

- ▶ Broadband customer lines may be connected to the NUC, NUS, and/or AU.
- ▶ Narrowband customer lines are not normally connected directly to a NUC.

(2) Subtended NU or AU

A NUC may parent one or more AU and/or NUS. Each NUS or AU can support NB and/or BB services

(3) AU in AGH (AGHA or AGHB)

An AU in an AGH (Aboveground Housing) has two subracks. The Main Subrack supports BB and associated POTS cards, along with special services. The Extension Subrack is NB only.

(4) NUS—AGH in AGH (Adjunct Housing)

A NUS—AGH in an AGHB has two subracks. Both subracks support only BB cards. NB services are supported by a co—located RIM/C—RIM.

(5) AU in ACPA

An AU in an ACPA (Customer Premises Rack) may have one or two subracks.

(6) AU in TAH

An AU in a TAH (Telstra Access Housing) may have one or two subracks.

3.5.2 ADSL Lines Only

The assumed configuration for CMUX FR 2.1F BB consists of up to twelve subracks.

- ▶ The main subrack (Rack 1/Subrack 1) is a MLS–hb equipped with:
 - One AANC, ASCC, or AICC.
 - Broadband line cards. The available combinations are:
 - ADSL triplets
(2 x LTAC–A, 1 x NACC–A, 1 x TSPP–A),
and/or
 - ADSL twins
(1 x LTAC–C, 1 x NACC–C, DSPP–B or DSAP),
and/or
 - LTAC–D.
- ▶ Extension subracks (Rack 1/Subrack 2 to Rack 4/Subrack 3), each of which is a MLS–hbe equipped with:
 - One BSEC.
 - ADSL triplets and/or ADSL twins, and/or LTAC–D.
- ▶ MiniMUX supports up to four MLS–sm–T9 subracks:
 - If equipped with ADSL twins, each subrack supports up to 24 ADSL services (total 96 ADSL services per MiniMUX).
 - If equipped with LTAC–D, each subrack supports up to 48 ADSL services (total 192 ADSL services per MiniMUX).
 - Different subracks in a MiniMUX can use either LTAC–C or LTAC–D, however these cannot be mixed in the same subrack.

A maximum sized system consists of a Main Subrack and 11 Extension Subracks.

Table 3–1 shows the maximum number of lines supported by a CMUX NE for each type of line and for each type of broadband controller card.

In some cases, the maximum is limited by the number of available slots while for other cases, the maximum is determined by other resource limits.

For each type of line card, there is a narrow column to the right which indicates the reason for the limit as S (slot limited) or R (controller resource limited).

When a CMUX Hub is subtending other CMUX NEs, the maximum number of lines is reduced due to the use of slots for PAICs in a fully configured system.

Note Only one subrack in the AGHA can be equipped with ADSL cards. Both subracks in the ACPA or in an Adjunct Housing can be equipped with ADSL cards.

Note If NB cards, transport cards, auxiliary or other cards are also installed in a subrack the fewer slots are available for ADSL triplets. This reduces the number of ADSL services supported by the subrack.

Note Table 3–1 shows the number of lines supported by FR2.1F BB.

Table 3–1 Maximum Number of Local lines – NUC, NUS, or AU

NT	ADSL								PAIC			
	Lines	LTAC–A		Lines	LTAC–C		Lines	LTAC–D		E1	PAIC	IMA Group
ASCC	480	120	S	1272	106	S	2304	96	R	424	106	318
AANC	480	120	S	528	44	R	528	22	R	32	8	16
AICC	480	120	S	480	40	R	480	20	R	32	8	24

3.5.3 V5.2 PSTN Lines

In a typical rack configuration, a CMUX provides hardware support for up to 1620 V5.2 PSTN lines. The assumed configuration consists of a NU Rack with four MLS–hb narrowband subracks, and with all LIM card slots equipped with ATLCC cards.

In this assumed configuration:

- ▶ The main subrack (Rack 1/Subrack 1) is a MLS–hb equipped with:
 - NEHC–P.
 - DURCC.
 - TARCB.
 - TACCB.
 - up to 12 x ATLCC.
- ▶ The other three narrowband subracks are MLS–hb or MLS–hbe configured as extension subracks. Each is equipped with:
 - NSEC.
 - DURCC.
 - up to 14 x ATLCC (MLS–hb),
or up to 16 ATLCC (MLS–hbe).

Note

- A NU may be equipped with POTS cards for up to 1620 POTS lines (assuming 4 x MLS–hb supporting narrowband cards).
- When equipped with 2 x MLS–hb:
 - the AGH supports up to 420 V5.2 PSTN lines.
 - The ACPA supports up to 720 V5.2 PSTN lines.
 - The AU in TAH supports up to 720 V5.2 PSTN lines.
- When equipped with 1 x MLS–hb + 1 x MLS–hbe:
 - the AGH supports up to 480 V5.2 PSTN lines.
 - The ACPA supports up to 780 V5.2 PSTN lines.
 - The AU in TAH supports up to 780 V5.2 PSTN lines.

3.5.4 V5.2 ISDN Lines

A CMUX NU being used only for ISDN can be equipped with ISDN cards which have hardware support for up to 944 V5.2 ISDN lines.

The assumed configuration consists of four subracks.

In this assumed configuration all the subracks are MLS–hb equipped as main or extension subracks:

- ▶ The main subrack is a MLS–hb equipped with:
 - NEHC–P.
 - TARCB.
 - TACCB.
 - 14 x BALCF.
- ▶ The three narrowband extension subracks are each a MLS–hb equipped with:
 - NSEC.
 - 15 x BALCF (MLS–hb) or 17 x BALCF (MLS–hbe).

Note *A NU may be equipped with ISDN cards for up to 944 ISDN lines (assuming four MLS–hb).*

An AU may be equipped with ISDN cards for up to 496 ISDN lines (assuming two MLS–hb).

3.5.5 Mirror Lines

The design of CMUX assumes that, where possible, narrowband services are supported via a V5.2 interface. Services are supported as mirror (non–integrated) services by exception.

The maximum number of mirror services which can be supported by a CMUX is determined by the capacity of the narrowband (NLC) bus rather than the number of line cards which can be equipped in a subrack.

Each CMUX NU or AU can support up to 300 mirror services. These include mirror POTS, mirror payphone, and mirror PABX.

Mirror services supported by a CMUX NU are cross–connected to associated lines of one or more subtended AUs as required. Each line of an NU mirror line card may be connected to lines of separate AUs. For example, the first four lines of an NU line card may connect to AU1, while the next two connect to AU2, etc.

3.6 Definition of Network Elements & Applications

The following CMUX Network Elements have been defined, according to their implementation.

3.6.1 CMUX Central NU

CMUX Network Units (NU) are systems installed at the exchange. NU may be either a Central NU (NUC) or a Subtended NU (NUS).

They are connected to narrowband interfaces on the exchange.

Connections to the broadband networks are:

- ▶ A NUC is connected to routers via either a STM–1 link or an IMA link.
- ▶ The NUC parents one or more NUS and/or AU via IMA links.
- ▶ A NUS is connected to the BB network via an IMA link to a NUC.

The CMUX NUC can provide the following services:

- 1** CMUX ANR2.0 Phases 1 and 1B (broadband only).
 - Local broadband services.
 - Parent broadband services for one or more CMUX AU or NUS.
- 2** CMUX ANR2.0 Phase 2 (narrowband and broadband).
 - Local broadband services.
 - Local narrowband services.
 - Parent broadband services for one or more CMUX AU or NUS.
 - Later shipments will be able to parent narrowband services for one or more CMUX AU or NUS. These services are:
 - Transparent.

No processing in the NU.
This is applied for V5 and Leased Line services.

- Mirror (non–integrated).

This system converts the signalling streams coming from the CMUX AU into mirror analog interfaces towards the exchange. This is used for Securitel and old PABX services.

- Leased Line Grooming:

Separates the Leased Lines (LL) traffic from the Mirror traffic coming from RUs, before entering the LL network.

3 CMUX ANR3.2.1 (narrowband and broadband).

- Local broadband services.
- Local narrowband services.
- Parent broadband services for one or more CMUX AU or NUS.
- Later shipments will be able to parent narrowband services for one or more CMUX AU or NUS. These services are:

- Transparent.

No processing in the NU.

This is applied for V5 and Leased Line services.

- Mirror (non–integrated).

This system converts the signalling streams coming from the CMUX AU into mirror analog interfaces towards the exchange. This is used for Securitel and old PABX services.

- Leased Line Grooming:

Separates the Leased Lines (LL) traffic from the Mirror traffic coming from RUs, before entering the LL network.

3.6.2 AU, MiniMUX, NUS, and NUS–AGH

Subtended NE are installed as follows:

- ▶ Subtended NU (NUS) are installed at exchanges.
- ▶ NUS–AGH are installed in AGHB housings.
- ▶ AU can be installed in:
 - Above Ground Housings (AGHA or AGHB)
 - AU Customer Premises Racks (ACPA)
 - Telstra Access Hut (TAH)
- ▶ MiniMUX is installed in RIM/C–RIM housings and racks.

The following services can be provided from an AU, NUS or NUS–AGH:

- ▶ POTS including metering.
- ▶ ISDN.
- ▶ ADSL.
- ▶ Securitel.
- ▶ $n \times 64$ Leased lines.

Network interfaces at the AU or NUS can be based on Optical PDH, with a maximum useable bandwidth of 16 x 2 Mbit/s.

- ▶ Up to 4 x 2 Mbit/s links are used to form an IMA link to the NUC for broadband services.
- ▶ The remaining links are used for narrowband services and special services.

Note *MiniMUX functions are similar to a NUS.*

- *BB services are subtended from a NUC.*
- *NB services are provided by co–located RIM/C–RIM equipment.*

Note *NUS–AGH functions are similar to a NUS.*

- *BB services are subtended from a NUC.*
- *NB services are provided by a RIM/C–RIM in a nearby housing.*

4 ADSL Architecture

ADSL in CMUX uses cards installed in subracks, which may be MLS–hb or MLS–hbe. MiniMUX uses the MLS–sm–T9 subrack.

Broadband ADSL services share the subracks with narrowband (NB) services in an overlay arrangement.

- ▶ Broadband controllers are as follows:
 - AANC and ASCC–S cards provide a high speed STM–1 optical transport interface. These cards are not used by MiniMUX.
 - The AICC card provides IMA encoded 2Mbit G.703 interfaces. MiniMUX and CMUX may use the AICC. PAICs at the NUC provide inverse multiplexing for IMA links to NUS or AU.
- ▶ Broadband line card is LTAC (LTAC–A, LTAC–C or LTAC–D).
- ▶ Physical access to customer lines at a CMUX is via the TSPP–A, DSPP–B, TSCP, or PRCPB.
- ▶ MiniMUX connections to customer lines are via T9APA or T9APB.

Broadband (BB) services use the IQ bus which is an ATM bus specifically for broadband cards. Upstream and downstream bandwidth is 155 Mbit/s. Master of the IQ bus is the BB controller.

The IQ bus is terminated on the termination plug installed in the backplane. In the MP this plug is the Main Board Termination Plug B (MBTPB). The MBTPB terminates the IQ bus, the narrowband bus (NLC) and the Inventory Access Bus (IAB). It also sets subrack characteristics such as Rack/Subrack ID.

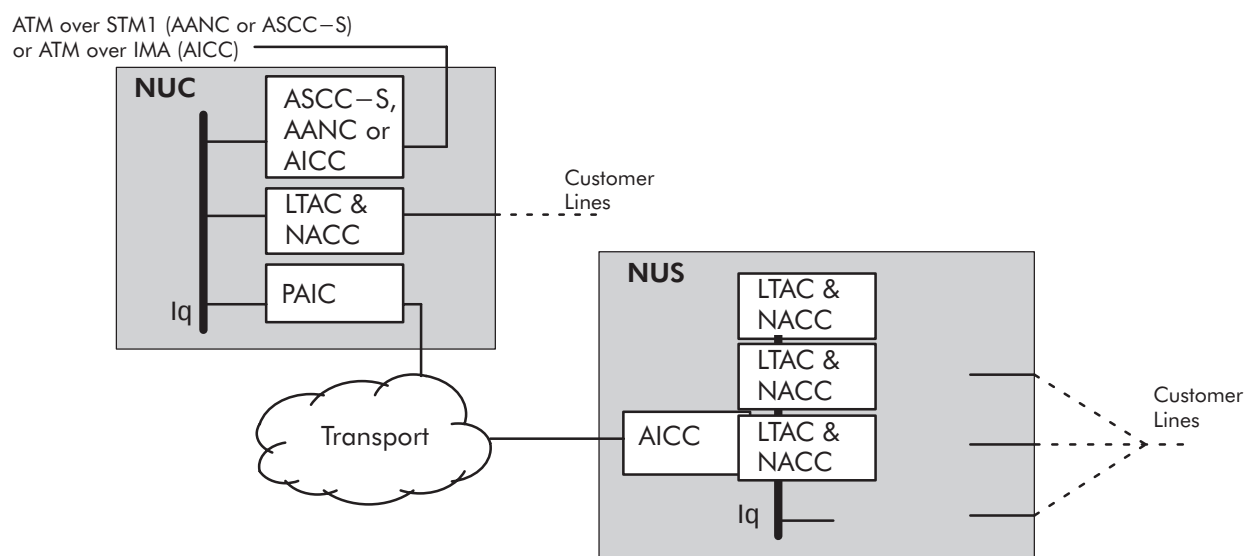
4.1 Network Configuration

The broadband controller at a Central NU (NUC) may be an AANC (STM-1), ASCC-S (STM-1) or an AICC (IMA).

The broadband controller at a Subtended NU (NUS), AU or MiniMUX is the AICC which is paired with a PAIC at the NUC. A 4 x 2 Mbit/s IMA link connects the AICC and its matching PAIC.

Transportation of the IMA link between the NUC and the NUS, AU or MiniMUX may use the following:

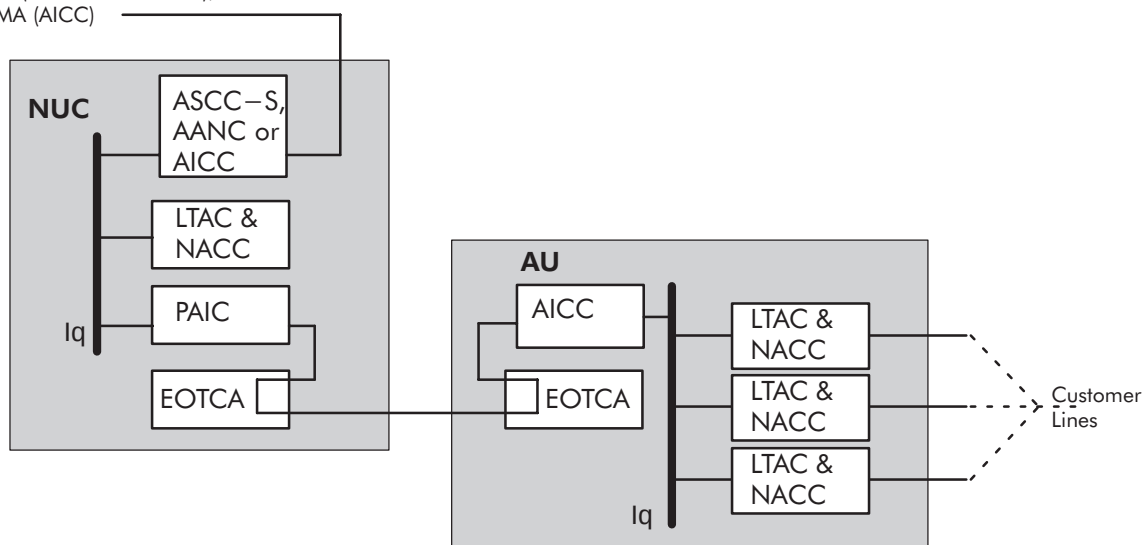
- ▶ The IMA link between the NUC and a NUS in the same building is via 2 Mbit/s links and the exchange DDF.
- ▶ The IMA link to an AU is uses 2 Mbit/s links carried via optical transmission. This uses an EOTCA at the NUC, an EOTCA at the AU, and an optical link between them.
- ▶ The IMA link to a NUS in a different building to the NUC is via 2 Mbit/s links carried by external transmission.
- ▶ The IMA link between the NUC and MiniMUX is via 2 Mbit/s links carried by RIM/C-RIM transmission.



Note: LTAC may be LTAC-A, LTAC-C or LTAC-D
NACC may be NACC-A, NACC-C, or NACC-D

Figure 4-1 Network Architecture – NUC to NUS

ATM over STM1 (AANC or ASCC-S),
or ATM over IMA (AICC)



Note: LTAC may be LTAC-A, LTAC-C or LTAC-D
NACC may be NACC-A, NACC-C, or NACC-D

Note: AU may be housed in AGH (AGHA or AGHB),
ACPA or TAH.

Figure 4-2 Network Architecture – NUC to AU

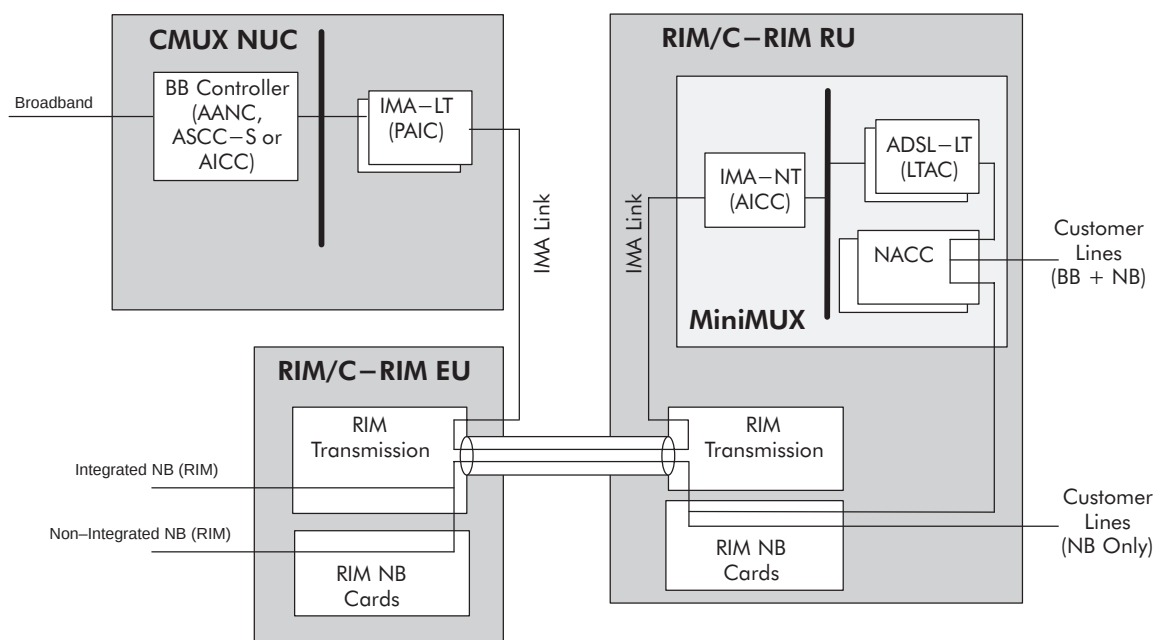


Figure 4-3 CMUX NUC, MiniMUX, RIM/C-RIM Architecture

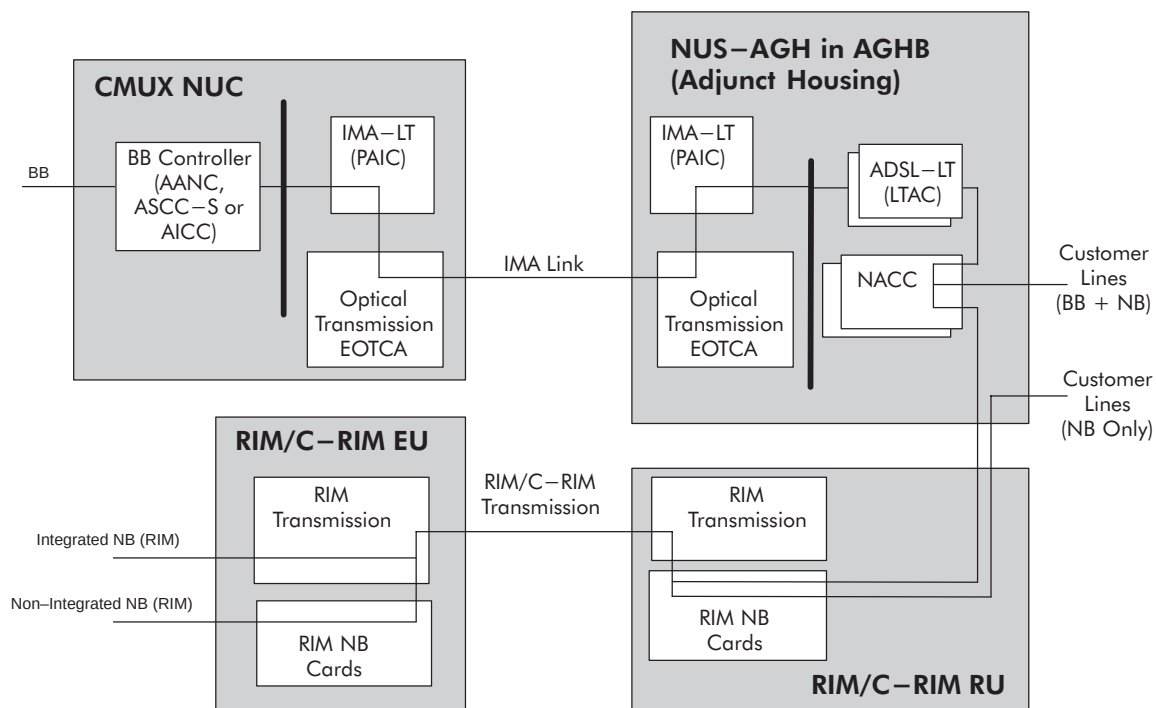


Figure 4-4 CMUX NUC / NUS-AGH / RIM Architecture

4.2 ADSL Modules

The primary functions of the main modules (cards and plugs) in the CMUX ADSL architecture are:

AICC – Broadband Controller.

- ▶ ATM Processing.
- ▶ IMA 4 x 2 Mbit/s physical payload interface.
- ▶ IQ bus master.
- ▶ Controls all broadband line cards:
 - LTAC–A/NACC–A/LTAC–A triplets
 - LTAC–C/NACC–C twins

Note *A future release of CMUX may optionally support two AICC in a 1+1 redundancy configuration.*

AANC – Broadband Controller.

- ▶ ATM Processing.
- ▶ STM–1 Optical physical payload interface.
- ▶ IQ bus master.
- ▶ Controls all broadband line cards:
 - LTAC–A/NACC–A/LTAC–A triplets
 - LTAC–C/NACC–C twins

Note *Two AANC cards can be used in a 1+1 redundancy configuration.*

ASCC–S – Broadband Controller.

- ▶ ATM Processing.
- ▶ STM–1 Optical physical payload interface.
- ▶ IQ bus master.
- ▶ Controls all broadband line cards:
 - LTAC–A/NACC–A/LTAC–A triplets
 - LTAC–C/NACC–C twins
 - LTAC–D

Note *Two ASCC–S cards can be used in a 1+1 redundancy configuration.*

BSEC – Broadband Extender Card.

- ▶ Performs IQ extension from the first subrack in a NU or AU to the subsequent subracks in the same NU or AU.
- ▶ Performs other functions such as Hardware Management Wires.

PAIC – IMA E1 broadband Line card.

- ▶ IMA to IQ ATM processing.
- ▶ Interfaces to 4 x 2 Mbit/s physical interfaces (120 ohm balanced).
- ▶ Interfaces to IQ bus.

LTAC–A – 4 line ADSL Line Card

- ▶ ATM Processing (physical mapping, UPC, OA&M, queueing and multiplexing).
- ▶ Interfaces to Line.
- ▶ Generates ADSL line code.
- ▶ 2 x LTAC–A and 1 x NACC–A are installed in three adjacent line card slots in the subrack.

LTAC–C – 12 line ADSL Line Card

- ▶ ATM Processing (physical mapping, UPC, OA&M, queueing and multiplexing).
- ▶ Interfaces to Line.
- ▶ Generates ADSL line code.
- ▶ 1 x LTAC–C and 1 x NACC–C are installed in two adjacent line card slots in the subrack.

LTAC–D – 24 line ADSL Line Card

- ▶ ATM Processing (physical mapping, UPC, OA&M, queueing and multiplexing).
- ▶ Interfaces to Line.
- ▶ Generates ADSL line code.
- ▶ The LTAC–D and the splitter daughterboard mounted on it form a double–width card assembly using two line card slots in the subrack.

NACC–A – 8 line POTS Splitter Card.

- ▶ Performs POTS/ADSL Splitting Function.
- ▶ Used in LIM slot to form ADSL triplet with two LTAC–A.
- ▶ 1 x NACC–A and 2 x LTAC–A are installed in three adjacent line card slots in the subrack.

NACC–C – 12 line POTS Splitter Card.

- ▶ Performs POTS/ADSL Splitting Function.
- ▶ Used in LIM slot to form ADSL twin with one LTAC–C.
- ▶ 1 x NACC–C and 1 x LTAC–C are installed in two adjacent line card slots in the subrack.

DSAP - Dual Slot Attenuator Plug

- ▶ Provides physical access to an ADSL twin (1 x LTAC–C and 1 x NACC–C).
- ▶ Provides attenuation of ADSL signal.
- ▶ Has the same pinouts as a DSPP–B.
- ▶ Does not have bypass relays.

DSPP–B – Dual Slot Position Plug.

LTAC–C ADSL line cards and NACC–C splitters work in ADSL twins. Each twin consists of one LTAC–C, and one NACC–C. These are located in two adjacent slots in the subrack.

The DSPP–B is a plug which provides the interconnections between a LTAC–C and a NACC–C in a twin. The DSPP–B is two slots wide. It is located below the twin in the subrack plug area.

The DSPP–B provides:

- ▶ Cross connections between NACC–C and LTAC–C.
- ▶ Physical connectors for POTS lines from POTS cards in the exchange or CMUX.
- ▶ Physical connectors for customer lines.
- ▶ Relays for bypassing the NACC–C.

PRCPB

The PRCPB is a single slot plug which provides connections for:

- ▶ HLTC.
- ▶ LTAC.

TSCP – Triple Slot Combiner Plug.

The TSCP is used in ACPA and AGH (AGHA or AGHB) to:

- ▶ Interconnect a LTAC–D with an ATLCC line card.
- ▶ The TSCP also provides the external connections for 24 ADSL–over–POTS lines and six POTS–only lines.

The TSCP is three slots wide and is located below the LTAC–D/ATLCC in the plug area of the subrack.

TSPP–A – Triple Slot Position Plug.

ADSL line cards and splitters work in ADSL triplets. Each triplet consists of two LTAC–As, and one NACC–A. These are located in three adjacent slots in the subrack.

The TSPP–A is a plug which provides the interconnections between the two LTAC–A and one NACC–A in a triplet. The TSPP–A is three slots wide and is located below the triplet in the plug area of the subrack.

The TSPP–A provides:

- ▶ Cross connections between NACC–A and LTAC–A.
- ▶ Physical connectors for POTS lines from POTS cards in the exchange or CMUX.
- ▶ Physical connectors for customer lines.
- ▶ Relays for bypassing the NACC–A.

MiniMUX Plugs

MiniMUX uses the MLS–sm–T9 subrack which has external dimensions similar to the RIM/C–RIM Access Panel. The plug and card areas are re–arranged to suit the available space, with the plug area having different dimensions of the plug area of the MLS–hb and MLS–hbe.

The MLS–sm–T9 uses three types of plug:

- ▶ The T9IPA is the controller plug. It also has power and auxiliary functions.

- ▶ The T9APA is a the line card plug which supports twelve ADSL lines. It interconnects the LTAC–C and NACC–C in an ADSL twin similar to the DSPP–A. It also provides connectors for the external cabling for the ADSL twin.
- ▶ The T9APB is a the line card plug which supports 24 ADSL lines. It provides external connections for the LTAC–D.

MiniMUX plugs are described in the MiniMUX Technical Handbook.

CPE Splitters and Filters

ADSL and POTS services must be separated at the customer's premises. This is done by CPE filters and splitters, as described in Appendix C.

- ▶ Filters or splitters are located at the customer's premises, and perform passive line filtering.
- ▶ Both distributed filters (one filter per phone) or central splitter (one splitter per incoming line) are available.

4.3 Internal Transport Architecture

4.3.1 Transport Maintenance – External Signals

(1) STM–1 Connections

The STM–1 from the AANC or ASCC–S ADSL broadband controller does not support access to the section overhead, or SDH specific transport features.

STM–1 access at the AANC or ASCC–S is only for data transport via a VC4. Therefore ADSL in CMUX does not support transport maintenance at the connection level. Loss of signal, simple maintenance indicators and path overhead insertion/extraction are supported, but not full transport maintenance.

(2) IMA ATM Connections

The AICC is a broadband controller with 4 x 2 Mbit/s IMA encoded interfaces for the physical connections. The AICC is similar in the restrictions of transport maintenance at the connection level because it does not support full out of band signalling. Only simple features such as loss of signal detection, frame alignment generation and detection, and bit timing recovery are supported.

The AICC is configurable for the following IMA topologies:

1 x IMA4:	4 x 2 Mbit/s IMA from AICC to exchange.
1 x IMA3:	3 x 2 Mbit/s IMA from AICC to exchange.
1 x IMA2:	2 x 2 Mbit/s IMA from AICC to exchange.
1 x IMA1:	1 x 2 Mbit/s IMA from AICC to exchange.
1 x E1:	1 x 2 Mbit/s (non IMA) to exchange.

The PAIC is the IMA LT card and provides four 2 Mbit/s IMA E1 interfaces. The PAIC translates the information between the physical E1 interfaces and the IQ broadband bus on the MLS backplane.

The PAIC is configurable for the following IMA topologies:

- 1 x IMA4:** PAIC connects to 4 x 2 Mbit/s IMA from one AICC.
- 1 x IMA3:** PAIC connects to 3 x 2 Mbit/s IMA from one AICC.
- 2 x IMA2:** PAIC connects to two AU and/or NUS, each of which has an AICC with 2 x 2 Mbit/s IMA.
- 4 x IMA1:** PAIC connects to four separate AU and/or NUS, each of which has one AICC. Uses IMA encoding.
- 4 x E1:** PAIC connects to four separate AU and/or NUS (4 separate AICCs). Does not use IMA.

All IMA interfaces are 120Ω balanced interfaces, and conform to ITU recommendations G.703 and G.704.

4.3.2 ATM Transport Functions

The ATM transport function is different depending on location in the system. The network side and customer side interfaces are described below:

(1) Towards Network Side with AICC:

At the network side the ATM data is sent via the AICC as IMA encoded 2 Mbit/s electrical connections.

This interface allows connection to devices such as ATM routers or ATM Access Devices. These cards can reconstruct the original ATM data streams from the IMA data. IMA is also a convenient format for transporting data between NU and AU.

(2) Towards Network Side with AANC or ASCC-S:

At the network side, the ATM data is sent via the AANC or ASCC-S as a VC-4 over STM-1. The AANC or ASCC-S performs clock recovery, line code conversion, frame alignment and some additional STM-1 related functions.

(3) From Network side with PAIC

On the network side, the PAIC connects to the IQ bus. On the side towards the customer, the PAIC provides 4 x 2 Mbit/s E1 IMA interfaces.

(4) Customer Side

The customer has an ADSL NT at their premises. The customer interfaces supported depend on the type of ADSL NT used.

Available interfaces are:

- ▶ Ethernet.
- ▶ 25M ATM Forum Port.

4.3.3 Internal ATM Connections

Internal ATM connections in CMUX are the maintenance links between the broadband controller and the broadband line cards.

The AANC or ASCC–S supports internal maintenance links in the form of Virtual Path / Virtual Circuits. These VP/VCs are established between the controller and the broadband line card.

The controller establishes the VP/VC, and uses it to gather information about the LIM status and also to send initialisation data and user configuration information to the line card.

4.3.4 Traffic Handling

The IQ bus is the internal data path between the ADSL line cards and the ADSL controllers. It operates synchronously and allows full duplex operation.

User traffic is transported across the backplane via VP/VCs. One or more VP/VCs are established for each user connection between the broadband controller and the LTAC (LTAC–A, LTAC–C or LTAC–D). One VP/VC is established when a user port is configured on the LTAC, and further (non OA&M) VP/VCs may be established under user control.

4.3.5 ATM Transport Resources

Related Physical Entity		Bandwidth (down/up)	
ASCC–S Optical transport	STM–1	150 Mbit/s	150 Mbit/s
AANC Optical transport	STM–1	150 Mbit/s	150 Mbit/s
AICC Electrical	E1 IMA G.703	8 Mbit/s	8 Mbit/s
Subrack Backplane	IQ	155 Mbit/s	155 Mbit/s

4.3.6 Broadband Extension Architecture

A CMUX NU or AU may have up to twelve Subracks.

- ▶ The first subrack is known as the main subrack. It is always a MLS–hb and is equipped with a broadband controller (AANC, ASCC–S, or AICC).
- ▶ The other eleven subracks are extension subracks. Each extension subrack containing broadband cards is equipped with a broadband extension controller (BSEC). Extension subracks may be MLS–hbe or MLS–hb.

MiniMUX may have up to four subracks.

Extension of the main subrack to provide for further line card interfaces is provided via an extension controllers in each extension subrack.

- ▶ The BSEC (Broadband Extension Card) extends the IQ bus and hardware management functionality for broadband services.
- ▶ The NSEC (Narrowband Extension Card) extends the NLC bus and hardware management functionality for narrowband services.

4.4 ATM Service Categories

In CMUX Releases ANR 2.0 and ANR 3.2.1 BB, CMUX supported CBR, UBR and UBR+ ATM Service Categories (ASC). From FR2.1F BB, the following additional ATM service categories will be supported:

- ▶ Real-Time Variable Bit Rate (rt-VBR)
- ▶ Non-Real-Time Variable Bit Rate (nrt-VBR)
- ▶ Guaranteed Frame Rate (GFR)

In addition to the new ASCs, a multi-QoS function is supported; allowing the ASC (or QoS) of each ATM connection carried over a xDSL interface to be set independently of each other.

Table 4-1 indicates the ATM Service Categories to be supported in CMUX. Previous releases of CMUX have been included for comparison. Note that in FR2.1F BB, the supported Service Categories depend on the specific line card hardware. The LTAC-C and LTAC-D are equipped with an enhanced ATM processor that supports a larger range of Service Categories.

The supported ASCs apply to all controller types i.e. ASCC, AANC and AICC.

Selective Cell Discard is used by nrt-VBR.2, nrt-VBR.3 and GFR.2 to discard by preference CLP=1 cells.

Frame Discard is a mandatory feature for GFR. If a cell is to be deleted, then all the following cells of a frame are deleted. This avoids the transmission of cells from errored frames that will need to be re-transmitted anyway. Frame Discard can be optionally enabled for other ASCs on the LTAC-C and LTAC-D on a per connection basis. Frame discard can provide significant improvements to throughput for frame based protocols such as IP.

Table 4–1 Supported ATM Service Categories

ATM Service Categories	ANR2.0	ANR3.2.1 BB		FR2.1F BB	
	LTAC–A PAIC	LTAC–A PAIC	LTAC–C	LTAC–A PAIC	LTAC–D LTAC–C
CBR.1	✓ §1	✓	✓	✓	✓
UBR	✓	✓	✓	✓	✓
UBR+	✓ §2	✓ §2	✓	✓ §2	✓
Bi–QoS (UBR & CBR on single line)		✓	✓	✓	✓
rt–VBR.1				✓ §3	✓
nrt–VBR.1				✓ §3	✓
nrt–VBR.2					✓ §4
nrt–VBR.3					✓ §4
GFR.1					✓ §4
GFR.2					✓ §4
Tri–QoS (CBR, UBR & VBR on single line)				✓	✓
Multi–QoS (any QoS mix on single line)					✓

Note

§1 Policing is not supported

§2 Aggregate MCR guarantee per LT interface

§3 Max. Burst Tolerance ≤ 1 second

§4 Not required by Telstra – not supported by XDM.

4.5 Internal Control Communication

4.5.1 Broadband Communication

(1) Broadband Communication – Peer Controllers

A serial link is implemented between redundant Broadband (BB) Controller pairs. This link is used for transmitting configuration information from the active to the standby controller such that the configurations are identical in both controllers. This ensures that a fast switchover is possible in the event of the active controller failing.

When a controller detects that a peer BB controller has been installed, it establishes communication with the peer board, and sends it configuration data.

(2) Broadband Communication – Controller to Line Cards

When a broadband LIM has initialised it begins to send ATM cells on the IQ bus to the broadband controller. The ATM cells contain information such as the board position and type which uniquely identify the board in the CMUX rack. The format of the ATM cells is recognised by the controllers as being an initialisation cell from a line card.

The Equipment Manager in the controller recognises that a broadband LIM has become active in the backplane and then proceeds to establish a Virtual Path/Virtual Channel (VP/VC) between the BB line card and the BB Controller.

The VP/VC is used for management and control of the BB line card. All broadband line cards have onboard controllers.

Hardware Management Wires (HMW) detect board presence and type. This allows the broadband controller to detect the presence of both narrowband and broadband line cards. HMW are also used to disable and reset broadband line cards.

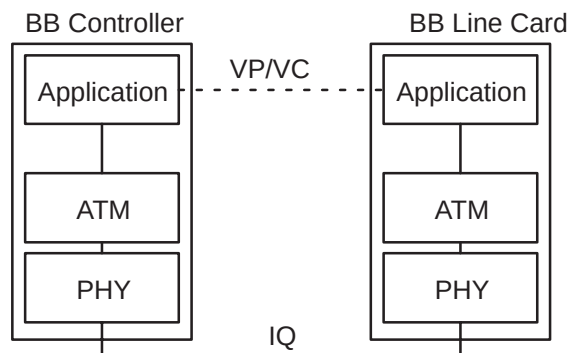


Figure 4-5 OA&M Link Between BB Controller and BB LIM

(3) Communication – CMUX to CPNT

A Virtual Path/ Virtual Channel (VP/VC) is setup between the ADSL LIM and the CPNT (Customer Premises Network Termination) at the customers premises. The CPNT is usually an ADSL modem.

Once a service is configured and the CPNT is installed at the customer premises, a VP/VC is established between the LTAC (LTAC-A, LTAC-C, or LTAC_D) and the CPNT. This link is used for all OA&M data between the CMUX and the CPNT.

The VP/VC between the broadband controller and the LTAC is separate to the VP/VC between the LTAC and the CPNT.

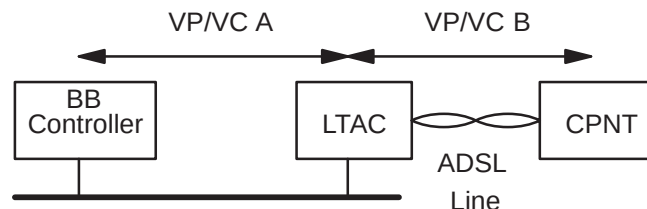


Figure 4-6 VP/VCs for OA&M

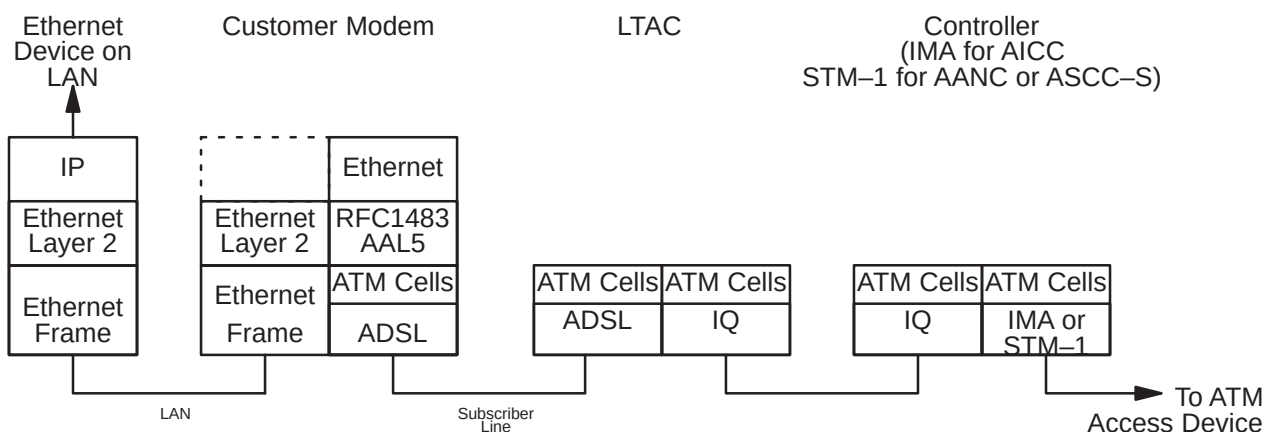


Figure 4-7 ADSL Layered Protocol Structure

4.5.2 Communication with Management Entities

(1) Broadband Network Management

The AWS is the CMUX network management system that manages the ADSL cards. The interface to the AWS is via a dedicated ATM cell (Virtual Path/Virtual Channel) transported over the ATM network from the CMUX ATM NT (AICC, ASCC-S, or AANC).

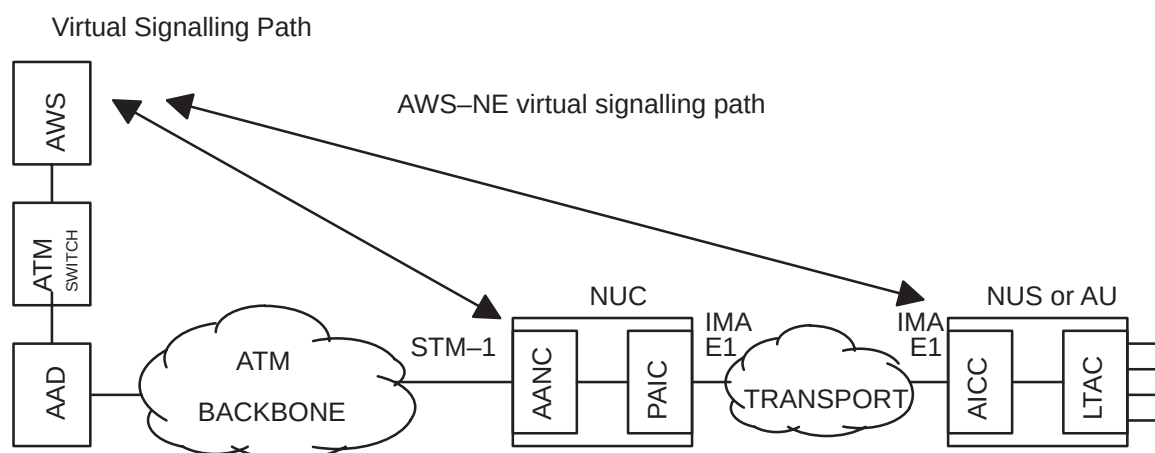


Figure 4-8 Example Network Management Transport Path

Note IMA link is carried as follows:

- Over an optical link between EOTC cards at the NUC and AU.
- Via the DDF where the NUC and NUS are co-located in the same building.
- Via external transmission between a NUC and a NUS in a different building.

(2) Broadband Local Craft

The CMUX Broadband Local Craft Terminal is a laptop computer running terminal emulator software such as Windows HyperTerminal. It allows local access to the TL1 command line interface at a CMUX NU or AU.

The configuration of a CMUX is normally done by AWS via the network. The CMUX Broadband Local Craft is only used for the basic configuration required to establish communication between AWS and CMUX.

4.6 Synchronisation

4.6.1 Synchronisation Sources and Selection

Synchronisation sources for the broadband cards are as follows:

(1) AANC and ASCC–S

The AANC or ASCC–S is a Network Termination, and so the default mode of operation is to synchronise from the extracted STM–1 clock. If the STM–1 clock is not available the AANC or ASCC–S synchronises to an onboard oscillator.

The user does not have control to override the clock selection. This prevents situations in which the AU loses synchronisation with the NU, and therefore losing communications. This situation would be unrecoverable.

(2) AICC

The AICC synchronises to the extracted clock from the 2Mbit IMA input. The synchronisation source is not selectable.

(3) PAIC

The PAIC synchronises to the IQ bus. The PAIC is a line termination card, and hence should be the clock source for the G.703.

This means that when an AICC is connected to the PAIC, the AICC is synchronised from the PAIC.

4.6.2 Broadband Clock Distribution

One clock is distributed for each of the two IQ busses (A and B). Extension of the clock is performed by the broadband extension.

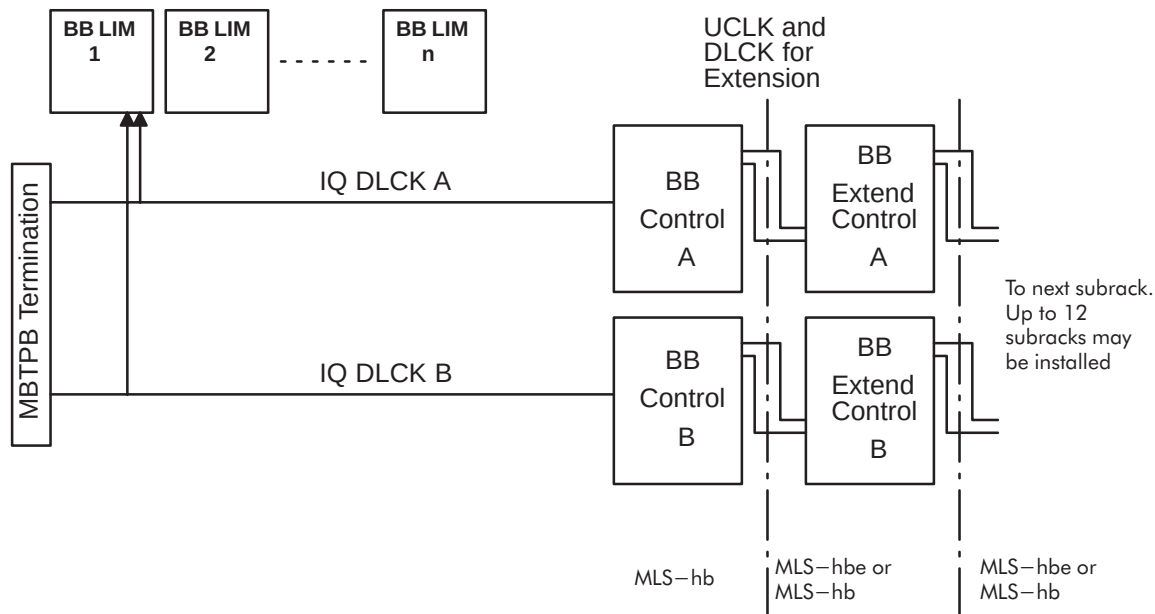


Figure 4–9 Broadband Clock Distribution

4.7 Error Detection on IQ Bus

The IQ bus is the subrack bus which carries broadband traffic. It is implemented in a redundant configuration for both upstream and downstream directions.

- ▶ In the downstream direction the HEC error control is used for fault detection.
- ▶ In the upstream direction the HEC is corrected by the BB NT. In cases where the HEC cannot be corrected, the cell is discarded.

4.8 Customer Line Testing – Broadband Lines

As ADSL lines share the physical copper pair as an existing POTS service, line testing is supported only via the existing POTS line test. Broadband line testing uses the same line tests that are performed on narrowband lines.

Broadband line tests are performed without bypassing, and the NACC (NACC–A, NACC–C or NACC–D) is in the path of the line under test. This method is simple and means that the test system and the broadband management do not need to synchronise.

4.9 System Network Interfaces

4.9.1 STM–1 Optical on AANC or ASCC–S

The optical STM–1 connection to the AANC or ASCC–S is a dedicated optical module.

Angled SC/APC connectors are located on the front plate of the AANC or ASCC–S, and are connected to the optical module via optical fibre patch cords.

4.9.2 4 x E1 IMA Channels on AICC

For broadband applications, the AICC controller provides four E1 ports supporting the IMA ATM protocol. If four ports are not required then fewer ports can be used. If only one port is used then IMA encoding is optional.

In the downstream direction the AICC assembles the data transmitted over these ports into a single 2.048 to 8.192 Mbit/s datastream for subsequent transmission to the IQ Bus.

Likewise in the upstream direction, the AICC receives a datastream of up to 8.192 Mbit/s and distributes this data over up to four E1 ports.

In CMUX the impedance of the incoming E1 line is 120 Ω . This impedance is set by the plug. Transmission of E1 signals complies with the following standards:

- ▶ G.703.
- ▶ G.704.
- ▶ G.804.
- ▶ IMA.

4.10 ADSL POTS Splitting

To minimise interference between the ADSL and the POTS systems filters are used to isolate the POTS service. The filter function is called a POTS splitter.

This section shows POTS splitter arrangements at the CMUX.

POTS splitters are also required at the customer's premises.

4.10.1 POTS Splitter – CMUX End

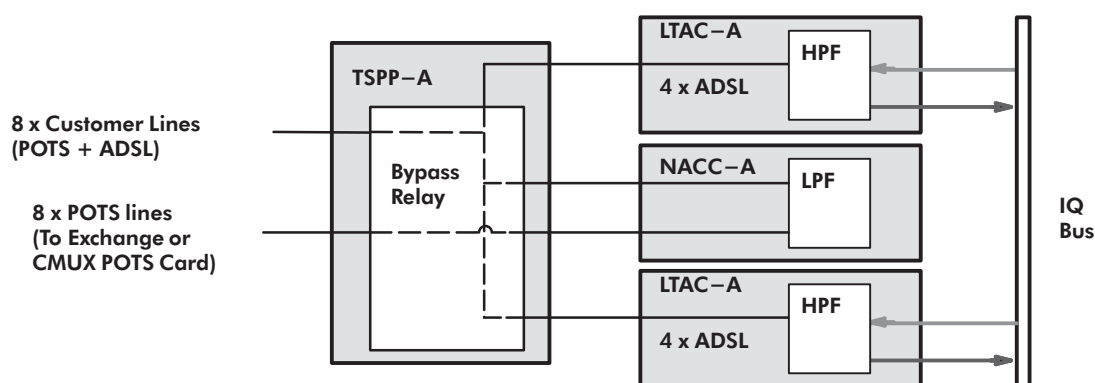


Figure 4-10 ADSL Triplet – Block Diagram

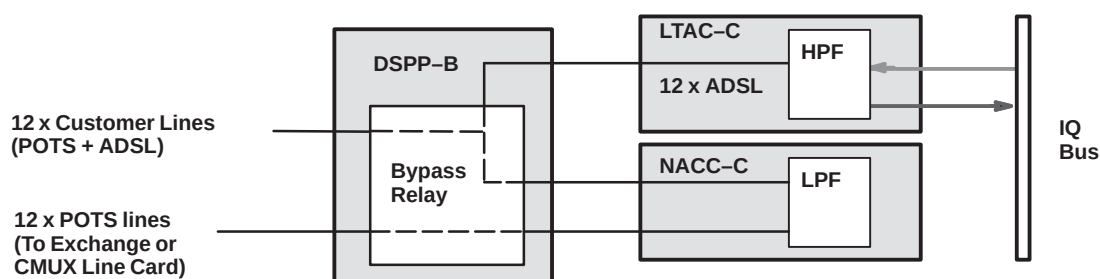


Figure 4-11 ADSL Twin with DSPP-B – Block Diagram – CMUX

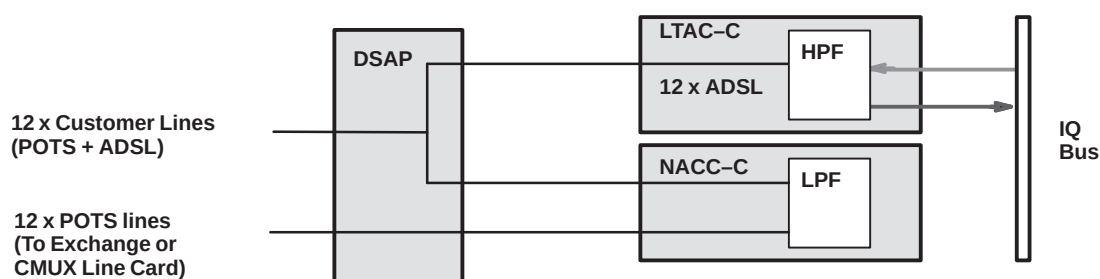


Figure 4-12 ADSL Twin with DSAP – Block Diagram – CMUX

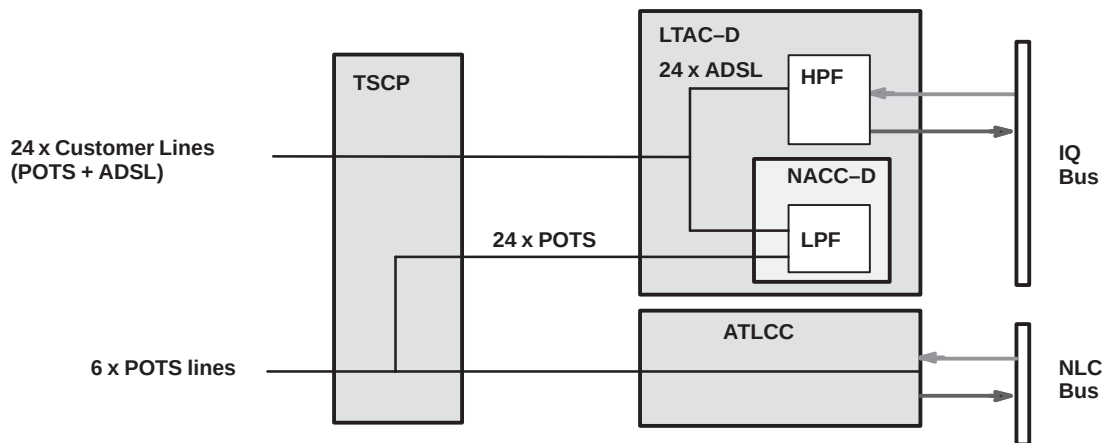


Figure 4-13 LTAC-D/ATLCC with TSCP – Block Diagram

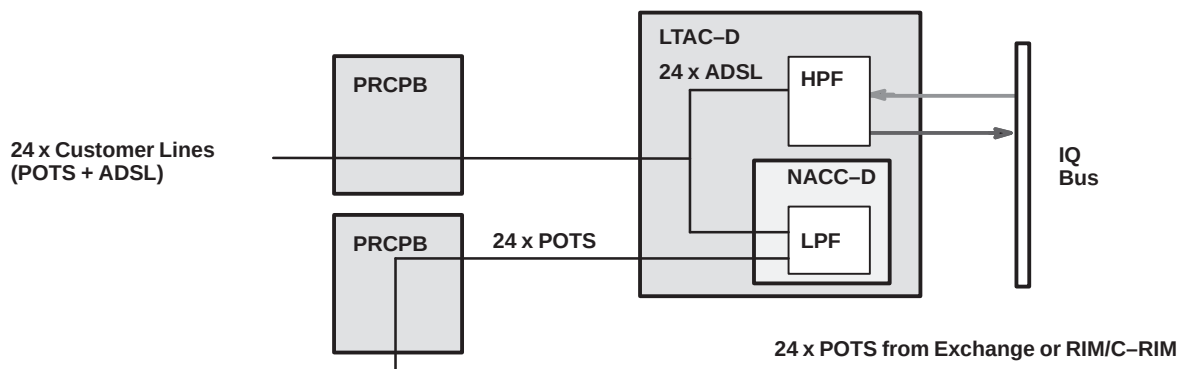


Figure 4-14 LTAC-D with 2 x PRCPB – Block Diagram

At the CMUX the POTS splitter function is incorporated into a triplet (NACC-A, 2 x LTAC-A and TSPP-A), a twin (LTAC-C, NACC-C, and DSPP-B, or a splitter daughterboard mounted on the LTAC-D:

- ▶ Customer lines are terminated on the TSPP-A, DSPP-B, DSAP, TSCP or PRCPB.
- ▶ The NACC (NACC-A or NACC-C or NACC-D), or the splitter daughterboard on the LTAC-D, has a low-pass filter to block ADSL signals from the POTS card in the exchange or CMUX.
- ▶ The LTAC (LTAC-A, LTAC-C or LTAC-D mainboard) has a high pass filter to block POTS frequencies.
- ▶ The DSAP attenuates the ADSL signal to the equivalent level of an ADSL signal using copper cable from the exchange to the location of the AU.

5 Customer Interface

This chapter summarises the customer interface requirements for the services available in a CMUX system.

The diagrams do not show auxiliary cards required for NB services:

- ▶ If ring is required a DURCC card is installed.
 - Ring is required at the NUC, NUS and AU for POTS and similar services originating from line cards at that location.
 - Ring is required at the NUC for indial, outdoor extension and similar services.
- ▶ The TACCB is required for line testing.
- ▶ The TARCB is required at each NE (NUC, NUS or AU).

5.1 Legend

Provided below is a legend describing each sub heading of the customer interface section.

Function Brief functional description of the customer interface, typically accompanied with a figure illustrating the appropriate system configuration.

Customer Premises Equipment List of typical customer equipment that might be used with the interface.

Card List of cards required to provide the customer interface.

CMEM and AWS Lists specific system configuration requirements that would be required to provide the customer service, such as enabling of certain signalling options.

In addition, all Cards must be assigned to a slot in a subrack. These standard configuration activities are not mentioned in the section for each service.

Special Considerations Considerations that must be taken into account when providing this customer interface. These typically relate to location of the card relative to the Customer Premises Equipment (CPE).

POTS From Exchange The diagrams in this chapter show POTS services originating from the ATLCC line card in a CMUX subrack. POTS services can also originate from a POTS line card in the exchange. POTS services from the exchange are then jumpered at the CMUX or MDF to connect to the TSPP–A, DSPP–B or DSAP.

5.2 Interfaces

The available customer interfaces depend on the mode of operation of the channel (V5.2 or Mirror). Availability of a service also depends on the Release of CMUX.

5.2.1 Broadband Interfaces and Services

Customer Service	Section
ADSL	5.3

5.2.2 DDN 2 Mbit/s G.703

Customer Service	Section
DDN 2 Mbit/s G.703	5.4

5.2.3 Narrowband Interfaces and Services

Customer Service	V5.2	Mirror	Leased Line	Section
ISDN BA	x			5.5
ISDN PRA	x			5.6
Analogue Leased Line			x	5.7
PABX – Indial		x		5.8
PABX – Outdoor Extension		x		5.9
PABX Tie Line			x	5.10
POTS	x	x		5.11
Payphone	x	x		5.12

5.2.4 Revertive Call

Customer Service	V5.2	Mirror	Leased Line	Section
Revertive Call	x	x		5.13

5.3 ADSL

Function To provide ADSL services to the customer's premises.

Customer Premises Equipment ADSL splitter(s) and ADSL CPE.

5.3.1 ADSL at NUC

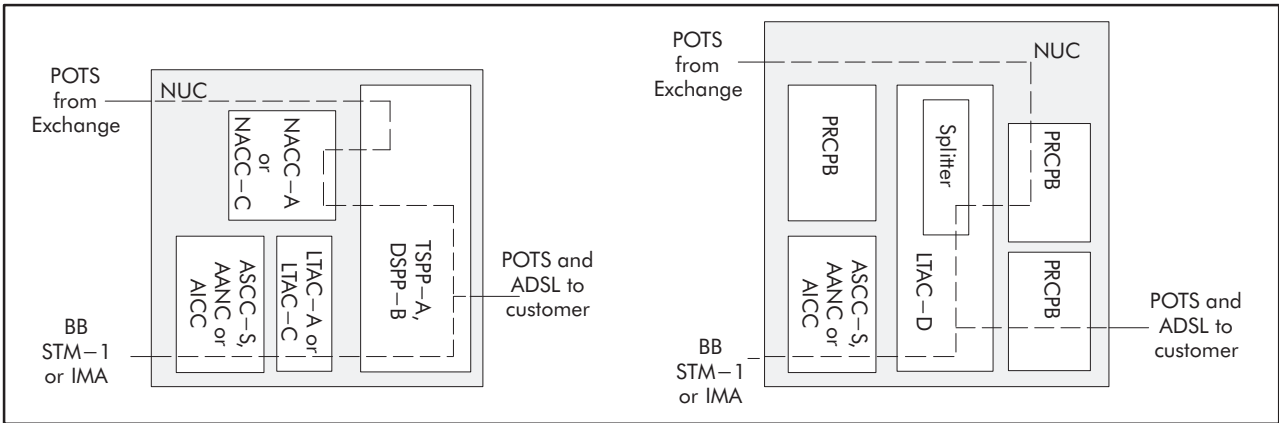


Figure 5-1 ADSL at NUC

Function	NUC
Narrowband controller	NEHC-P
Narrowband line card	Exchange POTS card
POTS/ADSL combiner	NACC-A, NACC-C or Splitter daughterboard on LTAC-D
Broadband controller	AANC, ASCC-S, or AICC
Broadband line card	LTAC-A, LTAC-C, or LTAC-D
Plug	TSP-A, DSPP-B, PRCPB

5.3.2 ADSL at NUS – External Transmission

(1) NUS with LTAC–A or LTAC–C

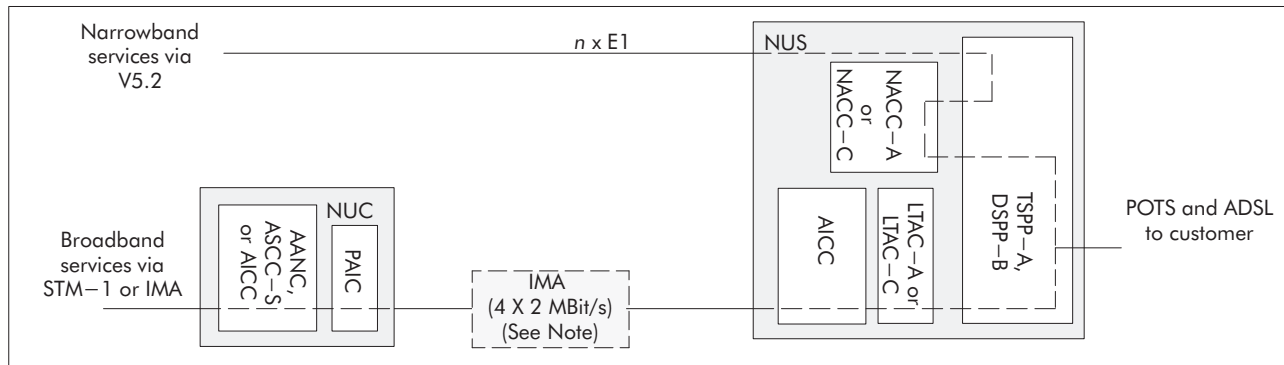


Figure 5–2 ADSL at NUS – LTAC–A or LTAC–C

Function	NUC	NUS
Narrowband controller		NEHC–P
Narrowband line card		ATLCC
POTS/ADSL combiner		NACC–A or NACC–C
Broadband controller	AANC, ASCC–S, or AICC	AICC
Broadband line card		LTAC–A or LTAC–C
Inverse multiplexer	PAIC	
Plug		TSPP–A or DSPP–B

Note

Transportation options for IMA links include:

- NUC and NUS co–located in same building: IMA links are cabled via the exchange DDF
- NUC and NUS at different locations: The IMA links are cabled to the DDF at the NUC and NUS and use external transmission between these DDFs.
- AU: The IMA link is carried by CMUX optical transmission.

Note

If NUS is co–located with an exchange, NB services at NUS may be from exchange POTS line card.

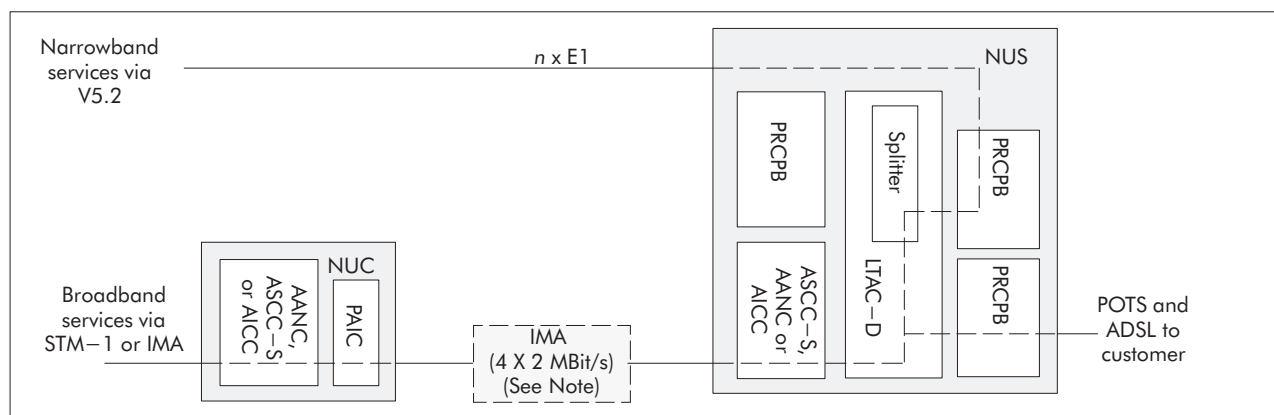
(2) NUS with LTAC-D

Figure 5-3 ADSL at NUS – LTAC-D

Function	NUC	NUS
Narrowband controller		NEHC-P
Narrowband line card		ATLCC
POTS/ADSL combiner		Splitter daughterboard on LTAC-D
Broadband controller	AANC, ASCC-S, or AICC	AICC
Broadband line card		LTAC-D
Inverse multiplexer	PAIC	
Plug		2 x PRCPB

Note Transportation options for IMA links include:

- NUC and NUS co-located in same building: IMA links are cabled via the exchange DDF
- NUC and NUS at different locations: The IMA links are cabled to the DDF at the NUC and NUS and use external transmission between these DDFs.
- AU: The IMA link is carried by CMUX optical transmission.

Note If NUS is co-located with an exchange, NB services at NUS may be from exchange POTS line card.

5.3.4 ADSL at MiniMUX – RIM/C–RIM Transmission

MiniMUX provides ADSL services in RIM/C–RIM housings and racks in a similar manner to ADSL services in a NUS.

Transportation for IMA links between NUC and MiniMUX is via RIM/C–RIM transmission.

(1) MiniMUX with LTAC–C

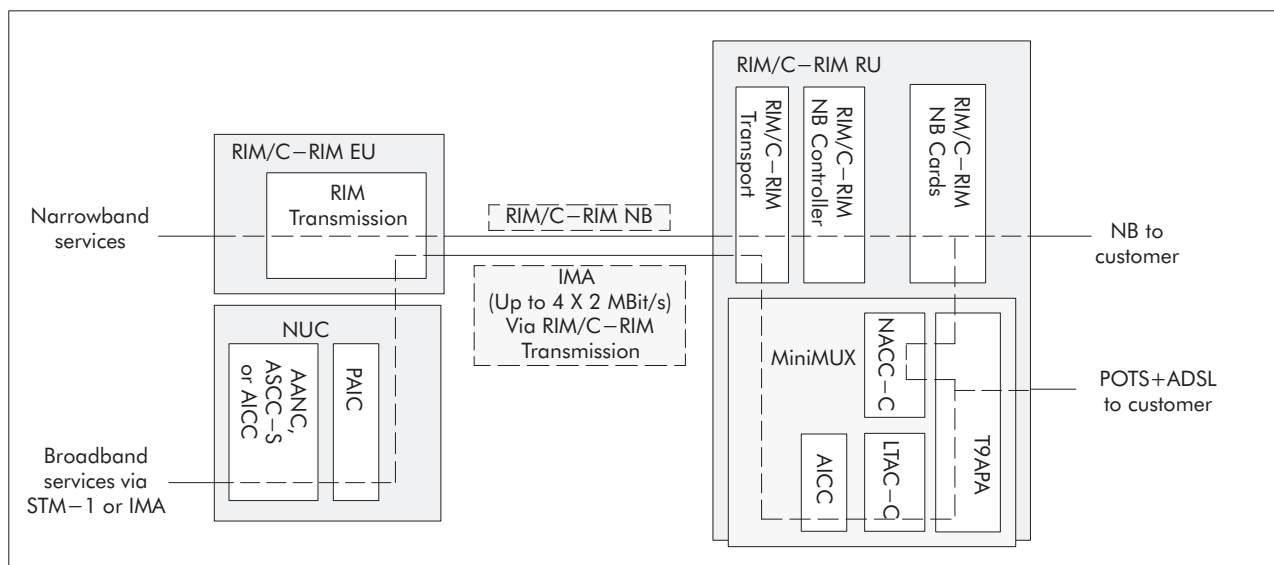


Figure 5–6 ADSL at MiniMUX (In RIM/C–RIM RU)

Function	NUC	RIM/C–RIM RU	MiniMUX
Narrowband line card		POTS or UNIV	
POTS/ADSL combiner			NACC–C
Broadband controller	AANC, ASCC–S or AICC		AICC
Broadband line card			LTAC–C
Inverse multiplexer	PAIC		
Plug			T9APA

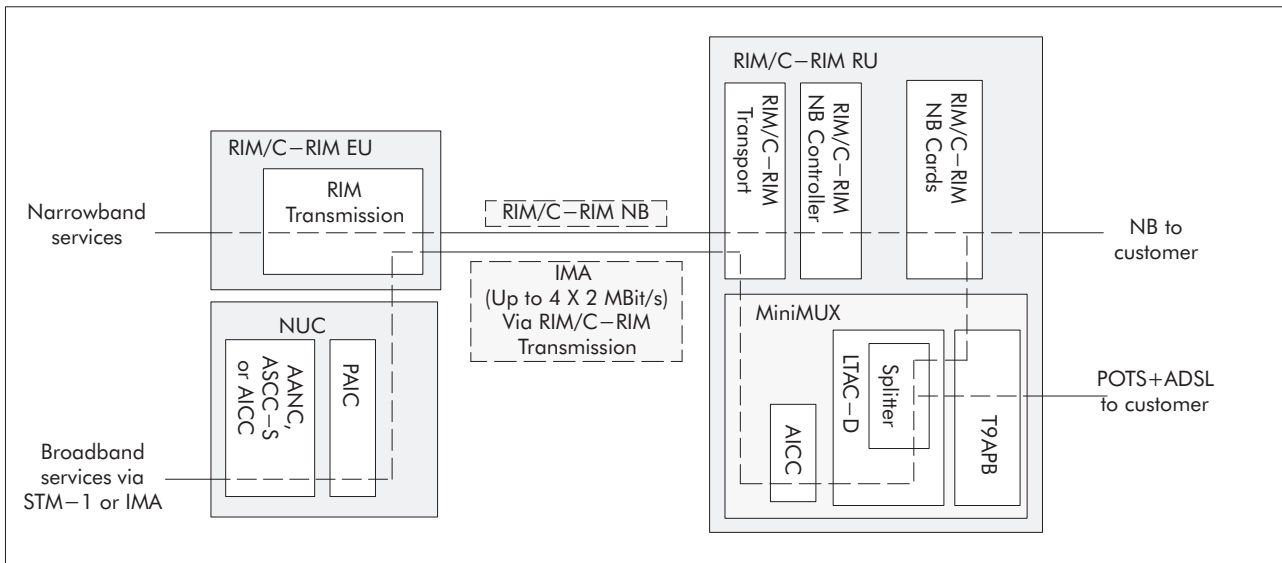
(2) MiniMUX with LTAC-D

Figure 5-7 ADSL at MiniMUX (In RIM/C-RIM RU)

Function	NUC	RIM/C-RIM RU	MiniMUX
Narrowband line card		POTS or UNIV	
POTS/ADSL combiner			Splitter daughterboard on LTAC-D
Broadband controller	AANC, ASCC-S or AICC		AICC
Broadband line card			LTAC-D
Inverse multiplexer	PAIC		
Plug			T9APA

5.3.5 ADSL at NUS-AGH – Adjunct Housing

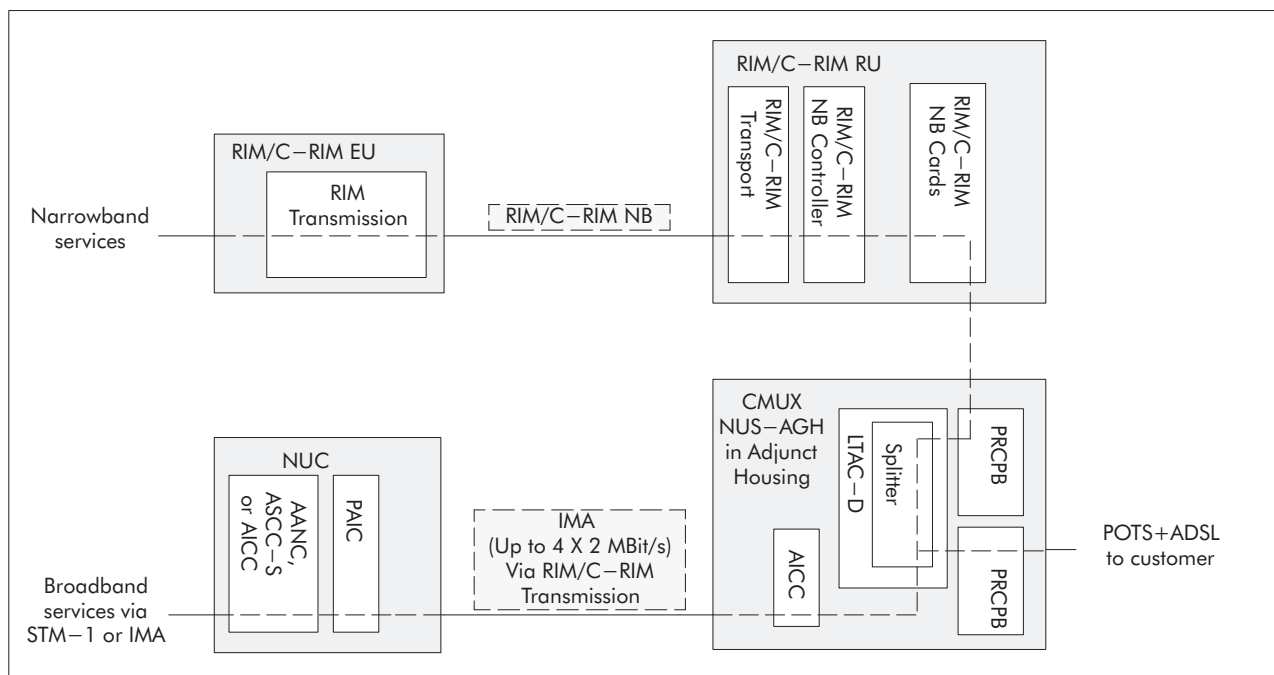


Figure 5-8 ADSL at AU in Adjunct Housing

Function	NUC	RIM/C-RIM RU	CMUX NUS-AGH in Adjunct Housing
Narrowband line card		POTS or UNIV	
POTS/ADSL combiner			Splitter daughterboard on LTAC-D
Broadband controller	AANC, ASCC-S or AICC		AICC
Broadband line card			LTAC-D
Inverse multiplexer	PAIC		
Plug			2 x PRCPB

5.4 DDN 2 Mbit/s G.703

Function To provide DDN 2 Mbit/s G.703 services to the customer’s premises. This service is provided via E1 links.
Typical scenarios are shown in Figure 5–9.

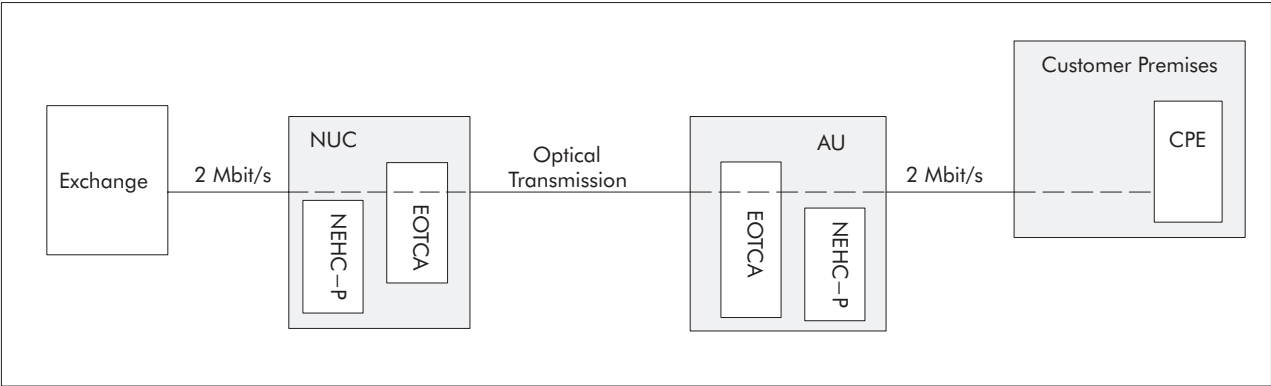


Figure 5–9 DDN 2 Mbit/s G.703

Customer Premises Equipment ISDN PRA CPE

Cards ISDN service may be provided by ISDN cards as indicated in the table below.

Option	NUC	NUS	AU	Customer Premises
DDN 2 Mbit/s G.703	EOTCA NEHC–P		EOTCA NEHC–P	CPE

5.5 ISDN BA

Function To provide ISDN BA services to the customer's premises.

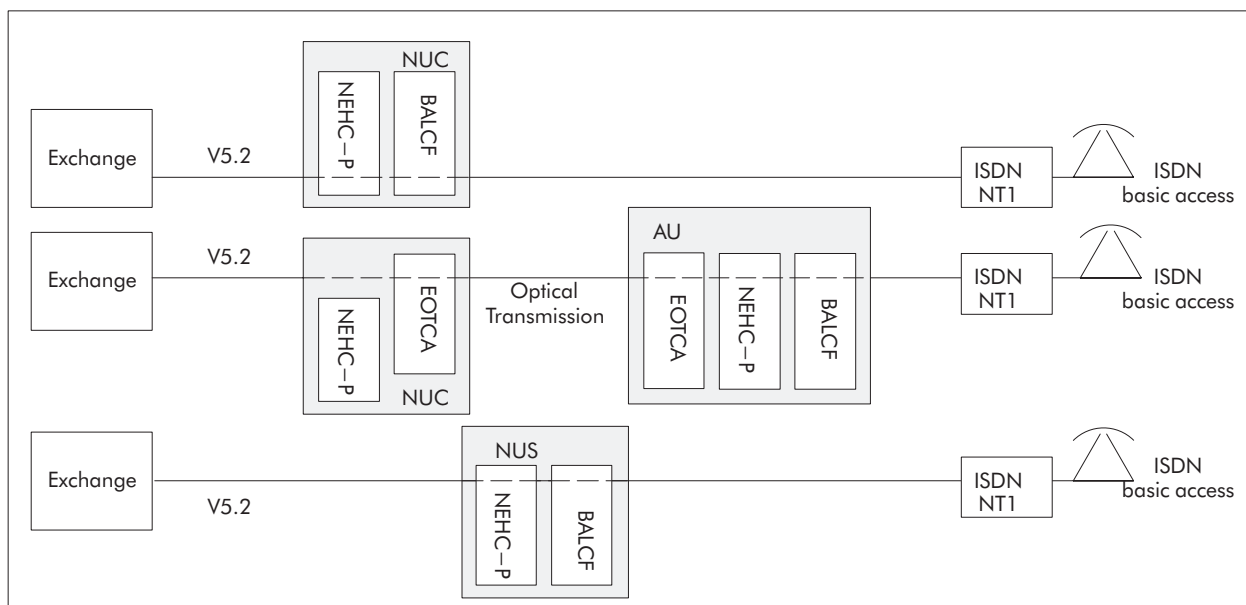


Figure 5–10 ISDN

Customer Premises Equipment ISDN CPE

Cards ISDN service may be provided by ISDN cards as indicated in the table below.

Option	Function	NUC	NUS	AU
ISDN 2B1Q from NUC	ISDN Line Card	BALCF		
	Narrowband Controller	NEHC–P		
ISDN 2B1Q from NUS	ISDN Line Card		BALCF	
	Narrowband Controller	NEHC–P	NEHC–P	
ISDN 2B1Q from AU	ISDN Line Card			BALCF
	Narrowband Controller	NEHC–P		NEHC–P
	PDH Optical Transport	EOTCA		EOTCA

Note ISDN Mirror services are not supported.

5.6 ISDN PRA

Function To provide ISDN PRA services to the customer’s premises. This service may be provided via HDSL or E1 links. Typical scenarios are shown in Figure 5–11.

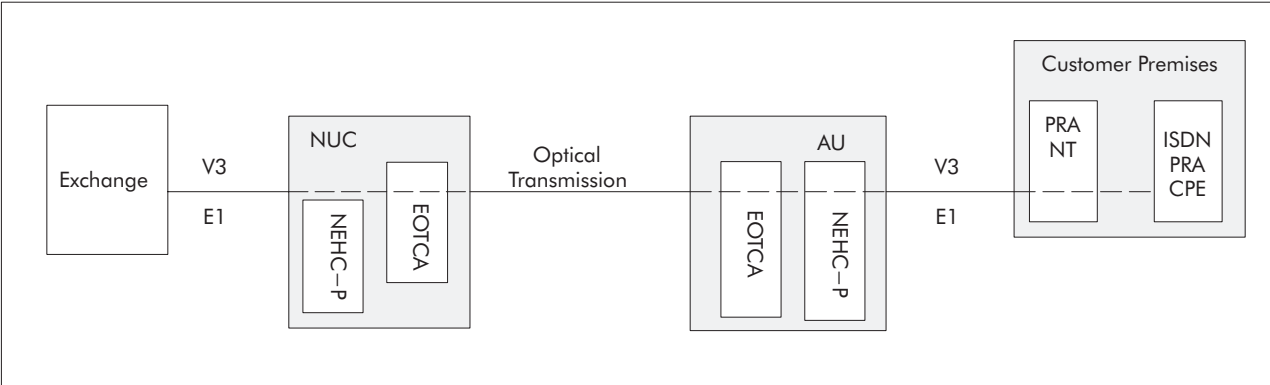


Figure 5–11 ISDN PRA

Customer Premises Equipment ISDN PRA CPE

Cards ISDN service may be provided by ISDN cards as indicated in the table below.

Option	NUC	NUS	AU	Customer Premises
ISDN PRA from AU (G.703)	EOTCA NEHC–P		EOTCA NEHC–P	PRA NT ISDN PRA CPE

5.7 Leased Line – Analogue

Function To provide Analogue Leased Line to the customers premises.

Services Telstra services provided by Analogue Leased Line are:

- ▶ 2W PAPL (Permitted Attachment Private Line)
- ▶ 4W PAPL
- ▶ 6W E & M Leased Line

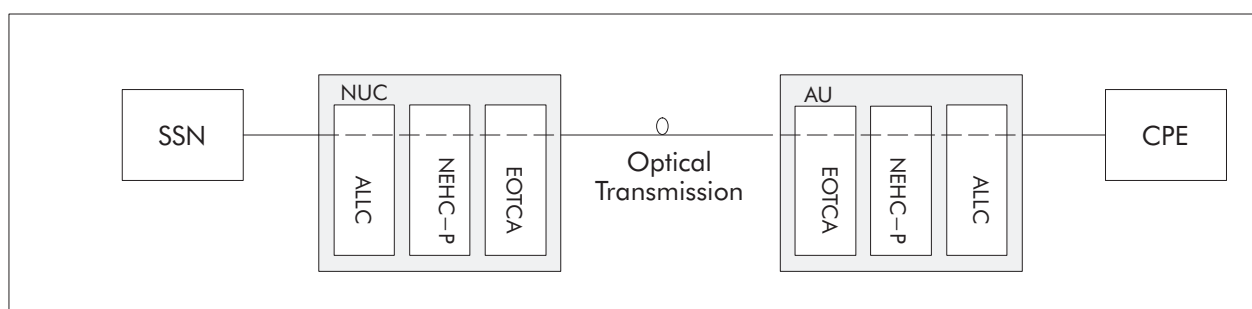


Figure 5–12 Leased Line

Customer Premises Equipment Leased Line CPE equipment.

Cards Leased Line service is provided by ALLC cards as indicated in the table below.

Function	NUC	AU
Line Card	ALLC	ALLC
Narrowband Controller	NEHC-P	NEHC-P
Optical Transport	EOTCA	EOTCA

5.8 PABX – Indial

Function To allow indial service. Separate lines are required for Indial and Bothway Trunk Circuits.

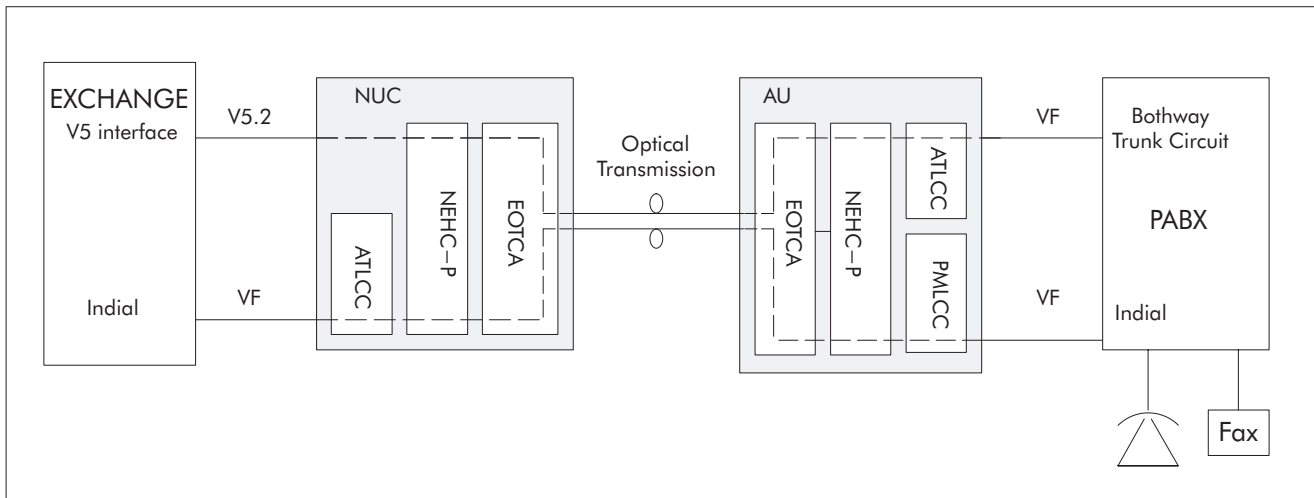


Figure 5–13 2W PABX – Indial Service

Customer Premises Equipment PABX with indial facility.

Cards PABX indial service is provided by cards as indicated in the table below.

Option	Function	NUC	AU
A – POTS (Outgoing Trunk Circuit)	Line Card		ATLCC
	Narrowband Controller	NEHC–P	NEHC–P
	Optical Transport	EOTCA	EOTCA
B – POTS (Indial)	B – POTS (Indial)	ATLCC	PMLCC
	Narrowband Controller	NEHC–P	NEHC–P
	Optical Transport	EOTCA	EOTCA

Special Consideration

- ▶ The ATLCC at the NUC requires ring from a DURCC.
- ▶ TACCB required for line testing at ATLCC.

5.9 PABX – Outdoor Extension

5.9.1 PABX at AU, Outdoor Extension at NUC

Function To allow a PABX connected to the AU to reach a remote extension near the NUC.

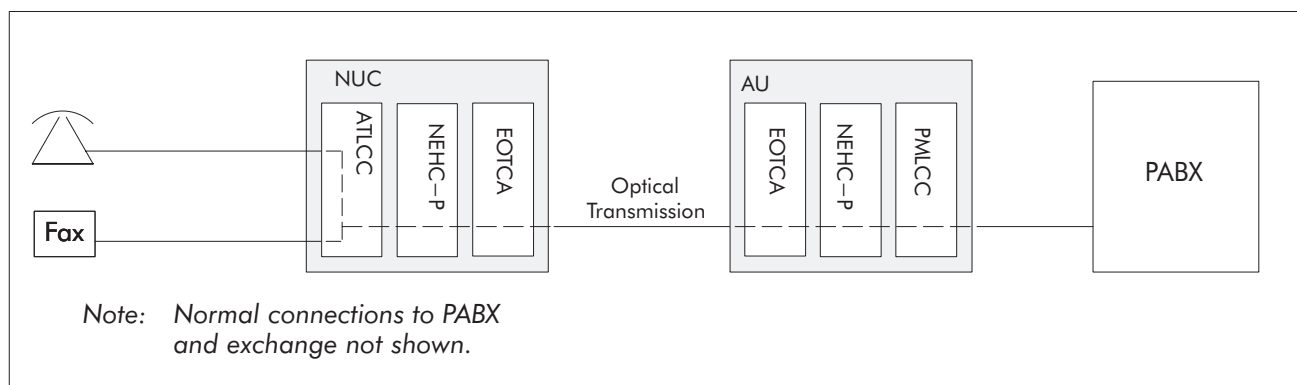


Figure 5–14 PABX 2W – Outdoor Extension Service

Customer Premises Equipment Standard 2W PSTN telephones, fax machines, modems and similar equipment.

Cards	Function	NUC	AU
	Line Card	ATLCC	PMLCC
	Narrowband Controller	NEHC–P	NEHC–P
	Optical Transport	EOTCA	EOTCA

Special Consideration The CPE connected to the ATLCC at the NUC may require ring. This may be obtained from a DURCC at the NUC.

5.9.2 PABX Outdoor Extension – Two CMUX Systems

Function To allow a PABX to reach a remote extension near an AU of a second CMUX. The NUCs of both systems are co-located.

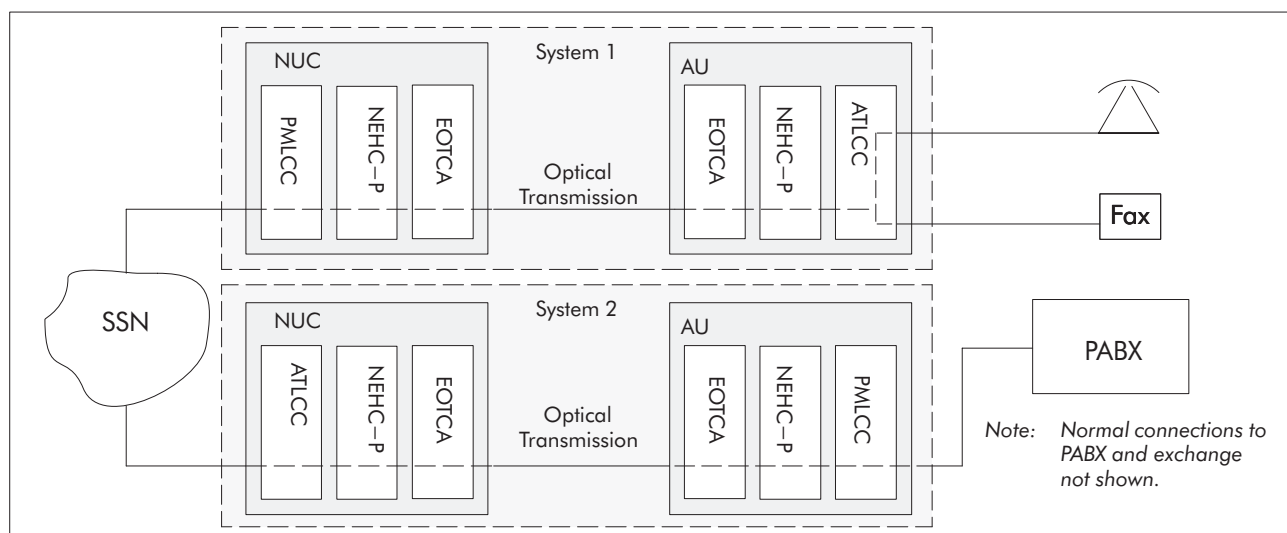


Figure 5–15 2 Wire PABX – Outdoor Extension Service

Customer Premises Equipment Standard 2W PSTN telephones, fax machines, modems and similar equipment.

Cards

System	Function	NUC	AU
System 1 (Outdoor Extension Side)	Line Card	PMLCC	ATLCC
	Narrowband Controller	NEHC-P	NEHC-P
	Optical Transport	EOTCA	EOTCA
System 2 (PABX Side)	Line Card	ATLCC	PMLCC
	Narrowband Controller	NEHC-P	NEHC-P
	Optical Transport	EOTCA	EOTCA

- Special Consideration**
- ▶ Ring voltage may be required by the ATLCC at the NUC and AU. This may be obtained from a DURCC in the NUC or AU respectively.
 - ▶ TACCB required for line testing at AU.

5.10 PABX Tie Line

Services Telstra services provided by PABX Tie Line are:

- PABX tie line (Voicelink T) 4W + E&M.

5.10.1 PABX at AU and NUC

Function To provide a tie line between two PABX connected to the NUC and AU of the same CMUX system.

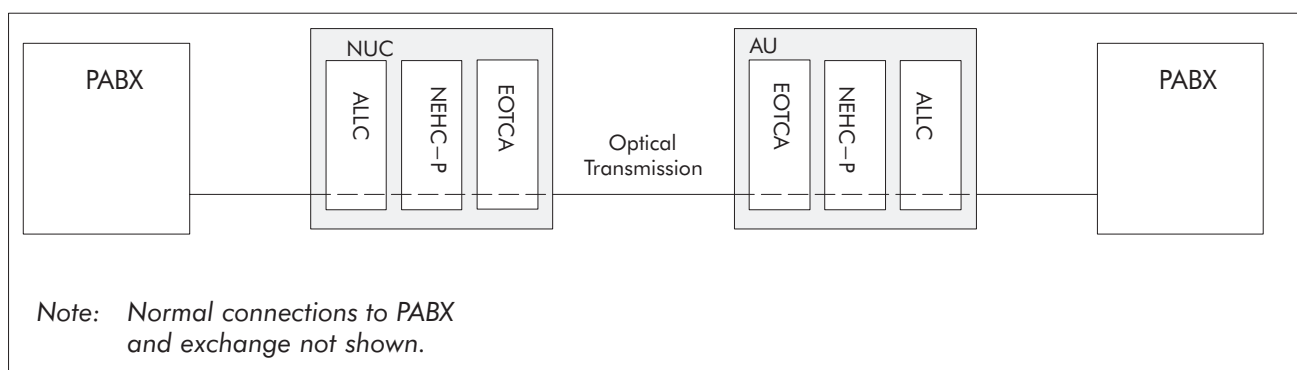


Figure 5–16 2W PABX – Outdoor Extension Service

Customer Premises Equipment PABX

Cards

Function	NUC	AU
Line Card	ALLC	ALLC
Narrowband Controller	NEHC-P	NEHC-P
Optical Transport	EOTCA	EOTCA

5.10.2 PABX Tie Line – Two CMUX Systems

Function To provide a tie line between two PABX connected to the AU of separate CMUX systems.

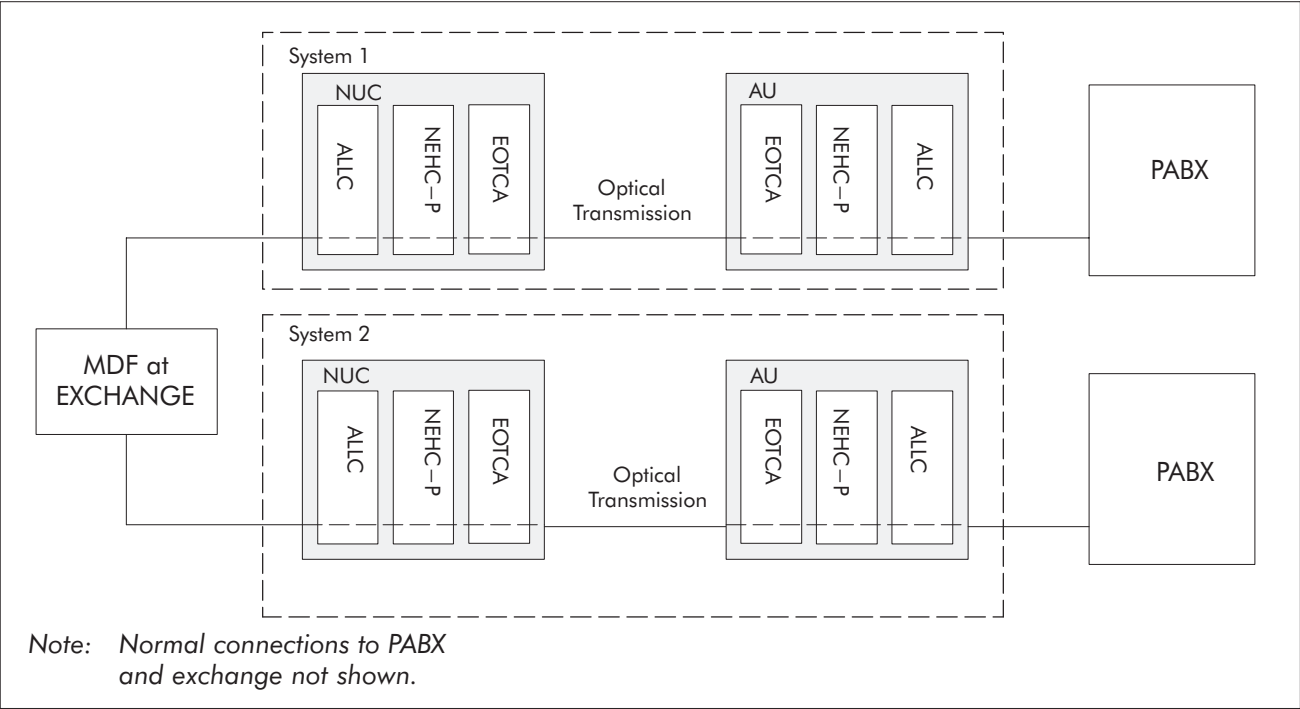


Figure 5–17 2 Wire PABX – PABX Tie Line

Customer Premises Equipment PABX

Cards

System	Function	NUC	AU
System 1	Line Card	ALLC	ALLC
	Narrowband Controller	NEHC–P	NEHC–P
	Optical Transport	EOTCA	EOTCA
System 2	Line Card	ALLC	ALLC
	Narrowband Controller	NEHC–P	NEHC–P
	Optical Transport	EOTCA	EOTCA

5.11 POTS

Function Analogue transmission of voice and data to provide POTS–based services to customers.

Services Telstra services provided by POTS are:

- ▶ POTS.
 - Decadic and DTMF.
 - Timed Loop Break (TLB).
 - Reversals.
 - Modems:
 - V.90 compatible (V5.2 only).
 - V.34 modems (V5.2 or Mirror).
 - Fax.
- ▶ Payphones (see Section 5.12).
- ▶ Customer metering (see Section 5.12).
- ▶ Easycall.
- ▶ Calling number display (V5.2 only).
- ▶ Distinctive ring (V5.2 only).
- ▶ Securitel (Mirror only).

Customer Premises Equipment Standard 2W PSTN telephones, fax machines, modems and similar equipment.

5.11.1 POTS – 2W (V5.2)

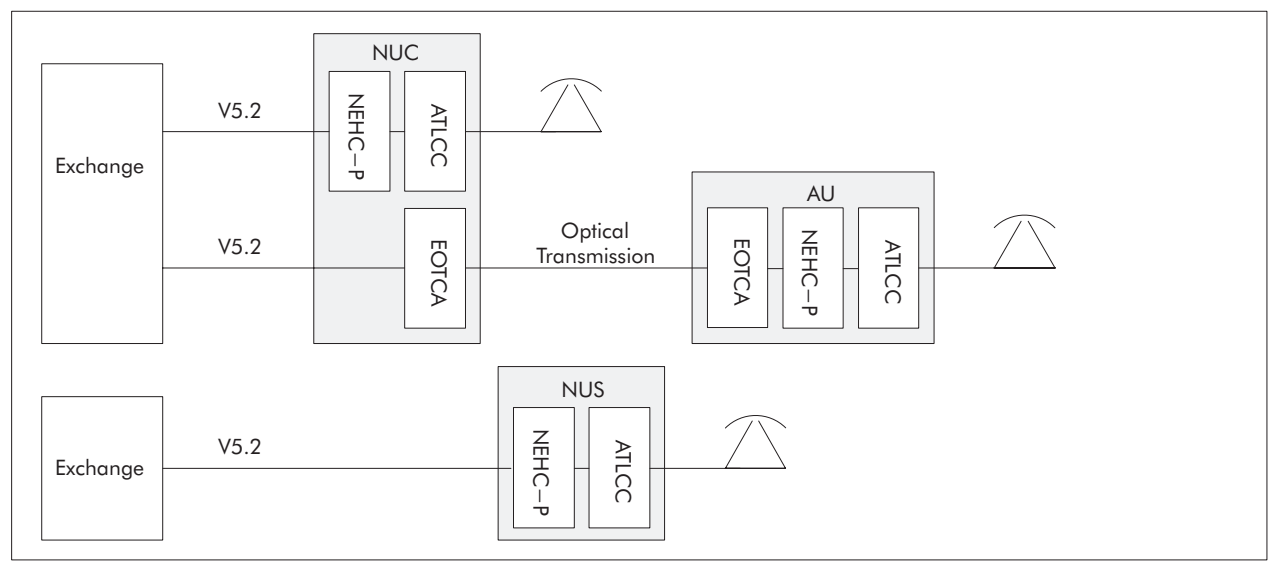


Figure 5 – 18 POTS –V5.2

Cards V5.2 POTS services are provided by the following cards:

Option	Function	NUC	NUS	AU
POTS–2W (V5.2) from NUC	Line Card	ATLCC		
	Narrowband Controller	NEHC–P		
POTS–2W (V5.2) from NUS	Line Card		ATLCC	
	Narrowband Controller		NEHC–P	
POTS–2W (V5.2) from AU	Line Card			ATLCC
	Narrowband Controller	NEHC–P		NEHC–P
	Optical Transport	EOTCA		EOTCA

- Special Consideration**
- ▶ Ring voltage is required by the ATLCC. This may be obtained from a DURCC.
 - ▶ TACCB required for line testing at ATLCC.

5.11.2 POTS – 2W (Mirror)

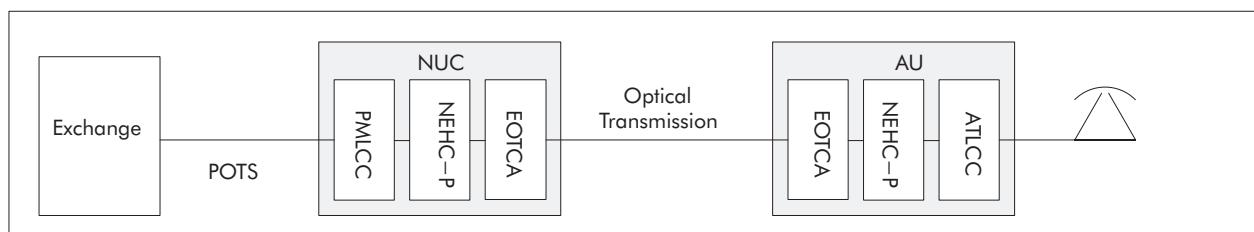


Figure 5–19 POTS – Mirror

Cards Mirror POTS services are provided by:

Function	NUC	AU
Line Card	PMLCC	ATLCC
Narrowband Controller	NEHC–P	NEHC–P
Optical Transport	EOTCA	EOTCA

Special Consideration

- ▶ Ring voltage is required by the ATLCC. This may be obtained from a DURCC.
- ▶ TACCB required for line testing via ATLCC.
- ▶ For correct operation, polarity of the POTS connection to the PMLCC must be:
 - A leg Positive
 - B leg Negative.
- ▶ Use of Securitel is NOT recommended on lines which are also used for ADSL.
- ▶ POTS mirror services do not support CLIP or distinctive ring.

Note

A PMLCC card is not limited to mirroring channels from a single ATLCC.

A PMLCC at the NUC can mirror channels from one or more ATLCC at one or more AU subtended from the NUC, up to the limit of 16 channels per PMLCC.

5.12 Payphone

Function To provide a payphone service with 12 kHz metering.

Customer Premises Equipment Payphone, private metering equipment.

5.12.1 Payphone (V5.2)

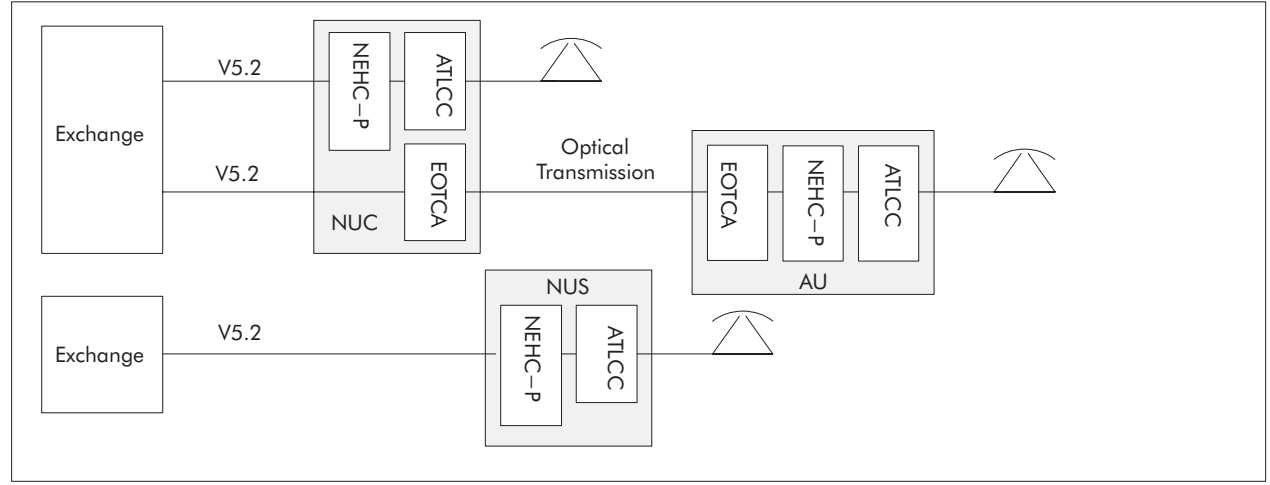


Figure 5–20 Payphone – V5.2

Option	Function	NUC	NUS	AU
Payphone from NUC	Line Card	ATLCC		
	Narrowband Controller	NEHC–P		
Payphone from NUS	Line Card		ATLCC	
	Narrowband Controller		NEHC–P	
Payphone from AU	Line Card			ATLCC
	Narrowband Controller	NEHC–P		NEHC–P
	Optical Transport	EOTCA		EOTCA

- Special Consideration**
- ▶ Ring voltage is required by the ATLCC. This may be obtained from a DURCC.
 - ▶ TACCB required for line testing via ATLCC.

5.12.2 Payphone (Mirror)

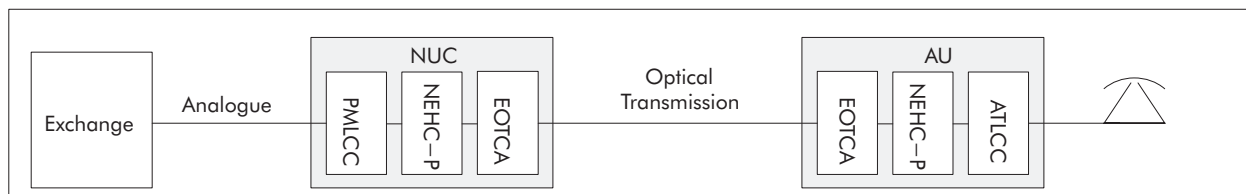


Figure 5–21 Payphone – Mirror

Function	NUC	AU
Line Card	PMLCC	ATLCC
Narrowband Controller	NEHC–P	NEHC–P
Optical Transport	EOTCA	EOTCA

Special Consideration

- ▶ Ring voltage is required by the ATLCC. This may be obtained from a DURCC.
- ▶ TACCB required for line testing via ATLCC.
- ▶ For correct operation, polarity of the POTS connection to the PMLCC must be:
 - A leg Positive
 - B leg Negative.

Note

A PMLCC card is not limited to mirroring channels from a single ATLCC.

A PMLCC at the NUC can mirror channels from one or more ATLCC at one or more AU subtended from the NUC, up to the limit of 16 channels per PMLCC.

5.13 Revertive Call

The Revertive Call port is located on the TACCB. This is cabled to a convenient POTS channel.

- ▶ Revertive Call lines are normally provided by a V5.2 POTS channel at the NUC, NUS or AU. The revertive call cable connects the TACCB to a channel on the ATLCC via the MDF or CCF. (Figure 5–22).
- ▶ A mirror connection may also be used in the revertive call path. This was not included in the CMUX offer and has not been formally tested, however it may be used where alternatives are not available. (Figures 5–23 and 5–24).

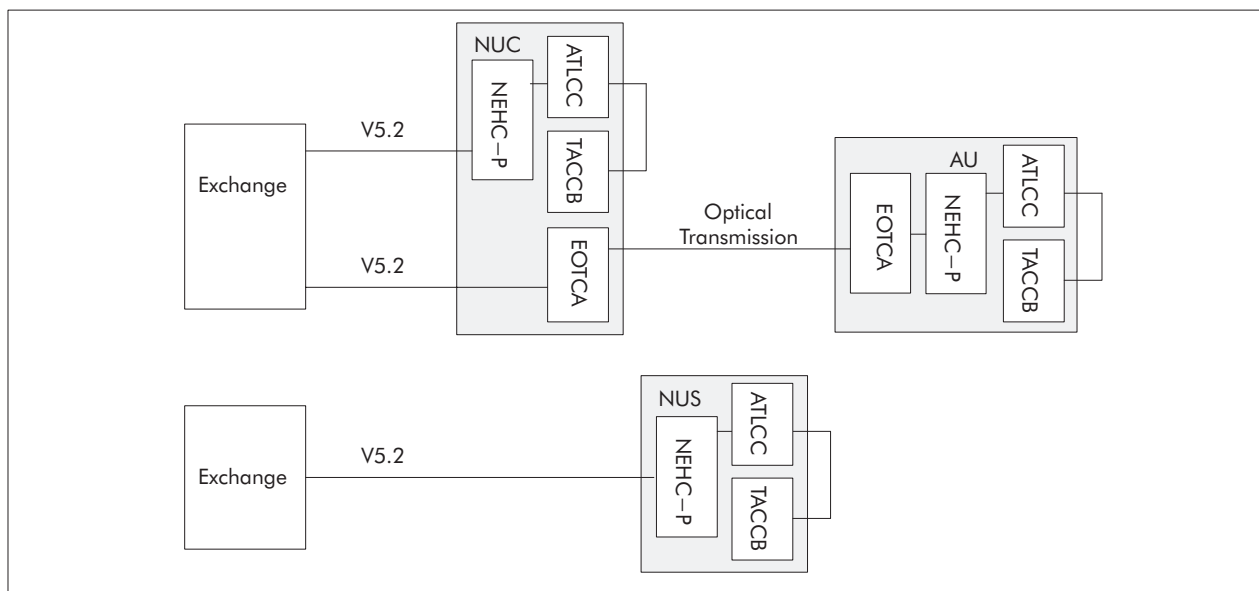


Figure 5–22 Revertive Call via V5.2 POTS

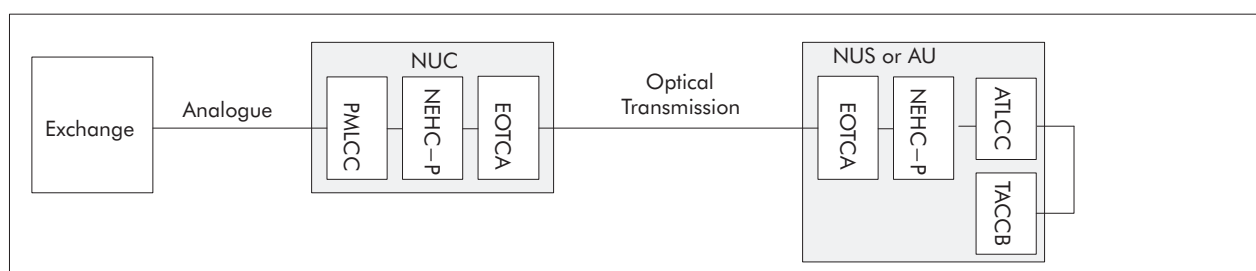


Figure 5–23 Revertive Call From NUS or AU via Mirror

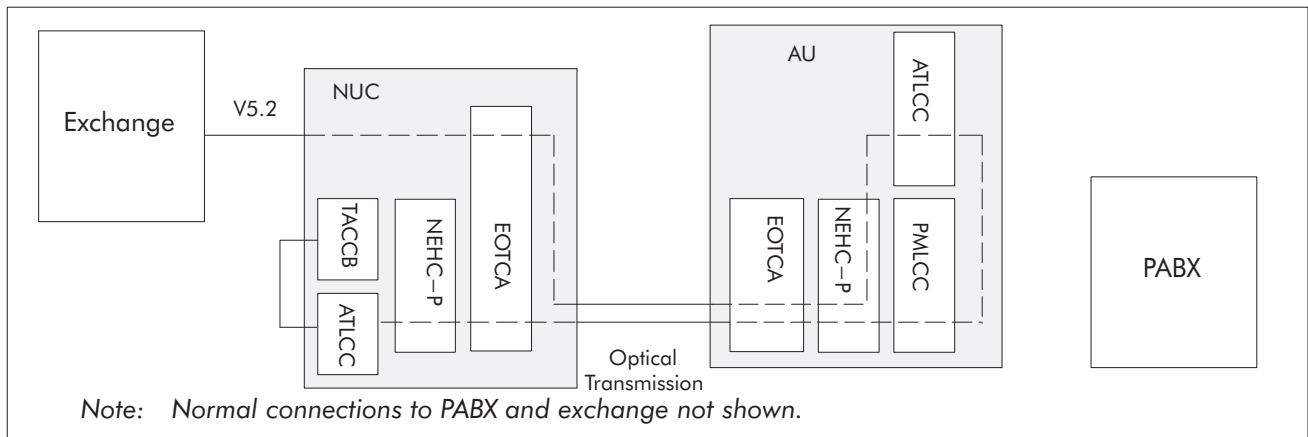


Figure 5–24 Revertive Call – ODX at NUC, No POTS at NUC

6 CMUX Subracks

CMUX subracks are used to house cards and plugs.

- ▶ Cards are installed in the upper part of the subrack.
- ▶ Plugs are installed in the lower part of the subrack.
- ▶ Cards and plugs are interconnected via the subrack backplane.

The *Alcatel CMUX Housing, Racks and Cabling Handbook* contains descriptions of power and alarm panels. These are:

- ▶ Alarm and Power Distribution Panel.
- ▶ AC Power Supply Panel.
- ▶ AC Transformer Panel.
- ▶ CMUX Power Panel.

6.1 Introduction

CMUX cards are installed in subracks which are installed in CMUX housings or racks. Up to twelve subracks may be interconnected to form a single Network Element (NE), i.e. a NU or AU.

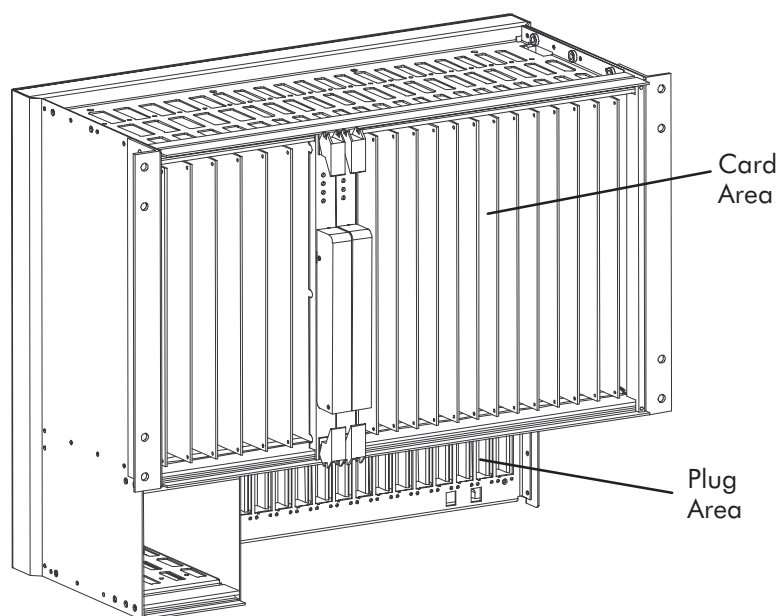


Figure 6-1 MLS-hb – External View

There are three types of subracks. These are:

► **MLS-hb** (Multiservice Line Shelf – High Band).

The MLS-hb is used in the main or extension subrack positions in a CMUX NE.. It is described in Section 6.3.

► **MLS-hbe** (Multiservice Line Shelf – High Band Extension).

The MLS-hbe is only used in extension subrack positions in a CMUX NE. It is described in Section 6.4.

- Narrowband cards are supported in the MLS-hbe.
- Broadband cards are supported.

► **MLS-sm-T9** (MLS Small T9).

The MLS-sm-T9 is used only in MiniMUX. The *MiniMUX Technical Handbook* describes the MLS-sm-T9.

Note **Main Subrack** and **Extension Subrack** refer to the subrack position and function in a housing or rack.

- A subrack in the Main Subrack position is the first subrack in a housing or rack, i.e. is the subrack in Rack 1/Subrack 1 position. It contains the broadband controller (AICC, AANC, or ASCC–S) and/or the narrowband controller (NEHC–P).
- Other subracks in a NU or AU are Extension Subracks. A subrack in an Extension Subrack position contains a broadband extension controller (BSEC) and/or a narrowband extension controller (NSEC)

Note **MLS–hb** and **MLS–hbe** refer to the subrack construction.

- The MLS–hb (Multiservice Line Shelf – High Band) is used in a Main Subrack position or an Extension Subrack position.
- The MLS–hbe (Multiservice Line Shelf – High Band Extension) is only used in an Extension Subrack position.
- Restrictions on sequencing MLS–hb and MLS–hbe are described in Section 6.1.1.

6.1.1 Subrack Interconnection

Subracks can be interconnected in a chain of up to twelve subracks.

- ▶ The first subrack in a NE is always a MLS–hb.
- ▶ Subsequent subracks can be MLS–hb or MLS–hbe.
 - As shown in Figure 6–2, a MLS–hb can parent a MLS–hbe but a MLS–hbe cannot parent a MLS–hb.
 - The MLS–hbe supports NB and BB cards and services. It does not support NB cards and services.
- ▶ The Main Subrack supports NB and BB services.
- ▶ There can be up to eleven Extension Subracks.

These may be NB only, BB only, or NB+BB.

- Up to three Extension Subracks can support NB services. The two extension subracks in Rack 1 can also support BB services.
- Up to eleven can support BB services. The two extension subracks in Rack 1 can also support NB services.

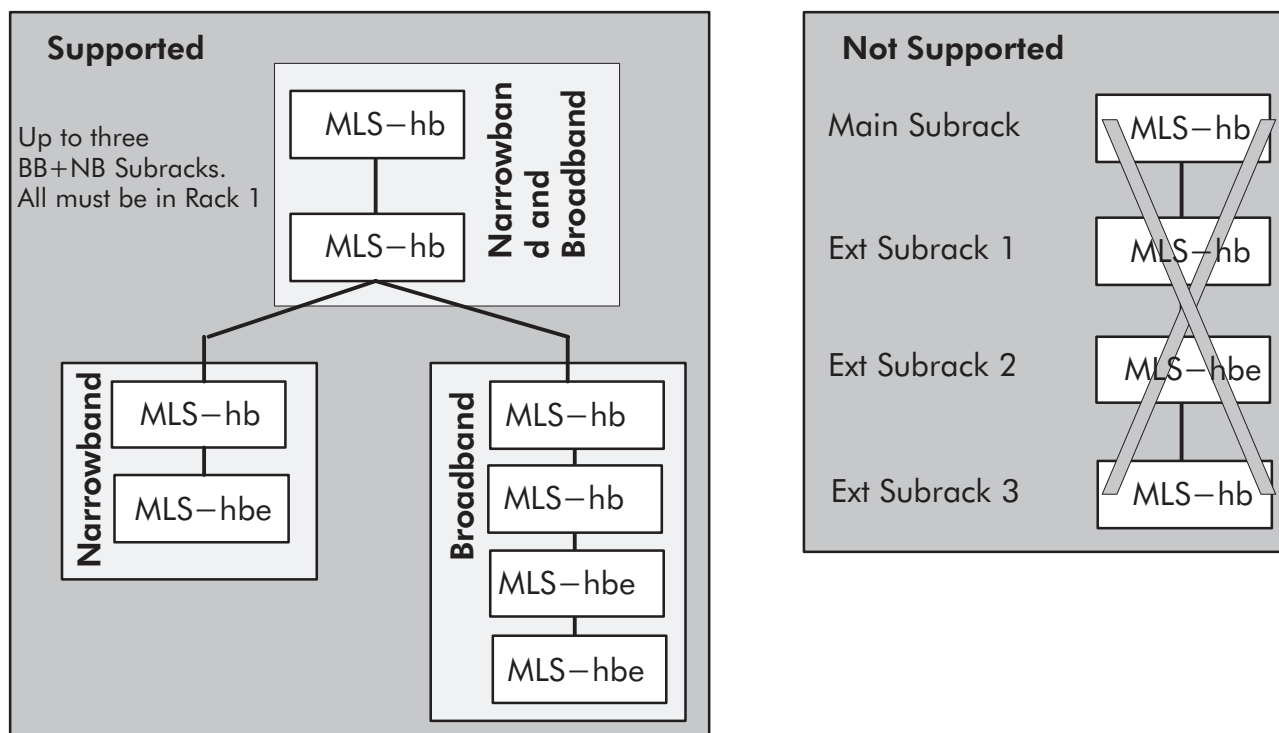


Figure 6–2 Subrack Sequencing – Typical

6.1.2 Subrack Positions

In this handbook the physical position of subracks in a rack or housing is denoted by rack/subrack number, and by the NPAMS Panel Number.

- ▶ The Main Subrack is the top subrack in the first rack in a system or the first subrack in a housing.
 - The main subrack is Rack 1/Subrack 1.
 - It is NPAMS Panel 1.
 - The main subrack is always a MLS–hb.
- ▶ Subsequent subrack positions are Extension Subracks.
 - Extension subracks have ID in the range from Rack 1 / Subrack 2 to Rack 4 / Subrack 3.
 - Extension subracks are NPAMS Panels 2 to 12.
 - Extension subracks may be MLS–hb or MLS–hbe.

Note Section 6.12 describes subrack logical numbering schemes and the mapping to physical subrack positions.

6.1.3 Subrack – Dimensions and Weight

Each subrack has the following dimensions and weight.

Height	Card Area		300 mm
	Plug Area		125 mm
Width	Inside		475 mm
	Between mounting holes		515 mm
Depth			250 mm
Weight	MLS–hb	Empty	9 kg
		Equipped (typical)	25.2 kg
		Equipped (max)	31.5 kg
	MLS–hbe	Empty	9 kg
		Equipped (typical)	27.8 kg
		Equipped (max)	30.2 kg

6.2 Subrack Layouts in Racks and Housings

This section shows physical positions of subracks in racks and housings. For mapping of logical subrack numbers to physical positions, and the associated MBTP settings, refer to Section 6.12.

This section does not show MiniMUX layouts, which are described in the *MiniMUX Technical Handbook*.

6.2.1 Narrowband and Broadband Cards

A CMUX NE (NU or AU) can have up to twelve subracks.

- ▶ Up to four of these subracks can support narrowband cards.
- ▶ Up to twelve of these subracks can support broadband cards.

Note *The NB and BB controllers are located in the Main Subrack (Rack 1/Subrack 1). Services supported in the Main Subrack are one of the following combinations:*

- *Hub: Located at NUC, and contains cards used to subtend NUS and/or AU. No local broadband or narrowband services.*
- *Hybrid: A mixture of narrowband and broadband services.*
- *Broadband: All services are broadband*
- *Narrowband: All services are narrowband.*

The other two subracks in Rack 1 (positions Rack 1/Subrack 2 and Rack 1/Subrack 3) are Extension Subracks. They support broadband services only, or narrowband services only, or a mixture of narrowband and broadband services.

Each subrack in Racks 2 to 4 is an Extension Subrack. Each of these subracks supports narrowband services only or broadband services only. Individual subracks in these positions do not support a mixture of narrowband and broadband services.

Subracks are identified by Rack ID/Subrack ID set on the MBTP. Section 6.12 describes the settings on the MBTP and the rules covering usage of subracks in a CMUX system.

Note *The main subrack is always a MLS–hb.
Extension subracks may be MLS–hb or MLS–hbe.*

6.2.2 NU Rack (NURA) – Typical Layout

6.2.3 NURA at Exchange

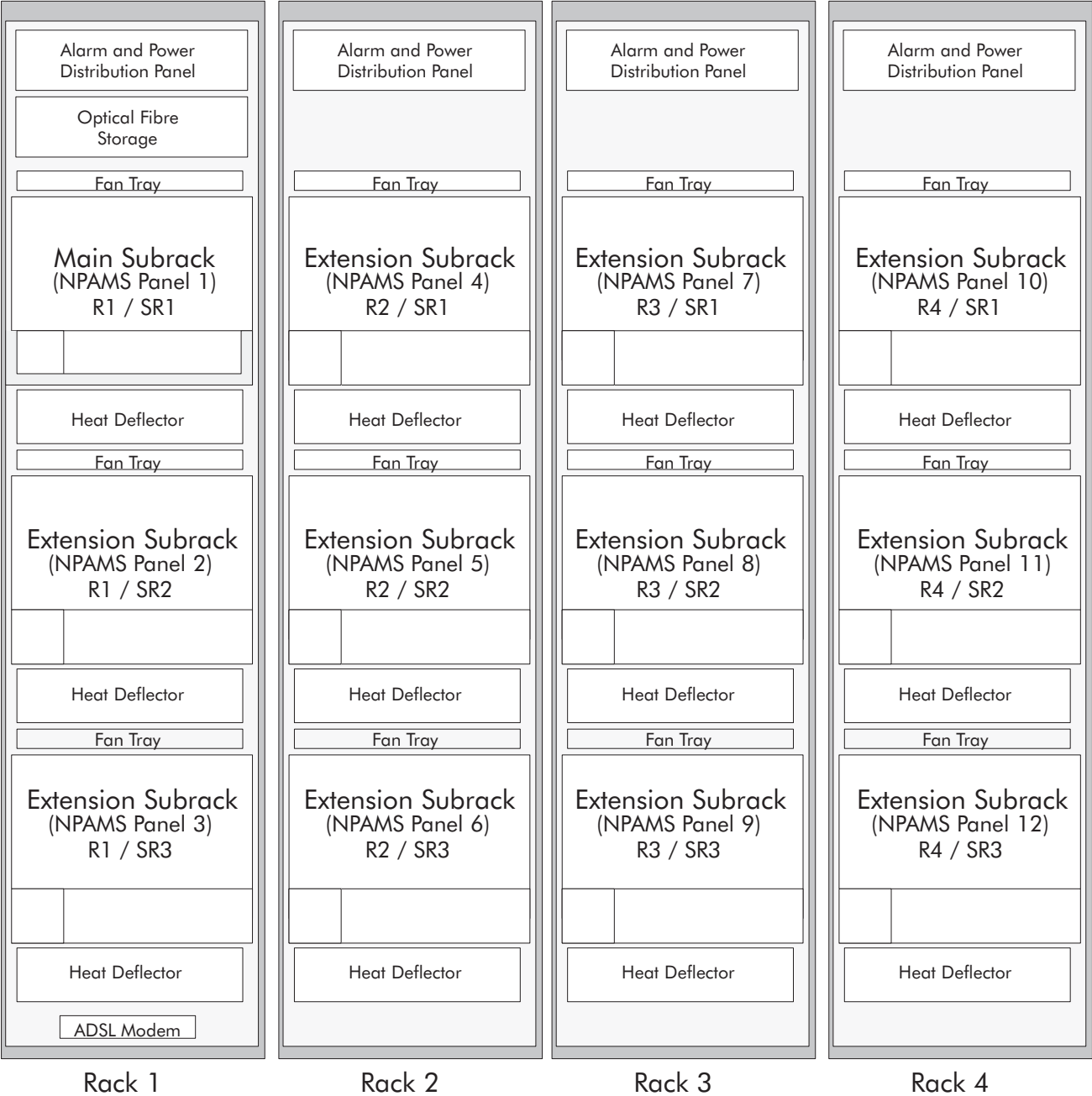


Figure 6–3 NURA in Exchange – Typical Layout

6.2.4 NURA – AU in TAH

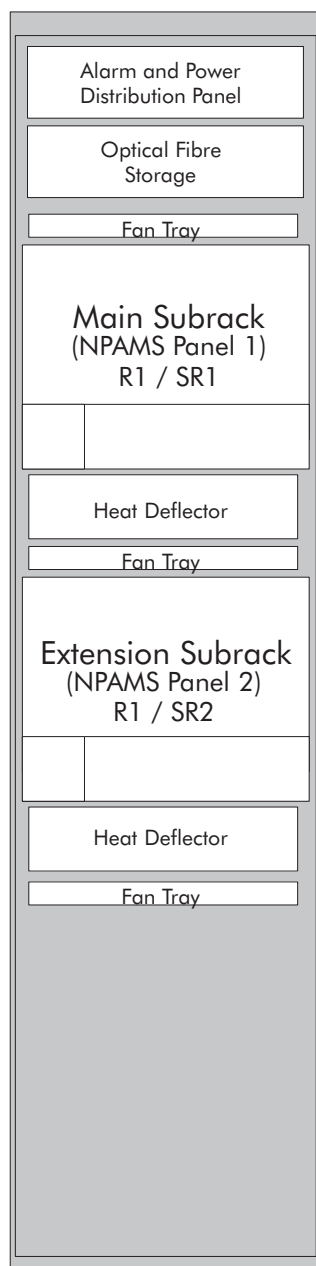


Figure 6–4 NU Rack in TAH – Typical Layout

6.2.5 **Type 84 Rack Adaptor Kit (T84) – Typical Layout**

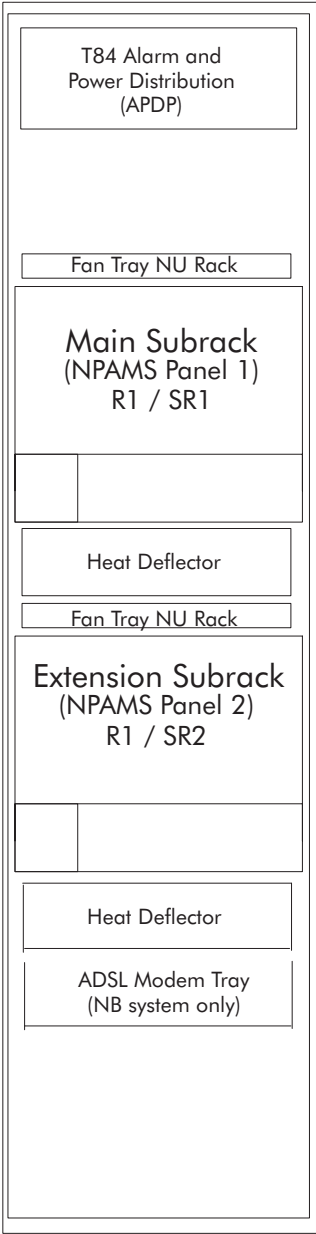


Figure 6–5 *Type 84 – Typical Layout*

6.2.6 AU Customer Premises Rack (ACPA) – Typical Layout

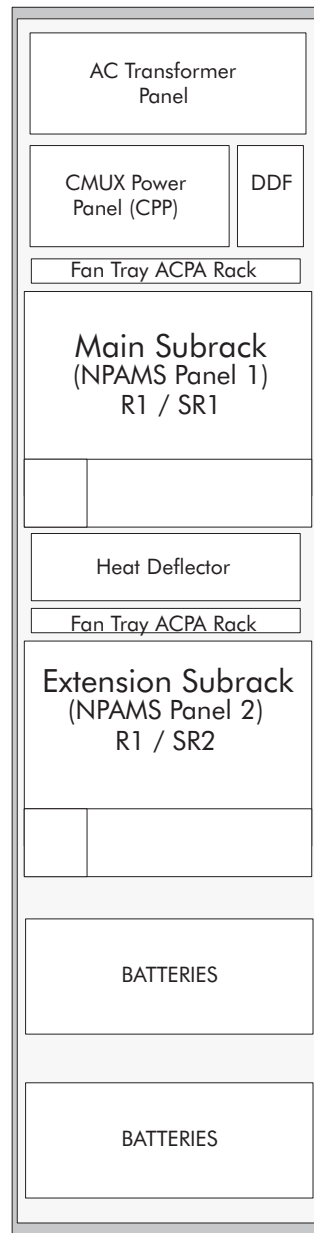


Figure 6–6 ACPA – Typical Layout

6.2.7 Above Ground Housing (AGH) – Typical Layout

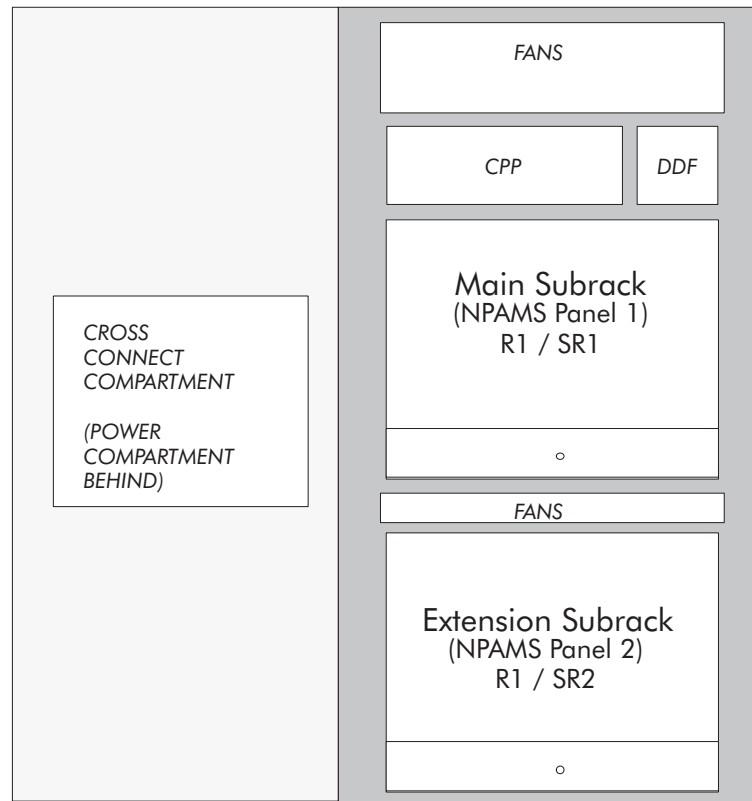


Figure 6–7 AGH – Typical Layout

Note AGH may be AGHA or AGHB

6.3 MLS–hb – 3AU 26500 AAAA

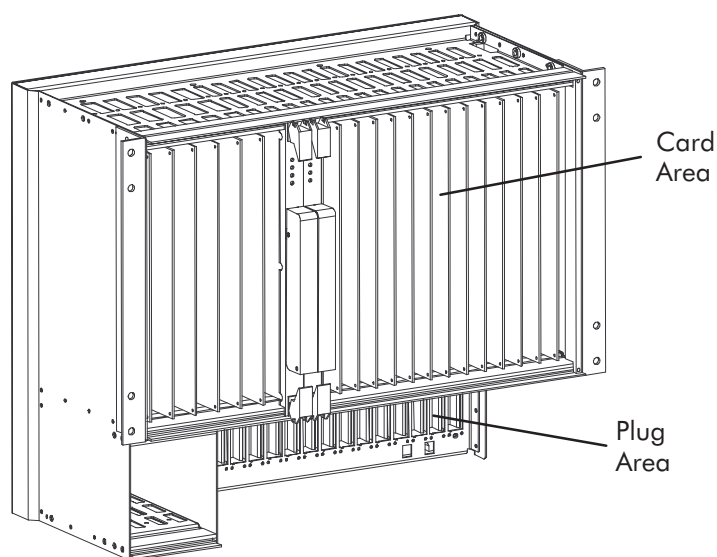


Figure 6–8 MLS–hb

The MLS–hb is the fundamental module in the CMUX system. In early CMUX releases the MLS–hb was referred to as a CMUX Main Panel.

The MLS–hb houses and interconnects:

- ▶ Cards.
 - Controller cards.
 - Transport cards.
 - Server cards.
 - Line cards.
 - Auxiliary and alarm cards.

Cards are housed in the card area, which is in the upper part of the MLS–hb.

- ▶ Plugs.

Plugs are required for external connections to cards. Plugs are located in the plug area, which is in the lower part of the MLS–hb.

Cards and plugs can be installed in many different combinations to provide a wide range of different services.

- ▶ Broadband services
- ▶ Narrowband services.

6.3.1 MLS–hb Card Slots and Plug Slots

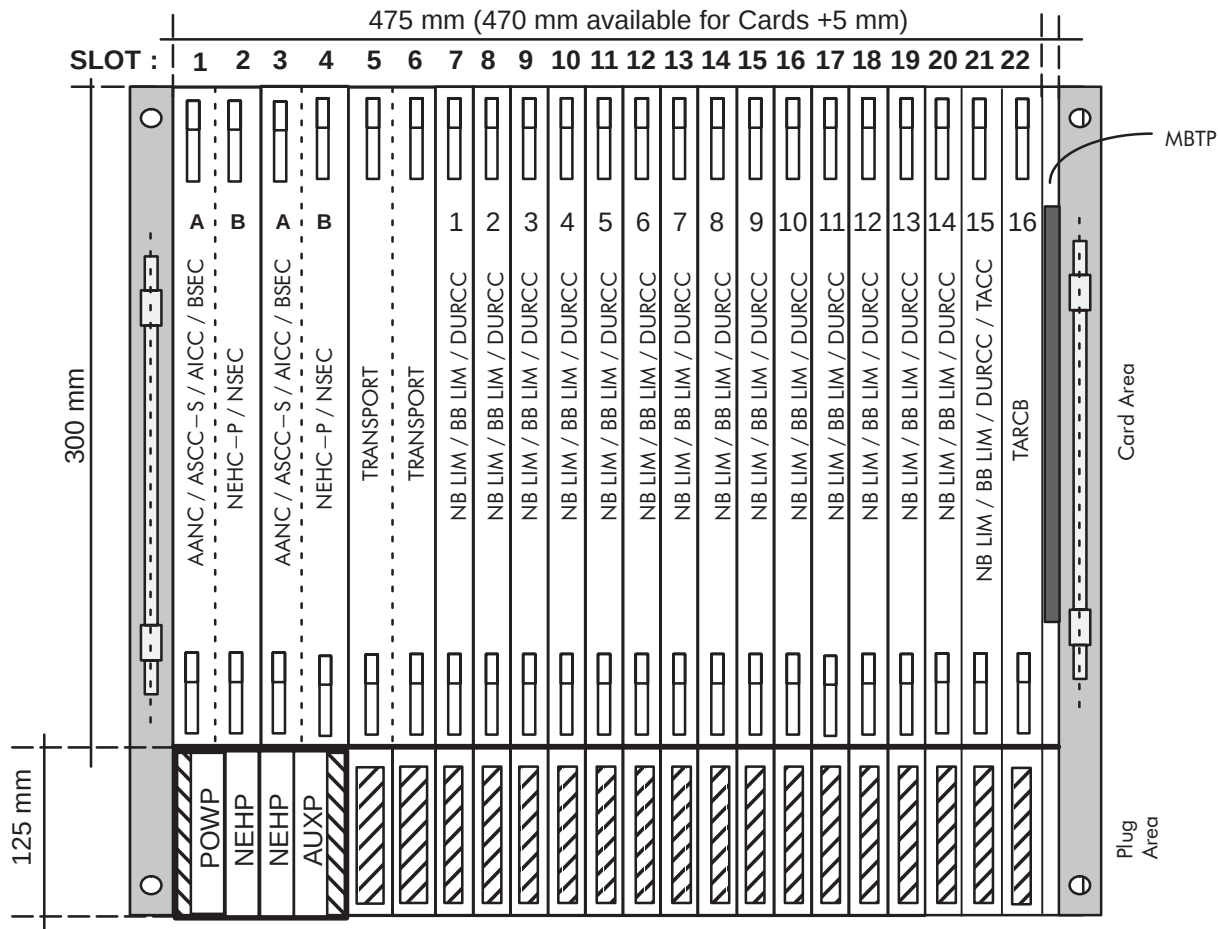


Figure 6–9 MLS–hb – Card and Plug Slots

Note LIM slots are also used for EOTCA.

MLS–hb are divided into two main sections:

- ▶ The card area is the upper part of the MLS–hb.
- ▶ The plug area is the lower part of the MLS–hb.

(1) MLS–hb Card Slots

The MLS–hb has 22 card slots.

The functions for these slots are:

Card Slot	Slot Type	Function	Card Types
1	BBCC	Broadband Controller	AANC, ASCC–S, AICC, BSEC (See Note)
2	NBCC	Narrowband Controller	NEHC–P, NSEC (See Note)
3	BBCC	Redundant Broadband Controller	AANC, ASCC–S, BSEC (See Note)
4	NBCC	Redundant Narrowband Controller	NEHC–P, NSEC (See Note)
5, 6	Transport	Transport Cards	(See Note)
7 – 21	BB LIM	Broadband Line Cards	LTAC (LTAC–A, LTAC–C, LTAC–D) NACC (NACC–A, NACC–C)
	NB LIM	Narrowband Line Cards	ALLC, ATLCC, BALCF, HLTCA, PMLCC
	BB MUX	Broadband Inverse MUX	PAIC
	Ring	Ringer Cards	DURCC
	NB LIM	Transport Cards	EOTCA
	Test	Test Access Card	TACC
22	Test	Test, Alarms and RI	TARCB

Note

- AANC, ASCC–S, AICC, and NEHC–P are controllers used in the first subrack (NPAMS Panel 1 or Rack 1/Subrack 1) in a NE (NU or AU).
- NSEC is the narrowband extension controller. It is used in extension subracks within an NE.
- BSEC is the broadband extension controller. It is used in all subracks except for the first subrack.
- Transport slots will be used in a future CMUX release.

(2) MLS–hb Plug Slots

The MLS–hb has 22 plug slots.

The functions for these slots are:

Plug Slot	Function	Plug Types
1	Power Plug	POWP
2, 3	Controller Plug	NEHP
4	Auxiliary Plug	AUXP
5, 6	Transport Plugs	EOTP
7 – 21	Broadband Line Plugs (BB LIM Plugs)	TSPP–A DSPP–B, DSAP, TSCP, PRCPB
	Narrowband Line Plugs (NB LIM Plugs)	LFSPB
	IMA Plugs	PAIP
	Ringer Plugs	DURP
	Other Plugs	PRCPB EOTP
22	Test, Alarms & Remote Inventory	TARP

Note For MBTP details refer to Section 6.11

6.4 MLS–hbe – 3AU 26499 AAAA

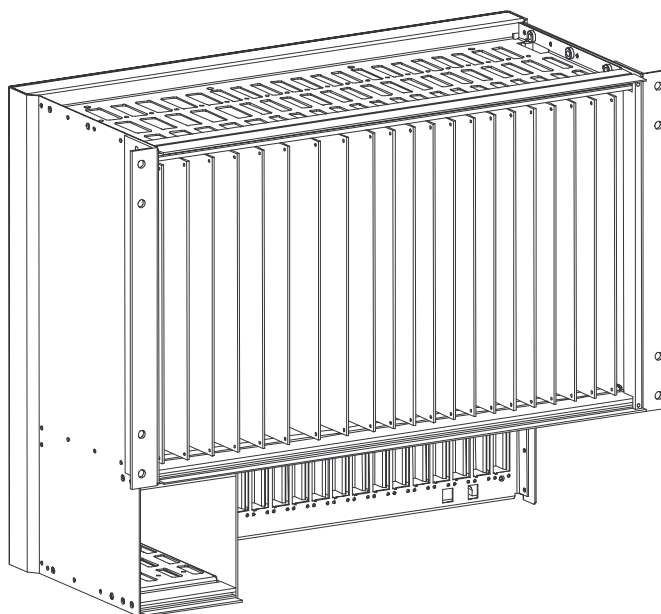


Figure 6–10 MLS–hbe

The MLS–hbe is used only in Extension Subrack positions in NU Racks. In early CMUX releases the MLS–hbe was referred to as the CMUX Extension Panel.

The MLS–hbe houses and interconnects:

- ▶ Cards. These are housed in the card area, in the upper part of the MLS–hbe.
 - Controller cards.
 - Line cards.
 - Auxiliary and alarm cards.
- ▶ Plugs. Plugs are required for external connections to cards. Plugs are located in the plug area, in the lower part of the MLS–hbe.

Cards and plugs can be installed in many different combinations to provide a wide range of different services.

- ▶ Broadband services
- ▶ Narrowband services.

6.4.1 MLS–hbe – Card Slots and Plug Slots

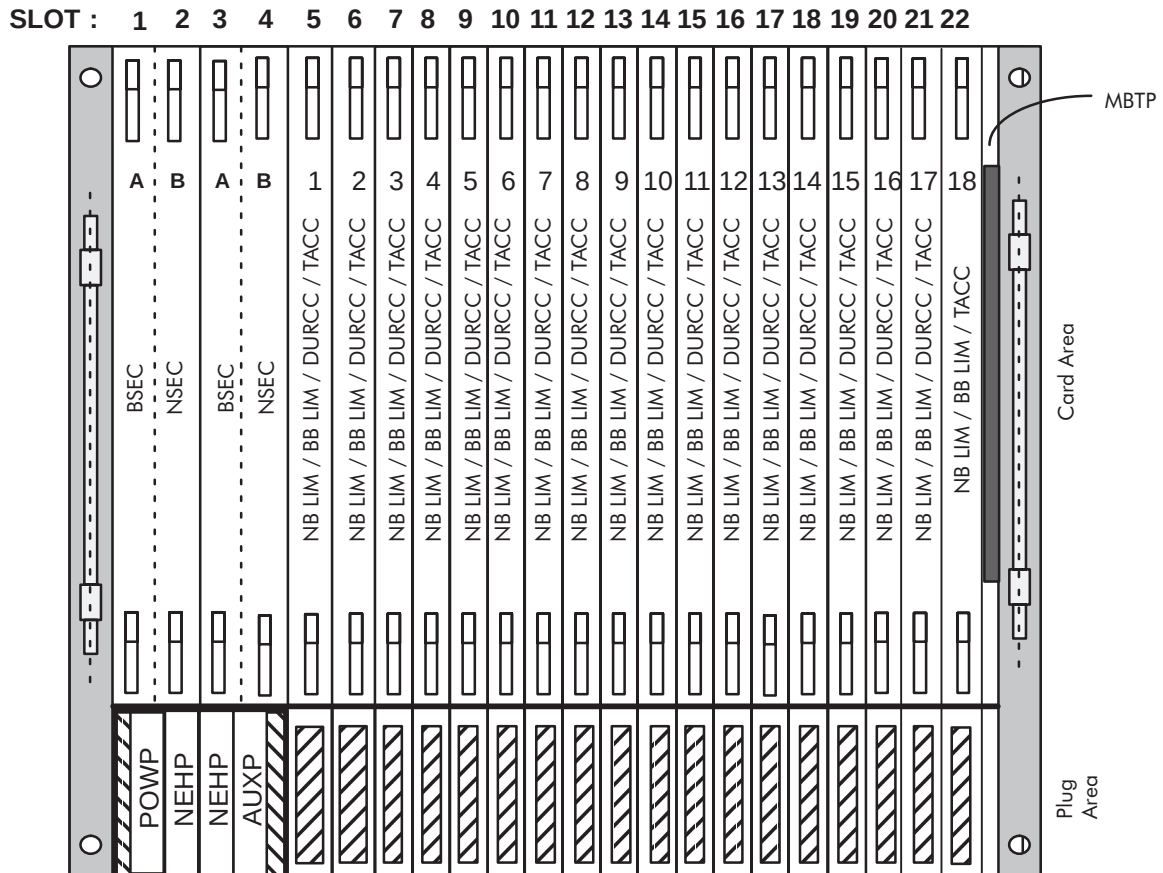


Figure 6–11 MLS–hbe – Card and Plug Slots

Note LIM slots are also used for EOTCA

MLS–hbe are divided into two main sections:

- ▶ The card area is the upper part of the MLS–hbe.
- ▶ The plug area is the lower part of the MLS–hbe.

(1) MLS–hbe Card Slots

The MLS–hbe has 22 card slots.

The functions for these slots are:

Card Slot	Slot Type	Function	Card Types
1	BBCC	Broadband Controller	BSEC
2	NBCC	Narrowband Controller	NSEC
3	BBCC	Redundant Broadband Controller	BSEC
4	NBCC	Redundant Narrowband Controller	NSEC
5 – 22	BB LIM	Broadband Line Cards	LTAC (LTAC–A, LTAC–C, LTAC–D) NACC (NACC–A, NACC–C)
	BB MUX	Broadband Inverse MUX	PAIC
	Ring	Ringer Cards	DURCC
	NB LIM	Narrowband Line Cards	ALLC, ATLCC, BALCF, PMLC, PRCC
	NB LIM	Transport Cards	EOTCA
	Test	Test Access Card	TACC

Note *BSEC is the broadband extension controller. It is required in any extension subrack supporting broadband services.*

(2) MLS–hbe Plug Slots

The MLS–hbe has 22 plug slots.

The functions for these slots are:

Plug Slot	Function	Plug Types
1	Power Plug	POWP
2, 3	Controller Plug	NEHP
4	Auxiliary Plug	AUXP
5 – 22	Broadband Line Plugs (BB LIM Plugs)	TSPP–A DSPP–B DSAP TSCP, PRCPB
	Narrowband Line Plugs (NB LIM Plugs)	LFSPB
	IMA Plugs	PAIP
	Ringer Plugs	DURP
	Other Plugs	PRCPB EOTP

Note For MBTP details refer to Section 6.11.

6.5 Card and Plug Slot Allocation Rules

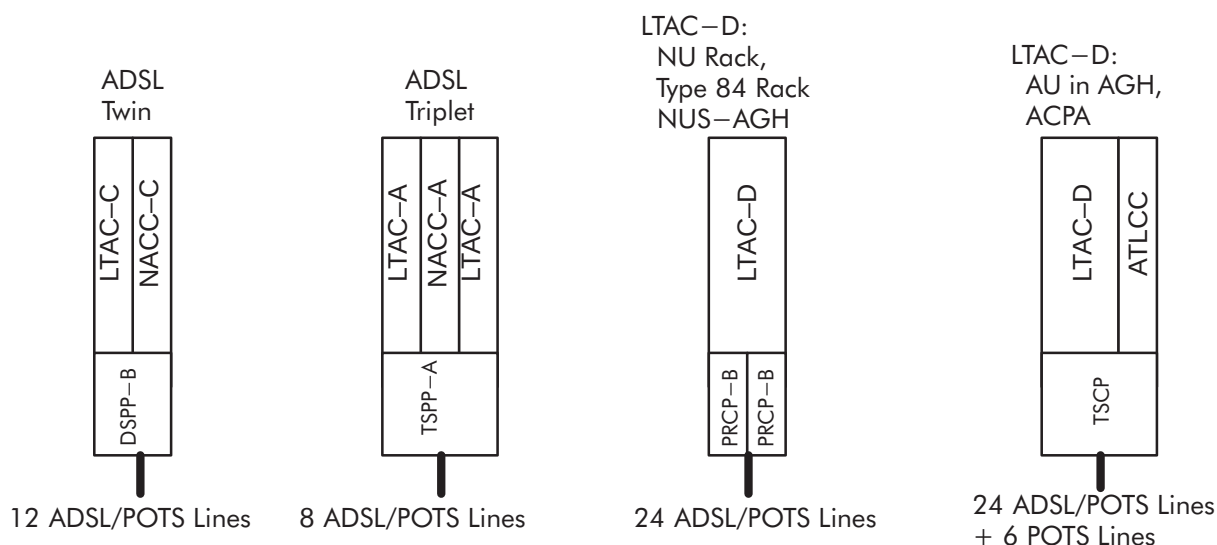


Figure 6-12 ADSL Twin, ADSL Triplet, and LTAC-D.

- ▶ The DURCC ringer card can be plugged in every LIM slot except for the rightmost, when using a card 40mm wide.
- ▶ The TACC can be located in any LIM slot, however it is recommended that it be installed in Slot 21.
- ▶ The TARCB must be plugged into Slot 22 in the first subrack.
- ▶ External interface cables are connected to the subrack via plugs located in the plug area of the subrack.
- ▶ LTAC-A and NACC-A are installed as a triplet, with LTAC-A/NACC-A/LTAC-A in three adjacent line card slots. The group of three cards support 8 ADSL lines via a TSPP-A.
- ▶ LTAC-C and NACC-C are installed as a twin, with LTAC-C/NACC-C in two adjacent line card slots. The two cards support 12 ADSL lines via a DSPP-B or DSAP plug.
- ▶ LTAC-D installation uses two different arrangements:
 - In NU Racks, Type 84 Racks, and NUS-AGH each LTAC-D has two PRCP-B plugs. One plug is for the X pairs to the exchange or to a RIM. The other is for the C pairs to the customer.
 - In AU in AGH (AGHA or AGHB) housings and ACPA racks each LTAC-D has an ATLCC card to its right.

A TSCP plug interconnects 30 POTS lines from the ATLCC to the LTAC-D and also provides the customer interface for 24 ADSL/POTS lines and 6 POTS lines.

6.6 Subrack – Bus Architecture

Subracks (MLS–hb or MLS–hbe) use several busses and interfaces to encompass the wide range of features in the system. For further details on CMUX architecture, refer to Chapter 3.

The busses and their functions are:

1 NLC bus:

Subracks have two NLC busses. Both are used to connect the narrowband controllers to the line card slots.

- NLC bus A connects the first narrowband controller (Slot 2) to all the LIM slots.
- NLC bus B connects the second narrowband controller (Slot 4) to all the LIM slots.

2 IQ bus:

There are two IQ busses. Both are used to connect broadband controller cards to LIM slots.

- IQ bus A connects the first broadband controller slot to all LIM slots.
- IQ bus B connects the second broadband controller slot to all LIM slots.

3 HCL bus:

The HCL bus provides multiple point-to-point connections from the broadband controller card to each LIM slot. Each HCL link is bidirectional and operates at 155 Mbit/s. The HCL bus is not used in current releases, however it is provided to make CMUX “future safe”.

4 Server Bus:

The server bus is a special purpose bus which is available in the first four universal line card slots. This bus provides an additional 16 Mbit/s bandwidth for TDM server pool applications, such as Voice over IP (VoIP), Securitel and Frame Relay (FR).

The server bus is not used in CMUX FR2.1F BB.

5 MTPL Interface:

A future release may support a bidirectional connection at 622 Mbit/s point-to-point between SDH Transport boards and all the controllers slots (NB and BB).

6 Low Speed Transport Interface:

The Low Speed Transport Interface connects Aggregate Transport Cards to the controllers by means of a bidirectional connection at 38.88 MHz. Maximum throughput is 51Mbps.

Interconnection features a crossover. This makes switch—over of transport independent of the switch—over of the controllers.

7 NB Subtending Interface:

The NB Subtending Interface provides 51.84 Mbps links to the next lower subrack, extending the NLC bus.

This connection starts from the controller (or extender) slots and is terminated on the extender slot of the next subrack.

8 BB Subtending Interface:

The BB Subtending Interface provides a link to the next lower subrack, extending the IQ bus.

This connection starts from the BB controller (or extender) slots and is terminated on the BB extender slot of the next subrack.

9 NB Only Secondary Assembly Interface:

The NB Only Secondary Assembly Interface provides one 51.84 Mbps link to a secondary subrack assembly, extending the NLC bus to a total of four subracks which support narrowband services.

This connection starts from the controller (or extender) slots and is terminated on the extender slot of the first subrack of the secondary assembly.

10 Transport Card Slots:

Special transport cards require special slot positions.

These positions are not used in CMUX FR2.1F BB.

6.7 Subrack Installation and Removal

Subracks are front mounted in racks or housings.

- ▶ Racks are installed in indoor situations.
- ▶ Housings (above ground and underground) have fittings to allow the installation of front-mounted subracks.

Subracks are installed and removed as detailed in Section 6.7.1 and Section 6.7.2.



Subrack Weight

Subracks weigh 9 kg empty and up to approximately 32 kg fully populated with cards.

- ▶ Two persons are required to install or remove a subrack fully equipped with cards.
- ▶ To install or remove a subrack with one person, remove all cards from the subrack before installing or removing it.



Subrack Height

The top subrack position in a NURA or ACPA is above shoulder height. To minimise the risk of injury when installing or replacing a subrack in the top position in a NURA or ACPA:

- ▶ Place a stable temporary platform in front of the rack.
- ▶ Stand on this platform while installing or removing the top subrack.



Subracks, cards and other equipment are sensitive to static electricity.

If equipment is mishandled it may be damaged by static electricity.

1. Pack all equipment which is to be transported into an anti-static bag and a suitable carton.
2. Dissipate all electrostatic charge before handling the equipment.
3. Minimize static build-up by wearing an anti-static wrist strap that is attached to the equipment rack.
4. Hold all Printed Board Assembly (PBA)s and Cards by the edge of the board, by the handle/s, or by the front plate.



DC Outlet on CPP – Hot Insertion Not Supported

The AGH (AGHA or AGHB) and ACPA are fitted with a CPP (CMUX Power Panel). A Mate&Lok outlet on the front of the CPP is used for the DC supply cables to subracks. This connector is not designed for hot insertion or extraction.

The connector on the cable or the outlet on the front of the CPP may be damaged if the connection is made or broken “hot”.

Always turn off the DC circuit breaker supplying the relevant subrack before making or breaking this connection.



Subrack Earth must be connected first and disconnected last

The subrack earth lead must be connected to the subrack before any other cables are connected to the subrack.

The subrack earth lead must not be disconnected from the subrack until all other cables have been disconnected from the subrack.

6.7.1 Subrack Installation

- ▶ The top subrack in a NURA or ACPA is above shoulder height. The top subrack in a Type 84 rack may be above shoulder height. If installing a subrack in this position, place a stable platform in front of the rack and stand on it while installing the subrack.
- ▶ Fit captive nuts in the desired positions in the rack. Four captive nuts and four screws are required to mount each subrack in the rack.
- ▶ If the subrack is to be installed by one person, remove all cards from the subrack.
- ▶ Move the subrack into position.
- ▶ Insert and finger tighten the top screws at each side of the subrack, then insert and finger tighten the bottom screws on each side of the subrack.
- ▶ Check the alignment of the subrack, then tighten all four screws.
- ▶ Connect the earth lead to the subrack.
- ▶ If the cards were removed before subrack installation, refit the cards as detailed in Section 7.4.
- ▶ Turn OFF the DC circuit breaker supplying the subrack, then plug the DC supply cable(s) into the input sockets on the front of the POWP plug.
- ▶ Connect other cables to the plugs in the plug area of the subrack.

6.7.2 Subrack Removal

The top subrack in a NURA or ACPA is above shoulder height. The top subrack in a Type 84 rack may be above shoulder height. If removing a subrack in this position, place a stable platform in front of the rack and stand on it while removing the subrack.

Two persons are required to remove a subrack that is fully equipped with cards. If subrack removal is to be carried out by one person all cards must be removed from the subrack before subrack removal.

To remove a subrack:

- ▶ Turn OFF the circuit breaker supplying the subrack.
- ▶ If cards are to be removed from the subrack:
 - Note the positions of each card.
 - Using anti-static precautions, remove each card as detailed in Section 7.5.
 - Store the card in an anti-static bag.
 - Repeat for the other cards.
- ▶ Unplug all cables other than the earth lead from the subrack.
- ▶ When all other cables have been unplugged, disconnect the earth lead from the subrack.
- ▶ Support the subrack.
- ▶ Loosen but do not remove all four screws holding the subrack to the rack.
- ▶ While supporting the subrack, remove the screws.
- ▶ Lift the subrack out of the rack.
- ▶ Lower the subrack to a stable surface.

6.8 Power and Ring Distribution

The power scheme for subracks is defined as “completely distributed”. This gives intrinsic power supply redundancy.

- ▶ No separate card for power conversion/regulation is fitted to the subrack.
- ▶ Battery voltage is distributed through DC power conductors on the subrack backplane.
- ▶ CMUX cards all have DC/DC converters to provide the voltages required for the components and circuits on each card.

Cards accept power from two separate battery lines on the subrack backplane.

- ▶ No power switch is provided at subrack level. Power switches or circuit breakers for each subrack may be located in the Top Rack Unit (TRU) for indoor installations and in the housing for outdoor installations.
- ▶ To fulfill EMC requirements, each card is equipped with a filter limiting the level of the noise injected into the battery wiring.

An additional filter is placed at subrack level to remove the noise coupled to the battery tracks in the back plane (inducted by high-frequency signals).

- ▶ Ring voltage is generated by a self redundant ringer card (DURCC) inserted in the subrack. A track on the backplane distributes the ringing voltage along the subrack.

This track is also equipped with an external (filtered) connector which can derive the ringing voltage from an external source or from another subrack.

Note *DURCC positions in a CMUX system are described in Section 12.1.*

6.9 Earthing

6.9.1 Electrical and Mechanical Earth

Earthing of the subracks connects together the electrical earth and the chassis earth. This provides EMC compliance.

When the electrical and chassis earth are connected together the electrical earth in the back plane is connected to the metallic frame of the shelf by means of a ring conductor all around the back plane itself.

The earth terminal on every shelf is connected, via a copper cable with a resistance lower than $10\text{m}\Omega$, to the main earthing terminal of the rack (or cabinet). The cable must have a cross-sectional area which can withstand without damage surge currents as high as 100 A.

Note

- *When removing a subrack, disconnect the earth from the subrack only after all other cabling has been disconnected from that subrack.*
- *When installing a subrack, connect the earth cable to the subrack before connecting any other cables to the subrack.*

6.9.2 Battery Return

In subracks the DC battery return is integrated in the earth of the equipment by a low impedance connection at back plane level obtained by means of a high number of distributed solder straps.

6.10 Subrack Construction

6.10.1 EMC

Subracks are fully EMC shielded:

- ▶ All cards have front covers with EMC shields.
- ▶ All common plugs must have front covers with EMC shields.
- ▶ All empty card positions and empty common plug positions must have blanking plates.
- ▶ All LIM slots are EMC compliant without blanking plates.

6.10.2 Backplane Characteristics

- ▶ Subrack backplanes are multilayer with controlled impedance. External layers have only the connector access. The rest of the area is filled by a ground plane (safety ground).
- ▶ Backplanes are protected using a rear cover.
- ▶ Backplane connectors in the card area are male metral, with 4, 5 or 8 rows (sub—equipped to 6 rows).
- ▶ Connectors in the plug area are male metral, with 4 or 5 rows.

6.10.3 Subracks – Switches, Links and Sockets

There are no user selectable switches, links or sockets on subracks.

- ▶ Optical connections and some Craft Terminal connections are made to cards.
- ▶ All other connections are made to plugs installed in the plug area at the bottom of the subracks.

Note *Solder links and/or DIP switches on the MBTP are used to set the various parameters for each subrack. The MBTP is described in Section 6.11.*

6.11 MBTP – 3EC 40065 xxxx

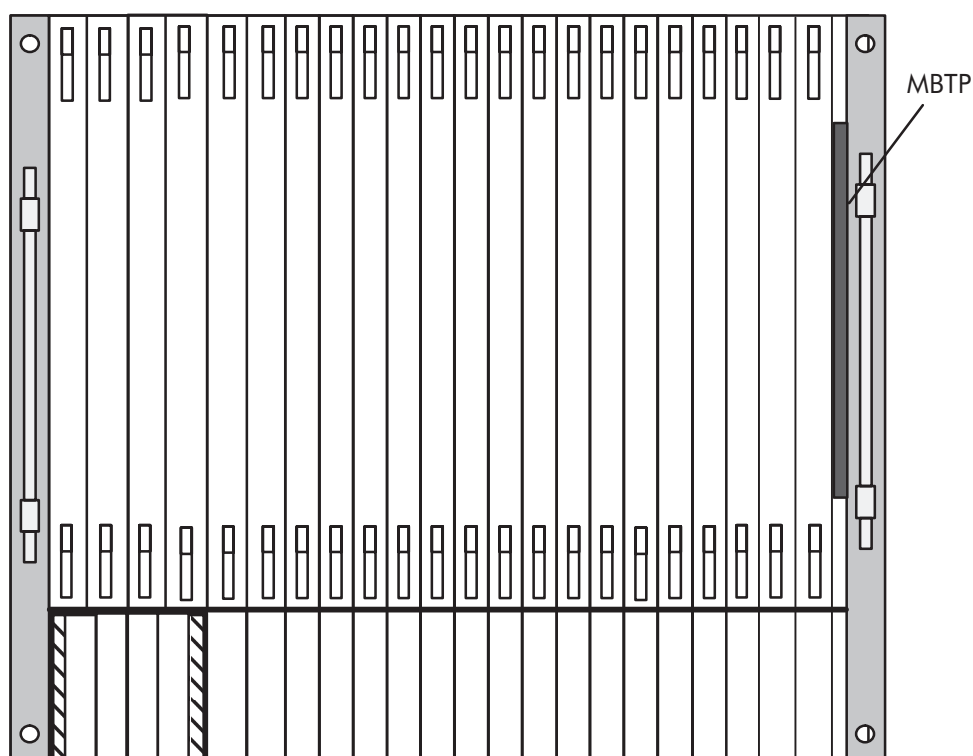


Figure 6–13 MBTP Location in subracks

The MBTP (Main Bus Termination Plug) is located at the right hand end of the subrack. It is plugged into a connector on the backplane and secured with three screws.

The MBTP has a number of functions.

- ▶ Bus Termination.

Subracks (MLS–hb and MLS–hbe) contain a number of busses.

 - The MBTP terminates the NLC, IQ and ICB bus at the right hand end of the subrack.
 - The busses are terminated at the left hand end of the subracks by the narrowband and broadband controllers.
- ▶ Backplane type and variant ID.
- ▶ Provides Remote Inventory (RI) for the subrack backplane.

► Rack and subrack ID

Each CMUX NE (NU or AU) may contain up to twelve subracks. The arrangement is as follows:

- A NE may have up to four racks per NE.
- Up to three subracks can be fitted to each rack.
- The three subracks in the first rack support narrowband and/or broadband cards.
- Each subrack in racks 2, 3 and 4 can support either narrowband cards or broadband cards, up to a maximum of four subracks per system containing narrowband cards and up to 12 subracks per system containing broadband cards.

► Solder jumpers on the MBTPB and DIP switches on the MBTPG determine the rack and subrack ID for each subrack in a rack.

- Positions of the solder links on the MBTPB are shown in Figure 6–14.
 - The settings for the solder links are shown in Tables 6–1, 6–3 and 6–4.
 - To close a jumper, bridge its two jumper pads together with solder.
 - To open a jumper, remove the solder bridge.
- Positions of the DIP switches on the MBTPG are shown in Figure 6–15.
 - The settings for the DIP switches are shown in Tables 6–1, 6–3 and 6–4.
 - Settings for the jumpers are shown in Tables 6–2, and 6–5

Note Sections 6.2 and 6.12 show typical subrack layouts and numbering schemes in racks and housings. Section 6.12 also details the rules for broadband/narrowband card usage in subracks.

6.11.1 MBTP Variants

Two variants of the MBTP are used in CMUX. The two variants have similar functions. The variation is in the manner in which settings are made:

Type	Part Number	Description
MBTPB	3EC 40065 AEAA	Settings made via solder links
MBTPG	3EC 40065 AGAA	Settings made via DIP switches and zero (0) ohm resistors.

Note *Remote Inventory (RI) functions report both variants as MBTPB.*

6.11.2 MBTPB Outline

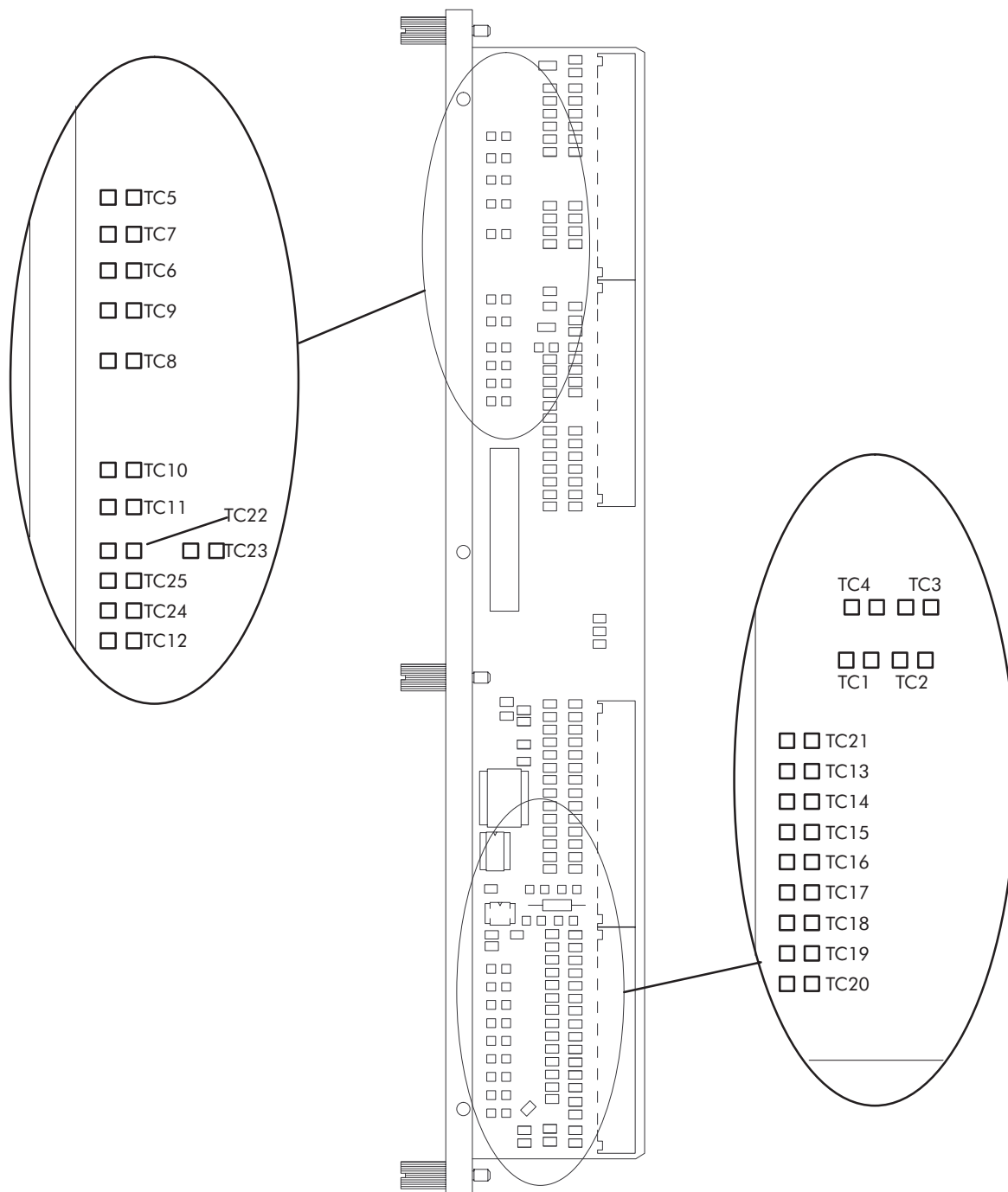


Figure 6–14 MBTPB Outline

6.11.3 MBTPG Outline

FACTORY SETTINGS — SOLDER LINKS

■ Link Closed

□ Link Open

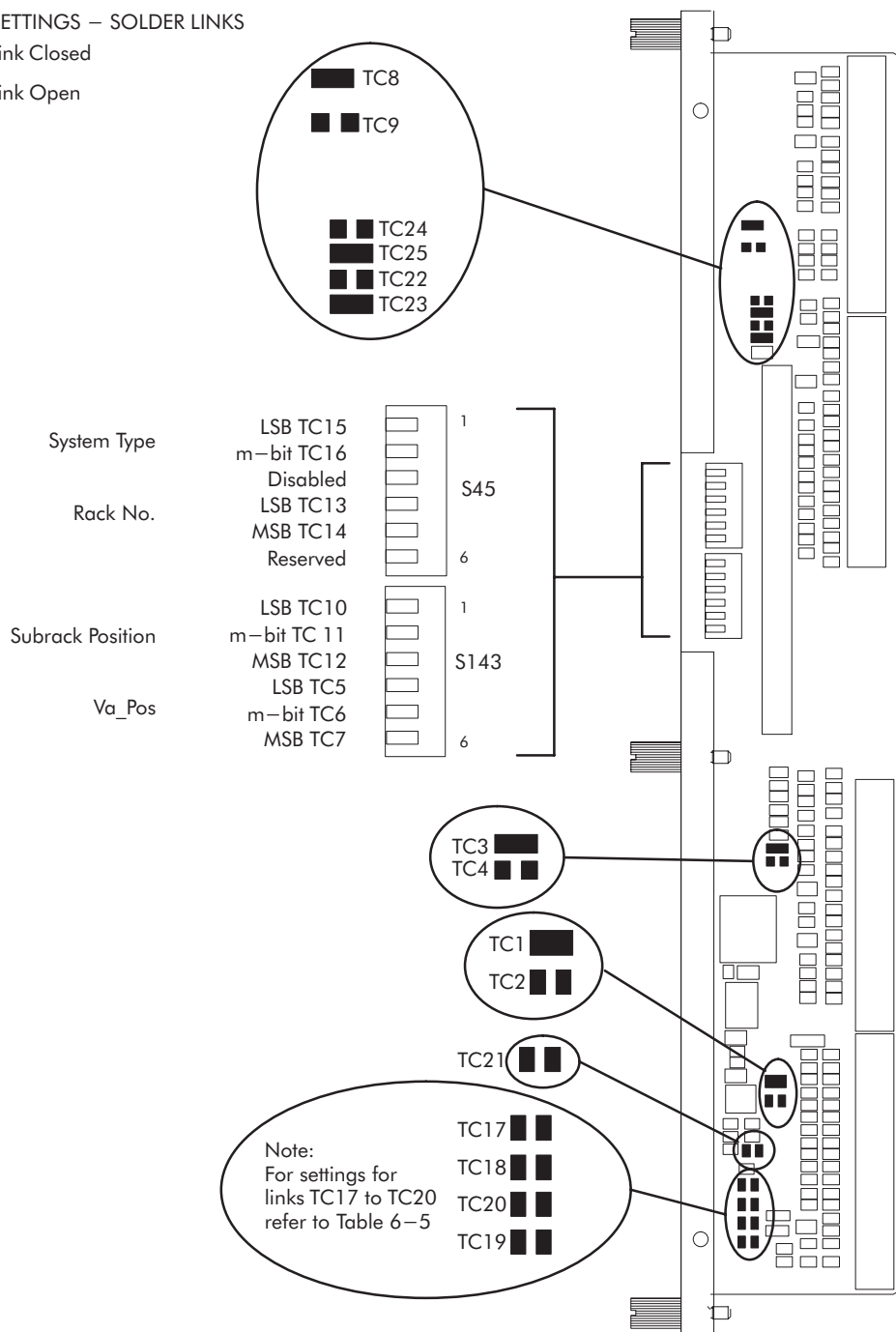


Figure 6-15 MBTPG Outline

6.11.4 Settings – MBTP Links and Switches

Table 6–1 MBTP Link and DIP Switch – User Settings

MBTPG		MBTPB	Acronym	Function	Factory Default	
Block	Switch	Link			Closed	Open
S45	1	TC15	SYSTEM_TYPE0	System Type	X	
	2	TC16	SYSTEM_TYPE1		X	
	3			Reserved		X
	4	TC13	RACK_POS0	Rack number in NU or AU	See Tables 6–3 and 6–4	
	5	TC14	RACK_POS1			
	6			Reserved		X
S143	1	TC10	SUB_POS0	Subrack position in rack	See Tables 6–3 and 6–4	
	2	TC11	SUB_POS1			
	3	TC12	SUB_POS2			
	4	TC5	VA_POS0	VA Positions	See Tables 6–3 and 6–4	
	5	TC6	VA_POS1			
	6	TC7	VA_POS2			

Table 6–2 MBTP Link and DIP Switch – Other Settings

MBTPG	MBTPB	Acronym	Function	Factory Default	
Link	Link			Closed	Open
TC1	TC1	RI_PE Internal	PE Program Enable internal status: always active	X	
TC2	TC2	RI_PE External	PE Program Enable IAB RI signal from outside		X
TC3	TC3	RI_3V	IAB RI +3 Vdc power supply	X	
TC4	TC4	RI_5V	IAB RI +5 Vdc power supply		X
TC8	TC8	VA_POS3	NT NB Setting	X	
TC9	TC9	VA_POS4	VA1CC Setting		X
TC17	TC17	SUB_TYPE0	Subrack Type (MLS–hb, MLS–hbe, etc.)	See Table 6–5	
TC18	TC18	SUB_TYPE1			
TC19	TC19	SUB_TYPE2			
TC20	TC20	SUB_TYPE3			
TC21	TC21	SH_VA	Shared VA handling		X
TC22	TC22	CBUP_1	Contention Bus_1 termination circuit		X
TC23	TC23			X	
TC24	TC24	CBUP_2	Contention Bus_2 termination circuit		X
TC25	TC25			X	

6.11.5 Link Settings – Rack/Subrack Position

Table 6–3 MBTP Rack Position Link Settings

Rack	MBTPG		MBTPB	Acronym	Closed	Open
	Switch Block	Switch	Link			
Rack 1 (R1)	S45	4	TC13	RACK_POS0	X	
		5	TC14	RACK_POS1	X	
Rack 2 (R2)	S45	4	TC13	RACK_POS0		X
		5	TC14	RACK_POS1	X	
Rack 3 (R3)	S45	4	TC13	RACK_POS0	X	
		5	TC14	RACK_POS1		X
Rack 4 (R4)	S45	4	TC13	RACK_POS0		X
		5	TC14	RACK_POS1		X

Table 6–4 MBTP Subrack Position Link Settings

Subrack Position In Rack	MBTPG		MBTPB	Acronym	Closed	Open
	Switch Block	Switch	Link			
Subrack 1 (SR1)	S143	4	TC5	VA_POS0	X	
		5	TC6	VA_POS1	X	
		6	TC7	VA_POS2	X	
		1	TC10	SUB_POS0	X	
		2	TC11	SUB_POS1	X	
		3	TC12	SUB_POS2	X	
Subrack 2 (SR2)	S143	4	TC5	VA_POS0		X
		5	TC6	VA_POS1	X	
		6	TC7	VA_POS2	X	
		1	TC10	SUB_POS0		X
		2	TC11	SUB_POS1	X	
		3	TC12	SUB_POS2	X	
Subrack 3 (SR3)	S143	4	TC5	VA_POS0	X	
		5	TC6	VA_POS1		X
		6	TC7	VA_POS2	X	
		1	TC10	SUB_POS0	X	
		2	TC11	SUB_POS1		X
		3	TC12	SUB_POS2	X	
Subrack 4 (SR4)	S143	4	TC5	VA_POS0		X
		5	TC6	VA_POS1		X
		6	TC7	VA_POS2	X	
		1	TC10	SUB_POS0		X
		2	TC11	SUB_POS1		X
		3	TC12	SUB_POS2	X	

Table 6–5 Subrack Type

Subrack Type	MBTPB	MBTPG	Acronym	Closed	Open
	Link	Link			
MLS–hb	TC17	TC17	SUB_TYPE0	X	
	TC18	TC18	SUB_TYPE1	X	
	TC19	TC19	SUB_TYPE2	X	
	TC20	TC20	SUB_TYPE3		X
MLS–hbe	TC17	TC17	SUB_TYPE0	X	
	TC18	TC18	SUB_TYPE1	X	
	TC19	TC19	SUB_TYPE2		X
	TC20	TC20	SUB_TYPE3	X	

6.12 Rack/Subrack Numbering Schemes

A CMUX NE (NU or AU) may have up to twelve subracks. Each subrack may contain:

BB	Broadband cards only.
NB	Narrowband cards only
HYBRID	Mixed broadband and narrowband cards. HYBRID subracks are only supported in the first three subrack positions. These are R1 / SR 1 to R1 / SR3.

Note AGH (AGHA or AGHB) and ACPA are limited to two subracks.

6.12.1 NPAMS Panel Allocation

Subracks are numbered from 1 to 12 in NPAMS. These map to physical subrack positions as shown in Figure 6–16 and Figure 6–17.

- ▶ Up to twelve subracks may support broadband (BB) services.
- ▶ Up to four subracks may support narrowband (NB) services. Up to three of these may be Hybrid (NB and BB).
- ▶ Hybrid (NB/BB) subracks can only be installed in subrack positions NPAMS Panel 1 to NPAMS Panel 3. These subrack positions are all located in Rack1.

6.12.2 NB and BB Controllers & Extension Cards

Narrowband and broadband controllers are required as follows:

- ▶ If there are any BB services in the NE a broadband controller (AANC, ASCC–S, or AICC) is required in NPAMS Panel 1.
- ▶ If any NB services are required in the NE a narrowband controller (NEHC–P) is required in NPAMS Panel 1.
- ▶ If narrowband services are required in any subrack in the range NPAMS Panel 2 to NPAMS Panel 12 a narrowband extension controller (NSEC) is required in that subrack.
- ▶ If broadband services are required in any subrack in the range NPAMS Panel 2 to NPAMS Panel 12 a broadband extension controller (BSEC) is required in that subrack.

6.12.3 Subrack Configurations

1 NPAMS Panel 1

NPAMS Panel 1 is the Main Subrack. It is in the first subrack position in Rack 1.

- If any subrack in the NE supports narrowband services a NEHC is installed in the main subrack.
- If any subrack in the NE supports broadband services an AANC, ASCC–S, or AICC is installed in the main subrack.
- The MBTP setting for NPAMS Panel 1 is 1/1 (Rack 1 / Subrack 1).

2 NPAMS Panel 2

NPAMS Panel 2 may be BB only, NB only, or Hybrid (NB/BB).

- Its MBTP setting is always 1/2.
- If NPAMS Panel 2 is BB only:
 - NPAMS Panel 1 must contain an AANC, ASCC–S, or AICC.
 - NPAMS Panel 2 must contain a BSEC.
- If NPAMS Panel 2 is NB only
 - NPAMS Panel 1 must contain a NEHC.
 - NPAMS Panel 2 must contain a NSEC.
- If NPAMS Panel 2 is Hybrid (NB/BB):
 - NPAMS Panel 1 must contain a NEHC and either an AANC, ASCC–S, or an AICC.
 - NPAMS Panel 2 must contain a NSEC and a BSEC.

3 NPAMS Panel 3

NPAMS Panel 3 may be BB, NB, or Hybrid (NB/BB), depending on the subrack type configured for NPAMS Panel 2

- If NPAMS Panel 2 is NB or Hybrid (NB/BB):
 - NPAMS Panel 3 can be NB, BB or Hybrid.
 - NPAMS Panel 3 MBTP settings are 1/3.
 - An NSEC is required in NPAMS Panel 3 if it supports NB services.
 - A BSEC is required in NPAMS Panel 3 if it supports BB services.
- If NPAMS Panel 2 is BB:
 - NPAMS Panel 3 can be BB or NB. It cannot be Hybrid (NB/BB)
 - If NPAMS Panel 3 is NB its MBTP settings are 1/2. It must be equipped with a NSEC.
 - If NPAMS Panel 3 is BB its MBTP settings are 1/3. It must be equipped with a BSEC.

4 NPAMS Panels 4 to 12

NPAMS Panels 4 to 12 may be NB only or BB only. These subracks cannot be Hybrid (NB/BB).

- If a subrack in this range is BB only
 - Its jumper settings match the physical position.
 - It must be equipped with a BSEC.
- If a subrack in this range is NB only:
 - Its jumper settings do not have to match the physical subrack positions.

However the MBTP jumper settings for all subracks supporting narrowband (i.e NB or Hybrid (NB/BB)) in an NE must be sequential in the range 1/1 to 1/4.
 - It must be equipped with a NSEC.

6.12.4 MBTP Jumper Settings

Rack and subrack ID for each subrack in a NE are set on solder link settings on the MBTP.

The subrack address ID is R/SR , where R is the rack position and SR is the subrack position. For example, the subrack in Rack 2 Subrack 3 has a subrack address ID of $R2/SR3$.

- ▶ If a subrack supports broadband services its MBTP solder link settings match the physical position, e.g. if a subrack in rack 2 subrack 3 supports broadband services its jumper setting is 2/3.

This also applies to any subrack supporting hybrid services (BB and NB in the same subrack).

- ▶ If a subrack supports only narrowband services its MBTP settings do not have to match the physical position, but must be in ascending order: 1/1, 1/2, 1/3, 1/4.

6.12.5 Subrack Layouts

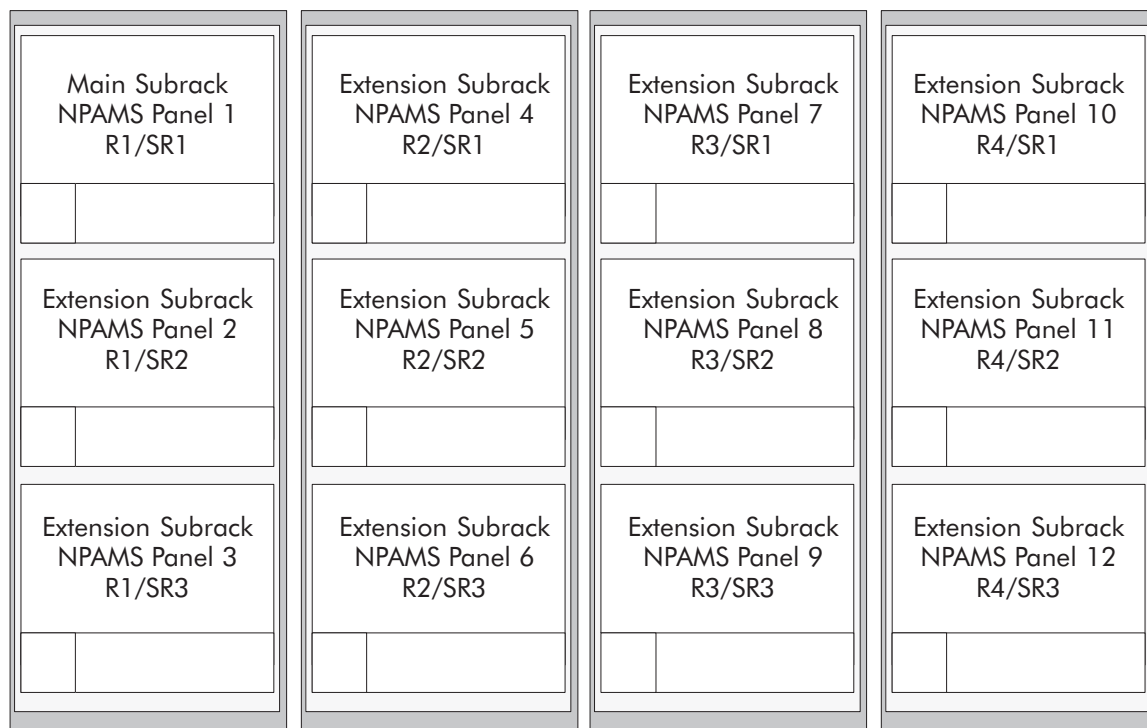


Figure 6-16 NURA Subrack Positions

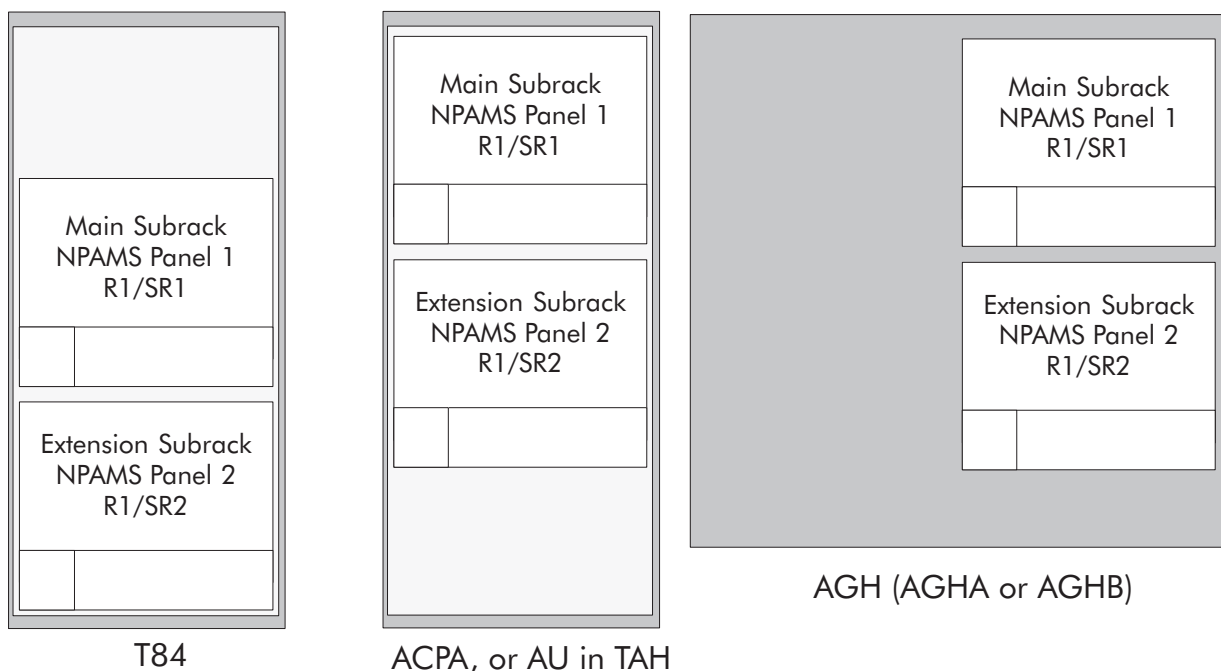


Figure 6-17 T84, ACPA and AGH Subrack Positions

7 Cards – Summary

7.1 Equipment Practice – CMUX Cards

CMUX cards are installed in the cards area of the CMUX subrack. The subrack may be either a MLS–hb or a MLS–hbe.

Equipment practice for each CMUX card is:

- ▶ PBA dimensions are 265 mm high by 213 mm deep.
- ▶ Each card has female metal connectors on the rear to provide connections to the backplane of the subrack. Connectors on the PBAs have 4, 5 or 6 rows. The ground and power pins connectors are pre-mating to allow for hot insertion and extraction.
- ▶ A metallic front plate is fitted to each card. This has screening contact springs to ensure EMC compliance.
- ▶ Card pitch is as follows:
 - Cards generally have a pitch of 20 mm, with the following exceptions.
 - The ringer card (DURCC) has double the pitch (40 mm).
 - Narrowband Controllers (NEHC–P), Broadband Controllers (ASCC–S, AANC and AICC) and Extender cards (BSEC and NSEC) have a pitch of 25 mm.
- ▶ Every card has its own onboard DC/DC converter that is fed by the installation's nominal –48 Vdc power supply.

CMUX cards meet the requirements of Telstra specification 1555 part 1, i.e. supply voltages from 40.5 Vdc to 60 Vdc.
- ▶ Front cabling on cards is only used for optical fibre connections.
- ▶ Latches are located at the top and bottom of the front plate of each CMUX card.
- ▶ 2 front LEDs indicating the card status
- ▶ Securing screws are located behind the latches at the top and bottom of the front plate of each card.

7.2 CMUX Cards – Chapter Contents

7.2.1 Controller Cards

Card Name	Part Number	Section
AANC	3EC 40152 Axxx	8.2
AICC	3EC 40136 AAxx	8.3
ASCC–S	3EC 40472 Sxxx	8.4
BSEC	3EC 40267 AAxx	8.5
NEHC–P	3EC 40088 Axxx	8.6
NSEC	3EC 40229 AAxx	8.7

7.2.2 Transport Cards

Card Name	Part Number	Section
EOTCA	3EC 41145 ABxx	9.2

7.2.3 Narrowband Line Cards

Card Name	Part Number	Section
ALLC	3EC 41112 Axxx	10.1
ATLCC	3EC 42053 ABxx	10.2
BALCF	3EC 40052 BFxx	10.3
HLTCA	3EC 40081 ABxx	10.4
PMLCC	3EC 41172 ACxx	10.5

7.2.4 Broadband Line Cards and IMA Cards

Card Name	Part Number	Section
LTAC–A	3EC 40137 Axxx	11.1
LTAC–C	3EC 40137 Cxxx	11.2
LTAC–D	3EC 43472 Axxx	11.3
NACC–A	3EC 40138 Axxx	11.4
NACC–C	3EC 40138 Cxxx	11.5
PAIC	3EC 40263 AAxx	11.6

7.2.5 Auxiliary Cards

Card Name	Part Number	Section
DURCC	3DY 00064 AAAA	12.1
TACCB	3EC 40034 ABxx	12.2
TARCB	3EC 40122 AAxx	12.3

7.3 Card Descriptions

The description of each CMUX card is presented in the following categories:

- ▶ Features and functions.
- ▶ Outline.
- ▶ Consequences of unplugging the card.
- ▶ Consequences of power failure.
- ▶ Redundancy.
- ▶ Power—up/reset.
- ▶ General information (architecture, databases, configuring, etc).
- ▶ LED description.
- ▶ Switches, links and sockets.
- ▶ Interfaces.
 - Physical.
 - Electrical.
 - Optical.
- ▶ Connector pinouts.
 - Front.
 - Top.
 - Backplane.
- ▶ Cabling.
(optical fibre handling precautions only).
- ▶ Summaries.
 - Card variants.
 - Card usage in subracks.
 - Cards grouped by function.
 - Card weight, power consumption, and module width.
 - Optical connectors.
 - Consequence of card failure.

Note *Only those sub—categories relevant to each card will be included in each section i.e. some categories may be missing in the section describing a particular card.*

1 Installation

When installing a card it must be firmly inserted into the subrack. It is best after fitting it to press it home by pushing it midway between the two ejector handles. Card installation is covered in Section 7.4.

2 Cabling

Cabling is discussed very briefly for each card where applicable. It is also covered in the *CMUX Housing, Rack and Cabling Handbook*.

3 Part Numbers

Part Numbers for CMUX cards are of the following pattern:

3EC 12345 xxxx

The Alcatel part numbering system and Part Number label are described in Chapter 1.

4 Variants

If there is more than one variant of a card the special features of each variant are described in the card description. Variants are summarised in the tables in Section 7.6.

5 Card Labels

Cards are labelled as shown in Section 1.1 of this handbook.

6 Switches, Links and Sockets

All settings for each CMUX Card are illustrated in the Card Outline for each card:

- Factory defaults are shown in the card outline drawings.
- User-configurable settings are described in the Switches, Links and Sockets sub-section for each card.

If the current settings on a card are lost or modified, check both of the above and restore the settings to match. If there is no Switches, Links and Sockets section for a card then the factory defaults apply.

7 Card Outlines

The generic outline of a CMUX card is shown in Figure 7–1.

ATTENTION

Possible faulty system operation.

Always make sure that any new or changeover cards replacing existing ones have all their switch, link or socket settings matching those of the one(s) removed.

If there is no heading "Switches, Links and Sockets" for a given card in this section, then no user adjustments are applicable, even though such devices may be present on the PBA.

Unless otherwise stated **do not change** any switches, links or sockets on any of the cards. Many are factory set and must not be touched.

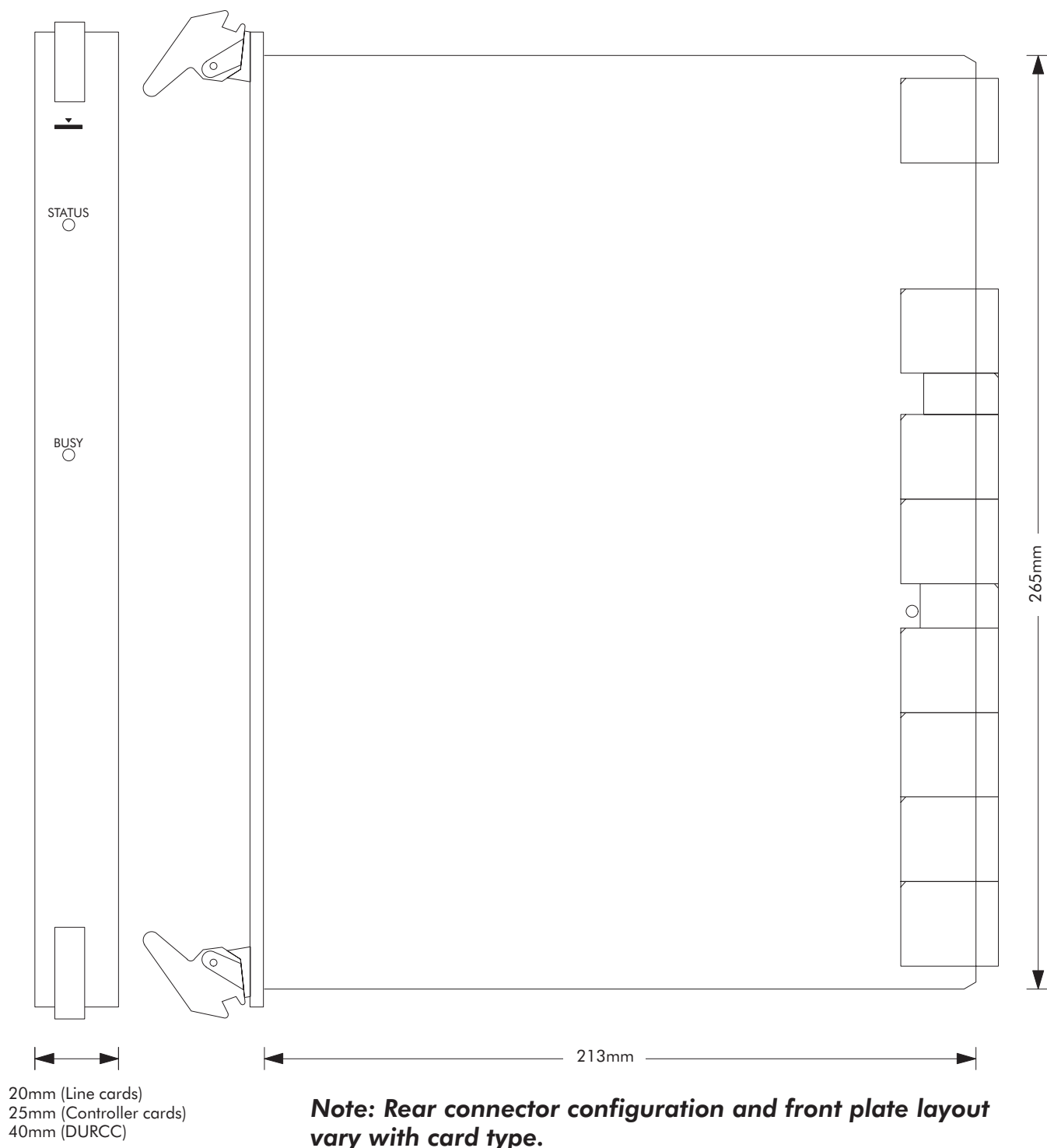


Figure 7–1 CMUX Cards – Typical Outline

7.4 Card Installation

CMUX Cards are Printed Board Assemblies (PBA) which slide into slots in the subrack (MLS–hb or MLS–hbe).

The cards have metal connectors at the rear edge which plug into connectors of the backplanes of the subrack.

Latches are fitted at the top and bottom of the front edge of each card. These latches are only used to eject cards from the subrack. They must not be used to force the card into the subrack.

A screw is located under each latch at the top and bottom of the front plate of the card. These screws secure the cards in the subrack.

7.4.1 Unpack Cards

- ▶ Select a card, and carefully unpack it.
- ▶ Inspect the card for any damage in transit.
- ▶ Decide which subrack and slot the card is to be installed in.

Note *Refer to Chapter 6 – “CMUX Subracks” for details of card positions in subracks.*

7.4.2 Card Installation

To install a card in a subrack:

- ▶ Slide the card into the slot until the connectors at the rear are almost into the connectors on the subrack backplane.
- ▶ Open the card securing latches at the top and bottom of the front edge of the card.
- ▶ Push the card until it just contacts the connectors at the rear of the slot.
- ▶ Firmly press in the centre of the front plate to push the card into position until the latches close.

Do NOT use the latches to lever the card into position.

- ▶ Secure the cards with the screws located under the latches.

7.5 Card Removal

To remove a card:

- ▶ Undo the retaining screws under the latches at the top and bottom of the front plate of the card.
If the screws are not undone, attempting to use the latches to force the card out of the slot will damage the latches.
- ▶ Ensure that the retaining screws for the adjacent cards are screwed in to positively retain these cards in the subrack.
- ▶ Open the top and bottom latches to disconnect the card from the backplane.
- ▶ Withdraw the card from the slot.
- ▶ If the card will not be reinserted or replaced, deconfigure the card in the element manager (AWS/NGAWS and CMEM). This should be done after the card has been physically disconnected from the backplane.



Card removal may affect services

If a card is removed services may be affected.

The services affected will vary from one type of card to another.

The services affected by removal of a card are described in the section on each type of card in this Handbook.

Before removing a card, refer to precautions described in the section for that type of card in this Handbook.

7.6 Summaries

This chapter shows the part numbers for the individual cards.

7.6.1 Cards Grouped by Function

Card	Part Number	Page
Controller Cards		
AANC	3EC 40152 Axxx	8.2
AICC	3EC 40136 AAxx	8.3
ASCC–S	3EC 40472 Sxxx	8.4
BSEC	3EC 40267 AAxx	8.5
NEHC–P	3EC 40088 Axxx	8.6
NSEC	3EC 40229 AAxx	8.7
Transport Cards		
EOTCA	3EC 41145 ABxx	9.2
Narrowband Line Cards		
ALLC	3EC 41112 Axxx	10.1
ATLCC	3EC 42053 ABxx	10.2
BALCF	3EC 40052 BFxx	10.3
HLTCA	3EC 40081 ABxx	10.4
PMLCC	3EC 41172 ACxx	10.5
Broadband Line Cards and IMA Cards		
LTAC–A	3EC 40137 Axxx	11.1
LTAC–C	3EC 40137 Cxxx	11.2
LTAC–D	3EC 43472 Axxx	11.3
NACC–A	3EC 40138 Axxx	11.4
NACC–C	3EC 40138 Cxxx	11.5
PAIC	3EC 40263 AAxx	11.6
Auxiliary Cards		
DURCC	3DY 00064 AAAA	12.1
TACCB	3EC 40034 ABxx	12.2
TARCB	3EC 40122 AAxx	12.3

7.6.2 Card Weight, Slot Type and Slot Width

Card	Part Number	Weight (kg)	Power Input	Slot Type	Slot	Width
Controller Cards						
AANC	3EC 40152 Axxx	0.672	10W	BB Controller	1, 3 MLS–hb	25mm
AICC	3EC 40136 AAxx	0.584	15W	BB Controller	1, 3 MLS–hb	25mm
ASCC–S	3EC 40472 Sxxx	0.870	12.5W	BB Controller	1, 3 MLS–hb	25mm
BSEC	3EC 40267 AAxx	0.580	10W	BB Controller	1, 3 MLS–hb 1, 3 MLS–hbe	25mm
NEHC–P	3EC 40088 Axxx	0.898	16W	NB Controller	2, 4 MLS–hb	25mm
NSEC	3EC 40229 AAxx	0.770	9W	NB Controller	2, 4 MLS–hb 2, 4 MLS–hbe	25mm

Card	Part Number	Weight (kg)	Power Input	Slot Type	Slot	Width
Transport Cards						
EOTCA	3EC 41145 ABxx	0.532	10W	Transport	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm

Card	Part Number	Weight (kg)	Power Input	Slot Type	Slot	Width
Narrowband Line Cards						
ALLC	3EC 41112 Axxx	0.618	10W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
ATLCC	3EC 42053 ABxx	0.698	12W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
BALCF	3EC 40052 BFxx	0.794	8W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
HLTCA	3EC 40081 ABxx	0.484	15W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
PMLCC	3EC 41172 ACxx	0.580	12W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm

Card	Part Number	Weight (kg)	Power Input	Slot Type	Slot	Width
Broadband Line Cards and IMA Cards						
LTAC–A	3EC 40137 Axxx	0.656	21W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
LTAC–C	3EC 40137 Cxxx	0.628	27W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
LTAC–D	3EC 43472 Axxx	1.760	26.5W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	40mm
NACC–A	3EC 40138 Axxx	0.984	4W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
NACC–C	3EC 40138 Cxxx	1.008	4W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
PAIC	3EC 40263 AAxx	0.426	6W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm

Card	Part Number	Weight (kg)	Power Input	Slot Type	Slot	Width
Auxiliary Cards						
DURCC	3DY 00064 AAAA	1.400	12W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	40mm
TACCB	3EC 40034 ABxx	0.574	24W	Line Card	7 – 21 MLS–hb 5 – 22 MLS–hbe	20mm
TARCB	3EC 40122 AAxx	0.494	7W	Line Card	22 MLS–hb	20mm

Note

- *MLS–hb = CMUX Main Panel.
May be used as a main subrack or as an extension subrack.*
- *MLS–hbe = CMUX Extension Panel.
Used only as an extension subrack.*

7.6.3 Customer Service Affecting Status

Card	Part Number	Service Affecting?	Effect of Card Failure or Removal
Controller Cards			
AANC	3EC 40152 Axxx	Yes	All broadband services lost at NUC and all NUS or AU parented by it are lost.
AICC	3EC 40136 AAxx	Yes	AICC at NUC: All broadband services lost at NUC and all NUS or AU parented by it. AICC at NUS or AU: All broadband services at NUS or AU lost
ASCC–S	3EC 40472 Sxxx	Yes	All broadband services lost at NUC and all NUS or AU parented by it are lost.
BSEC	3EC 40267 AAxx	Yes	All broadband services lost in subrack containing the BSEC and in all subracks below it in the NU or AU
NEHC–P	3EC 40088 Axxx	Yes	NEHC–P at NUC. * All NB services lost at NUC. * All NB and BB services lost at all NUS and/or AU parented by this NUC. NEHC–P at NUS or AU. * All NB services lost at the NUS or AU.
NSEC	3EC 40229 AAxx	Yes	All narrowband services are lost in the subrack containing the NSEC and all subracks beneath it in the NE.

Card	Part Number	Service Affecting?	Effect of Card Failure or Removal
Transport Cards			
EOTCA	3EC 41145 AAxx	Yes	All services carried by the EOTCA are lost

Card	Part Number	Service Affecting?	Effect of Card Failure or Removal
Narrowband Line Cards			
ALLC	3EC 41112 Axxx	Yes	All services carried by the ALLC are lost
ATLCC	3EC 42053 ABxx	Yes	All services carried by the ATLCC are lost
BALCF	3EC 40052 BFxx	Yes	All services carried by the BALCF are lost
HLTCA	3EC 40081 ABxx	Yes	All services carried by the HLTCA are lost
PMLCC	3EC 41172 ACxx	Yes	All services carried by the PMLCC are lost

Card	Part Number	Service Affecting?	Effect of Card Failure or Removal
Broadband Line Cards and IMA Cards			
LTAC–A	3EC 40137 Axxx	Yes	All ADSL services carried by the LTAC–A are lost. POTS services are maintained via the TSPP–A relays
LTAC–C	3EC 40137 Cxxx	Yes	All ADSL services carried by the LTAC–C are lost. POTS services are maintained.
LTAC–D	3EC 43472 Axxx	Yes	All ADSL services carried by the LTAC–D are lost. All POTS services carried via LTAC–D are lost.
NACC–A	3EC 40138 Axxx	Yes	All ADSL services carried by the triplet are maintained. POTS services are maintained via the TSPP–A relays
NACC–C	3EC 40138 Cxxx	Yes	ADSL services carried by the twin are maintained. If twin has a DSPP–B, POTS services are maintained via the DSPP–B relays If twin has a DSAP, POTS services are not maintained.
PAIC	3EC 40263 AAxx	Yes	All broadband services at the subtended NUS or AU are lost.

Card	Part Number	Service Affecting?	Effect of Card Failure or Removal
Auxiliary Cards			
DURCC	3DY 00064 AAAA	Yes	Loss of ring signal to line cards
TACCB	3EC 40034 ABxx	No	Line tests cannot be performed
TARCB	3EC 40122 AAxx	No	Environment and power supply alarms are not accessible. Battery test is not available. Narrowband CRAFT terminal is disconnected.

7.6.4 Channel and Signal Mapping – Cards to Plugs

1 LFSPB Channel Mapping

The LFSPB plug connects MDF cabling to the subrack for the ATLCC, BALCF, PMLCC, ALLC and TACCB.

The following table maps LFSPB pinouts to line card channels and MDF pairs.

The mapping allows for the same cabling and terminations to be used for the MDF to subrack cabling for all the listed card types.

LFSPB		MDF Pair	Line Card Channel Allocations				
Connector	Pins		ATLCC	BALCF	PMLCC	ALLC	TACCB
F1	B1 / D1	2–6	16	16	16	LI_8	
	A2 / C2	2–5	15	15	15	LI_7	
	B3 / D3	2–4	14	14	14	E/MW_8	
	A4 / C4	2–3	13	13	13	E/MW_7	
	B5 / D5	2–2	12	12	12	LO_8	
	A6 / C6	2–1	11	11	11	LO_7	
F2	B1 / D1	1–10	10	10	10	LI_6	
	A2 / C2	1–9	9	9	9	LI_5	
	B3 / D3	3–4	24			E/MW_6	
	A4 / C4	3–3	23			E/MW_5	
	B5 / D5	3–2	22			LO_6	
	A6 / C6	3–1	21			LO_5	
F3	B1 / D1	3–10	30				
	A2 / C2	3–9	29				
	B3 / D3	3–8	28				
	A4 / C4	3–7	27				
	B5 / D5	3–6	26				
	A6 / C6	3–5	25				
F4	B1 / D1	2–10	20			LI_4	
	A2 / C2	2–9	19			LI_3	
	B3 / D3	2–8	18			E/MW_4	
	A4 / C4	2–7	17			E/MW_3	
	B5 / D5	1–8	8	8	8	LO_4	
	A6 / C6	1–7	7	7	7	LO_3	
F5	B1 / D1	1–6	6	6	6	LI_2	Revertive Call
	A2 / C2	1–5	5	5	5	LI_1	
	B3 / D3	1–4	4	4	4	E/MW_2	
	A4 / C4	1–3	3	3	3	E/MW_1	
	B5 / D5	1–2	2	2	2	LO_2	
	A6 / C6	1–1	1	1	1	LO_1	

2 PRCPB Mapping

The PRCPB plug connects cabling to the subrack for the HLTCA and PRCC. Where OA&M is carried via a LTAC–A which is not part of a triplet, the connection is via a PRCPB plug.

The following table maps PRCP pinouts to signals.

PRCPB		Signals			
Connector	Pins	HTLC	LTAC–A	LTAC–D	
				Mainboard POTS + ADSL to Customer	Splitter daughterboard POTS from ATLCC
F1	B1 / D1	21_6C&5D (G.703_3 OUT)	4	24	24
	A2 / C2	21_6A&5B (G.703_4 OUT)	3	23	23
	B3 / D3	21_4C&3D (G.703_1 OUT)	2	22	22
	A4 / C4	21_4A&3B (G.703_2 OUT)	1	21	21
	B5 / D5	21_2C&1D (G.703_3 IN)		20	20
	A6 / C6	21_2A&1B (G.703_3 IN)		19	19
F2	B1 / D1	20_6C&5D (G.703_1 IN)		18	18
	A2 / C2	20_6A&5B (G.703_2 IN)		17	17
	B3 / D3	20_3D&GND		16	16
	A4 / C4	20_3B&GND		15	15
	B5 / D5	20_1D&GND		14	14
	A6 / C6	20_1B&GND		13	13
F3	B1 / D1				
	A2 / C2				
	B3 / D3				
	A4 / C4				
	B5 / D5				
	A6 / C6				
F4	B1 / D1			12	12
	A2 / C2			11	11
	B3 / D3			10	10
	A4 / C4			9	9
	B5 / D5	A (HDSL Line 1)		8	8
	A6 / C6	C (HDSL Line 3)		7	7
F5	B1 / D1			6	6
	A2 / C2			5	5
	B3 / D3			4	4
	A4 / C4	B (HDSL Line 2)		3	3
	B5 / D5	D (HDSL Line 4)		2	2
	A6 / C6			1	1

3 EOTP Mapping

The EOTP plug connects cabling to the subrack for the EOTCA. The following table maps EOTCA pinouts to signals.

EOTP		Signals
Connector	Pins	EOTCA
F1	B1 / D1	Rx 0 (Ch 1 IN)
	A2 / C2	Tx 0 (Ch 1 OUT)
	B3 / D3	Rx 1 (Ch 2 IN)
	A4 / C4	Tx 1 (Ch 2 OUT)
	B5 / D5	Rx 2 (Ch 3 IN)
	A6 / C6	Tx 2 (Ch 3 OUT)
F2	B1 / D1	Rx 3 (Ch 4 IN)
	A2 / C2	Tx 3 (Ch 4 OUT)
	B3 / D3	Rx 4 (Ch 5 IN)
	A4 / C4	Tx 4 (Ch 5 OUT)
	B5 / D5	Rx 5 (Ch 6 IN)
	A6 / C6	Tx 5 (Ch 6 OUT)
F3	B1 / D1	Rx 6 (Ch 7 IN)
	A2 / C2	Tx 6 (Ch 7 OUT)
	B3 / D3	Rx 7 (Ch 8 IN)
	A4 / C4	Tx 7 (Ch 8 OUT)
	B5 / D5	Rx 8 (Ch 9 IN)
	A6 / C6	Tx 8 (Ch 9 OUT)
F4	B1 / D1	Rx 9 (Ch 10 IN)
	A2 / C2	Tx 9 (Ch 10 OUT)
	B3 / D3	Rx 10 (Ch 11 IN)
	A4 / C4	Rx 11 (Ch 12 IN)
	B5 / D5	Rx 12 (Ch 13 IN)
	A6 / C6	Rx 13 (Ch 14 IN)
F5	B1 / D1	Rx 14 (Ch 15 IN)
	A2 / C2	
	B3 / D3	
	A4 / C4	Tx 15 (Ch 16 IN)
	B5 / D5	
	A6 / C6	
F6	B1	Tx 15 –ve (Ch 16 OUT)
	A2	Tx 15 +ve (Ch 16 OUT)
	B3 / D3	Tx 11 (Ch 12 OUT)
	A4 / C4	Tx 12 (Ch 13 OUT)
	B5 / D5	Tx 10 (Ch 11 OUT)
	C6	Tx 13 +ve (Ch 14 OUT)
F7	B1 / D1	
	A2 / C2	
	B3	Tx 13 –ve (Ch 14 OUT)
	C3 / D3	Tx 14 (Ch 15 OUT)
	A4 / C4	
	B5 / D5	
	A6 / C6	

8 Controller Cards

8.1 Optical Cards – Warnings

AANC and ASCC–S cards have an optical interface for the STM–1 connection. The following warnings apply to all CMUX optical connections.



To minimise the possibility of optical exposure the card should be unpowered while optical connections to it are being made or broken.

To make or break the optical connections, unplug the card from the backplane, then withdraw it halfway from the subrack before connecting or disconnecting the optical cable.



The optical connectors on the card are protected by plastic caps. Before use, these must be removed and stored, so that in the event of the station optical cabling being removed from the card, the caps can be quickly replaced on the connectors.

It is most important that the optical connector faces are kept free from dirt and dust.

After the removal of the caps and before connection of station cabling, the optical connector faces must be cleaned either as indicated below or in accordance with approved local practices.



Should the optical connector faces to the fibre on the card require cleaning this can be done by:

- 1) removing the plastic support plate from above the fibre.
 - 2) carefully withdrawing the connector on the internal fibre from its housing, similar to disconnecting the external fibre.
 - 3) cleaning the optical connector faces using a lint-free soft cloth moistened with ethanol.
 - 4) reassembling in reverse order.
-

8.2 AANC – 3EC 40152 Axxx

The AANC (ADSL ATM NT Card) is a CMUX broadband controller and STM–1 network termination in the CMUX NU.

Two AANC are supported in a 1+1 redundancy configuration.

The AANC is installed in the first Main Subrack (NPAMS Panel 1, or Rack1, Subrack 1) at the Central NU (NUC).

8.2.1 AANC – Features and Functions

(1) Features

- ▶ Provides an STM–1 network termination in the CMUX.
- ▶ Is responsible for the multiplexing and concentration of broadband traffic from the broadband line cards such as LTAC–A and LTAC–C.
- ▶ Acts as the master of the IQ broadband bus on the subrack backplane.

(2) Functions

1 Upstream

- ATM.
 - Reading ATM cells from the IQ (local and via extension bus).
 - ATM cell extraction.
 - ATM cell insertion.
 - ATM layer processing and cell rate decoupling.
 - ATM cell HEC calculation.
 - ATM cell payload scrambling.
 - Mapping of ATM cells in VC–4.
- STM–1.
 - STM–1 Tx signal generation to ITU–T G.825 and G.957.
 - STM–1 Tx clock generation according to selected clock.
 - STM–1 scrambling, frame generation.

- Internal transfer of ATM from STM–1 to IQ bus (via Utopia Interfaces).
- F1/2/3 OA&M functions.

2 Downstream

- Clock & Data recovery from STM–1 G.813 signals to G.825 and G.957.
- Locking on received clock (loop timing mode).
- STM–1.
 - STM–1 frame alignment recovery, alarm detection & performance monitoring.
 - STM–1 descrambling.
- ATM.
 - ATM cell delineation (in VC–4).
 - ATM cell HEC check and single bit correction.
 - ATM cell payload descrambling.
 - ATM layer processing and cell rate decoupling.
 - ATM cell extraction.
 - ATM cell insertion.
- Internal transfer of ATM from STM–1 to IQ bus (via Utopia Interfaces).
- F1/2/3 OA&M functions.

3 General

- AAL termination/generation for OA&M with AWS.
- IQ extension bus support.
- CMUX system OA&M functions.
- Debug testing via GICI interface.
- Hardware Management Wires (HMW) support.
- Reading/Programming of Remote Inventory via the GICI interface.
- Craft Terminal via local interface.
- Support for Internal Control Bus (ICB).
- Support for IOBS bus for alarm information transfer between AANC and TARCB.

- Remote Inventory (RI).
 - Onboard RI information to uniquely identify the AANC.
 - Receives RI from broadband cards via ATM over the IQ bus.

Note *Downstream refers to traffic passing from the STM–1 interface through the AANC towards the IQ bus and then to the LTACs. Upstream is user traffic from the LTACs. This passes through the AANC towards the SDH network via STM–1.*

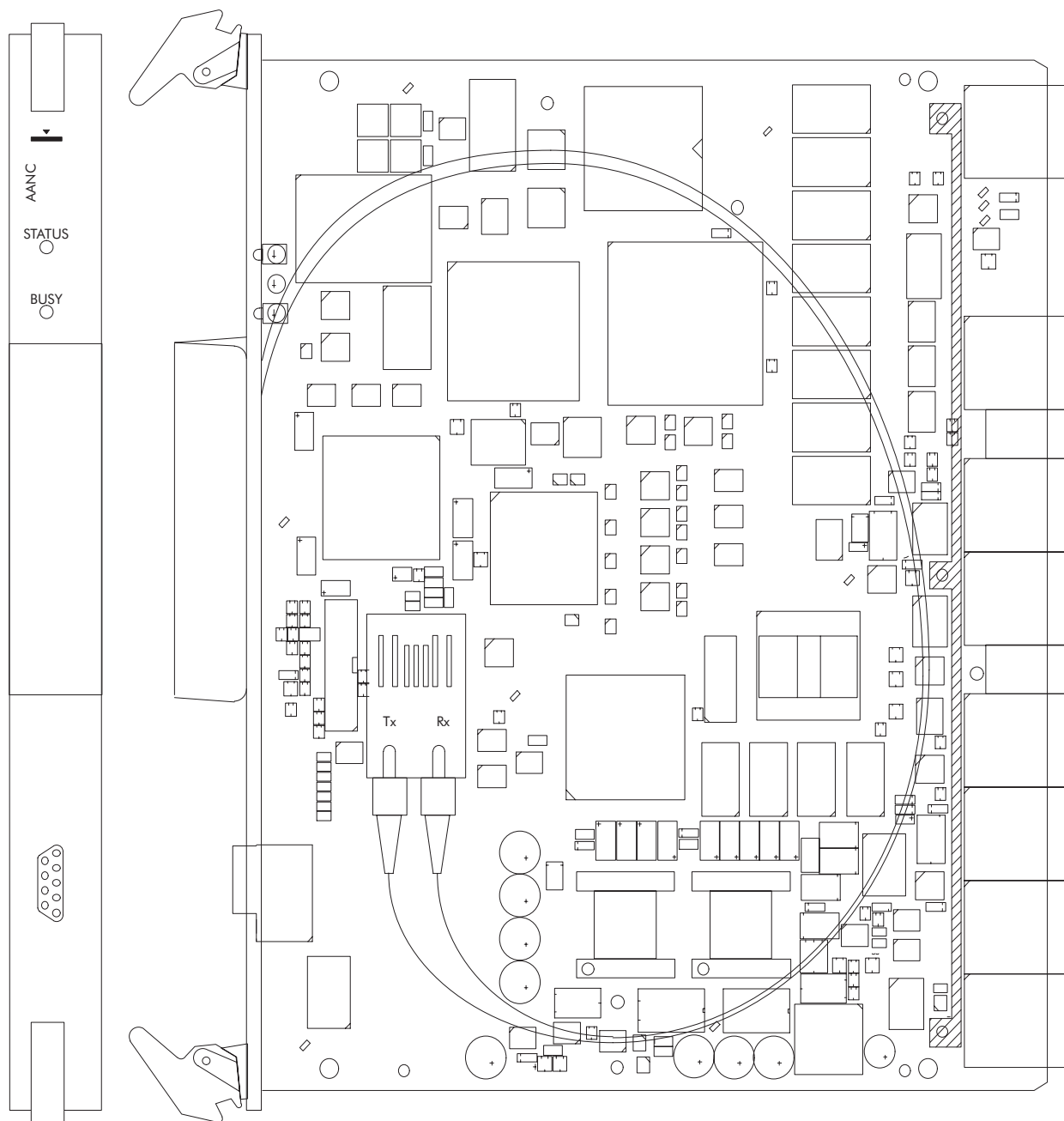
8.2.2 AANC – Variants

There are two variants of the AANC. These have different optical interfaces, providing different maximum range.

In all other respects the two variants are the same.

Variant	Optical Interface	Range
3EC 40152 AAxx	Short haul STM–1 (S1.1)	15 km
3EC 40152 ACxx	Long haul STM–1 (L1.1)	40 km

8.2.3 AANC – Outline



Note: Optical connectors are under hinged cover on front plate.

Figure 8–1 AANC – Outline

8.2.4 AANC – Context Diagram

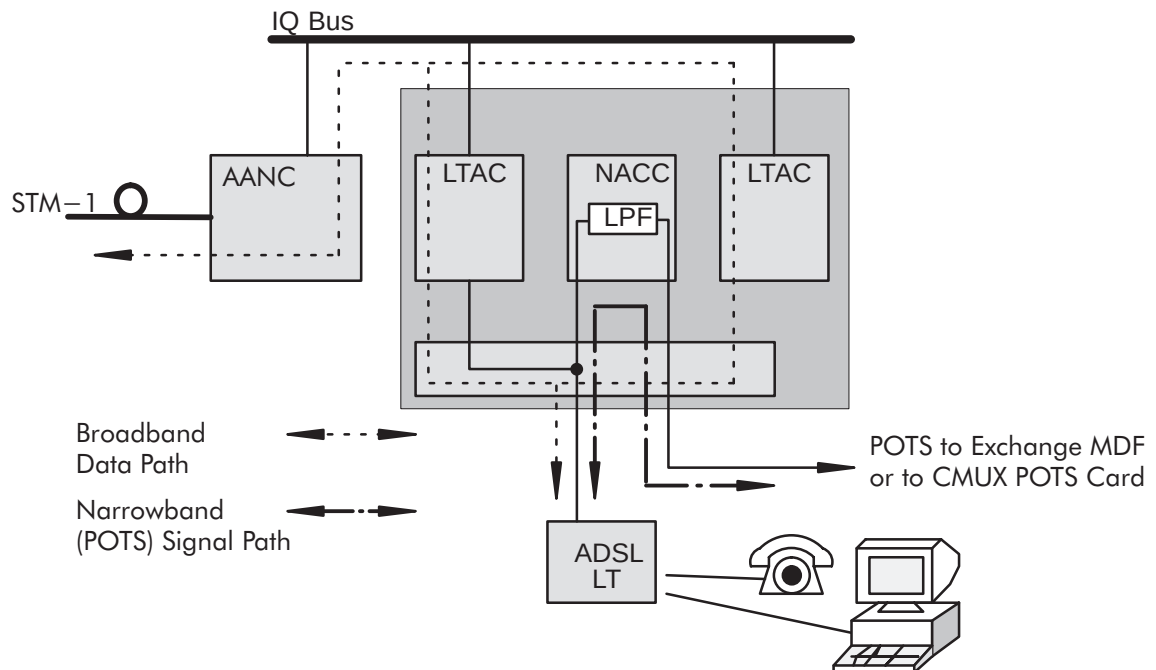


Figure 8–2 AANC – Context Diagram

8.2.5 AANC – Block Diagram

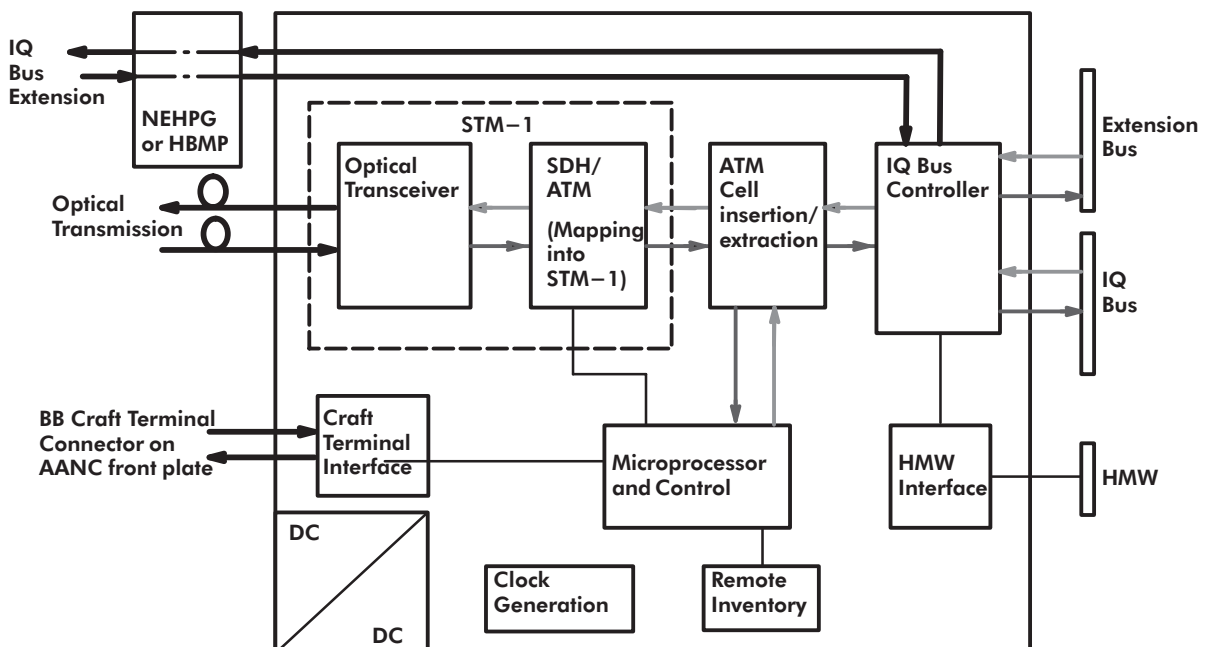


Figure 8–3 AANC – Block diagram

8.2.6 AANC – Consequences of Unplugging

ATTENTION

If an AANC is removed from the Subrack the effects are:

- 1) If a single AANC is installed all STM–1 and ADSL traffic is lost.
 - 2) If two AANC are installed in a 1+1 redundant pair, STM–1 and ADSL traffic is transferred to the redundant AANC.
-

Note *1+1 redundancy of AANC is supported.*

ATTENTION

AANC Hot Extraction Restrictions

Hot extraction of the AANC is NOT supported under the following conditions:

- 1) During software upgrades.
- 2) While ATM services are live.

Ensure that neither of these conditions is occurring before removing an AANC.

8.2.7 AANC – Switches, Links and Sockets

There are no user–selectable switches, links or sockets on the AANC.

8.2.8 AANC – LED Description

Two LEDs are located on the front plate of the AANC.
Indications during operation are:

LED	Indication	Description
Green STATUS LED	ON	AANC operating correctly
	OFF	AANC is powered down or has a hardware problem
Yellow BUSY LED	ON	AANC is active card in redundant pair
	OFF	AANC is standby card in redundant pair
	FLASH	No valid STM–1 signal on optical interface

Note *During startup both LEDs will flash at varying intervals for a period of up to 45 seconds.*

8.2.9 AANC – Interface – Electrical

(1) IQ Bus Interface

The AANC connects to the IQ bus via rear connectors on the AANC.

The IQ bus transports ATM traffic along the subrack backplane from broadband line cards (e.g. LTAC) to the AANC. The AANC interfaces to the upstream, downstream and access control elements of the IQ bus.

(2) Physical Location Identity

The subrack backplane is hard-wired so that each card can recognise its physical location. The MBTPB indicates the subrack type, rack identifier, and subrack identifier.

The AANC uses this information for:

- ▶ Determining which slot the AANC has been installed in.
- ▶ Determining the type of backplane and thus where and how many broadband line cards can be installed.

(3) Power Supply

Power supply to the AANC is via the –48 Vdc supply on the subrack backplane. An onboard DC/DC converter creates all supply rail voltages on the AANC.

(4) Extension Interface

The AANC has an external interface via the plug connector area on the backplane for an extension bus connection. This interface allows the cascading of extension subracks from the main subrack.

The extension interface supports the extension of the IQ bus to the extension subracks from the main subrack. Physically it is composed of 155 Mbit/s links between the AANC and the Broadband Shelf Extender Card (BSEC).

(5) Internal Control Bus

The Internal Control Bus (ICB) is a bus on the subrack backplane that connects to the controller cards and to every line card slot. It is used for sending messages between cards. Currently only controllers are hardware ready.

The uses of the ICB with the AANC are:

- ▶ Communication with the narrowband controller.
- ▶ Communication with the server cards. (Future CMUX release).

The AANC connects to the ICB via rear connectors on the AANC.

(6) Hardware Management Wires

Hardware Management Wires (HMW) are direct connections along the backplane between the controller cards and the LIMs.

A common set of hardware management wires are shared by the narrowband and broadband cards and controllers. A contention mechanism ensures that no two controllers can access the HMW at the same time.

HMW allow the AANC to detect narrowband and broadband cards, disable cards, power down cards, and reset cards.

(7) CRAFT Terminal

There are two physical CRAFT terminal connections on the AANC:

- ▶ Front connection via a DB9 connector (RS-232) on the AANC front plate.
- ▶ Connection through the backplane and TARC (RS-485) (future CMUX release).

The front connector is the only useable CRAFT port on the AANC in current CMUX releases. The backplane craft port will be available in a future CMUX release, when the TARCB will support dual access of the CRAFT port by narrowband and broadband controllers.

8.2.10 AANC – Interface – Optical

The AANC has two optical interfaces (transmit and receive). These interface via optical fibre to an STM–1 SDH compatible device.

Item	AAxx	ACxx
Classification	S1.1	L1.1
Line Coding	STM–1	STM–1
Line Rate	155 Mbit/s	155 Mbit/s
Wavelength	1300 nm nominal	1300 nm nominal
Optical Output		
Minimum launched power:	–15 dBm	–5 dBm
Maximum launched power:	–8 dBm	–0 dBm
Optical Input		
Minimum sensitivity	–28 dBm @ BER 1×10^{-10}	–34 dBm @ BER 1×10^{-10}
Maximum sensitivity	–8 dBm	–8 dBm
Connector	8° Angled SC (SC–APC)	8° Angled SC (SC–APC)

8.2.11 AANC – Connector Pinouts – Front

The DB9 Broadband CRAFT Terminal connector is located on the front plate of the AANC. The connector is RS232 DCE.

Pin	Signal	Description
1	DCD	Data Carrier Detect
2	CFT–RXD	Receive Data by CRAFT Terminal (AANC to CT)
3	CFT–TXD	Transmit Data by CRAFT Terminal (CT to AANC)
4	DTR	Data Terminal Ready
5	SG	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

8.2.12 AANC – Alarms

For full details of AANC alarms and their consequences, refer to the *Alcatel AWS Operator's Handbook*.

8.3 AICC – 3EC 40136 AAxx

The AICC (ATM IMA Controller Card) is a Broadband Controller Card (BBCC) in NUC, AU and NUS. An AICC in a NUS or AU communicates with a PAIC at the NUC via 4 x 2 Mbit/s IMA links.

The AICC multiplexes broadband traffic from broadband line cards such as LTACs. It acts as the master of the IQ broadband bus on the subrack backplane.

A future release of CMUX may support two AICC in a 1+1 redundancy configuration.

8.3.1 AICC – Features and Functions

(1) Features

Features of the AICC are:

- ▶ Provides 4 x E1 network termination in CMUX using the IMA protocol.
- ▶ Provides ATM payload processing between the physical 4 x 2 Mbit/s links and the IQ bus.
- ▶ Terminates IMA encoded transmission and routes traffic to the relevant Line Interface Modules (LIMs) via the IQ bus or via an extension bus to extension subracks.
- ▶ Supports connection management at subrack level.
- ▶ Is capable of providing OA&M functionality.
- ▶ Contains a microprocessor so that it can perform the following tasks:
 - Initialisation of board.
 - Handling of general communications messages.
 - Supervision of external interfaces.
 - Initialisation of connected broadband line cards.
 - CRAFT Terminal.
 - Monitoring and processing of the maintenance messages.
 - Online/offline test support.
 - Communication with TARCB for external alarm collection.
 - Control of broadband Hardware Management Wires.
 - Software download to broadband cards.
 - Programming of onboard FPGAs.

(2) Functions

Functions of the AICC are:

1 Downstream.

- HDB3 Decoding.
- Bit Timing Recovery.
- Frame/Multiframe Recovery.
- IMA ATM Cell extraction from E1 frame.
- Extraction of ATM cells from IMA frame.
- Removal of filler cells.
- Removal of IMA ICP cells.
- Realignment of IMA links using ICP cells.
- Cell rate adaption.
- Cell insertion/extraction.
- HEC checking.
- Support for Permanent Virtual Circuits.

2 Upstream.

- Frame/Multiframe Generation.
- HDB3 Encoding.
- IMA encoded ATM to E1 frame mapping.
- ATM cell insertion into IMA frame.
- IMA cell stuffing (to maintain bitrate).
- Insertion of IMA ICP cells.
- Cell rate adaption.
- Cell insertion/extraction (e.g. OA&M channels to LIMs).
- HEC generation.
- Support for Permanent Virtual Circuits.

3 General

- AAL termination/generation for OA&M with AWS.
- IQ extension bus support.
- CMUX system OA&M functions.
- Debug testing via GICI interface.
- Hardware Management Wires (HMW) support.
- Reading/Programming of Remote Inventory via the GICI interface.
- Craft Terminal via local interface.
- Support for Internal Control Bus (ICB).
- Support for IOBS bus for alarm information transfer between AICC and TARCB.
- Remote Inventory (RI).
 - Onboard RI information to uniquely identify the AICC.
 - Receives RI from broadband cards via ATM over the IQ bus.

Note

- *Downstream refers to traffic passing from the IMA interface through the AICC towards the IQ bus and then to the LTACs.*
- *Upstream is user traffic from the LTACs. This passes through the AICC towards the PAIC via IMA.*

8.3.2 AICC – Outline

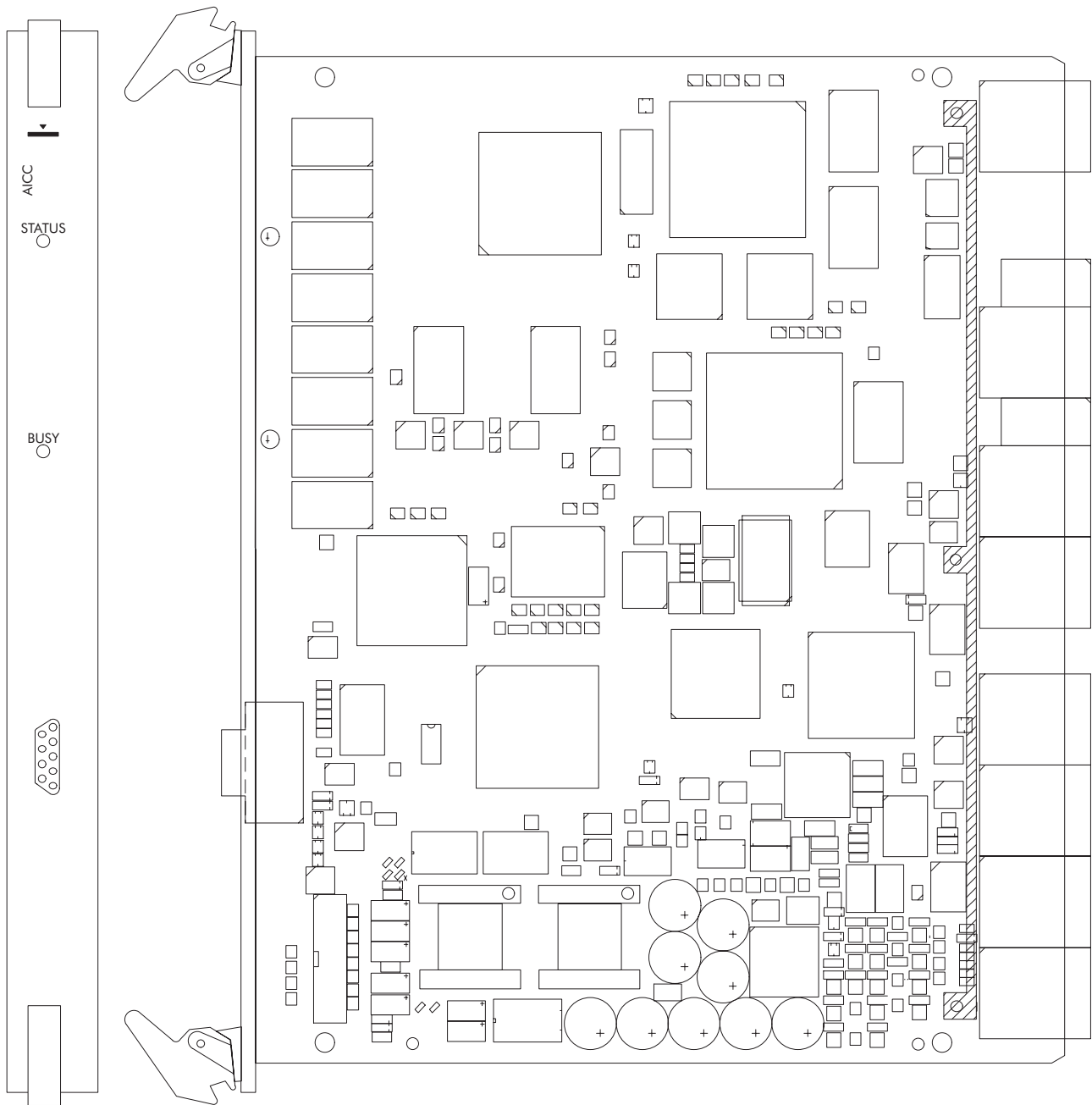


Figure 8–4 AICC – Outline and Front Plate

8.3.3 AICC – Context Diagram

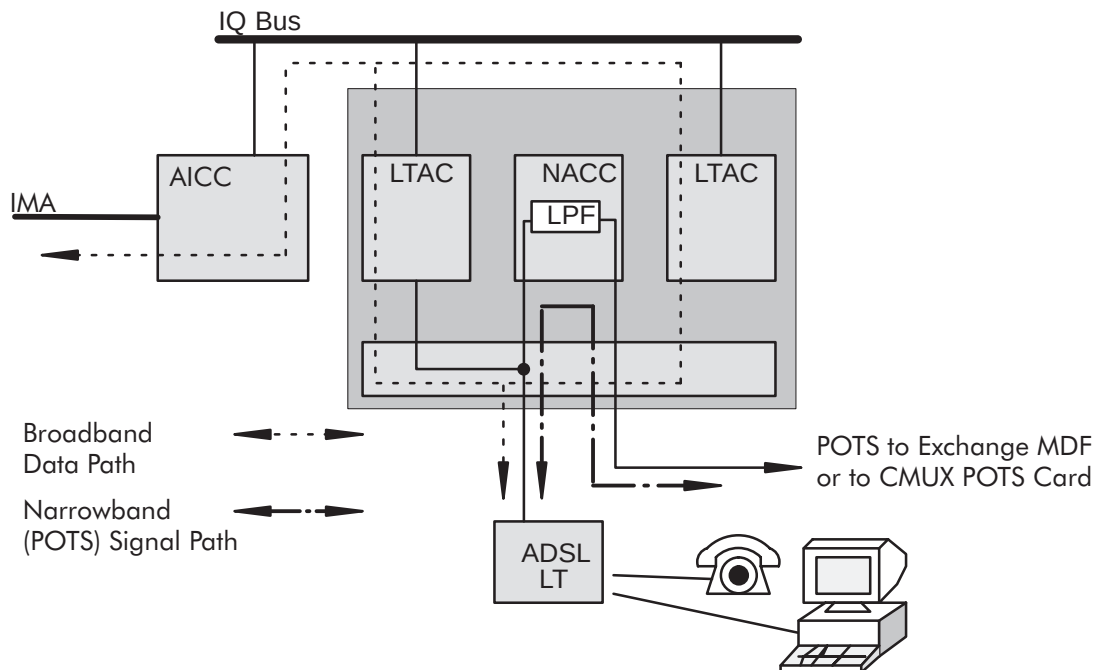


Figure 8–5 AICC – Context Diagram

8.3.4 AICC – Block Diagram

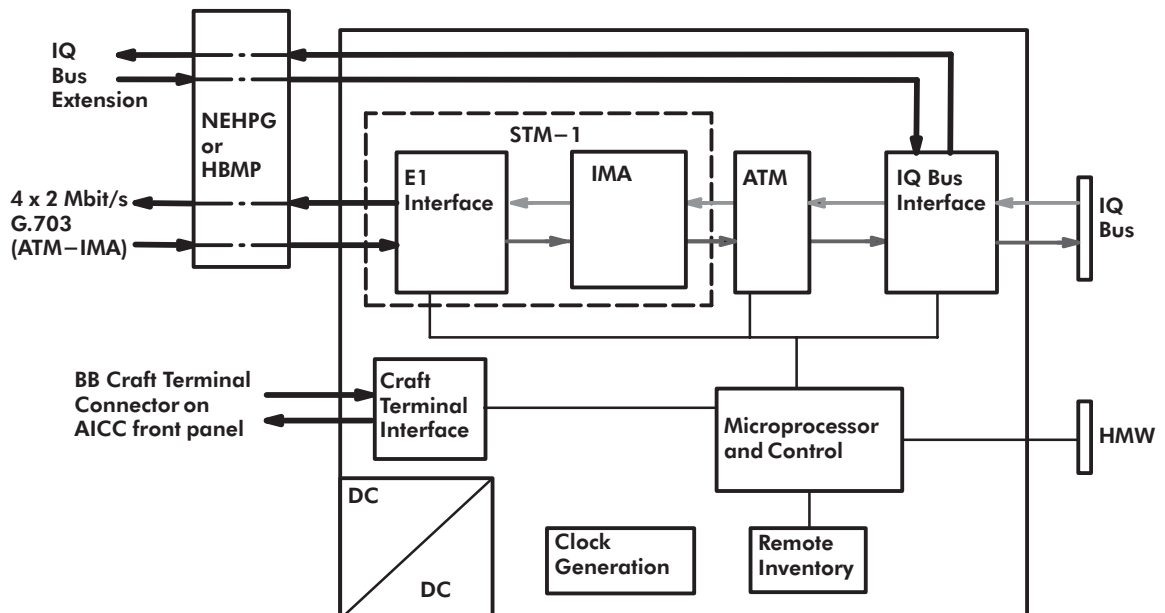


Figure 8–6 AICC – Block Diagram

8.3.5 AICC – Consequences of Unplugging

ATTENTION

If an AICC is removed from the subrack

If an AICC is removed from the subrack, all services carried by the AICC are lost.

ATTENTION

AICC Hot Extraction Restrictions

Hot extraction of the AICC is NOT supported under the following conditions:

- 1) During software upgrades.
- 2) While ATM services are live.

Ensure that neither of these conditions is occurring before removing an AICC.

8.3.6 AICC – Switches, Links and Sockets

There are no user–selectable switches, links or sockets on the AICC.

8.3.7 AICC – LED Description

Two LEDs are located on the front plate of the AICC.

LED	Indication	Description
Green STATUS LED	ON	AICC operating correctly
	FLASH	AICC is starting up
	OFF	AICC is powered down or has a hardware problem
Yellow BUSY LED	ON	AICC is active

8.3.8 AICC – Interface – Electrical

The AICC has the following external interfaces:

- ▶ IQ Bus interface.
- ▶ IQ Extension Bus interface.
- ▶ 4 x 2 Mbit/s electrical network interface.
- ▶ Physical location identity.
- ▶ Universal Debug Interface (GICI).
- ▶ Internal Control Bus (ICB).
- ▶ IONS Bus (to TACCB).
- ▶ IOBS Bus (to TARCB).
- ▶ Hardware Management Wires (HMW).
- ▶ Craft Terminal.
- ▶ Redundancy Communication Bus.

(1) IQ Bus Interface

The IQ bus transports ATM traffic along the subrack backplane from broadband LIMs to the broadband controller. The AICC interfaces to the upstream, downstream and access control elements of the IQ bus.

(2) IQ Extension Bus

In a CMUX NE (NU or AU) the IQ bus can be extended to up to eleven extension subracks in addition to the main subrack. This gives a total of up to twelve subracks in the NE.

A BSEC (Broadband Shelf Extender Card) in each extension subrack acts as the controller card for the extension subrack. The BSEC extends the IQ bus from the previous subrack.

(3) Physical Connection

The AICC has four electrical interfaces (4 x 2 Mbit/s Tx and 4 x 2 Mbit/s Rx) for payload transport. The AICC supplies these interfaces as 2 Mbit/s E1 datastreams which are transformer coupled on the plugs to create the physical G.703 interfaces.

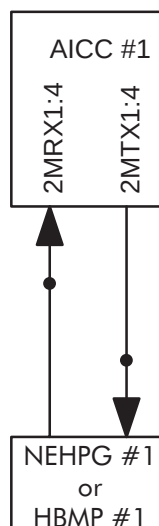


Figure 8–7 Physical Connections – AICC to NEHPG or HBMP

Line Coding	HDB3
Line Rate	4 x 2 Mbit/s
Impedance	Impedance is determined by the NEHPG or HBMP variant. 120Ω balanced and 75Ω unbalanced interfaces are available.

(4) Physical Location Identity

The subrack backplane is hard-wired so that each card can recognise its physical location and other information about the subrack. The AICC uses this information to determine which slot the AICC has been installed in.

(5) Internal Control Bus

The Internal Control Bus (ICB) is a bus on the subrack backplane that runs to all card slots. It is used for sending messages between cards. Controller boards support the ICB in hardware.

(6) IOBS Bus

The IOBS is a serial link between the broadband controllers and the TARCB alarm collection card. The AICC uses the IOBS to gather information about external signals that include housing related alarms. It also optionally provides software download capability towards the TARCB.

(7) Hardware Management Wires

Hardware Management Wires (HMW) are direct connections along the backplane between the controller cards and the LIMs.

A common set of hardware management wires are shared by the narrowband and broadband cards and controllers. A contention mechanism ensures that no two controllers can access the HMW at the same time.

HMW allow the AICC to detect narrowband and broadband cards, disable cards, power down cards, and reset cards.

(8) CRAFT Terminal

There are two physical CRAFT Terminal (CT) connections on the AICC:

- ▶ A DB9 connector (RS-232) on the front plate of the AICC.
- ▶ Connection through the backplane and TARCB (RS-485).

The front connector takes priority over the backplane connection. If the front connector is not being used, the craft defaults to the rear connector on the backplane.

The front connector is the only useable CRAFT port on the AICC in current CMUX release. The backplane CRAFT port will be available in a future CMUX release, when the TARCB will support dual access of the CRAFT port by narrowband and broadband controllers.

8.3.9 AICC – Connector Pinouts – Front

The only electrical connector on the front plate of the AICC is a DB9 connector, RS232 DCE. The connector is used to connect a Broadband Craft Terminal (BB CT). Pinouts are:

Pin	Signal	Description
1	DCD	Data Carrier Detect
2	CFT–RXD	Receive Data by CRAFT Terminal (AICC to CT)
3	CFT–TXD	Transmit Data by CRAFT Terminal (CT to AICC)
4	DTR	Data Terminal Ready
5	SG	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

8.3.10 AICC – Alarms

For full details of AICC alarms and their consequences, refer to the *Alcatel AWS Operator's Handbook*.

8.4 ASCC–S – 3EC 40472 Sxxx

The ATM Shelf Controller Card (ASCC) performs the broadband controller function as a Network Element Controller in the MLS.

Variants support the following types of network interface:

- ▶ SDH (STM–1 Long Haul)
- ▶ STM–1 Short Haul)

The ASCC–S is constructed as a main board with two daughter boards:

- ▶ The CPUD (CPU Daughter Board) carries the CPU and associated circuitry.
- ▶ The PLIM (Physical Layer Interface Module) daughter board carries the network interface. The PLIM used in the ASCC–S is the SATD.

The CPUD and the PLIM are factory fitted to the ASCC–S main board. They are not interchangeable in the field.

8.4.1 ASCC–S – Features and Functions

The ATM Shelf Controller Card (ASCC) is a CMUX broadband (BB) controller card. It also provides data path functions such as multiplexing/demultiplexing of user traffic to/from a high bandwidth network interface.

The ASCC–S is located in the broadband controller slots in the first subrack in the CMUX.

Features of the ASCC–S are:

- ▶ Adaptation of ATM cells carried on the internal CMUX IQ bus to the digital transmission system and vice versa
- ▶ Control functions for the broadband part of the CMUX.
- ▶ Modular design reduces cost when implementing new features.
 - All variants of the ASCC–S have the same main board.
 - The CPU and associated circuitry is located on the CPUD (CPU Daughter board). This is common to all variants of the ASCC.
 - The network interface is located on the PLIM (Physical Layer Interface Module) daughter board. A different PLIM is used for each variant of the ASCC. The PLIM is not field replaceable.

► Redundancy

The ASCC–S supports

- Unit redundancy.
- Line redundancy (Automatic Protection Switching).

The ASCC–S provide the following enhancements over AANC/AICC designs:

- Adaptable to different network interfaces by means of daughterboards
- Supports up to 10000 ATM virtual connections
- Additional RAM memory allows more cross–connects
- Additional FLASH memory supports more types of line interface card.
- On board DC/DC convertor. Input voltage is 48 VDC (nominal). The convertors generate the correct voltages for the supply rails on the ASCC.

8.4.2 ASCC–S – Variants

There are two variants of the ASCC–S. Both have an STM–1 interface.

ASCC–SL (long haul) – 3EC 40472 SAAA

ASCC–SS (short haul) – 3EC 40472 SBAA

8.4.3 ASCC-S – Outline

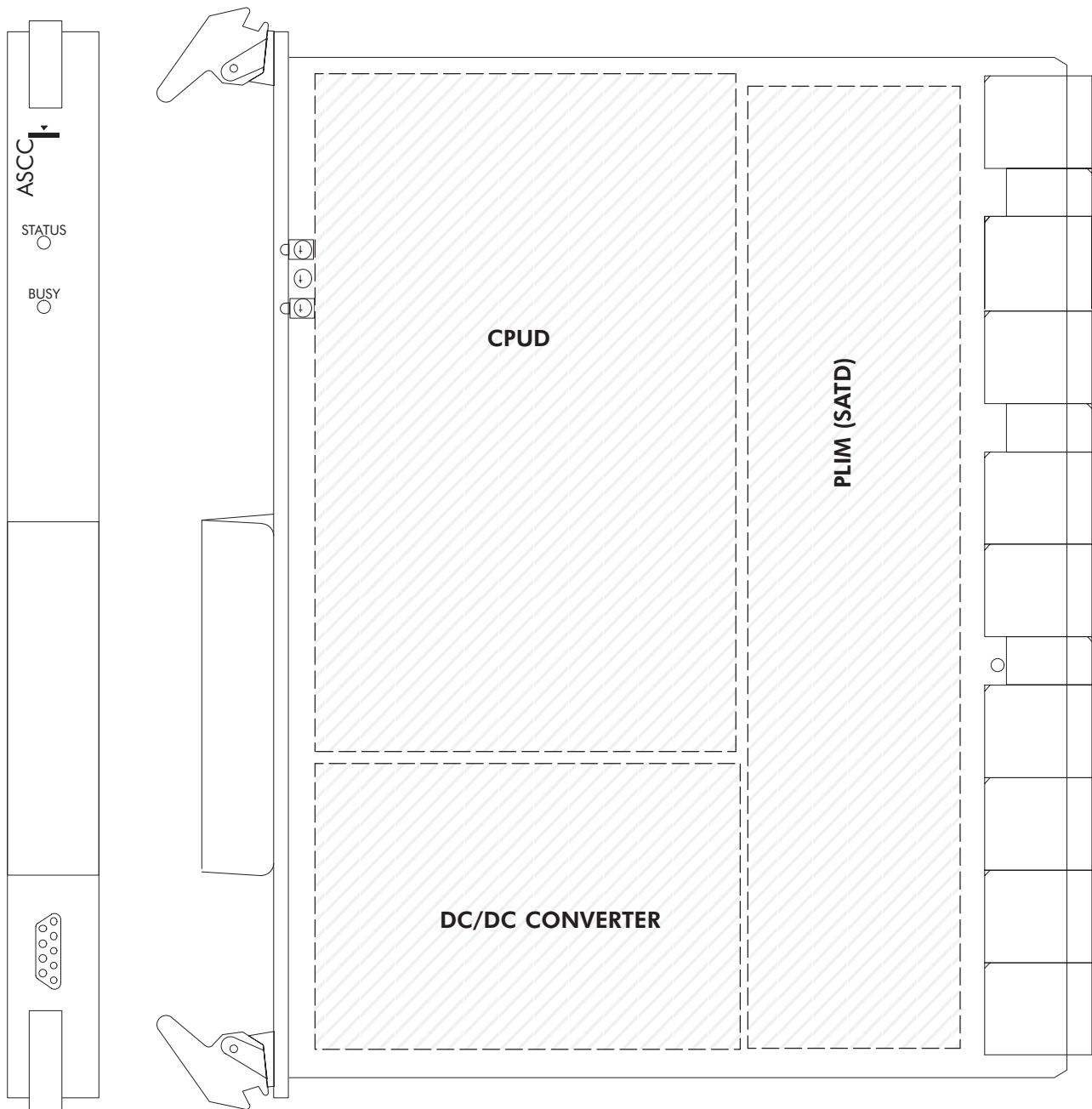


Figure 8–8 ASCC-S – Outline and Front Plate

8.4.4 ASCC-S – Context Diagram

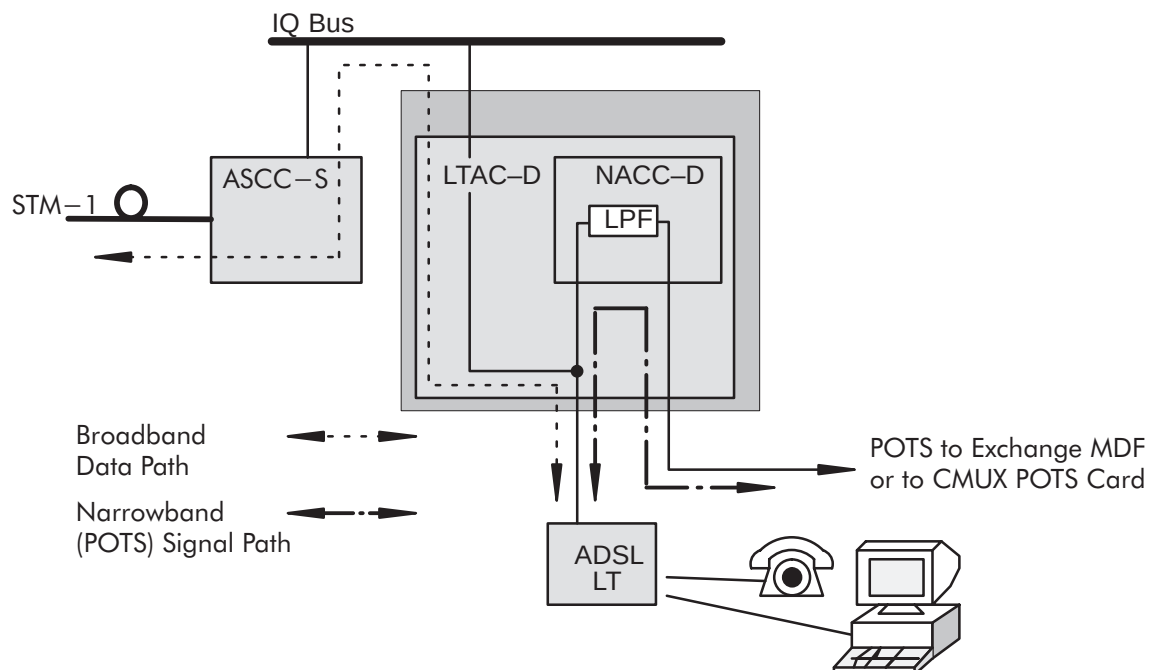


Figure 8–9 ASCC-S – Context Diagram

8.4.5 ASCC-S – Block Diagram

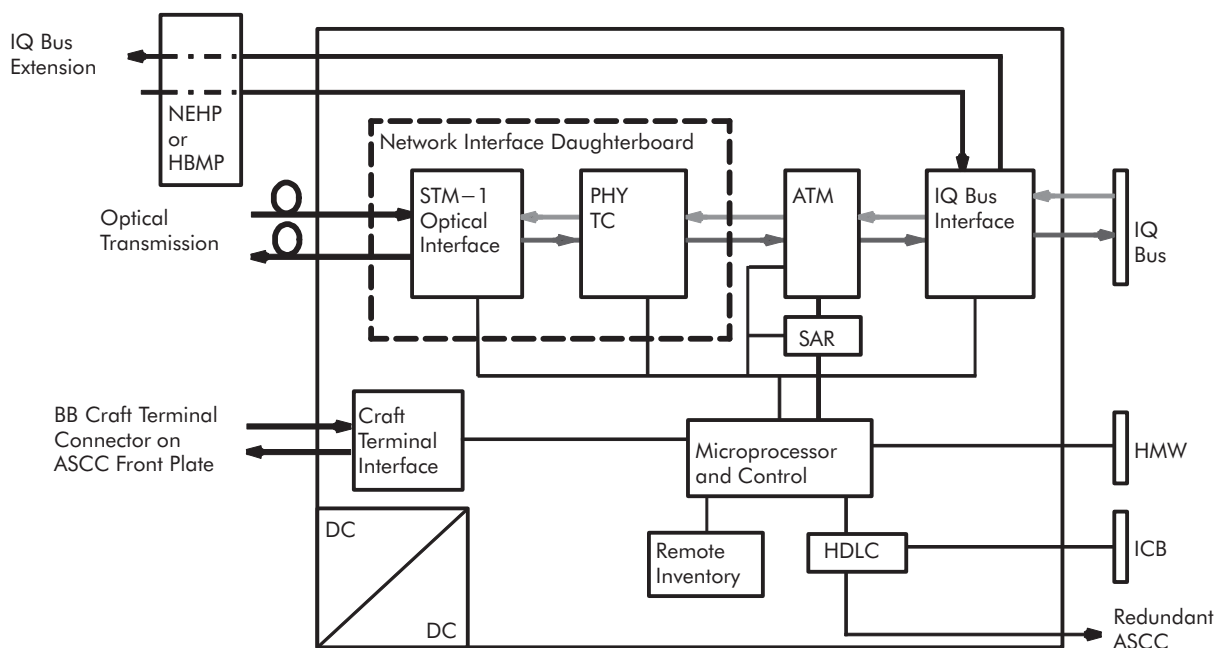


Figure 8–10 ASCC-S – Block diagram

8.4.6 ASCC–S – Consequences of Unplugging

ATTENTION

If an ASCC–S is removed from the Subrack the effects are:

- 1) If a single ASCC–S is installed all STM–1 and ADSL traffic is lost.
- 2) If two ASCC–S are installed in a 1+1 redundant pair, STM–1 and ADSL traffic is transferred to the redundant ASCC–S.

8.4.7 ASCC–S – Switches, Links and Sockets

The ASCC–S is fitted with a reset pushbutton on the main board. This pushbutton is located behind the front plate so that it is not easily accessible and the board cannot be reset accidentally.

8.4.8 ASCC–S – LED Description

LED	Indication	Description
Green STATUS LED	ON	ASCC–S operating correctly
	OFF	ASCC–S is powered down or has a hardware problem
Yellow BUSY LED	ON	ASCC–S is active card in redundant pair
	OFF	ASCC–S is standby card in redundant pair
	FLASH	No valid STM–1 signal on the optical interface

8.4.9 ASCC–S – Interface – Electrical

The ASCC–S has the following external interfaces:

- ▶ IQ Bus interface.
- ▶ IQ Extension Bus interface.
- ▶ 4 x 2 Mbit/s electrical network interface.
- ▶ Physical location identity.
- ▶ Universal Debug Interface (GICI).
- ▶ Internal Control Bus (ICB).
- ▶ IONS Bus (to TACCB).
- ▶ IOBS Bus (to TARCB).
- ▶ Hardware Management Wires (HMW).
- ▶ Craft Terminal.
- ▶ Redundancy Communication Bus.

(1) IQ Bus Interface

The IQ bus transports ATM traffic along the subrack backplane from broadband LIMs to the broadband controller. The ASCC–S interfaces to the upstream, downstream and access control elements of the IQ bus.

(2) IQ Extension Bus

In a CMUX NE (NU or AU) the IQ bus can be extended to up to eleven extension subracks in addition to the main subrack. This gives a total of up to twelve subracks in the NE.

A BSEC (Broadband Shelf Extender Card) in each extension subrack acts as the controller card for the extension subrack. The BSEC extends the IQ bus from the previous subrack.

(3) Physical Location Identity

The subrack backplane is hard-wired so that each card can recognise its physical location and other information about the subrack. The ASCC–S uses this information to determine which slot the ASCC–S has been installed in.

(4) Internal Control Bus

The Internal Control Bus (ICB) is a bus on the subrack backplane that runs to all card slots. It is used for sending messages between cards. Controller boards support the ICB in hardware.

(5) IOBS Bus

The IOBS is a serial link between the broadband controllers and the TARCB alarm collection card. The ASCC–S uses the IOBS to gather information about external signals that include housing related alarms. It also optionally provides software download capability towards the TARCB.

(6) Hardware Management Wires

Hardware Management Wires (HMW) are direct connections along the backplane between the controller cards and the LIMs.

A common set of hardware management wires are shared by the narrowband and broadband cards and controllers. A contention mechanism ensures that no two controllers can access the HMW at the same time.

HMW allow the ASCC–S to detect narrowband and broadband cards, disable cards, power down cards, and reset cards.

(7) CRAFT Terminal

There are two physical CRAFT Terminal (CT) connections on the ASCC–S:

- ▶ A DB9 connector (RS–232) on the front plate of the ASCC–S.
- ▶ Connection through the backplane and TARCB (RS–485).

The front connector takes priority over the backplane connection. If the front connector is not being used, the craft defaults to the rear connector on the backplane.

The front connector is the only useable CRAFT port on the ASCC–S in current CMUX release. The backplane CRAFT port will be available in a future CMUX release, when the TARCB will support dual access of the CRAFT port by narrowband and broadband controllers.

(8) Redundancy Communication Bus

This bus provides a hand-shaking mechanism and a serial communication link between two ASCC-S in order to handle error conditions on a redundant system.

Should the primary ASCC-S fail, the secondary ASCC-S takes control.

8.4.10 ASCC-S – Interface – Optical

The ASCC-S has two optical interfaces (transmit and receive). These interface via optical fibre to an STM-1 SDH compatible device.

Note *Optical connectors on the ASCC point upwards, and optical fibres are routed from above the subrack.*

In NU Racks the optical fibres are supported by an ASCC Fibre Guide assembly, located in front of the left hand end of the fan tray immediately above the main subrack.

For more information refer to the ASCC Optical Fibre Guide section of the NU Rack chapter in 3AU 48131 DBAA – CMUX Housing Rack and Cabling Handbook ANR3.1 NB/FR2.1F BB.

Item	Long Haul (ASCC-SL)	Short Haul (ASCC-SS)
Classification	L1.1	S1.1
Line Coding	STM-1	STM-1
Line Rate	155 Mbit/s	155 Mbit/s
Wavelength	1300 nm nominal	1300 nm nominal
Optical Output		
Minimum launched power:	-5 dBm	-15 dBm
Maximum launched power:	-0 dBm	-8 dBm
Optical Input		
Minimum sensitivity	-34 dBm @ BER 1×10^{-10}	-28 dBm @ BER 1×10^{-10}
Maximum sensitivity	-10 dBm	-8 dBm
Connector	8° Angled SC (SC-APC)	8° Angled SC (SC-APC)

8.4.11 ASCC–S – Connector Pinouts – Front

The only electrical connector on the front plate of the ASCC–S is a DB9 connector, RS232 DCE. The connector is used to connect a Broadband Craft Terminal (BB CT). Pinouts are:

Pin	Signal	Description
1	DCD	Data Carrier Detect
2	CFT–RXD	Receive Data by CRAFT Terminal (ASCC–S to CT)
3	CFT–TXD	Transmit Data by CRAFT Terminal (CT to ASCC–S)
4	DTR	Data Terminal Ready
5	SG	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

8.4.12 ASCC–S – Alarms

For full details of ASCC–S alarms and their consequences, refer to the *Alcatel AWS Operator's Handbook*.

8.5 BSEC – 3EC 40267 AAxx

The BSEC is the Broadband Shelf Extender Card.

A CMUX Network Element (NE) may have up to twelve subracks.

- ▶ The first subrack in an NE is always a MLS–hb.
- ▶ The other eleven subracks are either MLS–hbe or MLS–hb equipped as extension subracks.

Interconnection of up to twelve subracks to form a single NE reduces the number of physical traffic connectors towards the network and therefore reduces the cost of transport and switching.

The BSEC is a broadband extension controller card that is used in the second and subsequent subracks in a system. It transports user traffic and OA&M traffic between the first subrack in a NE and the other subracks in the same NE.

The BSEC has two extension interfaces – one upwards, and one downwards.

- ▶ The BSEC's upward interface connects to the broadband controller in the subrack in the previous position in the NE.
 - This is an AANC, ASCC–S, or AICC if the subrack above is the first subrack in the NE.
 - It is a BSEC if the subrack above it is in the second or subsequent positions in the NE.
- ▶ The downward interface extends the bus to the BSEC in the next subrack in the NE.
- ▶ The extension interfaces are physically connected via the backplane from the BSEC to the NEHPG or HBEP plug. NEHPG and HBEP plugs have separate front connectors for the upwards and downwards interface.

Embedded channels in the ATM data transport OA&M data between the first MLS in a NE and the subsequent subracks in the NE. This allows network management to access remote inventory and alarms, and to control ADSL line cards and controllers in the extension subracks via the HMW.

The BSEC functions in the same manner and has the same purpose regardless of the type of system (SDH or PDH) that it is installed in, and the type of broadband controller (ASCC–S, AANC or AICC) that it connects to.

8.5.1 BSEC – Features and Functions

The main features and functions of the BSEC are:

- ▶ Extends ATM traffic from the first subrack in a CMUX NE (NU or AU) to the other subracks in the NE.
- ▶ Controls hardware management wires for broadband cards only. It can also detect narrowband cards.

The Hardware Management Wire (HMW) interface allows the BSEC to control and detect the presence of line cards in the subrack.

- ▶ Extends the IQ bus throughout the CMUX NE generally, regenerating a local version in the backplane in which it is installed.
- ▶ Provides access to the IQ bus.
- ▶ Provides extension interface upwards to previous broadband controller (AANC, ASCC–S, AICC, or BSEC).
- ▶ Provide IQ extension interface downwards to the next BSEC.
- ▶ Backplane Identification Interface

The backplane rack and subrack information is set by the MBTPB plug in the subrack. This information is readable by the BSEC, which uses it to identify itself towards the broadband controller (AANC, ASCC–S or AICC).

The CMUX Rack/Subrack numbering scheme is described in Section 6.12 of this handbook.

- ▶ 1 + 1 redundancy of the BSEC.
- ▶ In a future CMUX release the BSEC will be able to read onboard Remote Inventory (RI) data.

8.5.2 BSEC – Outline

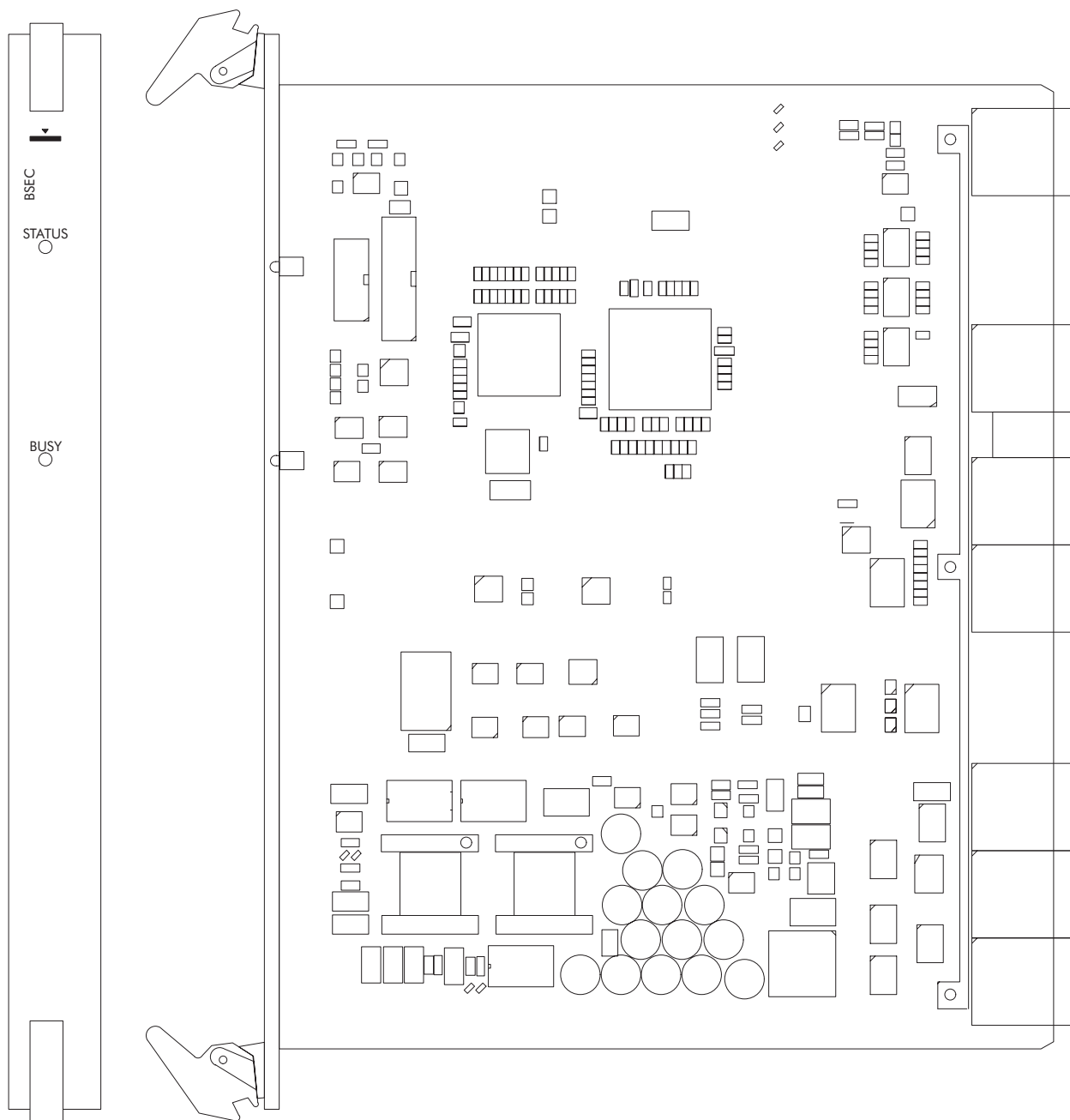


Figure 8–11 BSEC– Outline and Front Plate

8.5.3 BSEC – Context Diagram

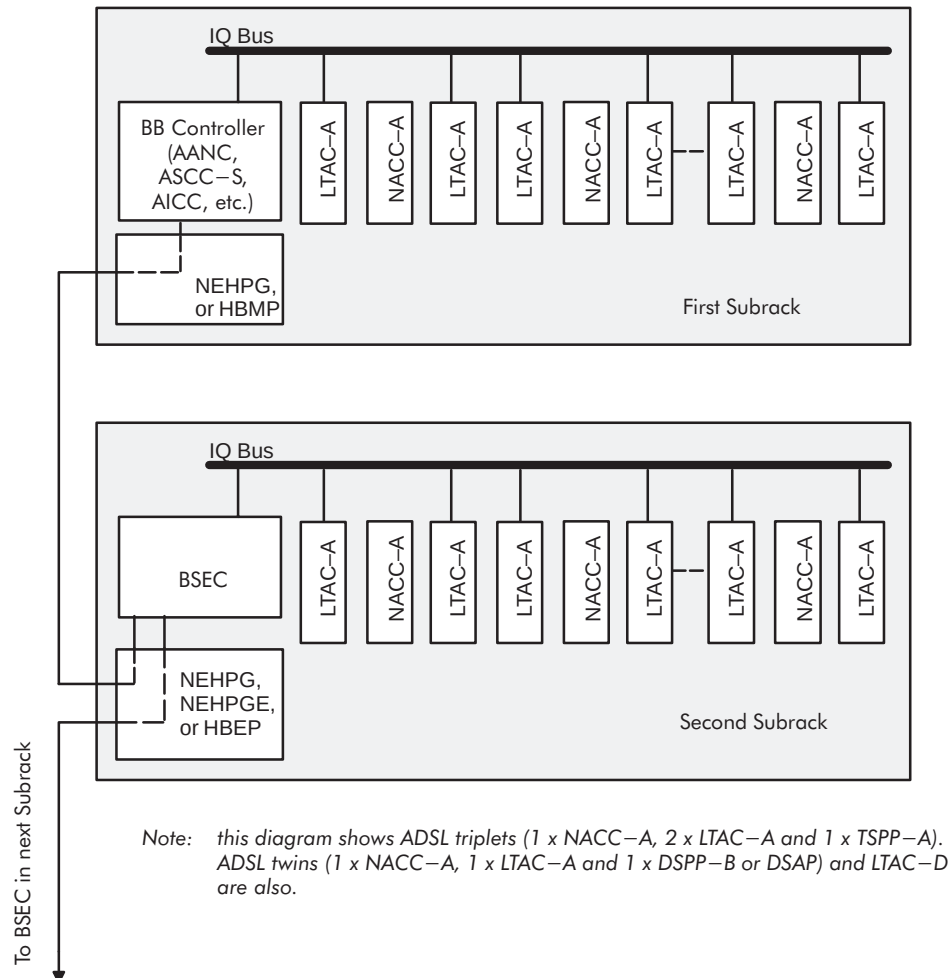


Figure 8–12 BSEC – Context Diagram

8.5.4 BSEC – Block Diagram

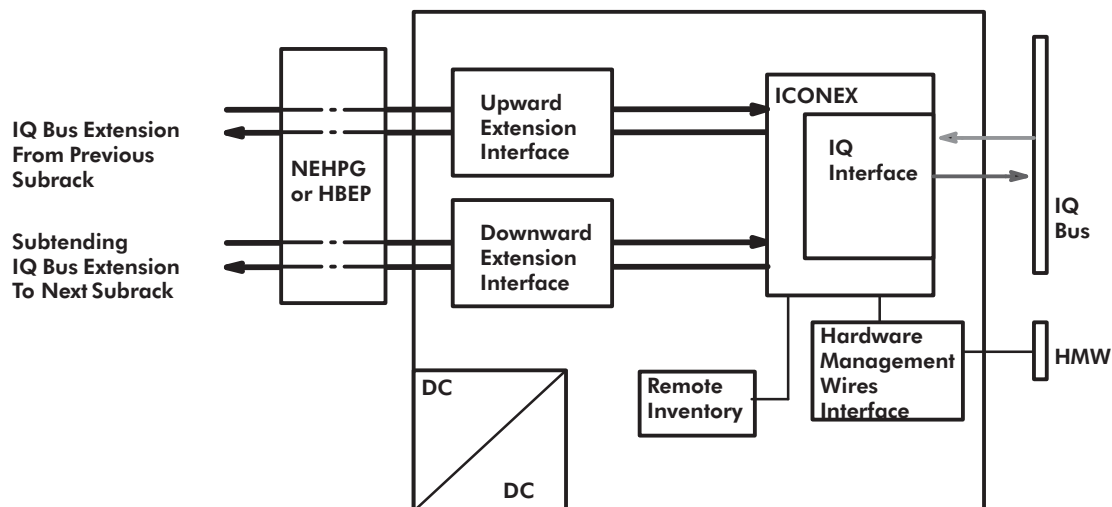


Figure 8–13 BSEC – Block Diagram

8.5.5 BSEC – Consequences of Unplugging

ATTENTION

If a BSEC is removed from the subrack

If a BSEC is removed the effects are:

- 1) Loss of all broadband services in the subrack in which the BSEC is installed.
- 2) Loss of all broadband services in all subracks below the one in which the BSEC is installed.

8.5.6 BSEC – Switches, Links and Sockets

There are no user-selectable switches, links or sockets on the BSEC.

8.5.7 BSEC – LED Description

Two LEDs are located on the front plate of the BSEC.
Indications during operation are:

LED	Indication	Description
Green STATUS LED	ON	BSEC operating correctly
	OFF	BSEC is powered down, has a hardware problem, or has errors on the upwards extension interface (e.g. cable not connected or faulty).
Yellow ACT LED	ON	BSEC is active card in redundant pair
	OFF	BSEC is standby card in redundant pair

8.5.8 BSEC – Interfaces Electrical

BSEC electrical interfaces are via rear connectors on the PBA and the subrack backplane. The upward and downward busses are connected via the backplane to the NEHPG or HBEP plug.

- ▶ Pinouts of the NEHPG connectors for the upward and downward busses are in Section 13.12 – *NEHPG*.
- ▶ Pinouts of the HBEP connectors for upward and downward busses are in Section 13.9 – *HBEP*.

The subrack backplane also contains redundant IQ busses to transport ATM data along the subrack backplane between the BSEC and broadband line cards.

The backplane contains two IQ buses, but only one is connected to each broadband controller slot. The active BSEC is the master of the IQ bus, and provides the clocking for the bus.

8.5.9 BSEC – Connector Pinouts – Front

There are no front connectors on the BSEC.

8.5.10 BSEC – Alarms

For full details of BSEC alarms and their consequences, refer to the *Alcatel AWS Operator's Handbook*.

8.6 NEHC–P – 3EC 40088 Axxx

The NEHC–P (Network Element Handler Card – PDH) is the CMUX narrowband system controller. It provides the management functionality for the narrowband, transport and auxiliary cards in the subrack, including alarms, configuration and software management.

The NEHC–P is responsible for configuration management of CMUX narrowband functions. It is equipped with Flash memory for permanent storage of operational software and configuration data for the cards managed by the NEHC–P.

When cards managed by the NEHC–P restart, they are loaded with operational software and are then provided with configuration commands from the NEHC–P.

The NEHC–P collects Remote Inventory (RI) data for narrowband and common items, including narrowband cards and MBTPB.

The NEHC–P provides 16 x 2 Mbit/s G.703 interfaces. These provide V5.2 interfaces towards the exchange(s).

- ▶ The 2 Mbit/s G.703 links from the NEHC–P provide one or more V5.2 interfaces, which can be connected to different exchanges. A typical CMUX NE with 480 lines would use four of the 2 Mbit/s links to form a single V5.2 interface.
- ▶ V5.2 services are supported from NU hosted services and AU hosted services.

The NEHC–P in each NUC, NUS and/or AU have separate V5.2 interfaces which are independently transported to the exchange.

- ▶ The 2 Mbit/s links may also carry leased line or mirror (non–integrated) services.

The NEHC–P provides narrowband signal processing, V5.2 signalling termination, traffic routing and clock distribution functions.

The NEHC–P is installed in the main subrack in a AU or NU (NUS or NUC).

The NEHC–P has support for 1+1 redundancy.

8.6.1 NEHC–P – Features and Functions

Features and functions of the NEHC–P are:

- ▶ Narrowband controller for the CMUX NU or AU.
- ▶ 16 electrical G.703 interfaces.
- ▶ Narrowband signalling processor (V5.2).
- ▶ Controls narrowband line cards (LIM) and transport cards such as the EOTCA. The Hardware Management Wires (HMW) are used to detect and control line and transport cards.
- ▶ Collects Remote Inventory (RI) data.
- ▶ Master of the NLC bus.
- ▶ Optionally redundant.
- ▶ Where a CMUX NE has two or more subracks, the NEHC–P extends the NLC bus from the subrack in the first position in the NE to the other subracks in the NE.
- ▶ Provides an interface for the narrowband management system CMEM (CMUX Element Manager).
- ▶ Has a logical interface for a local narrowband CRAFT Terminal (CT). The physical connector for the CT logical interface is on the TARCB.
- ▶ System Clock generation. The NEHC–P is the synchronization master in PDH applications.
- ▶ On–board Controller.
- ▶ Flash EPROM Memory on a PCMCIA memory card for master database and application software for narrowband cards.
- ▶ RAM Memory.
- ▶ Serial controllers, supporting:
 - Ethernet interface (Q interface).
 - TMN link via the X.25 interface.
 - ICB interface.
 - Interface to the redundant controller.
 - Craft Terminal termination.
 - Debug port.
 - Remote Inventory (IAB bus).
- ▶ Onboard DC/DC converter for power supply to the NEHC–P.

8.6.2 NEHC-P – Outline

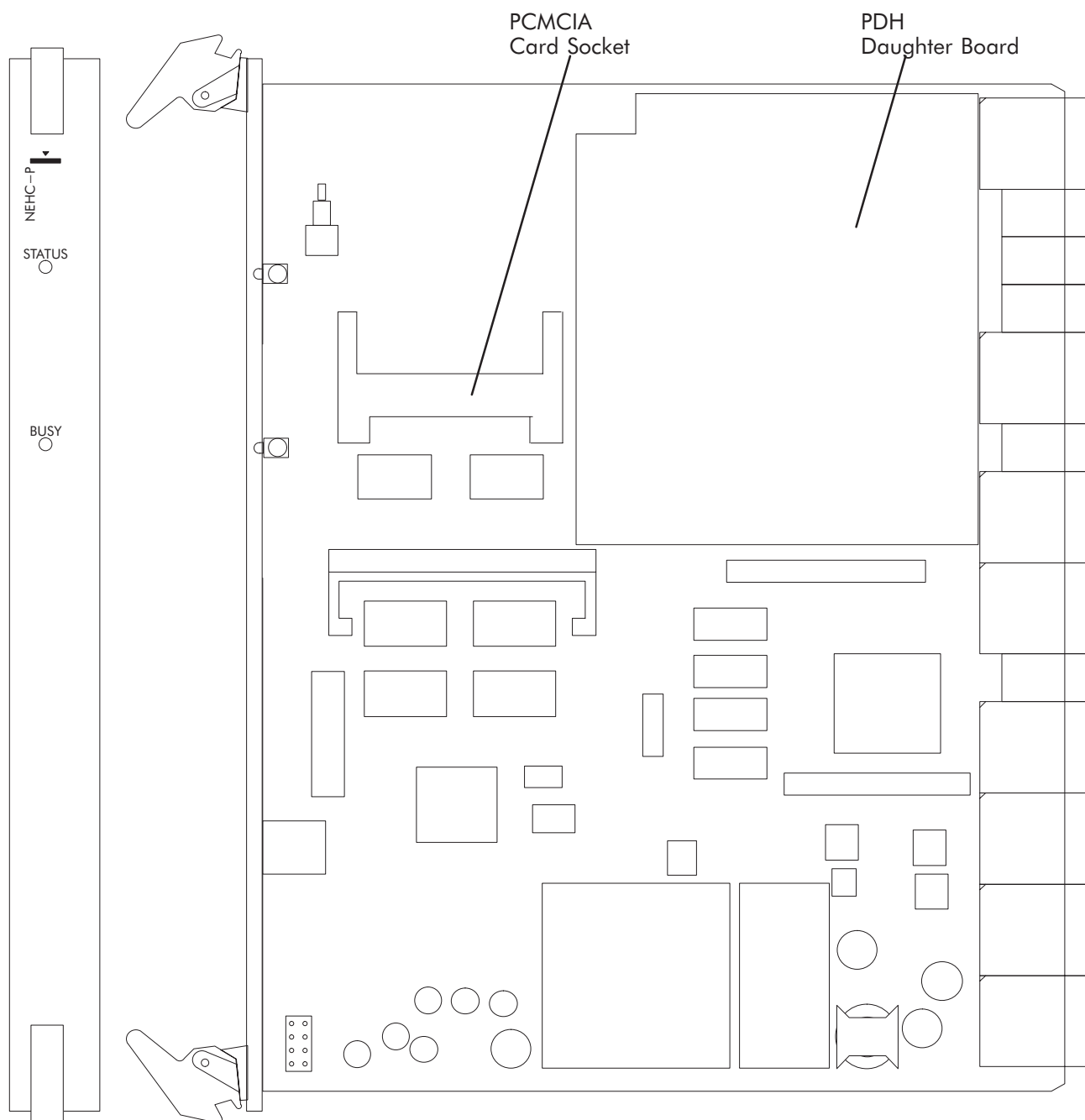


Figure 8–14 NEHC-P – Outline and Front Plate

8.6.3 NEHC-P – Block Diagram

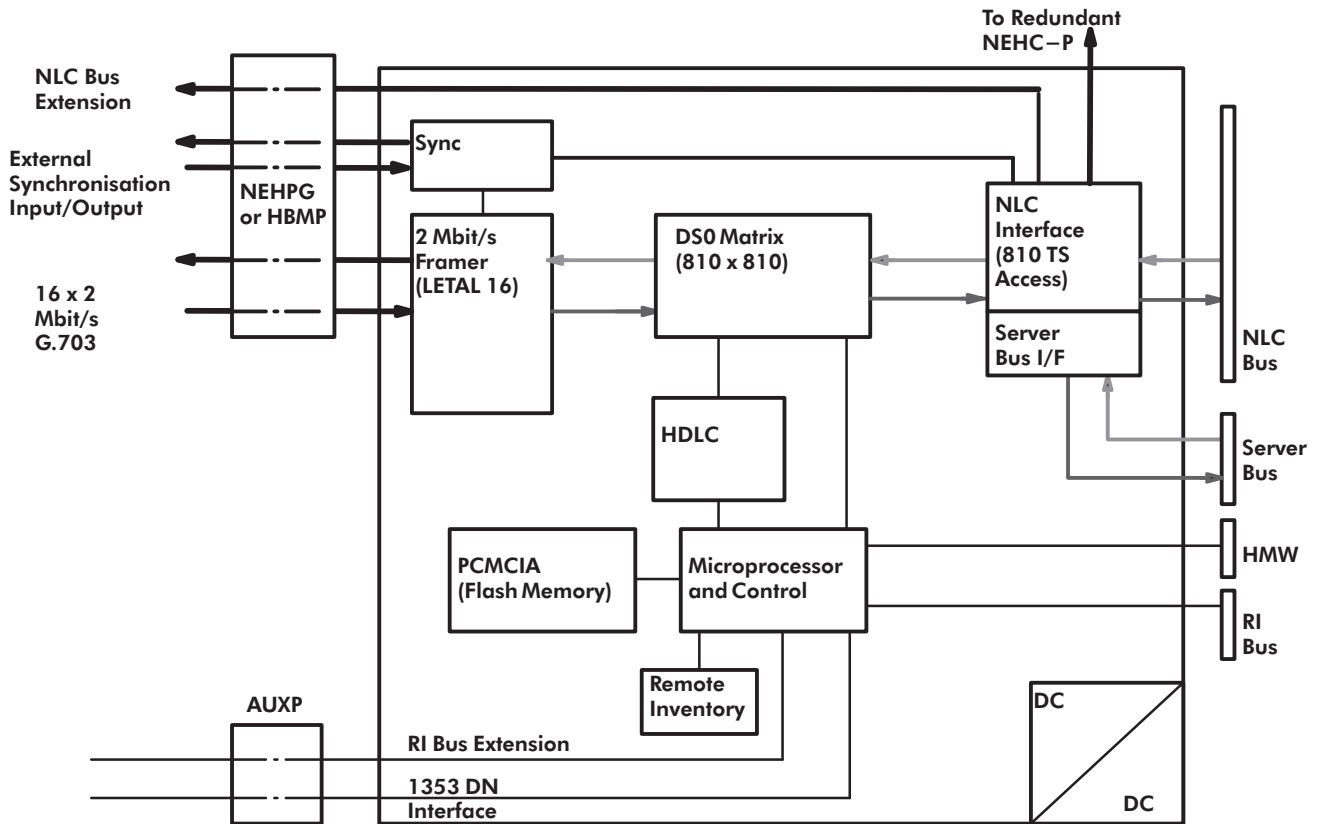


Figure 8–15 NEHC-P – Block diagram

8.6.4 NEHC-P – Consequences of Unplugging

ATTENTION

If the NEHC-P is removed from the subrack

If a NEHC-P is removed from a system with two NEHC-P the effect is that its functions are transferred to the redundant NEHC-P.

If a NEHC-P is removed from a system with a single NEHC-P the effects are:

- 1) Loss of all narrowband services at the NUC, NUS or AU.
- 2) New narrowband calls cannot be set up.
- 3) Loss of communication with management systems.

8.6.5 NEHC–P– Hot Insertion of Redundant Card

ATTENTION

Redundant NEHC–P – Hot Insertion

Spurious alarms may be raised if the second NEHC–P in a redundant pair makes intermittent contact with the backplane connector during hot insertion. This may occur if the card is “rocked” into place or if it is not inserted in a smooth movement.

The correct insertion procedure is:

- ▶ Slide the NEHC–P into the subrack rails until the rear connectors on the card are just clear of the backplane connectors.
 - ▶ Line up the rear connectors on the NEHC–P with the backplane connectors.
 - ▶ Press the NEHC–P into place in one smooth movement.
-

8.6.6 NEHC–P – Switches, Links and Sockets

The NEHC–P has a PCMCIA Card socket, which is located near the top of the NEHC–P behind the front plate.

A flash memory card is installed in the PCMCIA socket. This memory card provides non–volatile storage for configuration data and for software for CMUX cards.

Other sockets, links and switches are for factory use only.

8.6.7 NEHC–P – LED Description

Two LEDs are located on the front plate of the NEHC–P.
Indications during operation are:

LED	Indication	Description
Green STATUS LED	ON	NEHC–P operating correctly
	OFF	NEHC–P is powered down or has a hardware problem
Yellow BUSY LED	ON	The NEHC–P is the active card in a redundant pair
	OFF	The NEHC–P is the standby card in a redundant pair
	SLOW FLASH (2s on, 2s off)	NEHC is the standby card. It is aligning its configuration and NE software with the active card.
	FAST FLASH (0.5s on, 0.5s off)	NEHC is the standby card. The standby card is receiving a copy of new application software from the active card. This mode is observed during an application software download to the CMUX which is initiated from CMEM.
	FLASH Periodically (0.5s on, 2.5s off)	NEHC is the standby card. The standby card is in sleep mode. This mode is initiated when the new application software is activated on the active board. This mode is exited when the new software is committed or a rollback is requested.

8.6.8 NEHC–P – Interface – Electrical

The NEHC–P has the following interfaces. All are accessed via the AUXPA, two NEHPG, or two HBMP.

► NEHPG or HBMP.

The NEHPG or HBMP plugs are located in plug slots 2 and 3 in the front access section below the NEHC–P.

Interfaces on the NEHPG and HBMP are:

- 16 x 2Mbit/s G.703 interfaces – 120Ω balanced.
These are typically used for V5.2 interfaces.
 - Directly from a NU to the exchange.
 - Indirectly from an AU to the exchange via CMUX internal transport or via external transport.
- Extension of the narrowband bus.

► AUXPA.

The AUXPA is located in plug slot 4 in the Main Subrack, and provides interfaces for the management system. There are two variants of the AUXPA, with the difference being the interface on the front plate.

NEHC–P interfaces on the AUXP–A (variant dependent) are:

- X.25 via a Metral connector.
- Ethernet via an RJ–45 10BaseT connector.

8.6.9 NEHC–P – Connector Pinouts – Front

There are no front connectors on the NEHC–P. All connectors for external cabling are on the NEHPG or HBMP.

The NEHC–P communicates with the NEHPG or HBMP via the subrack backplane. Rear connectors on the NEHC–P and the NEHPG or HBMP plug into connectors on the subrack backplane.

- For details of NEHPG pinouts, refer to Section 13.12.
- For details of HBMP pinouts, see Section 13.10.

8.6.10 NEHC–P – Alarms

For full details of NEHC–P alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

8.7 NSEC – 3EC 40229 AAxx

The NSEC is the Narrowband Shelf Extender Card. Where a CMUX Network Element (NE) has more than one NB or mixed NB/BB subrack, an NSEC is installed in the second NB or NB/BB subrack in each NE and also in each subsequent NB or NB/BB subrack in the same NE. The NSEC controls the NLC bus in the subrack in which it is installed.

The NSEC does not have an onboard controller as the narrowband controller in the first subrack is the master of the narrowband busses.

The NSEC has hardware support for 1 + 1 redundancy of the NSEC.

8.7.1 NSEC – Features and Functions

The main features and functions of the NSEC are:

- ▶ Extends narrowband busses from the main subrack in a CMUX NE (NU or AU) to the extension narrowband or mixed broadband/narrowband subracks in the NE.
- ▶ Extends synchronisation and test busses from the subrack above it and to the subrack below it.
- ▶ Controls hardware management wires (HMW).
The Hardware Management Wire (HMW) interface allows the NSEC to control and detect the presence of line cards in the subrack.
- ▶ Reads Remote Inventory (RI) data from narrowband cards in the same subrack.
- ▶ Provides extension interface upwards to previous narrowband controller (NEHC–P or NSEC).
- ▶ Provide a narrowband bus extension interface downwards to the next NSEC.
- ▶ Onboard DC–DC converter.
- ▶ Provides hardware support for 1 + 1 redundancy of the NSEC.
- ▶ Provides relays for Test bus isolation.

8.7.2 NSEC – Outline

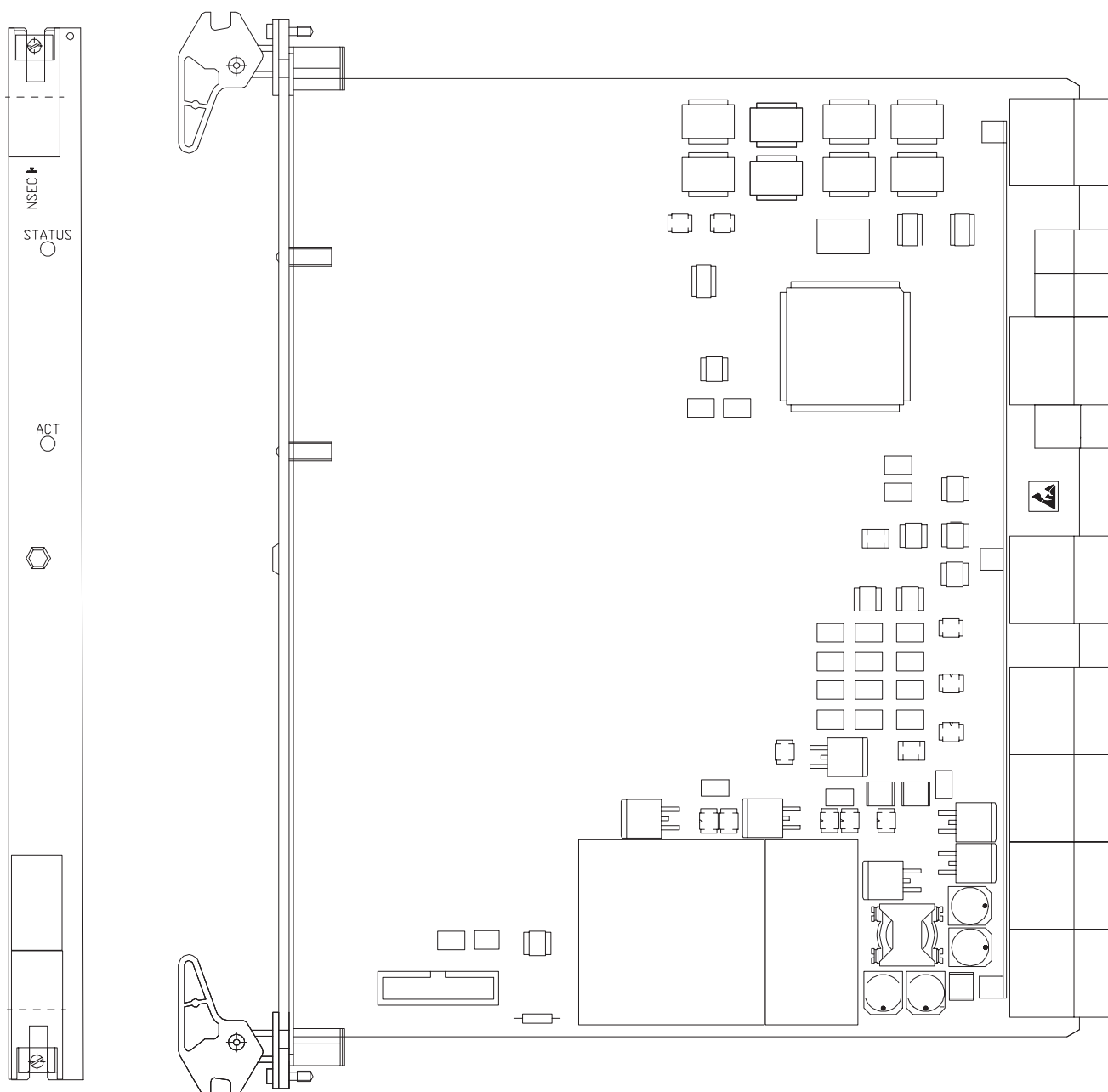


Figure 8–16 NSEC – Outline and Front Plate

8.7.3 NSEC – Block Diagram

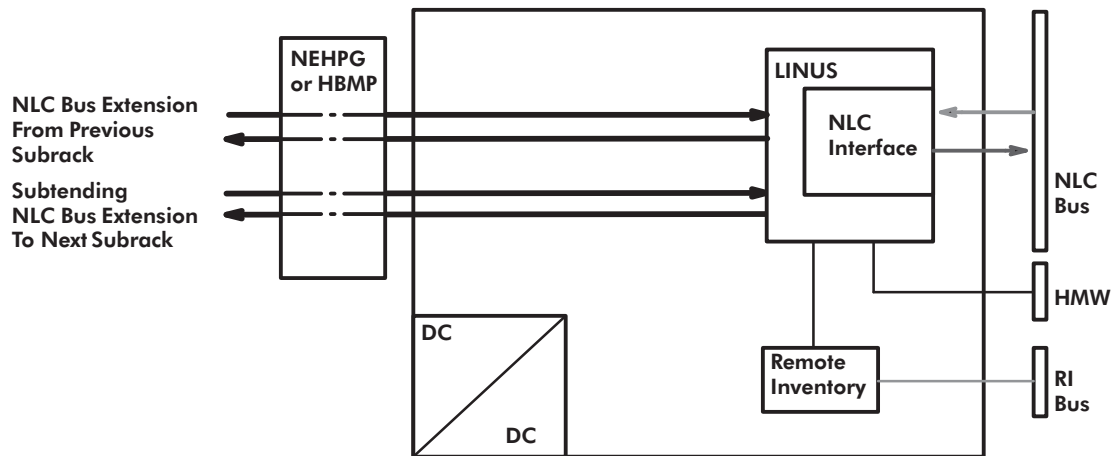


Figure 8–17 NSEC – Block Diagram

8.7.4 NSEC – Consequences of Unplugging

ATTENTION

If NSEC Card is removed from the subrack

If a NSEC is removed from a subrack with two redundant NSEC the effect is that its functions are transferred to the remaining NSEC.

If a NSEC is removed from a subrack with one NSEC the effect is:

- 1) Loss of all narrowband services in the subrack in which the NSEC is located.
- 2) Loss of all narrowband services in subracks within the NE which are lower than the subrack containing the NSEC.
- 3) Loss of communication with the subrack in which the NSEC is installed and in all lower subracks.

Note: In a system which does not have redundant NSEC, removal of the NSEC from a subrack containing a DURCC will result in loss of incoming calls for all customers in subracks sharing that DURCC.

8.7.5 NSEC – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the NSEC.

8.7.6 NSEC – LED Description

Two LEDs are located on the front plate of the NSEC. Indications during operation are:

LED	Indication	Description
Green STATUS LED	ON	NSEC operating correctly
	OFF	NSEC is powered down or has a hardware problem
Yellow ACT LED	ON	The NSEC is the active card in a redundant pair
	OFF	The NSEC is the standby card in a redundant pair

8.7.7 NSEC – Interface – Electrical

A CMUX Network Element (NE) may have one or more subracks. The NSEC is installed in the second and subsequent subracks in an NE where more than one subrack which supports NB is installed.

The NSEC electrical interfaces are:

- ▶ Upwards narrowband bus extension, to the narrowband controller in the previous subrack in the NE. This is a NEHC–P in the first subrack in a NE, or an NSEC in the second and subsequent subracks.
- ▶ Downwards narrowband bus extension to the NSEC in the next subrack in the NE.
- ▶ NLC bus interface to narrowband line cards in the same subrack as the NSEC.

The NSEC has no front connectors. All electrical interfaces are accessed via the NEHPG or HBEP plug, located in the plug area in the subrack. For details of NEHPG and HBEP pinouts, see Sections 13.12 and 13.9 of this handbook

8.7.8 NSEC – Alarms

For full details of NSEC alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

9 Transport Cards

9.1 Optical Cards – Warnings

The EOTCA has an optical interface for transportation between the NUC and any subtended NUS or AU.



If an EOTCA is powered up, do not look into the Optical Out port on the EOTCA front panel.

Do not look into the connector on the optical fibre when not connected to the EOTCA.



The optical connectors on the card are protected by plastic caps. Before use, these must be removed and stored, so that in the event of the station optical cabling being removed from the card, the caps can be quickly replaced on the connectors.

It is most important that the optical connector faces are kept free from dirt and dust.

After the removal of the caps and before the connection of the station cabling, the optical connector faces must be cleaned as indicated below or as per approved local practices.



Should the optical connector faces to the fibre on the card require cleaning this can be done by:

- 1) Removing the plastic support plate from above the fibre.
 - 2) Carefully withdrawing the connector on the internal fibre from its housing, similar to disconnecting the external fibre.
 - 3) Cleaning the optical connector faces using a lint-free soft cloth moistened with ethanol.
 - 4) Reassembling in reverse order.
-



To avoid damage to the optical fibre when removing an EOTCA from a subrack or inserting an EOTCA into a subrack:

- 1) Disconnect the optical fibre from the front of the EOTCA before withdrawing the EOTCA.
 - 2) Insert the EOTCA into the subrack before reconnecting the optical fibre.
-

9.2 EOTCA – 3EC 41145 CBxx

The EOTCA (Electro Optical Transport Card) has electrical interfaces for 16 x 2 Mbit/s G.703 tributaries. These are interfaced onto a single–fibre optical link.

Where internal CMUX optical transmission is used between an NUC and a NUS or AU, an EOTCA is required at each end of the optical link.

Typically four of the 2 Mbit/s tributaries are used to transport an IMA link carrying broadband services between the NUC and a subtended NUS or AU. The remaining tributaries may be used for other purposes, including transport of V5.2 services to the NUS or AU, or for the transport of other services.

9.2.1 EOTCA – Features and Functions

Features and functions of the EOTCA are:

- ▶ Provides optical and electrical interfaces and multiplexes up to 16 x 2Mbit/s G.703 links onto a single fibre E3 optical link.
- ▶ Contains an onboard controller.
- ▶ Contains a Remote Inventory (RI) EEPROM.
- ▶ Provides an onboard DC/DC converter.
- ▶ The Optical Section (LT +NT) must carry synchronization from the Exchange Unit towards the Remote Unit.
 - At the NUC.
The Optical Line clock is synchronised with the system clock in the NLC Bus.
 - At the NUS or AU.
The EOTCA extracts the clock from the optical line and delivers a 64 KHz reference to the clock unit in the NEHC–P narrowband controller.
- ▶ One 8° Angled SC (SC–APC) connector.
- ▶ Power budget of the EOTCA is 18 dB. It is suitable for optical bearer systems for distances of up to 30 kilometres.

9.2.2 EOTCA – Outline

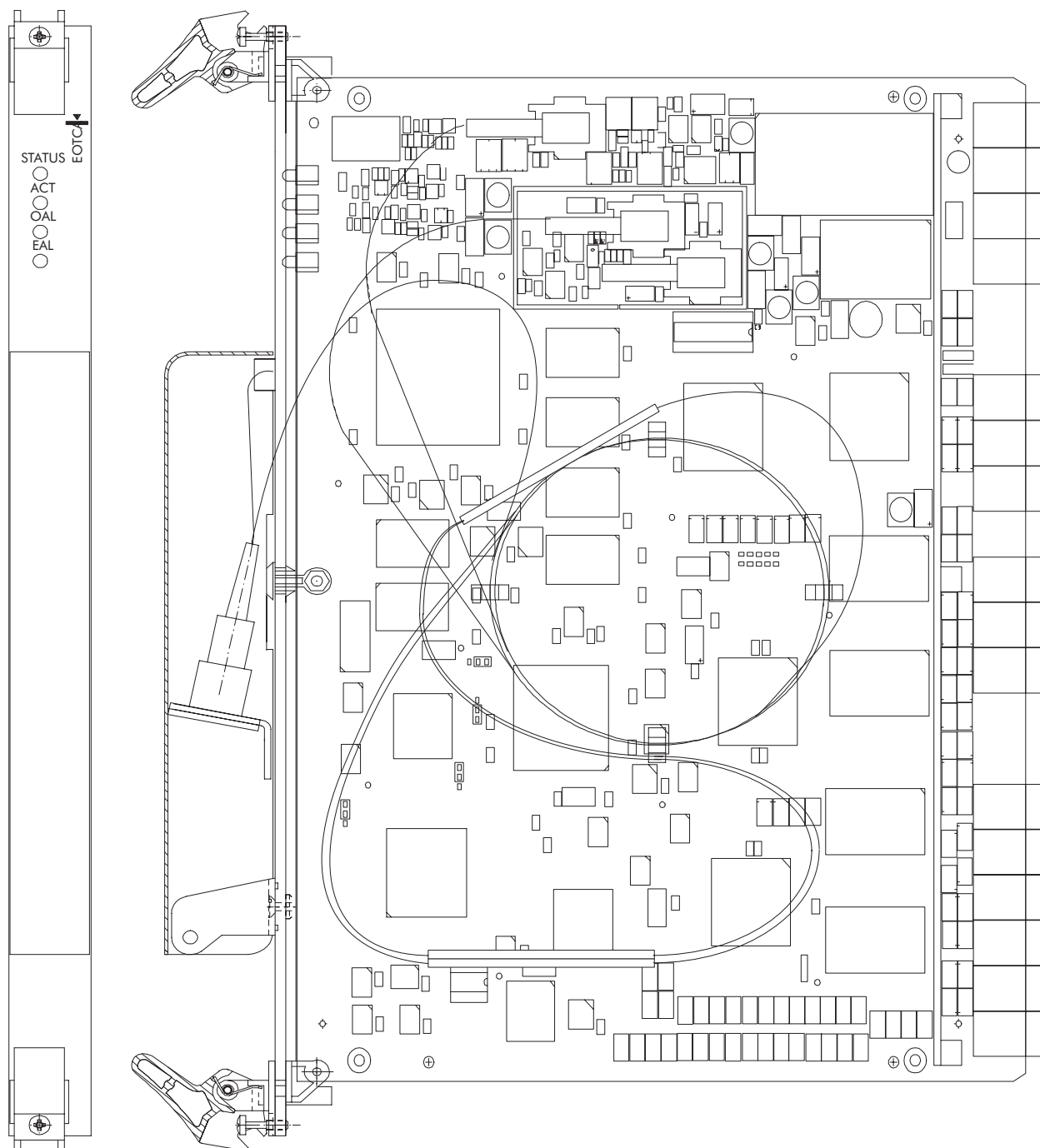


Figure 9–1 EOTCA – Outline and Front Plate

9.2.3 EOTCA – Block Diagram

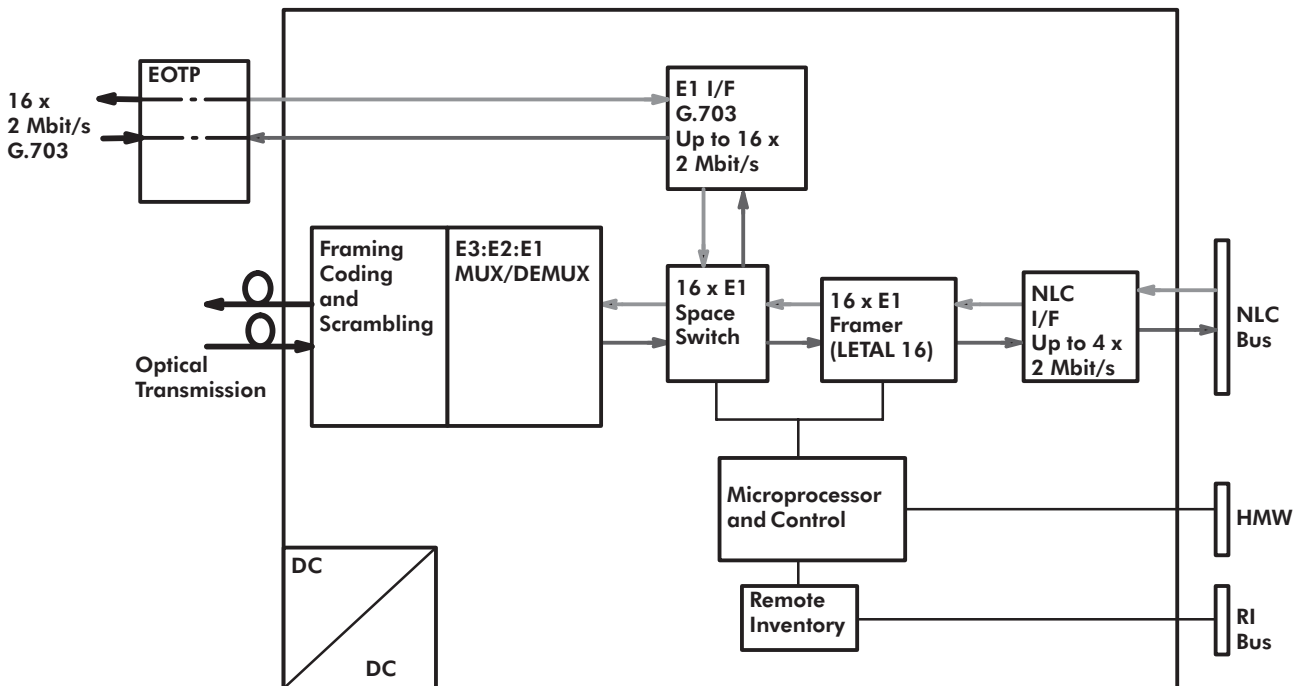


Figure 9–2 EOTCA – Block Diagram

9.2.4 EOTCA – Consequences of Unplugging

ATTENTION

if EOTCA is removed from the subrack

If a EOTCA is removed the effects are that all services carried by the optical link are lost.

9.2.5 EOTCA – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the EOTCA.

9.2.6 EOTCA – LED Description

There are four LEDs located near the top of the front plate of the EOTCA.

LED	Indication	Description
Green STATUS LED	ON	EOTCA operating correctly
	OFF	EOTCA is powered down or has a hardware problem
Yellow ACTIVE LED (See Note)	ON	EOTCA is active card in redundant pair
	OFF	EOTCA is standby card in redundant pair
RED OAL LED	ON	Failure has occurred in the optical interface
RED EAL LED	ON	Failure has occurred in one or more G.703 2 Mbit/s external interfaces.

Note *CMUX provides hardware support for EOTCA redundancy. Current software releases do not support EOTCA redundancy.*

9.2.7 EOTCA – Interface – Electrical

The EOTCA supports 16 x 2 Mbit/s G.703 tributaries. Connectors for these tributaries are on the EOTP plug, located beneath the EOTCA in the plug area in the subrack.

The EOTCA is connected to the EOTP via the subrack backplane. Rear connectors on the EOTCA and EOTP mate with connectors on the backplane.

EOTP pinouts are shown in Section 13.8 of this handbook.

9.2.8 EOTCA – Interface – Optical

The EOTCA has optical connectors mounted on the front plate under a hinged cover. The cover pivots on a lower spring clip and is held in place by an upper spring clip.

To open the cover, pull on the top of the cover to separate it from the upper spring clip. The cover will then pivot open around the lower spring clip.

The characteristics of the optical interface are:

Line Coding	3B6B (Proprietary)
Line Rate	51.552 Mbit/s $\pm$ 20 ppm
Wavelength	1310 nm (Single mode)
Optical Output	–7 dBm $\pm$ 1dB
Optical Input	–6 to –26* dBm for BER = 1E–10 (*includes margin for ageing, temperature, component tolerances etc.)
Connector	1 x Angled SC (SC–APC)
Laser	Class 1 laser product

9.2.9 EOTCA – Alarms

For full details of EOTCA alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

10 Narrowband Line Cards

10.1 ALLC – 3EC 41112 Axxx

The ALLC (Analogue Leased Line Card) supports up to eight customer lines which may be 2W, 4W or 4W E&M.

The ALLC supports the following services:

- ▶ 64 kbit/s A law (G.711 ITU–T).

10.1.1 ALLC – Features and Functions

Features of the ALLC are:

- ▶ Customer line interface for eight analogue leased lines.
- ▶ Electrical line termination.
- ▶ E/M signalling interface.
- ▶ A/D conversion and PCM coding.
- ▶ Channel insertion and extraction into 2 Mbit/s frame.
- ▶ Onboard Controller (OBC).
- ▶ Onboard DC/DC converter.

Note *The ALLC requires a 30 pair cable to the MDF or CCF from the plug located beneath the slot containing the ALLC.*

10.1.2 ALLC – Outline

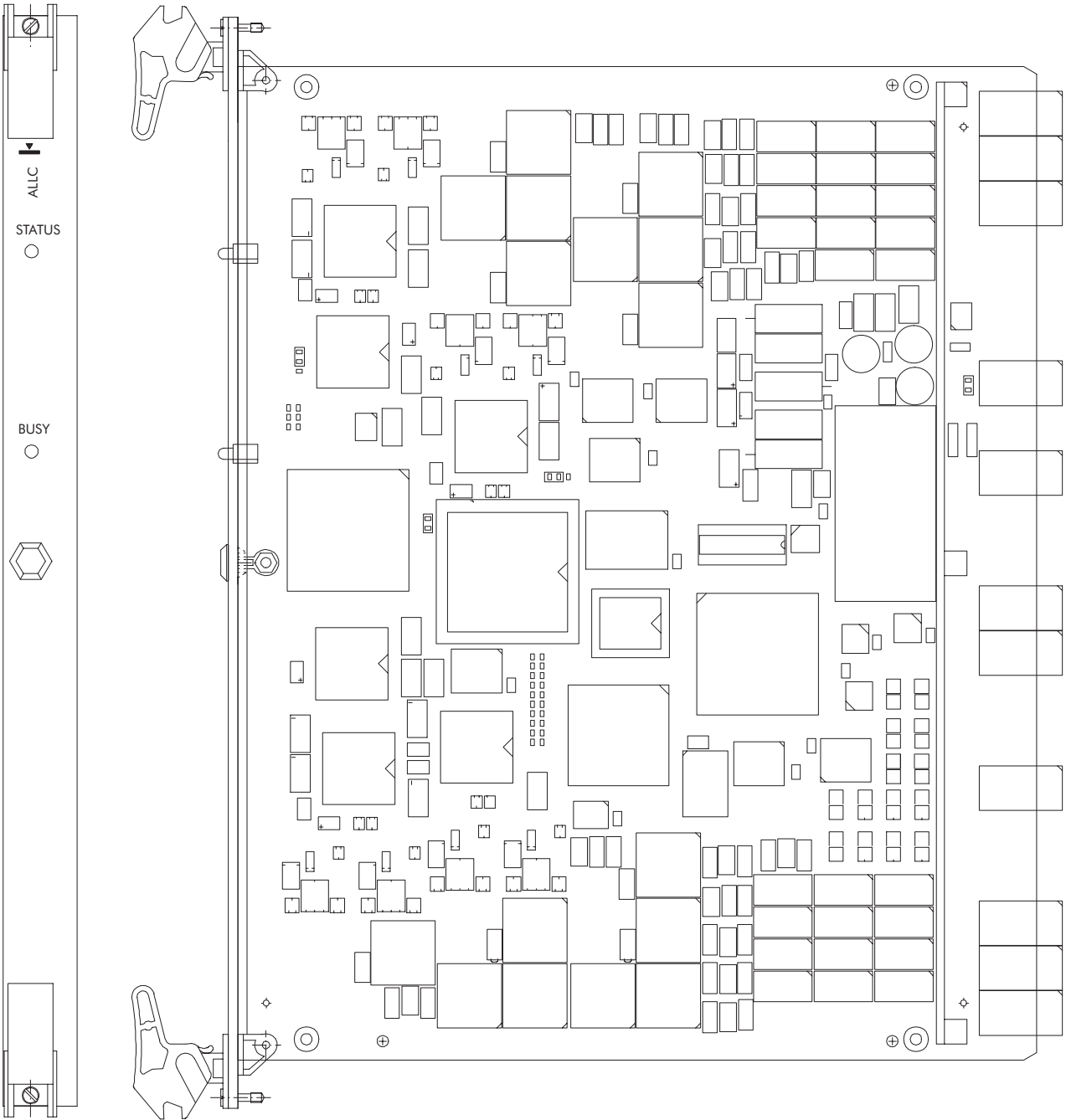


Figure 10–1 ALLC – Outline and Front Plate

10.1.3 ALLC – Block Diagram

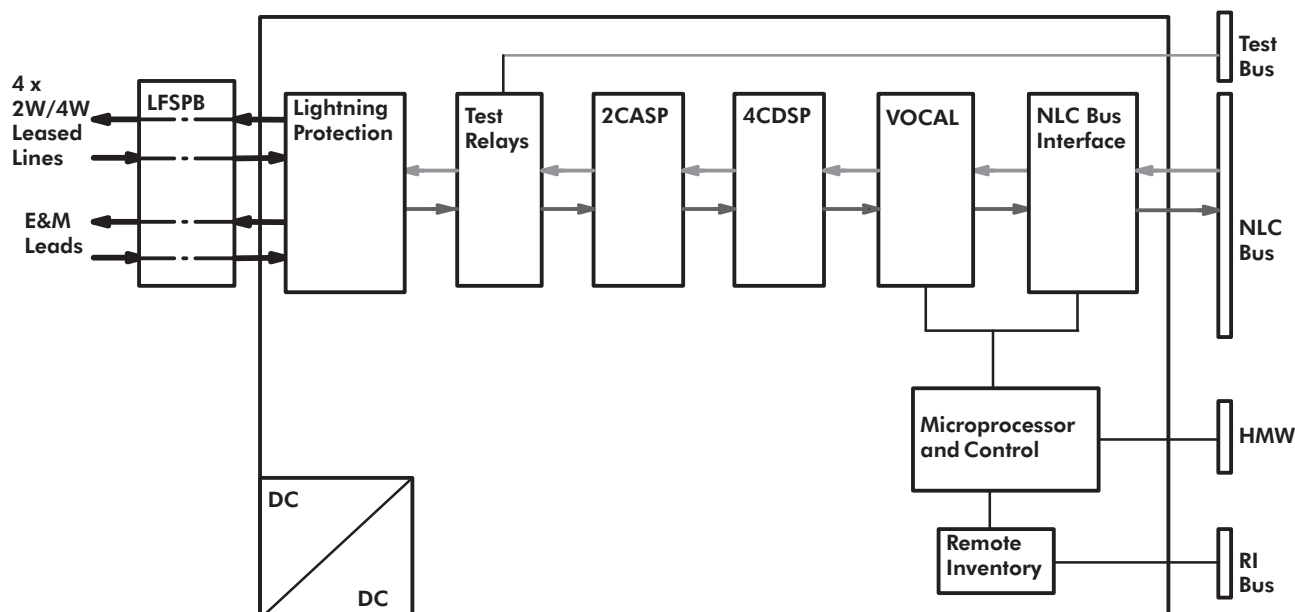


Figure 10–2 ALLC – Block Diagram

10.1.4 ALLC – Consequences of Unplugging

ATTENTION

If an ALLC is removed from the subrack

If an ALLC is removed the effect is that all services carried by the ALLC are lost. They can be re-established by re-inserting the card.

10.1.5 ALLC – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the ALLC.

10.1.6 ALLC – LED Description

There are two LEDs on the front plate of the ALLC. Functions of these LEDs are:

LED	Indication	Description
Green STATUS LED	OFF	ALLC is powered down or has a hardware problem
	Fast Flash (0.5s On, 0.5s Off)	Downloading phase
	Medium Flash (2s On, 2s Off)	In operation with/without established communications (Awaiting download)
	Periodic Blink (Blink On/Off every 60s)	VA Alignment (Normal)
Yellow BUSY LED	ON	One or more customer lines has been configured to carry traffic.
	OFF	No customer lines have been configured to carry traffic.
	Fast Blink	ALLC is performing self test.

10.1.7 ALLC – Interface – Electrical

(1) Customer line interface

The ALLC provides eight identical customer line interfaces. Each of the eight channels can be configured independently in two different modes:

- ▶ Two–wire access port connection.
- ▶ Four–wire access port connection.

Interface Specification	Range
Impedance	600Ω
Current limit	50 mA
Bandwidth	300 to 3400 Hz
Gain (Rx and Tx)	– 14 dBr to +4 dBr

Note *Complex impedance selection is not intended for use in Australia. Complex impedance on the ALLC is 270Ω + 750Ω // 150nF. This is not the Australian complex impedance standard. Use of this impedance in Australia will give a different performance to that which would be expected for the Australian complex impedance.*

(2) Signalling interface

ALLC provides an E&M signalling interface per channel with the following electrical characteristics:

Item	Value
Number of E/M pairs per channel	1 or 2
Protection	
Max. overcurrent over E wire	< 100mA
Max. resistance in E wire	< 50Ω (earth state)
Activating conditions in M wire	
ON	M–wire detects ground when $0 < R < 200\Omega$
OFF	M–wire detects open when $R > 20\text{ K}\Omega$
Residual voltage in E wire	$\leq 2\text{V}$

Note *The signalling interface is for indoor use only. It must not be connected to cabling which is routed external to the building.*

10.1.8 ALLC – Connector Pinouts – Front

There are no connectors on the front plate of the ALLC.

Customer lines are terminated on an LFSPB plug in the plug area beneath the ALLC in the subrack.

The ALLC communicates with the LFSPB via the subrack backplane.

The ALLC and the LFSPB have connectors on the rear which plug into connectors on the subrack backplane.

10.1.9 ALLC – Alarms

For full details of ALLC alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

10.2 ATLCC – 3EC 42053 ABxx

The ATLCC (Analogue Telephone Line Card) is a 30 Line POTS Card for CMUX.

10.2.1 ATLCC – Features and Functions

Features and functions of the ATLCC are:

- ▶ DC feed.
- ▶ AC impedance termination.
- ▶ Digital to analog (receive path) and analog to digital (transmit path) conversion.
- ▶ Insertion of ringing signal on customer lines.
- ▶ Loop supervision:
 - On/off hook detection.
 - Dial pulse detection.
 - Ring trip detection.
- ▶ 12kHz meter pulse generation.
- ▶ Test access.
- ▶ Overcurrent detection.
- ▶ Protection from overvoltages.
- ▶ Echo cancelation.
- ▶ Onboard DC/DC converters for generation of all feed voltages and internal supply rails.
- ▶ Supports Securitel (Mirror only)
- ▶ Manually initiated hybrid balancing.

10.2.2 ATLCC – Outline

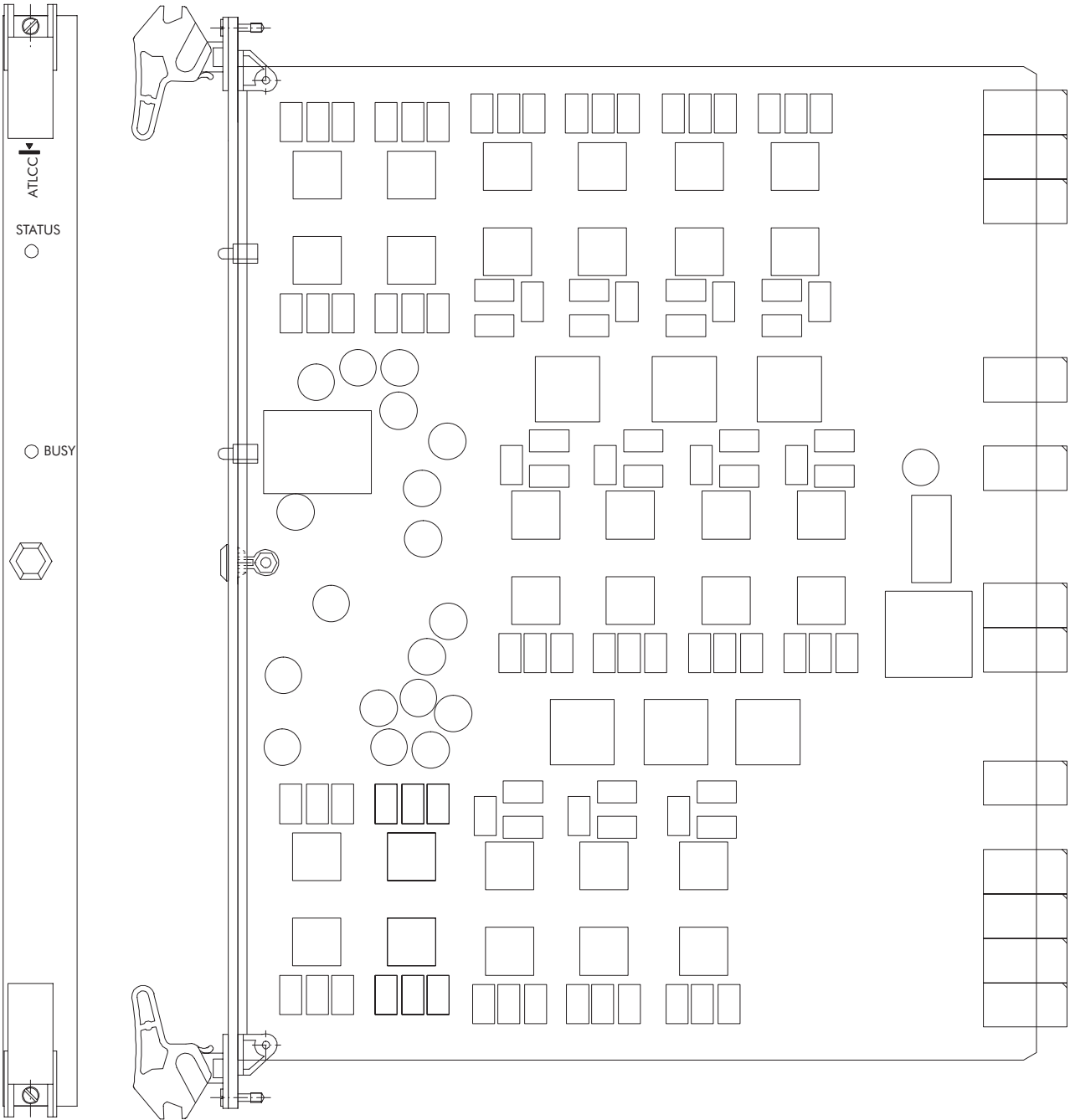


Figure 10–3 ATLCC – Outline and Front Plate

10.2.3 ATLCC – Block Diagram

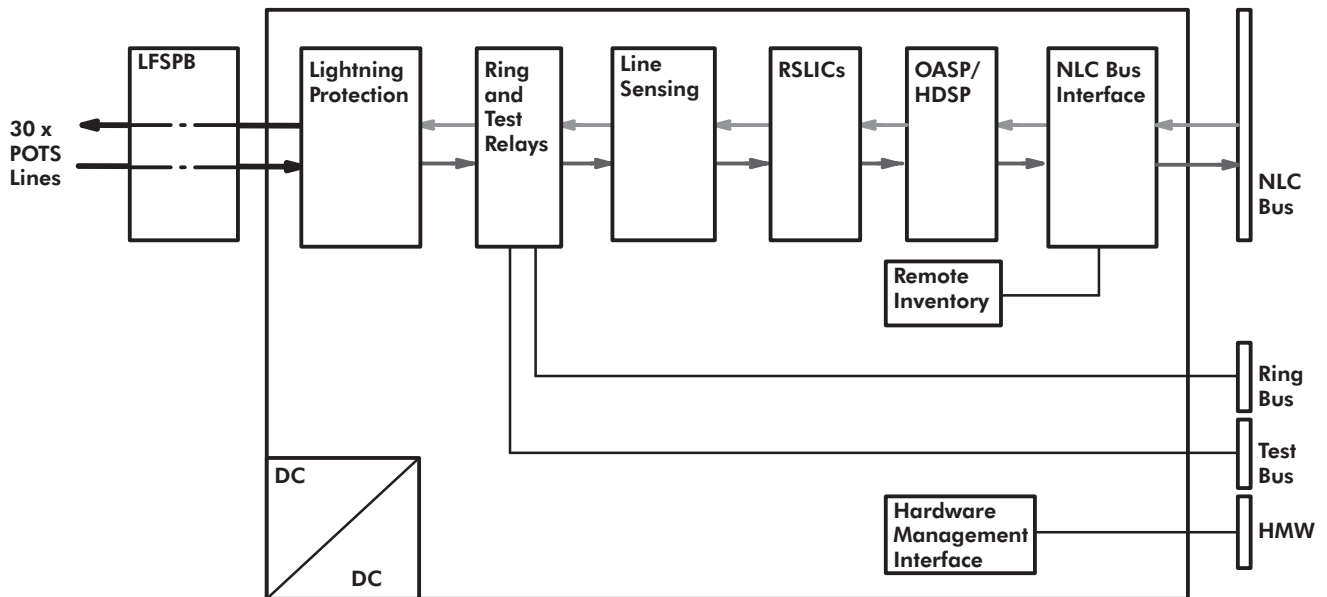


Figure 10–4 ATLCC – Block Diagram

10.2.4 ATLCC – Consequences of Unplugging

ATTENTION

If an ATLCC is removed from the subrack

If an ATLCC is removed the effect is loss of all narrowband services carried by the ATLCC.

10.2.5 ATLCC – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the ATLCC.

10.2.6 ATLCC – LED Description

There are two LEDs on the front plate of the ATLCC. Functions of these LEDs are:

LED	Indication	Description
Green STATUS LED	ON	ATLCC operating correctly
	OFF	ATLCC is powered down or has a hardware problem
Yellow BUSY LED	ON	One or more customer lines are active.
	OFF	All customer lines are inactive.

10.2.7 ATLCC – Interface – Electrical

The ATLCC provides external electrical interfaces for thirty POTS lines. These are connected via the front connector on an LFSPB plug below the ATLCC.

If the customer line carries broadband services as well as narrowband service, ADSL triplets (1 x NACC–A, 2 x LTAC–A and 1 x TSPP–A) and/or ADSL twins (1 x LTAC–C, 1 x NACC–C, 1 x DSPP–B or DSAP) are used to multiplex the narrowband services from an ATLCC with the broadband services from the LTACs.

Electrical characteristics of the POTS interface on the ATLCC are:

Interface Specification	Range – Software Controlled	Factory Setting
Impedance	600Ω, complex*	Complex
Send level (Tx Gain)	–8 dBr to +5 dBr	0 dBr
Receive level (Rx Gain)	–11 dBr to +2 dBr	–6 dBr
Current limit	26 mA	
Loop resistance	0 to 1800 ohms (including a 500 ohm telephone)	

Complex Impedance is:

220Ω plus 820Ω in parallel with 120 nF

10.2.8 ATLCC – Connector Pinouts – Front

There are no front connectors on the ATLCC. Customer lines are connected to the front connectors on the LFSPB plug, located beneath the ATLCC in the subrack.

The ATLCC is connected to the LFSPB via the backplane of the subrack. Rear connectors on the ATLCC and LFSPB plug into connectors on the subrack backplane.

Section 13.11 of this handbook describes the LFSPB, and contains diagrams of the connector pinouts on the LFSPB.

10.2.9 ATLCC – Alarms

For full details of ATLCC alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

10.3 BALCF – 3EC 40052 BFxx

The BALCF (Basic Access Line Card) is the CMUX ISDN Basic Access (BA) Line Card. It provides the interface for connection to ISDN Basic Access NT.

The BALCF supports up to sixteen customer lines, accessed via an LFSPB plug in the plug area of a subrack.

10.3.1 BALCF – Features and Functions

Features and functions of the BALCF are:

- ▶ Sixteen ISDN customer lines with the following characteristics:
 - ISDN BA interface compliant to ITU–T Rec G.961.
 - 2B1Q line code.
 - Constant voltage feed: $118\text{V} \pm 2\text{V}$.
 - Feeding current limit: $52\text{ mA} \pm 4\text{mA}$.
 - Maximum loop impedance: $36\text{dB} @ 40\text{ kHz}$.
 - Line test facilities.
- ▶ Overvoltage protection.
- ▶ Power feed for NT, repeater and terminal equipment via customer line.
- ▶ Overvoltage and undervoltage detection.
- ▶ Overcurrent detection.
- ▶ Open loop detection.
- ▶ Onboard DC/DC converter for generation of all feed voltages and internal supply rails.

10.3.2 BALCF – Outline

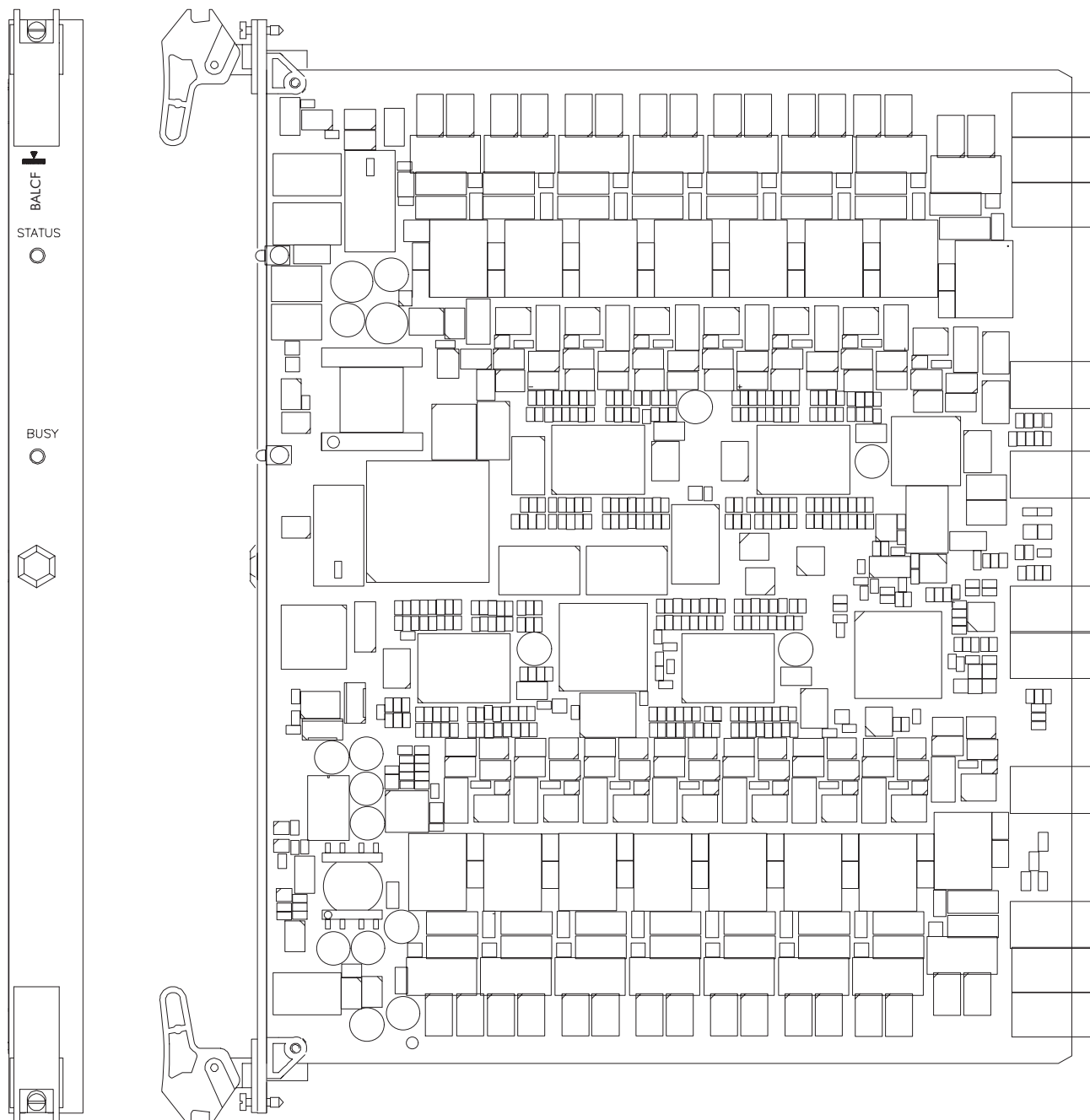


Figure 10–5 BALCF – Outline and Front Plate

10.3.3 BALCF – Block Diagram

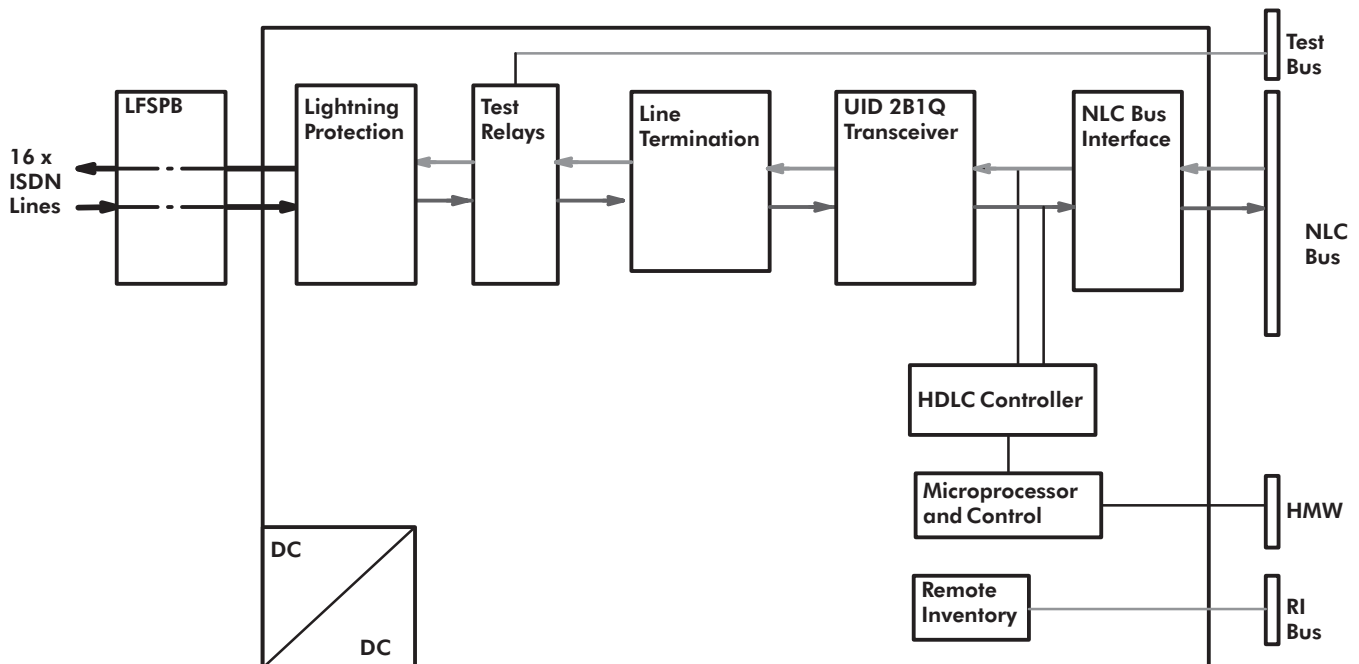


Figure 10–6 BALCF – Block Diagram

10.3.4 BALCF – Consequences of Unplugging

ATTENTION

If a BALCF is removed from the subrack

If a BALCF is removed the effects are loss of all services carried by the BALCF.

10.3.5 BALCF – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the BALCF.

10.3.6 BALCF – LED Description

There are two LEDs on the front plate of the BALCF.
Functions of these LEDs are:

LED	Indication	Description
Green STATUS LED	OFF	BALC is powered down or has a hardware problem
	Fast Flash (0.5s On, 0.5s Off)	Downloading phase
	Medium Flash (2s On, 2s Off)	In operation with/without established communications (Awaiting download)
	Slow Flash (40s On, 20s Off)	VA Alignment (Normal)
Yellow ACTIVE LED	ON	One or more customer lines are in the activated state.
	OFF	All customer lines are deactivated.

10.3.7 BALCF – Interface – Electrical

Characteristics of the U interface are:

Characteristic	Value
Line code	2B1Q (2 Binary, 1 Quaternary)
Symbol rate	80 kBaud $\pm$ 1ppm
Termination impedance	135 Ω resistive
Output pulse amplitude	2.5V $\pm$ 5%
Feed current limit	52 mA

10.3.8 BALCF – Connector Pinouts – Front

There are no connectors on the front panel of the BALCF. Customer lines are terminated on a LFSPB plug in the plug area beneath the BALCF.

The BALCF communicates with the LFSPB via the subrack backplane. Connectors on the rear of the BALCF and LFSPB mate with connectors on the subrack backplane.

10.3.9 BALCF – Alarms

For full details of BALCF alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

10.4 HLTCA – 3EC 40081 ABxx

The HLTCA (HDSL Line Termination Card) is the CMUX HDSL Card.

The HLTCA supports four 2 Mbit/s customer interfaces of one pair each. Alternatively it provides two 2 Mbit/s interfaces of two pairs each for double the transmission distance.

The customer interfaces connect to an HDSL Alcatel 1512 NT.

The HLTCA is located in a line card slot in a subrack.

Note *The HLTCA is not used in CMUX FR2.1F BB.*

10.4.1 HLTCA – Features and Functions

Features and functions of the HLTCA are:

- ▶ Customer interfaces:
 - Two HDSL interfaces of two pairs each, or
 - Four HDSL interfaces of one pair each.
- ▶ Power feed for remote HDSL NT.
- ▶ Transport of:
 - 2 Mbit/s structured according to the ITU–T Rec. G.704. This can contain Nx64 Kbit/s services, Leased Line, or Primary Rate Access to ETSI Rec. ETS 300 233.
 - 2 Mbit/s unstructured.
 - 2 Mbit/s G.703 transparent (local G.703).
- ▶ Onboard DC/DC converter.
- ▶ Manages alarms for the remote HDSL–NT.
- ▶ 2B1Q line code.
- ▶ Line interface protection.
Each line interface has protection against overvoltages.
- ▶ The HDSL line can be either synchronised to the NLC clock or free running. This does not impact the actual frequency of the transported E1 which can be asynchronous with respect to the CMUX frequency.
- ▶ The HLTCA can power feed the remote HDSL–NT.

10.4.2 HLTCA – Outline

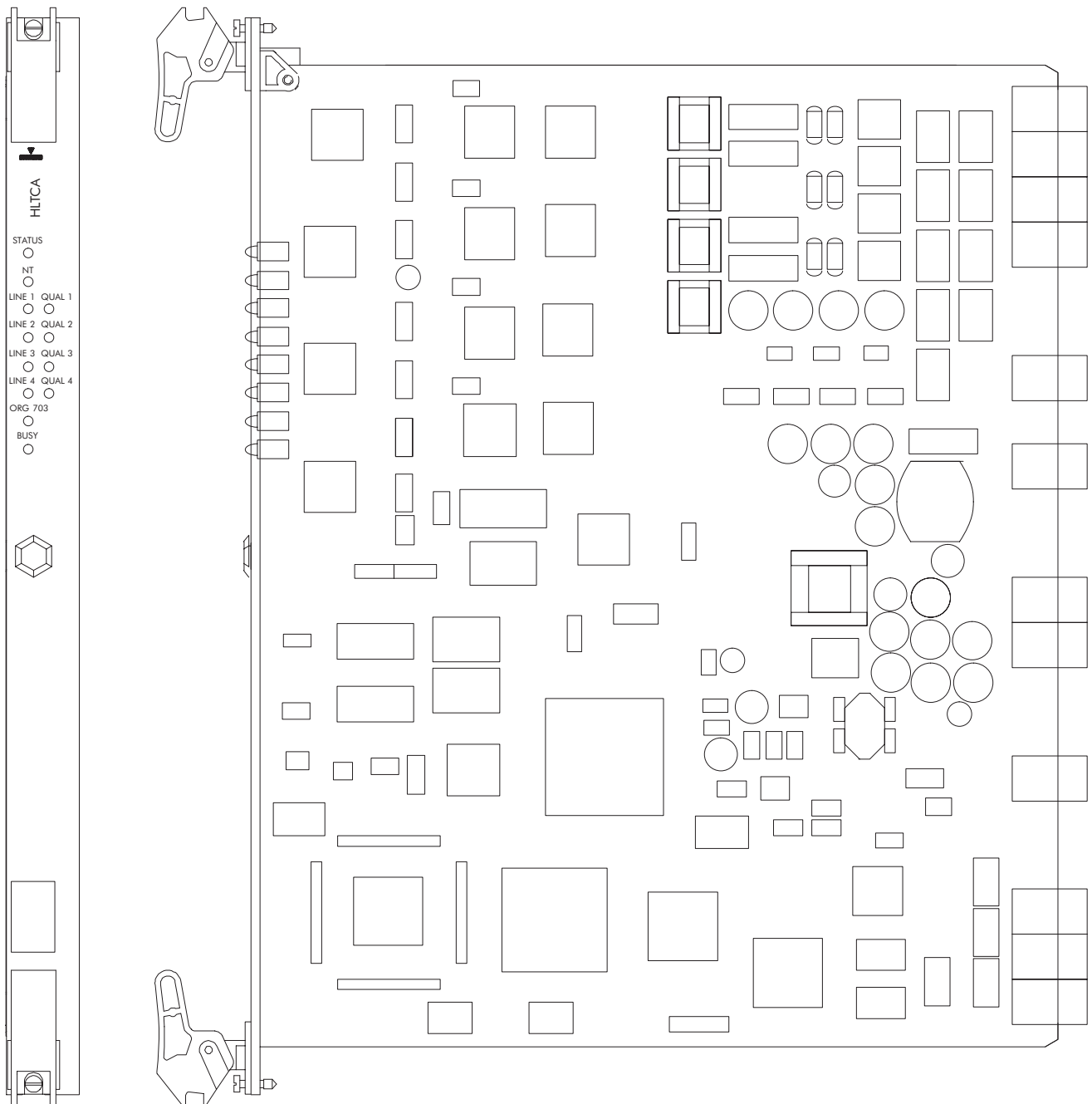


Figure 10–7 HLTCA – Outline and Front Plate

10.4.3 HTLCA – Block Diagram

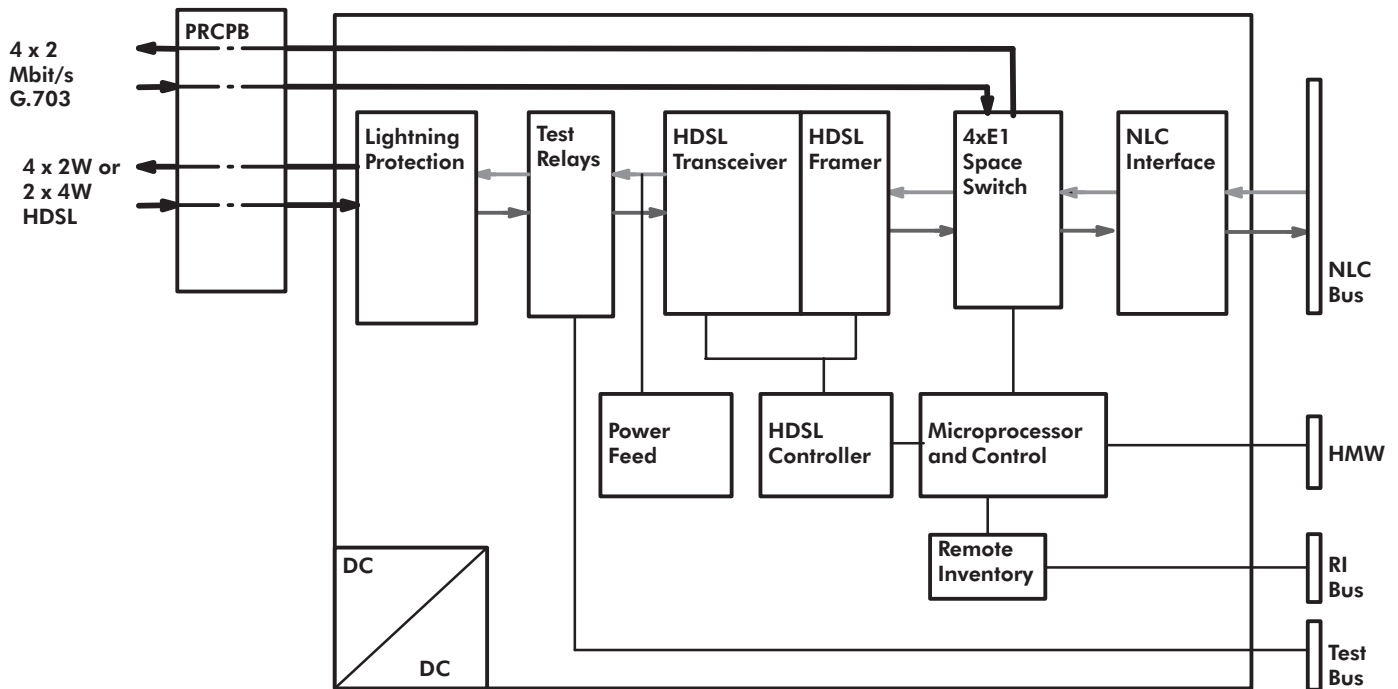


Figure 10–8 HTLCA – Block Diagram

10.4.4 HTLCA – Consequences of Unplugging

ATTENTION

If a HTLCA is removed from the subrack

If a HTLCA is removed the effects are loss of all services carried by the HTLCA.

10.4.5 HTLCA – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the HTLCA.

10.4.6 HLTCA – LED Description

There are twelve LEDs on the front plate of the HLTCA.
Functions of these LEDs are:

LED	Indication	Description
Green STATUS LED	ON	HTLC is powered on and working correctly.
	OFF	HTLC is powered down or has a hardware problem.
Yellow NT LED	ON	HLTCA is an NT
	OFF	HLTCA is an LT
Red LINE <i>N</i> LED (<i>N</i> = 1 to 4)	ON	Line is not working correctly.
	OFF	All interfaces working correctly or inactive.
	FLASH	Interface is in loop mode
Green QUAL <i>N</i> LED (<i>N</i> = 1 to 4)	ON	HDSL link established
	OFF	Link inactive
Red ORG 703 LED	ON	One or more G.703 is not working correctly
	OFF	All G.703 are working correctly
Yellow BUSY LED	ON	One or more customer lines are active.
	OFF	All customer lines are inactive.

10.4.7 HLTCA – Interface – Electrical

The HLTCA provides bidirectional transmission of 2048 kbit/s over copper pairs. It can be configured to provide either four single-pair interfaces or two dual-pair interfaces.

Item	Value
Transmission rate	Bidirectional 2048 kbit/s
Line transmission rate	
Single pair	2320 kbit/s
Two pair	1168 kbit/s
Line code	2B1Q
Reference clock	2320 ± 32 ppm

10.4.8 HLTCA – Connector Pinouts – Front

There are no connectors on the front plate of the HLTCA.

Customer lines are connected to front connectors on an PRCPB plug, located in the plug area beneath the HLTCA.

The HLTCA communicates with the PRCPB via the subrack backplane. Rear connectors on the HLTCA and PRCPB mate with connectors on the subrack backplane.

10.4.9 HLTCA – Alarms

For full details of HLTCA alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

10.5 PMLCC – 3EC 41172 ACxx

The PMLCC is the POTS Mirror Line Card. It is used in conjunction with one or more ATLCC cards to provide 16 mirror (non-integrated) services. Other lines on the ATLCC(s) can be configured for other services. There is no mandatory 1:1 relationship between one PMLCC and one ATLCC.

- ▶ Normal configuration is for a PMLCC at the NUC with one or more ATLCC cards at the NUS or AU. This provides mirrored services to the customer lines.
- ▶ The alternative configuration has a PMLCC at the NUS or AU and one or more ATLCC cards at the NUC. This is used for special services such as PABX indial.
- ▶ Individual mirrored lines connected to one or more ATLCC cards are groomed to the lines on the PMLCC. Other channels on the ATLCC cards are generally integrated.

10.5.1 PMLCC – Features and Functions

Feature and functions of the PMLCC are:

- ▶ Sending of decadic pulses or passing of DTMF signals.
- ▶ Generation of Timed Loop Break.
- ▶ Ring detection.
- ▶ 12 kHz metering detection.
- ▶ Reversal detection.
- ▶ Securitel support by passing 37 Hz pilot tone.
- ▶ Overvoltage Protection.

10.5.2 PMLCC – Outline

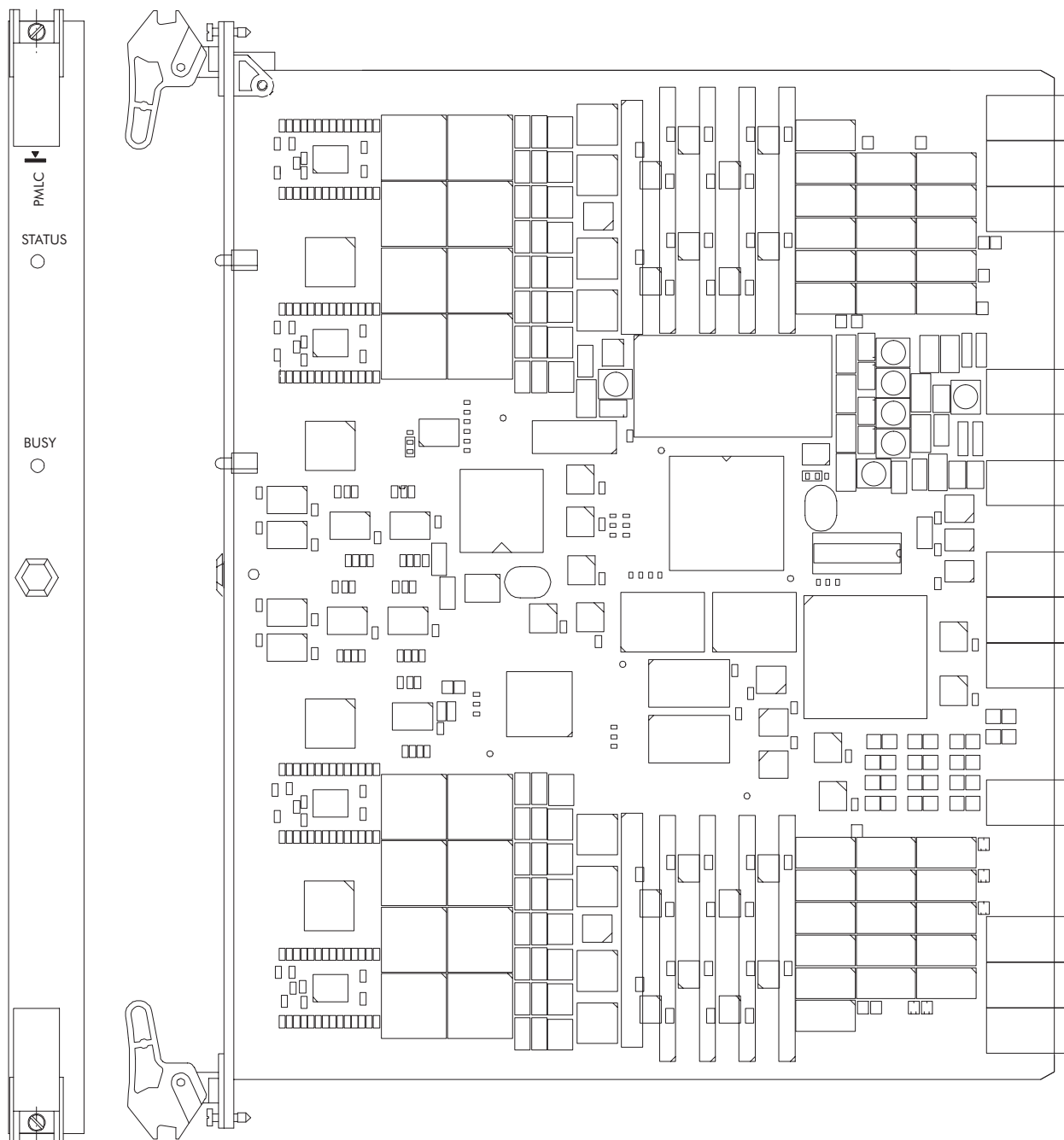


Figure 10–9 PMLCC – Outline and Front Plate

10.5.3 PMLCC – Block Diagram

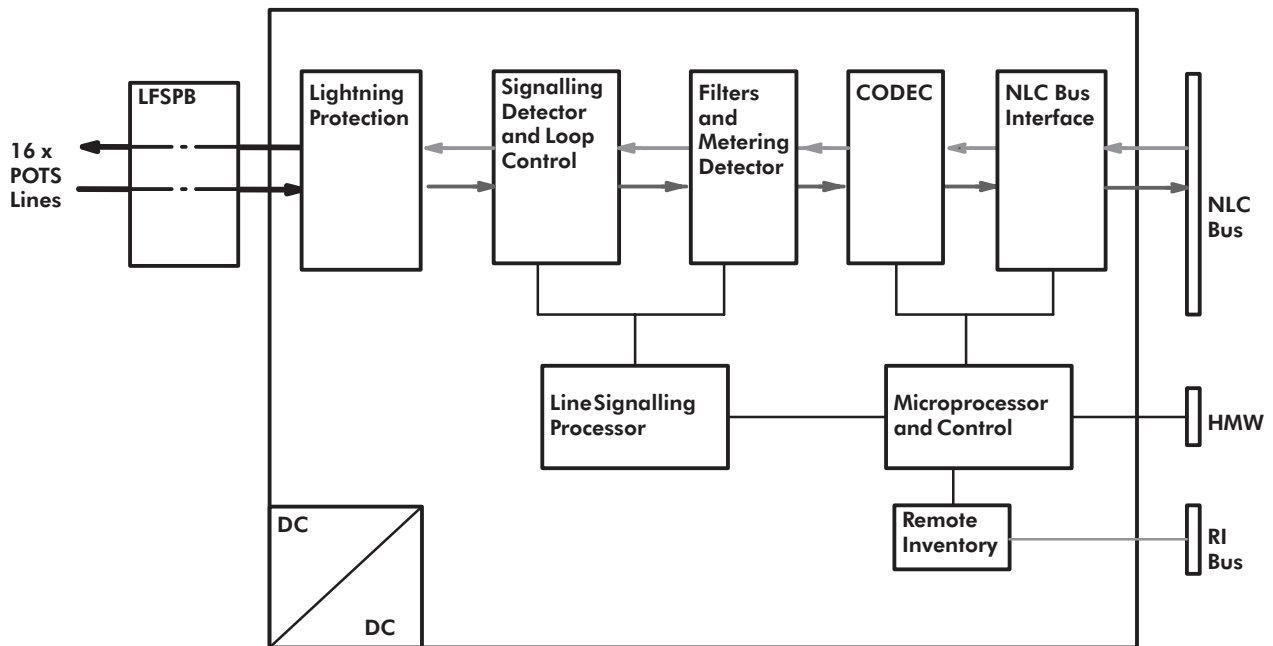


Figure 10–10 PMLCC – Block Diagram

10.5.4 PMLCC – Consequences of Unplugging

ATTENTION

If a PMLCC is removed from the subrack

If a PMLCC is removed the effects are that all the services connected to the PMLCC are lost.

10.5.5 PMLCC – Switches, Links and Sockets

There are no user-selectable switches, links or sockets on the PMLCC.

10.5.6 PMLCC – LED Description

There are two LEDs on the front plate of the PMLCC.
Functions of these LEDs are:

LED	Indication	Description
Green STATUS LED	ON	PMLCC operating correctly
	OFF	PMLCC is powered down or has a hardware problem
	SLOW FLASH	PMLCC is in operation with/without established communications (awaiting download)
	FAST FLASH (0.5s on, 0.5s off)	Downloading phase
Yellow ACTIVE LED	ON	One or more customer lines are active.
	OFF	All customer lines are inactive.

10.5.7 PMLCC – Interface – Electrical

The PMLCC provides external electrical interfaces for sixteen mirror POTS lines. These are connected via the front connector on an LFSPB plug below the PMLCC.

Electrical characteristics of the POTS interface on the PMLCC are:

Interface Specification	Range – Software Controlled	Factory Setting
Impedance	Complex (TN12), 600 Ω	Complex
Send level (Tx gain)	–8 dBr to +5 dBr	–6 dBr
Receive level (Rx gain)	–11 dBr to +2 dBr	0 dBr
Loop resistance	0 to 1600 ohms	

Note For correct operation, polarity of the POTS connection from the exchange to the PMLCC must be:

- A leg Positive
- B leg Negative.

10.5.8 PMLCC – Connector Pinouts – Front

There are no connectors on the front plate of the PMLCC.

Customer lines are connected to front connectors on an LFSPB plug, located in the plug area beneath the PMLCC.

The PMLCC communicates with the LFSPB via the subrack backplane. Rear connectors on the PMLCC and LFSPB mate with connectors on the subrack backplane.

10.5.9 PMLCC – Alarms

For full details of PMLCC alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

11 Broadband Line Cards

11.1 LTAC–A – 3EC 40137 Axxx

The LTAC–A (Line Termination ADSL Card) is the four channel ADSL Line Card.

- ▶ The LTAC–A contains four independent ADSL Line Terminations (LT). Each of these LTs allows bidirectional access to an ADSL Network Termination (NT) over conventional twisted pair cable, already in use for POTS service.
- ▶ The LTAC–A connects via the IQ bus to a broadband controller card (BBCC) card such as the AANC, ASCC–S, AICC or BSEC. The BBCC card provides access to a transport network carrying ATM cells.

11.1.1 LTAC–A – Features and Functions

The LTAC–A:

- ▶ Extracts and inserts ATM cells from and to the IQ bus based on their VPI/VCI (Virtual Path Identifier/Virtual Channel Identifier) value.
- ▶ Uses a DMT (Discrete Multi Tone) approach to convert these cells to a bandpass signal that can be sent over a customer line. On the customer line the DMT modulated ATM cells are frequency multiplexed with the analogue POTS service.
- ▶ Is used in conjunction with a NACC–A (Narrowband ADSL Combiner Card) and a TSPP–A (Triple Slot Position Plug) to combine the POTS and ADSL services on customer lines.
 - Two LTAC–A cards interface with one NACC–A card via one TSPP–A.
 - The NACC–A provides a low pass filter which blocks ADSL signals from the customer line towards the POTS line circuit.
 - The TSPP–A:
 - Interconnects the LTAC–A and NACC–A.
 - Provides interfaces for POTS lines from the exchange or from CMUX POTS line cards.
 - Provides interfaces for customer lines.
- ▶ Has an onboard DC/DC converter.

Note *To provide inband narrowband management in some installations a LTAC–A may be installed in Slot 7 of the Main Subrack. This LTAC–A uses a PRCPB plug and is not part of an ADSL Triplet.*

11.1.2 LTAC-A – Outline

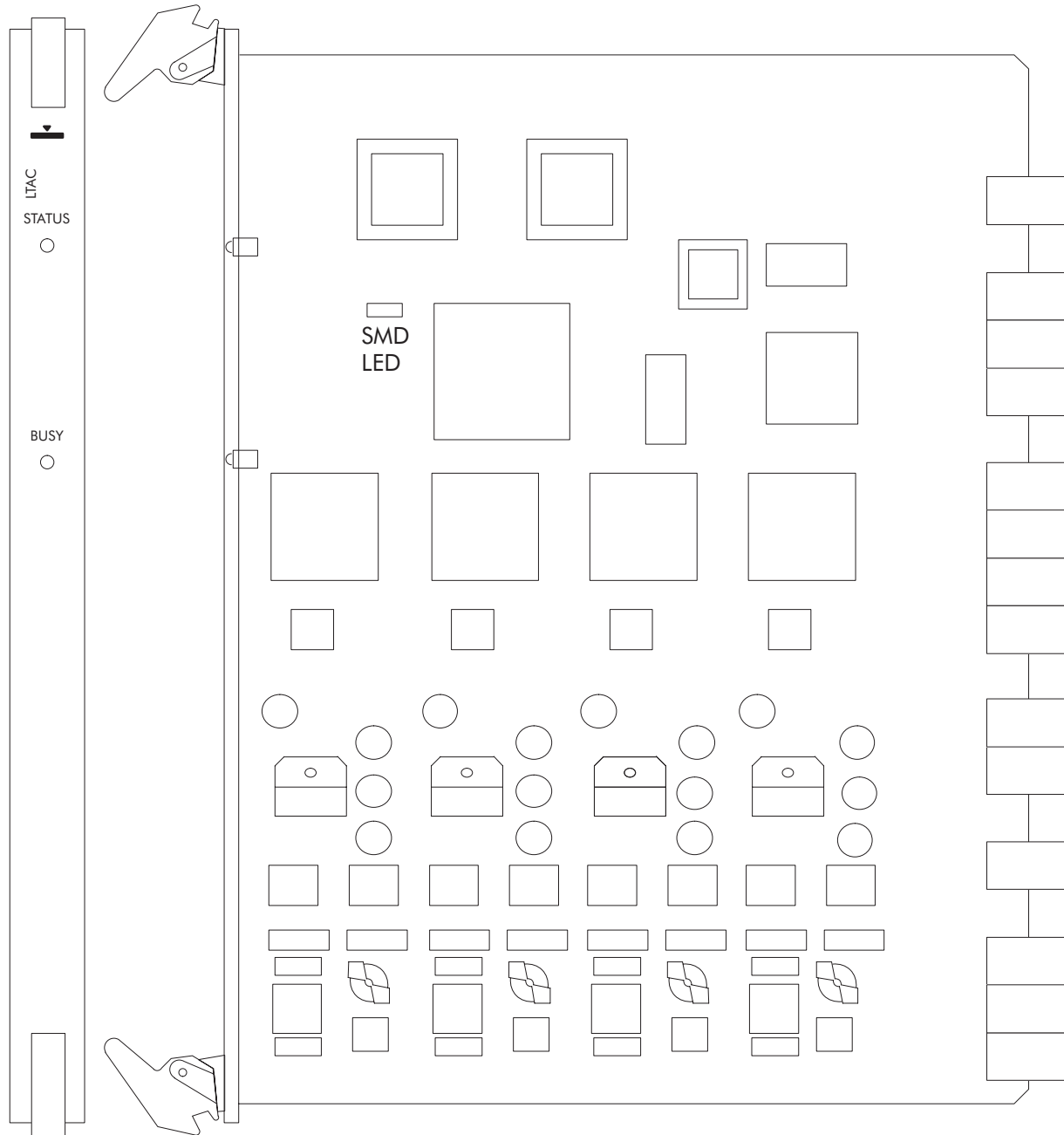


Figure 11–1 LTAC-A – Outline and Front Plate

11.1.3 LTAC-A – Context Diagram

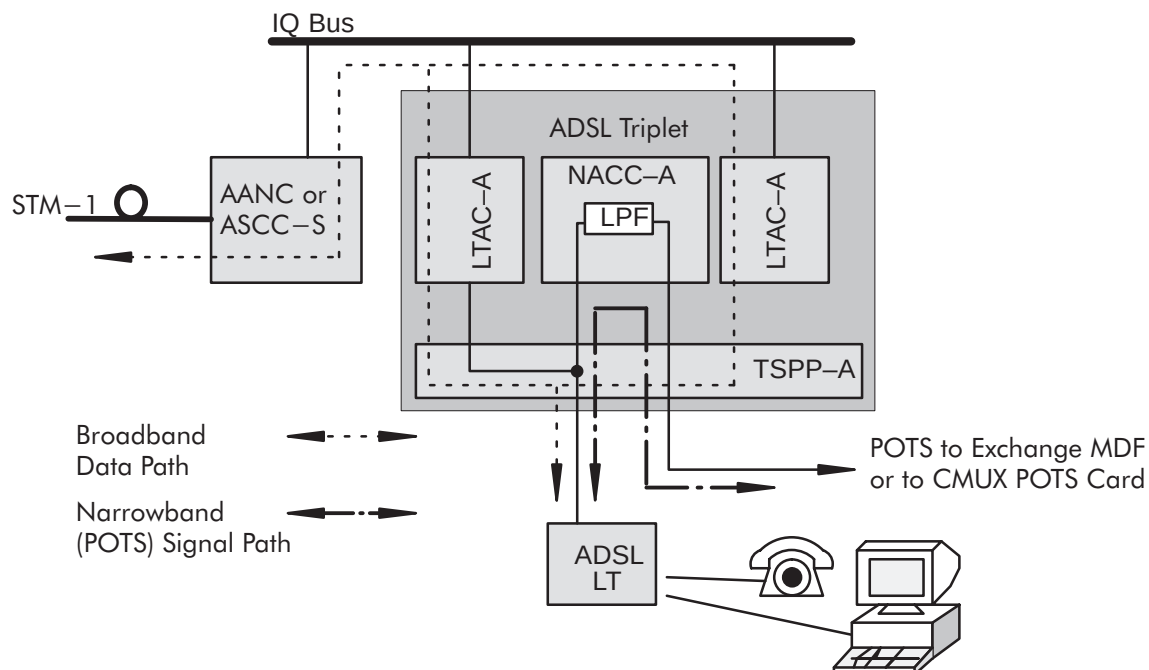


Figure 11–2 LTAC-A + AANC or ASCC-S – Context Diagram

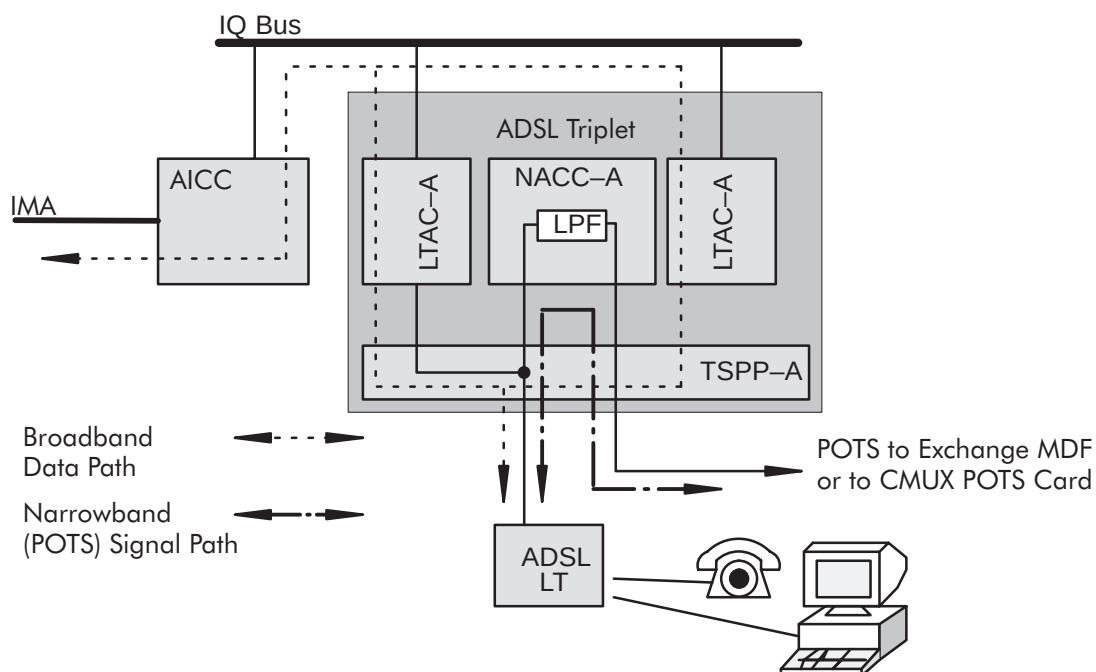


Figure 11–3 LTAC-A/AICC – Context Diagram

11.1.4 LTAC-A – Block Diagram

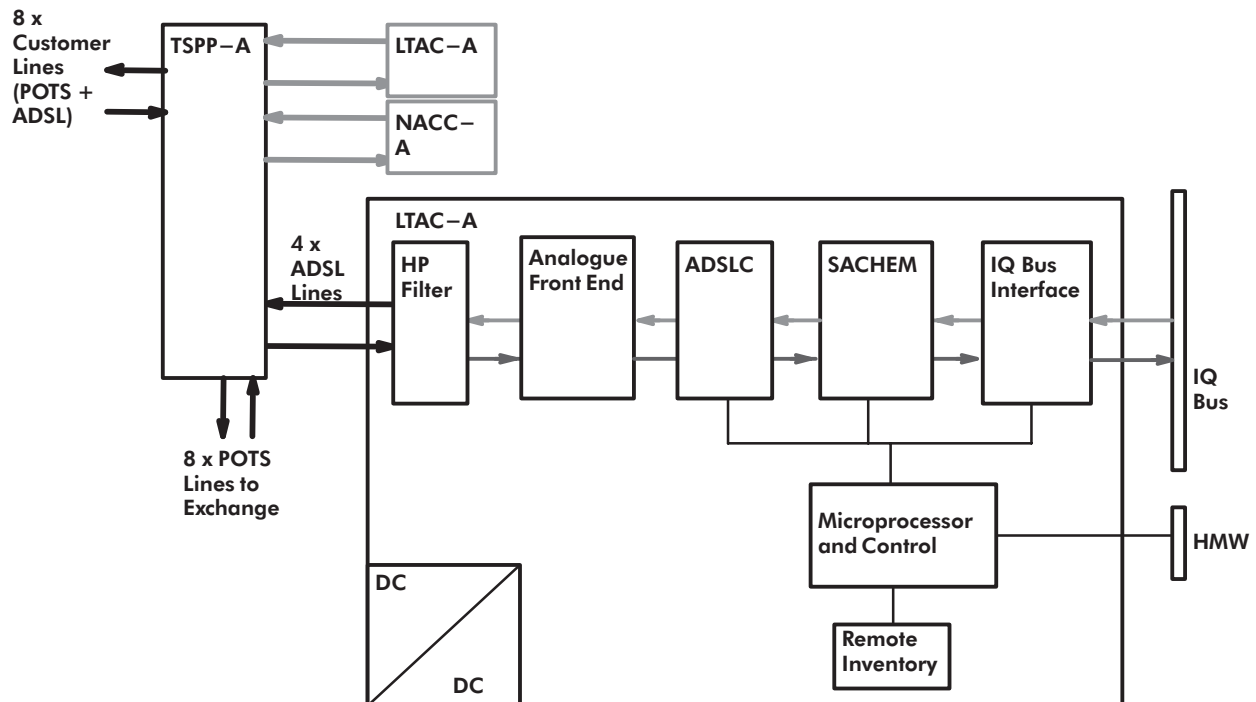


Figure 11-4 LTAC-A – Block Diagram

11.1.5 LTAC-A – Consequences of Unplugging

ATTENTION

If LTAC-A is removed from the subrack

If an LTAC-A is removed:

- 1) Bypass relays in the TSPP-A switch the customer lines directly to the POTS lines from the exchange or from a CMUX POTS line card.
- 2) All ADSL services supported by the LTAC-A are lost.
- 3) If the LTAC-A is used for OA&M via inband ATM then communication with the management system will be lost.

11.1.6 LTAC-A – Switches, Links and Sockets

There are no user-selectable switches, links or sockets on the LTAC-A.

11.1.7 LTAC–A – LED Description

The LTAC–A is fitted with three LEDs:

- ▶ The front plate of the LTAC–A is fitted with two LEDs:
- ▶ The SMD LED is fitted to the PBA as shown in Figure 11–1. It is located near the Onboard Controller (OBC).

(1) LTAC–A – Front Plate LED

LED	Indication	Description
Green STATUS LED	ON	LTAC–A operating correctly
	OFF	LTAC–A disabled or has been powered down by BBCC
Yellow BUSY LED	FLASHING	LTAC–A is initialising

(2) LTAC–A – PBA LED

LED	Indication	Description
SMD LED	ON	Processor Initialisation Check has failed

11.1.8 LTAC–A – Interface – Electrical

The LTAC–A has the following electrical interfaces. All connections to these interfaces are via the LTAC–A rear connectors to the subrack backplane, and then to the external connectors on the TSPP–A.

(1) Customer Line Interfaces

The customer line interface carries the ADSL service. This is combined with the POTS service by the NACC–A. Connections to customer lines are via the TSPP–A.

The ADSL transceiver for each customer line is protected against over–voltage surges.

The specifications of the customer line interfaces are:

Item	Value
Nominal Impedance (ADSL Frequency Band)	100Ω
Frequency Band	32 kHz to 138 kHz (upstream) 138 kHz to 1.1 MHz (downstream)
Maximum Number of ADSL Carriers	23 (upstream) 218 (downstream)
Line Coding	DMT
Tone Spacing	4.3125 kHz
RMS Downstream Power	100 mW

(2) IQ Interface

The IQ interface connects the LTAC–A to the IQ bus on the MP backplane via a connector on the rear of the LTAC–A.

The LTAC–A supports redundancy of the IQ bus and selects either IQ Bus A or IQ Bus B under the control of the broadband controller (BBCC). The LTAC–A transmits data to both IQ busses.

The IQ interface contains the following busses:

- ▶ IQ_D bus: downstream ATM cells.
- ▶ IQ_U bus: upstream ATM cells.
- ▶ IQ_A bus: access control on the IQ_U bus.

(3) Remote Inventory Interface

The LTAC–A is fitted with a SEEPROM for Remote Inventory data. RI access from the subrack to the LTAC–A is via the rear connector on the LTAC–A.

(4) Hardware Management Wires Interface

The broadband controller (BBCC) communicates with the LTAC–A via Hardware Management Wires (HMW) on the MP backplane. These are connected to the LTAC–A via the rear connector.

The BBCC is able to set the following LTAC–A states via the HMW:

- | | |
|-------------------------|--|
| Disable State: | The LTAC–A isolates its transmitting drivers from the IQ bus forcing a high impedance condition. All other functionality may remain active. |
| Reset State: | The LTAC–A activates all hardware reset commands. Action from the HMW controller is required to exit this state. |
| Power–off State: | The LTAC–A shuts down its DC/DC converter. Power supply provided from the HMW is used by the power–off circuit to guarantee stability in this state. |
| Normal State: | The normal state of operation for the LTAC–A. |

11.1.9 LTAC–A – Connector Pinouts – Front

There are no connectors on the front plate of the LTAC–A. All connections are made via rear connectors to the subrack backplane.

11.1.10 LTAC–A – Alarms

For full details of LTAC–A alarms and their consequences, refer to the Alcatel AWS Operator’s Handbook.

11.2 LTAC–C – 3EC 40137 Cxxx

The LTAC–C (Line Termination ADSL Card) is the twelve channel ADSL Line Card.

- ▶ The LTAC–C contains twelve independent ADSL Line Terminations (LT). Each of these LTs allows bidirectional access to an ADSL Network Termination (NT) over conventional twisted pair cable, already in use for POTS service.
- ▶ The LTAC–C connects via the IQ bus to a broadband controller card (BBCC) card such as the AANC, ASCC–S, AICC or BSEC. The BBCC card provides access to a transport network carrying ATM cells.

11.2.1 LTAC–C – Features and Functions

The LTAC–C:

- ▶ Extracts and inserts ATM cells from and to the IQ bus based on their VPI/VCI (Virtual Path Identifier/Virtual Channel Identifier) value.
- ▶ Uses a DMT (Discrete Multi Tone) approach to convert these cells to a bandpass signal that can be sent over a customer line. On the customer line the DMT modulated ATM cells are frequency multiplexed with the analogue POTS service.
- ▶ Is used in conjunction with a NACC–C (Narrowband ADSL Combiner Card) and a DSPP–B (Dual Slot Position Plug) or DSAP (Dual Slot Attenuator Plug) to combine the POTS and ADSL services on customer lines.
 - One LTAC–C card interface with one NACC–C card via one DSPP–B or DSAP.
 - The NACC–C provides a low pass filter which blocks ADSL signals from the customer line towards the POTS line circuit.
 - The DSPP–B or DSAP:
 - Interconnects the LTAC–C and NACC–C.
 - Provides interfaces for POTS lines from the exchange or from CMUX POTS line cards.
 - Provides interfaces for customer lines.
 - The DSAP also provides ADSL attenuation.
- ▶ Has an onboard DC/DC converter.

11.2.2 LTAC-C – Outline

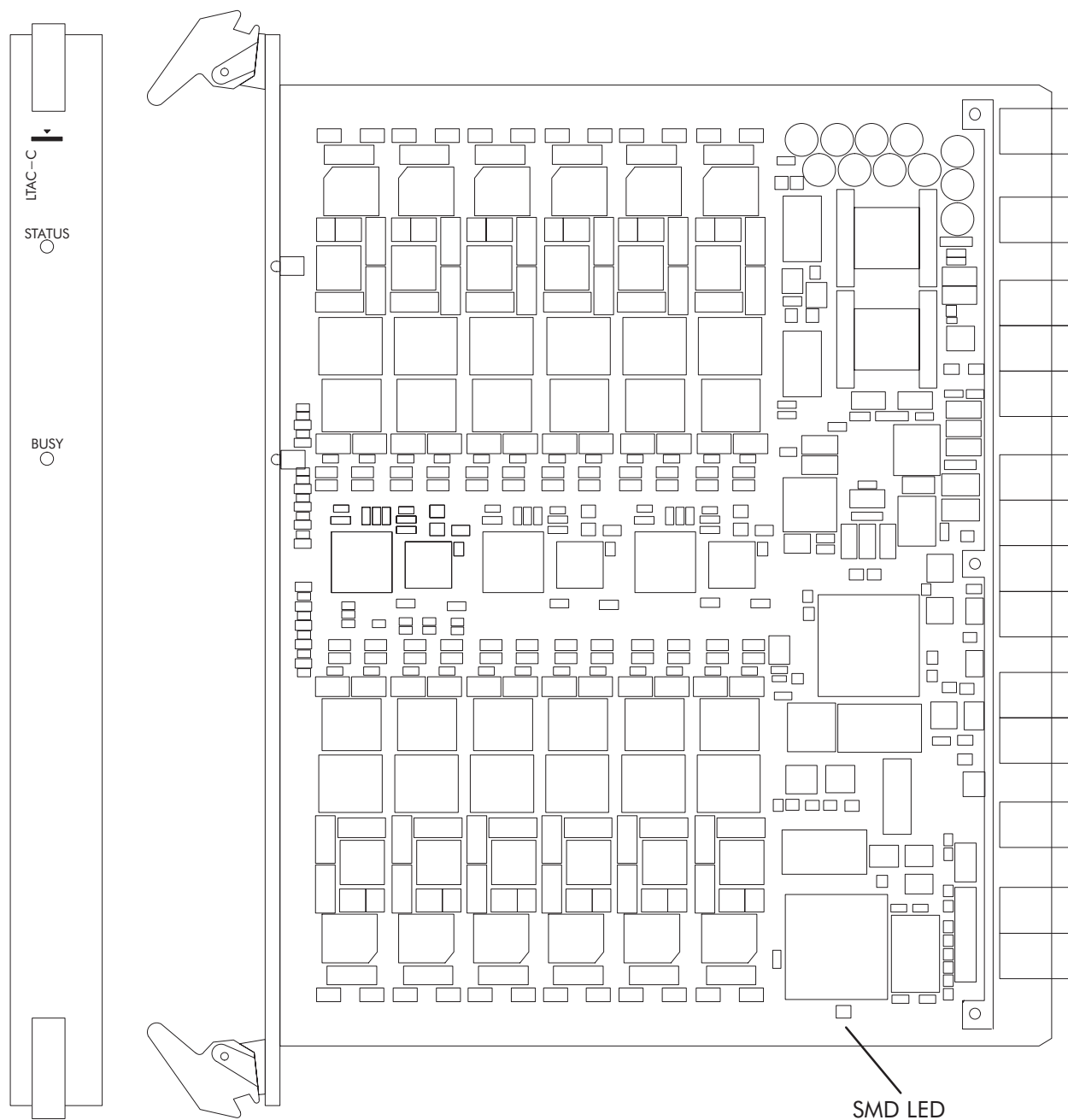


Figure 11-5 LTAC-C – Outline and Front Plate

11.2.3 LTAC-C Context Diagram

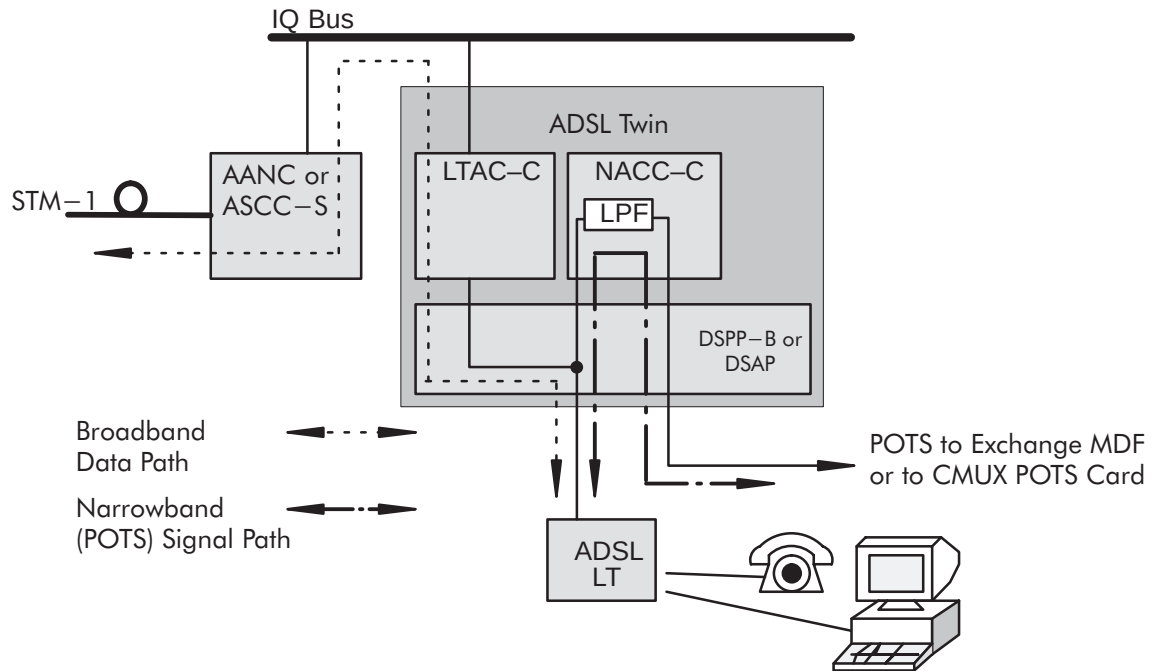


Figure 11-6 LTAC-C plus AANC or ASCC-S – Context Diagram

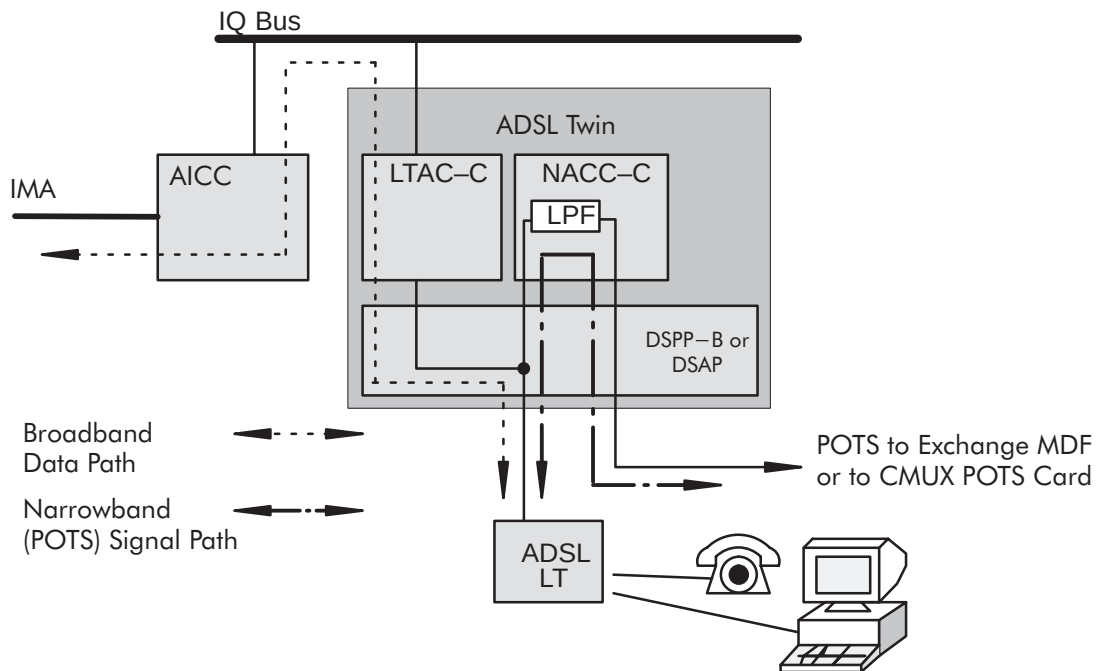


Figure 11-7 LTAC-C/AICC – Context Diagram

11.2.4 LTAC-C – Block Diagram

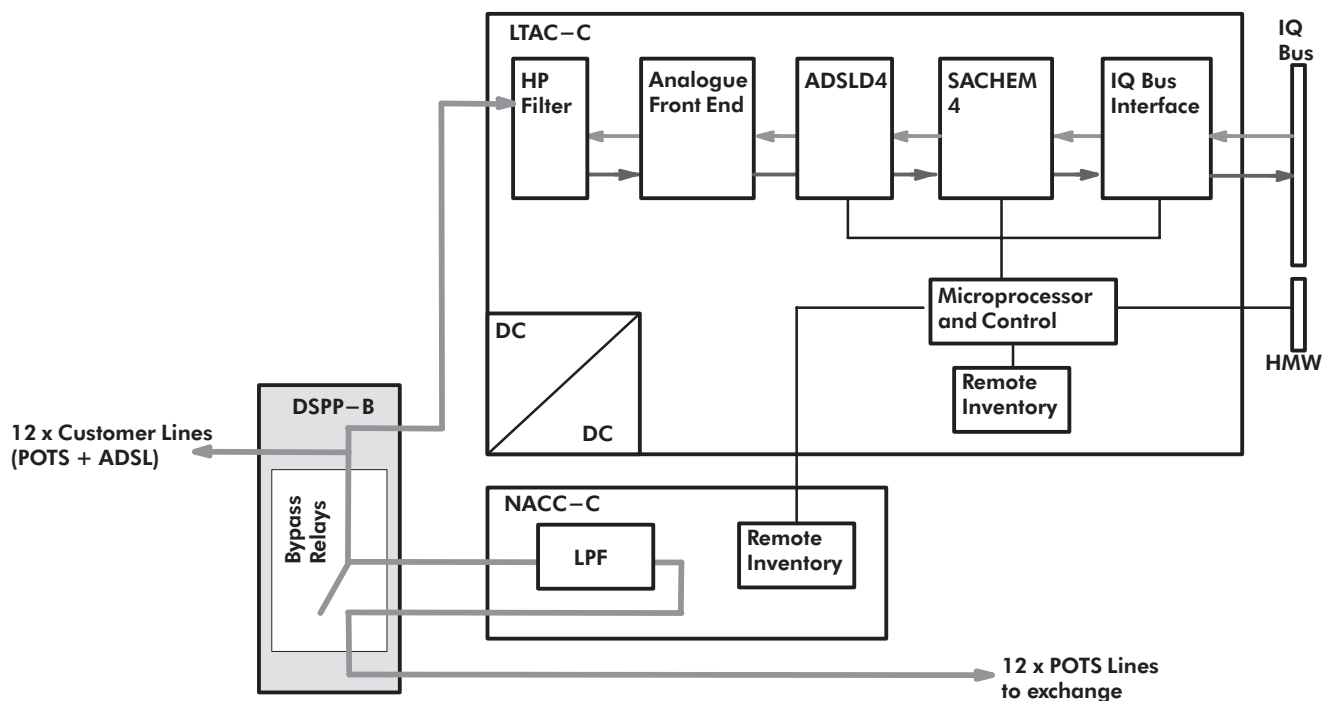


Figure 11–8 LTAC-C – Block Diagram wit DSPP-B

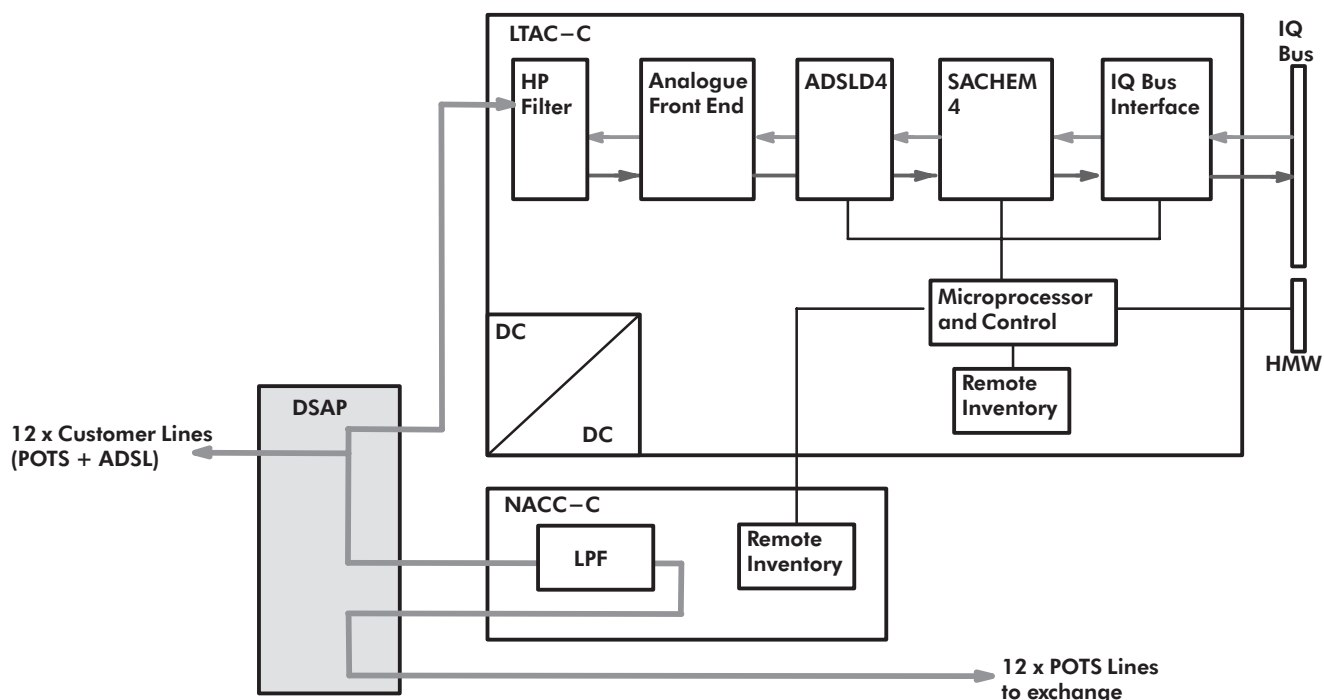


Figure 11–9 LTAC-C – Block Diagram with DSAP

11.2.5 LTAC–C – Consequences of Unplugging

ATTENTION

If a LTAC–C is removed from the subrack

If an LTAC–C is removed:

- 1) Bypass relays in the DSPP–B switch the customer lines directly to the POTS lines from the exchange or from a CMUX POTS line card.
- 2) If a DSAP is installed POTS services are maintained.
- 3) All ADSL services supported by the LTAC–C are lost.
- 4) If OA&M is via in–band ATM then communication with the management system is lost.

11.2.6 LTAC–C – Switches, Links and Sockets

LTAC–C has no user–selectable switches, links or sockets.

11.2.7 LTAC–C – LED Description

The LTAC–C is fitted with three LEDs:

- ▶ The front plate of the LTAC–C is fitted with two LEDs:
- ▶ The SMD LED is fitted to the PBA as shown in Figure 11–5. It is located near the Onboard Controller (OBC) .

(1) LTAC–C – Front Plate LEDs

LED	Indication	Description
Green STATUS LED	ON	LTAC–C operating correctly
	OFF	LTAC–C disabled or has been powered down by BBCC
Yellow BUSY LED	FLASHING	LTAC–C is initialising

(2) LTAC–C – PBA LED

LED	Indication	Description
SMD LED	ON	Processor Initialisation Check has failed

11.2.8 LTAC–C – Interfaces Electrical

The LTAC–C has the following electrical interfaces. All connections to these interfaces are via the LTAC–C rear connectors to the subrack backplane, and then to the external connectors on the DSPP–B.

(1) Customer Line Interfaces

The customer line interface carries the ADSL service. This is combined with the POTS service by the NACC–C. Connections to customer lines are via the DSPP–B.

The ADSL transceiver for each customer line is protected against over-voltage surges.

The specifications of the customer line interfaces are:

Item	Value
Nominal Impedance (ADSL Frequency Band)	100Ω
Frequency Band	32 kHz to 138 kHz (upstream) 138 kHz to 1.1 MHz (downstream)
Maximum Number of ADSL Carriers	23 (upstream) 218 (downstream)
Line Coding	DMT
Tone Spacing	4.3125 kHz
RMS Downstream Power	100 mW

(2) IQ Interface

The IQ interface connects the LTAC–C to the IQ bus on the MP backplane via a connector on the rear of the LTAC–C.

The LTAC–C supports redundancy of the IQ bus and selects either IQ Bus A or IQ Bus B under the control of the broadband controller (BBCC). The LTAC–C transmits data to both IQ busses.

The IQ interface contains the following busses:

- ▶ IQ_D bus: downstream ATM cells.
- ▶ IQ_U bus: upstream ATM cells.
- ▶ IQ_A bus: access control on the IQ_U bus.

(3) Remote Inventory Interface

The LTAC–C is fitted with a SEEPRO for Remote Inventory data. RI access from the subrack to the LTAC–C is via the rear connector on the LTAC–C.

(4) Hardware Management Wires Interface

The broadband controller (BBCC) communicates with the LTAC–C via Hardware Management Wires (HMW) on the MP backplane. these are connected to the LTAC–C via the rear connector.

The BBCC is able to set the following LTAC–C states via the HMW:

Disable State:	The LTAC–C isolates its transmitting drivers from the IQ bus forcing a high impedance condition. All other functionality may remain active.
Reset State:	The LTAC–C activates all hardware reset commands. Action from the HMW controller is required to exit this state.
Power–off State:	The LTAC–C shuts down its DC/DC converter. Power supply provided from the HMW is used by the power–off circuit to guarantee stability in this state.
Normal State:	The normal state of operation for the LTAC–C.

11.2.9 LTAC–C – Connector Pinouts – Front

There are no connectors on the front plate of the LTAC–C. All connections are made via rear connectors to the subrack backplane.

11.2.10 LTAC–C – Alarms

For full details of LTAC–C alarms and their consequences, refer to the Alcatel AWS Operator's Handbook.

11.3 LTAC–D – 3EC 43472 Axxx

The LTAC–D (Line Termination ADSL Card) is the 24 channel ADSL Line Card with a splitter daughterboard.

- ▶ The LTAC–D contains 24 independent ADSL Line Terminations (LT). Each of these LTs allows bidirectional access to an ADSL Network Termination (NT) over conventional twisted pair cable, already in use for POTS service.
- ▶ The LTAC–D connects via the IQ bus to a broadband controller card (BBCC) card such as the AANC, ASCC–S, AICC or BSEC. The BBCC card provides access to a transport network carrying ATM cells.
- ▶ The splitter daughterboard combines ADSL and POTS signals.

11.3.1 LTAC–D – Features and Functions

(1) LTAC–D Main Board

The LTAC–D main board:

- ▶ Extracts and inserts ATM cells from and to the IQ bus based on their VPI/VCI (Virtual Path Identifier/Virtual Channel Identifier) value.
- ▶ Uses a DMT (Discrete Multi Tone) approach to convert these cells to a bandpass signal that can be sent over a customer line. On the customer line the DMT modulated ATM cells are frequency multiplexed with the analogue POTS service.
- ▶ Is used in conjunction with a splitter daughterboard to combine the POTS and ADSL services on customer lines. The splitter provides a low pass filter which blocks ADSL signals from the customer line towards the POTS line circuit.
- ▶ Plugs used with LTAC–D are:
 - TSCP.
Interconnects the LTAC–D and an adjacent ATLCC POTS card. Provides external connections to the CCF.
Used in AU in AGH (AGHA or AGHB), AU in ACPA, and AU in TAH
 - PRCPB.
Two PRCPB per LTAC–D provide connections to the exchange MDF or CMUX CCF for C pairs and X pairs.
Used in NU (NUC or NUS in NURA), and NUS–AGH (in AGHB).
- ▶ Has an onboard DC/DC converter.

(2) Splitter Daughterboard

The splitter daughterboard provides the low pass filter part of a splitter/combiner arrangement for superimposing ADSL and POTS onto a single customer line. The LTAC–D provides the high pass filter in the combination.

The splitter is mounted on the LTAC–D main board via spacers, and interconnected via sockets and multi–pin headers.

External lines are connected to the splitter via the TSCP plug.

- ▶ The customer line carries the combined ADSL and POTS signal.
- ▶ The low pass filter in the splitter blocks the ADSL signal and passes the pure POTS signal to the POTS line termination equipment. This may be any of the following:
 - A CMUX POTS card.
 - An exchange POTS card or equivalent.
 - Other POTS line termination equipment.
- ▶ The splitter achieves this by:
 - Blocking the ADSL transmission and preventing it from reaching the POTS line card.
 - Blocking spurious emissions from the POTS equipment in the ADSL frequency band, preventing them from adversely affecting the ADSL signal.
 - Providing a high impedance termination in the ADSL frequency band for the POTS equipment.
- ▶ The high pass filter in the LTAC–D passes the ADSL signal. It removes low frequencies contained in the ADSL signal in the direction towards the line and removes POTS signals in the direction from the line.

Other features supported by the splitter are:

- ▶ Supports ring, DC feed and decadic dialling.
- ▶ Remote Inventory is provided via the LTAC–D.

Note *The low pass filter in the splitter is limited to the POTS passband. Accordingly:*

- *Metering pulses (12 kHz) are not supported.*
- *Securitel is not recommended on lines which also support ADSL as the splitter would degrade the Securitel signal.*

11.3.2 LTAC-D – Outline

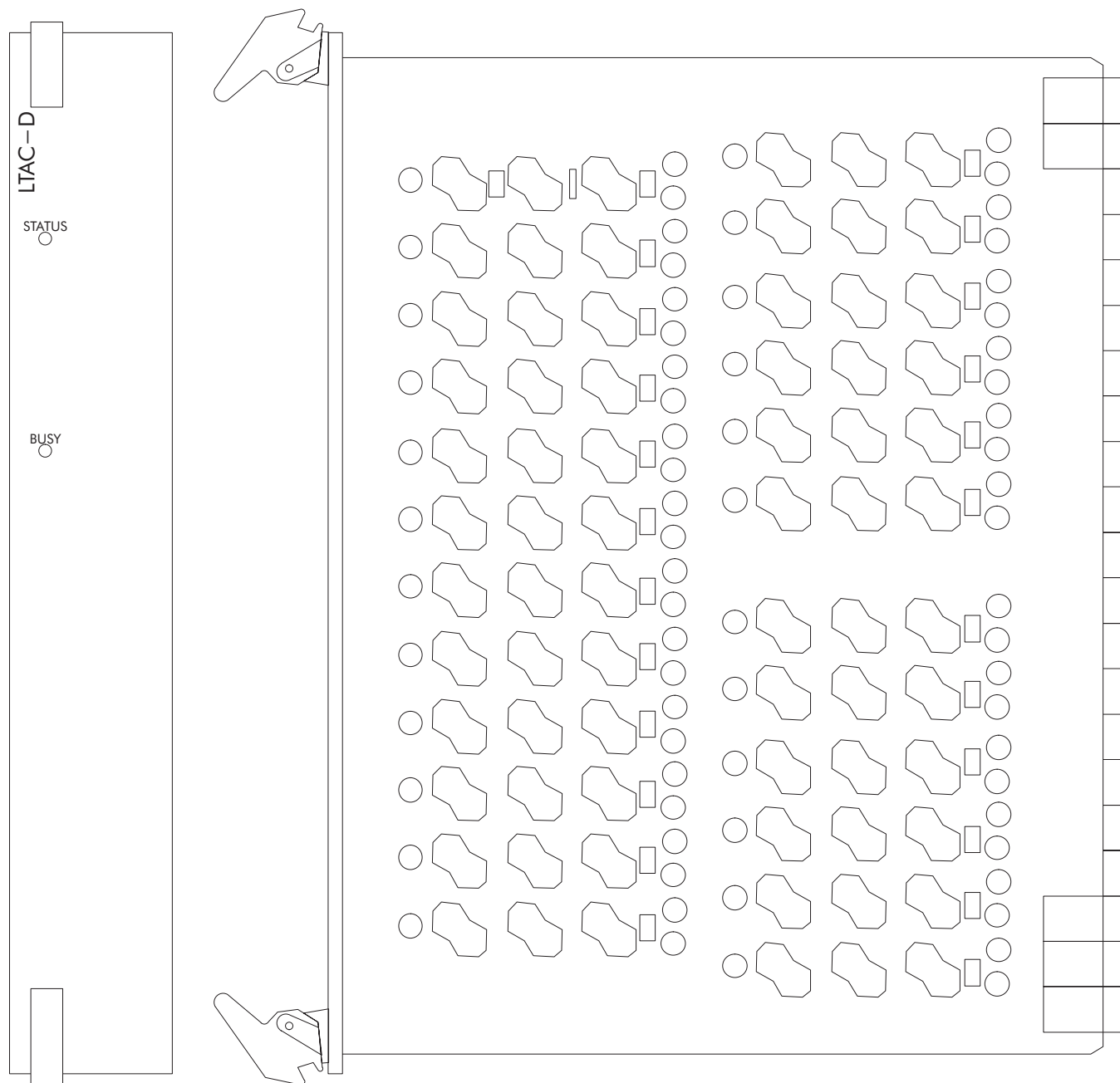


Figure 11–10 LTAC-D – Outline and Front Plate

11.3.3 LTAC-D Context Diagram

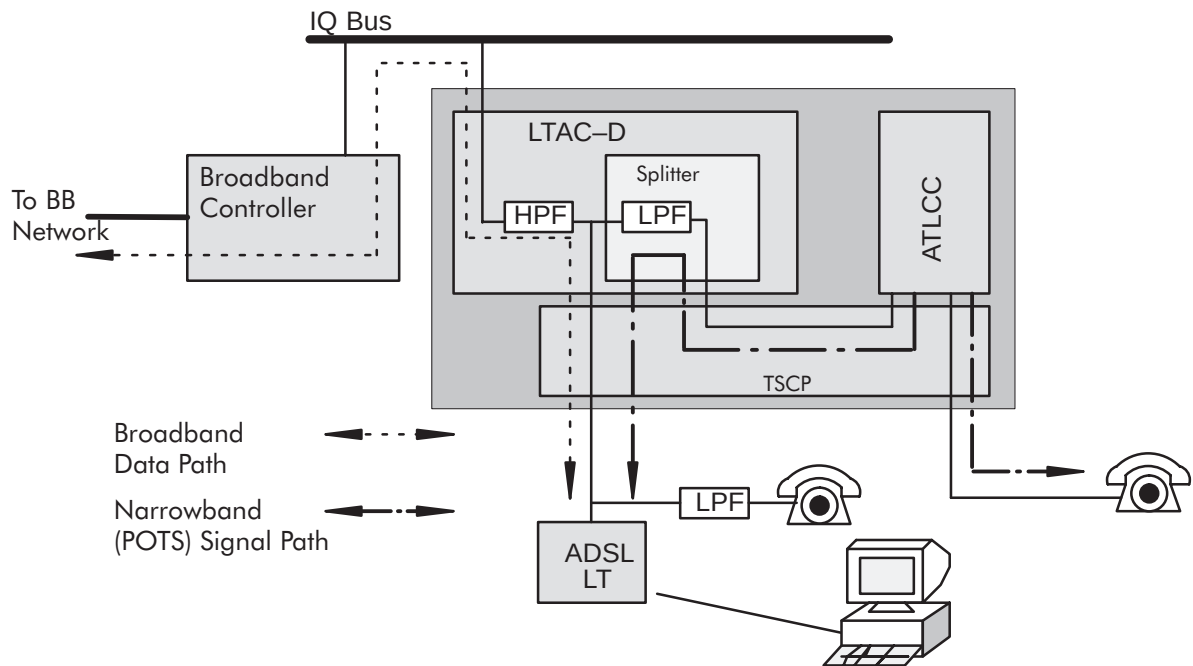


Figure 11-11 LTAC-D – Context Diagram – AU

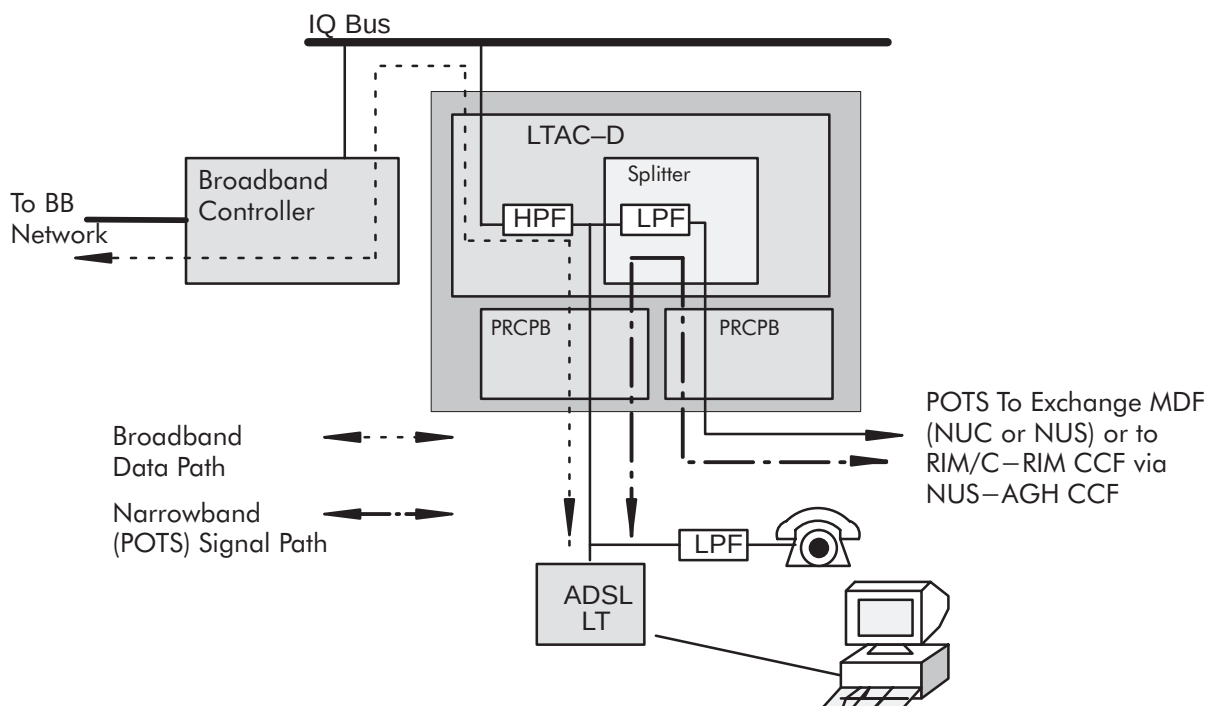


Figure 11-12 LTAC-D – Context Diagram – NU (NUC, NUS or NUS-AGH)

11.3.4 LTAC-D – Block Diagram

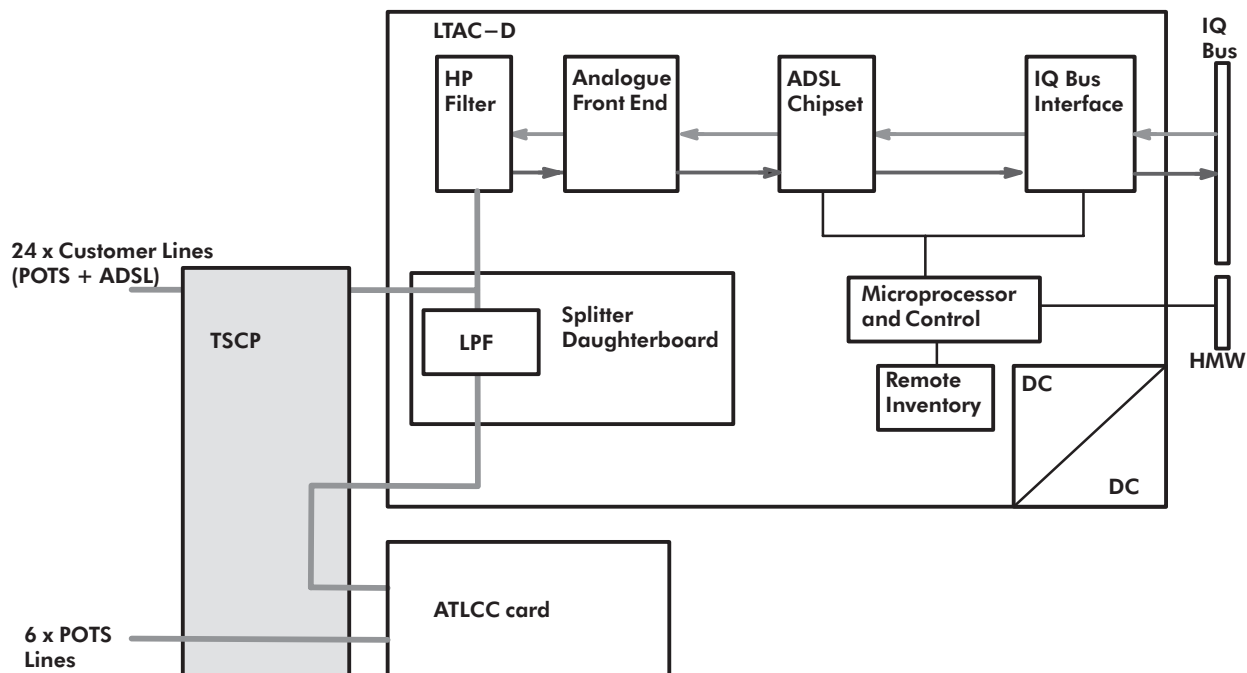


Figure 11-13 LTAC-D – Block Diagram – AU

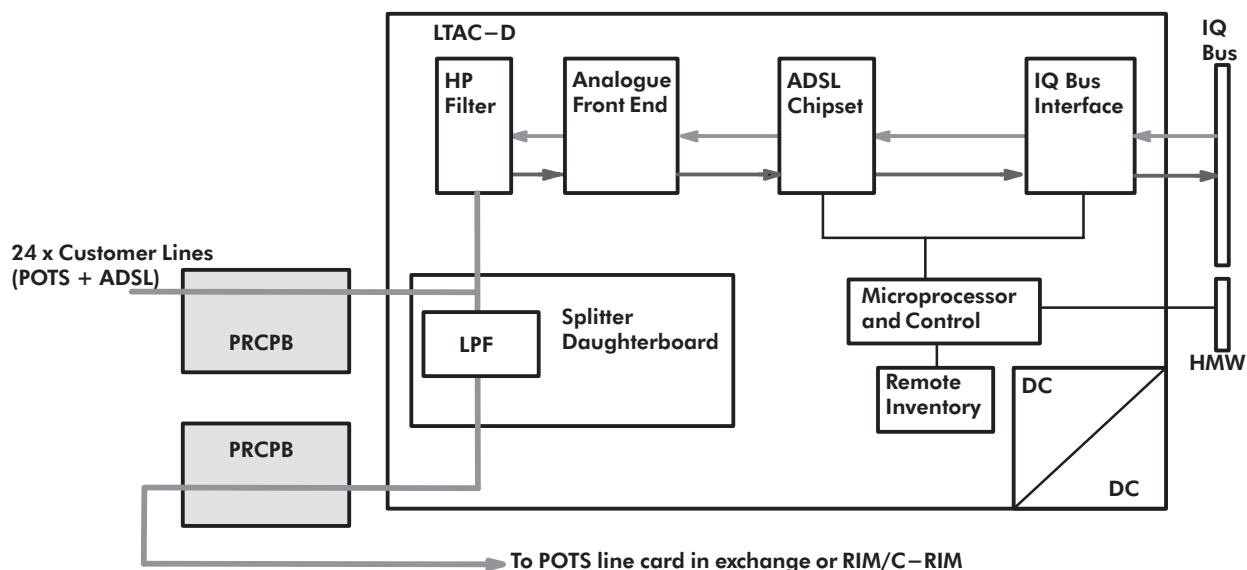


Figure 11-14 LTAC-D – Block Diagram – NU or NUS-AGH

11.3.5 LTAC–D – Consequences of Unplugging

ATTENTION

If a LTAC–D is removed from the subrack

If an LTAC–D is removed all services are lost.

11.3.6 LTAC–D – Switches, Links and Sockets

LTAC–D has no user–selectable switches, links or sockets.

11.3.7 LTAC–D – LED Description

The LTAC–D is fitted with three LEDs:

- ▶ The front plate of the LTAC–D is fitted with two LEDs:
- ▶ The SMD LED is fitted to the PBA as shown in Figure 11–5. It is located near the Onboard Controller (OBC) .

(1) LTAC–D – Front Plate LEDs

LED	Indication	Description
Green STATUS LED	ON	LTAC–D operating correctly
	OFF	LTAC–D disabled or has been powered down by BBCC
Yellow BUSY LED	FLASHING	LTAC–D is initialising

(2) LTAC–D – PBA LED

LED	Indication	Description
SMD LED	ON	Processor Initialisation Check has failed

11.3.8 LTAC–D – Interfaces Electrical

The LTAC–D has the following electrical interfaces. All connections to these interfaces are via the LTAC–D rear connectors to the subrack backplane, and then to the external connectors on the TSCP, PRCPB, or T9AP–B plugs.

Note *The LTAC–D cable pair assignments in NU, AU and MiniMUX applications are shown in the CMUX Housing Rack and Cabling Handbook. Refer to the LTAC–D – Cable Pair Assignments section of the Drawings and Cable Diagrams chapter.*

(1) Customer Line Interfaces

The customer line interface carries the ADSL service. This is combined with the POTS service by the splitter daughterboard. Connections to customer lines in CMUX are via the following plugs:

- ▶ CMUX AU: TSCP
- ▶ CMUX NU: PRCPB
- ▶ MiniMUX: T9AP–B.

The ADSL transceiver for each customer line is protected against over–voltage surges.

The specifications of the customer line interfaces are:

Item	Value
Nominal Impedance (ADSL Frequency Band)	100Ω
Frequency Band	32 kHz to 138 kHz (upstream) 138 kHz to 1.1 MHz (downstream)
Maximum Number of ADSL Carriers	23 (upstream) 218 (downstream)
Line Coding	DMT
Tone Spacing	4.3125 kHz
RMS Downstream Power	100 mW

(2) IQ Interface

The IQ interface connects the LTAC–D to the IQ bus on the MP backplane via a connector on the rear of the LTAC–D.

The LTAC–D supports redundancy of the IQ bus and selects either IQ Bus A or IQ Bus B under the control of the broadband controller (BBCC). The LTAC–D transmits data to both IQ busses.

The IQ interface contains the following busses:

- ▶ IQ_D bus: downstream ATM cells.
- ▶ IQ_U bus: upstream ATM cells.
- ▶ IQ_A bus: access control on the IQ_U bus.

(3) Remote Inventory Interface

The LTAC–D is fitted with a SEEPROM for Remote Inventory data. RI access from the subrack to the LTAC–D is via the rear connector on the LTAC–D.

(4) Hardware Management Wires Interface

The broadband controller (BBCC) communicates with the LTAC–D via Hardware Management Wires (HMW) on the MP backplane. these are connected to the LTAC–D via the rear connector.

The BBCC is able to set the following LTAC–D states via the HMW:

Disable State:	The LTAC–D isolates its transmitting drivers from the IQ bus forcing a high impedance condition. All other functionality may remain active.
Reset State:	The LTAC–D activates all hardware reset commands. Action from the HMW controller is required to exit this state.
Power–off State:	The LTAC–D shuts down its DC/DC converter. Power supply provided from the HMW is used by the power–off circuit to guarantee stability in this state.
Normal State:	The normal state of operation for the LTAC–D.

(5) POTS Line Interfaces

The LTAC–D splitter daughterboard has 24 POTS line interfaces.

- ▶ In CMUX the POTS interfaces are connected via TSCP or PRCPB plugs to POTS ports in the exchange or CMUX
- ▶ In MiniMUX the POTS interfaces are connected via T9AP–B plugs to POTS ports in the RIM or C–RIM.

Low pass filtering on the LTAC–D splitter daughterboard blocks all ADSL signal components from the POTS interface.

11.3.9 LTAC–D – Connector Pinouts – Front

There are no connectors on the front plate of the LTAC–D. All connections are made via rear connectors to the subrack backplane.

11.3.10 LTAC–D – Alarms

For full details of LTAC–D alarms and their consequences, refer to the Alcatel AWS Operator's Handbook.

11.4 NACC–A – 3EC 40138 AAxx

The Narrowband ADSL Combiner Card (NACC–A) is used in conjunction with a LTAC–A and TSPP–A to combine ADSL and POTS signals.

11.4.1 NACC–A – Features and Functions

The NACC–A provides the low pass filter part of a splitter/combiner arrangement for superimposing ADSL and POTS onto a single customer line. The LTAC–A provides the high pass filter in the combination. The TSPP–A contains the circuitry which interconnects the LTAC–As and the NACC–A, and connects them to the customer lines.

- ▶ The customer line carries the combined ADSL and POTS signal.
- ▶ The low pass filter in the NACC–A blocks the ADSL signal and passes the pure POTS signal to the POTS line termination equipment. This may be any of the following:
 - A CMUX POTS card.
 - An exchange POTS card or equivalent.
 - Other POTS line termination equipment.
- ▶ The NACC–A achieves this by:
 - Blocking the ADSL transmission and preventing it from reaching the POTS line card.
 - Blocking spurious emissions from the POTS equipment in the ADSL frequency band, preventing them from adversely affecting the ADSL signal.
 - Providing a high impedance termination in the ADSL frequency band for the POTS equipment.
- ▶ The high pass filter in the LTAC–A passes the ADSL signal. It removes low frequencies contained in the ADSL signal in the direction towards the line and removes POTS signals in the direction from the line.

- ▶ The TSPP–A combines the ADSL circuits from the LTAC–A with the POTS circuits from the POTS line cards, and connects them to the Customer line.

The TSPP–A is fitted with bypass relays which allow the NACC–A to be bypassed. ADSL services are not available if the NACC–A is bypassed.

The NACC–A is bypassed under the following circumstances:

- The NACC–A is removed from the subrack or powered down.
- A line test is being performed.
- The LTAC–A has been removed or powered down.

Other features supported by the NACC–A are:

- ▶ Supports ring, DC feed and decadic dialling.
- ▶ Remote Inventory is provided via the LTAC–A to the left of the NACC–A in the subrack.
- ▶ Onboard DC/DC converter.

Note *The low pass filter in the NACC–A is limited to the POTS passband. Accordingly:*

- *Metering pulses (12 kHz) are not supported.*
- *Securitel is not recommended on lines which also support ADSL as the NACC–A would degrade the Securitel signal.*

11.4.2 NACC-A – Outline

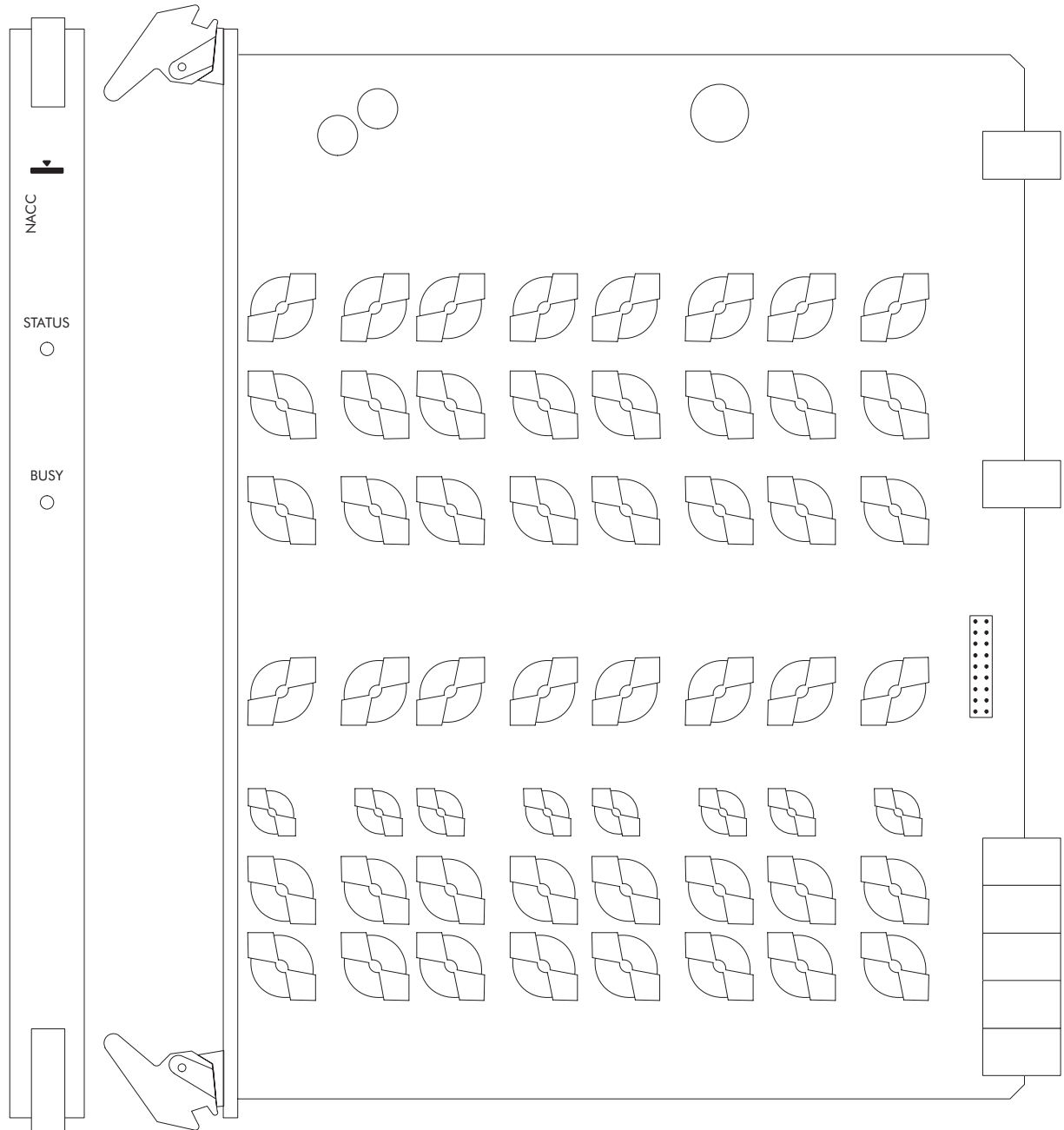


Figure 11–15 NACC-A – Outline

11.4.3 NACC-A – Block Diagram

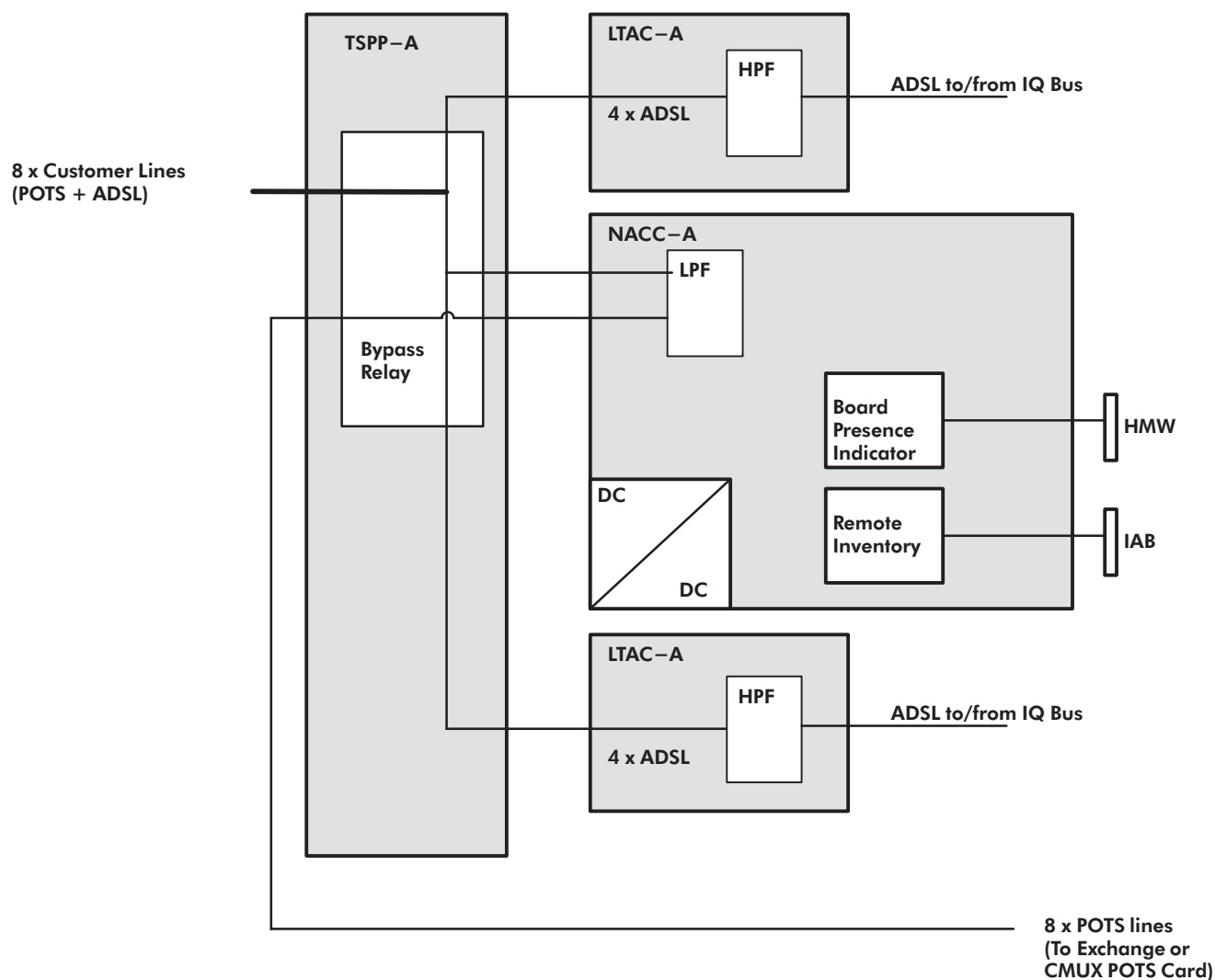


Figure 11-16 NACC-A – Block Diagram

11.4.4 NACC–A – Consequences of Unplugging

ATTENTION

If NACC–A is removed from the subrack

If a NACC–A is removed the bypass relays in the TSPP–A switch the customer lines directly to the POTS lines from the exchange or from a CMUX POTS line card. This has the following effects:

- 1) All eight ADSL services supported by the two LTAC–As associated with the NACC–A are lost.
- 2) POTS services are maintained by bypassing customer lines directly to the CMUX POTS cards or to the exchange POTS cards.

11.4.5 NACC–A – Switches, Links and Sockets

The NACC–A has no user–selectable switches, links or sockets.

11.4.6 NACC–A – LED Description

Two LEDs are fitted to the front plate of the NACC–A.

LED	Indication	Description
Green STATUS LED	ON	NACC–A card is operating correctly
	OFF	NACC–A has been powered down.
Yellow ACTIVITY LED	ON	At least one line is active

11.4.7 NACC–A – Interface – Electrical

The NACC–A has no connectors on the front plate. All interfaces are via the rear connector to the subrack backplane and then to the external connectors on the TSPP–A.

(1) POTS Line Interface

The POTS line interface is a two wire line that connects the NACC–A via the TSPP–A to the exchange. The POTS line is the result of low pass filtering on the customer line which removes all of the ADSL signal components from the line.

The NACC–A has provision for eight POTS line interfaces.

(2) Customer Line Interface

The Customer line interface is a two wire line interface that connects to the two wire line to the customer premises. This line carries both POTS and ADSL signals.

(3) Hardware Management Wire Interface

The Hardware Management Wire (HMW) interface on the NACC–A is only used to notify the broadband controller (BBCC) that the NACC–A is present. It does not utilise other available HMW functions such as board disabling or power down.

(4) Remote Inventory Access Interface

The NACC–A has no processor, and therefore has no means of reading its own remote inventory information.

In an ADSL triplet (1 x NACC–A, and 2 x LTAC–A) the leftmost LTAC–A reads the NACC–A remote inventory via the subrack backplane and the TSPP–A. The LTAC–A sends the NACC–A remote inventory data back to the broadband controller (BBCC) via the OA&M channel in the IQ bus.

11.4.8 NACC–A – Connector Pinouts – Front

There are no front connectors on the NACC–A.

11.4.9 NACC–A – Alarms

For full details of NACC–A alarms and their consequences, refer to the *Alcatel AWS Operator's Handbook*.

11.5 NACC–C – 3EC 40138 CAxx

The Narrowband ADSL Combiner Card (NACC–C) is used in conjunction with a LTAC–C and DSPP–B to combine ADSL and POTS signals.

11.5.1 NACC–C – Features and Functions

The NACC–C provides the low pass filter part of a splitter/combiner arrangement for superimposing ADSL and POTS onto a single customer line. The LTAC–C provides the high pass filter in the combination. The DSPP–B or DSAP contains the circuitry which interconnects the LTAC–Cs and the NACC–C, and connects them to the customer lines.

- ▶ The customer line carries the combined ADSL and POTS signal.
- ▶ The low pass filter in the NACC–C blocks the ADSL signal and passes the pure POTS signal to the POTS line termination equipment. This may be any of the following:
 - A CMUX POTS card.
 - An exchange POTS card or equivalent.
 - Other POTS line termination equipment.
- ▶ The NACC–C achieves this by:
 - Blocking the ADSL transmission and preventing it from reaching the POTS line card.
 - Blocking spurious emissions from the POTS equipment in the ADSL frequency band, preventing them from adversely affecting the ADSL signal.
 - Providing a high impedance termination in the ADSL frequency band for the POTS equipment.
- ▶ The high pass filter in the LTAC–C passes the ADSL signal. It removes low frequencies contained in the ADSL signal in the direction towards the line and removes POTS signals in the direction from the line.

- ▶ The DSPP-B or DSAP combines the ADSL circuits from the LTAC-C with the POTS circuits from the POTS line cards, and connects them to the Customer line.

The DSPP-B is fitted with bypass relays which allow the NACC-C to be bypassed. ADSL services are not available if the NACC-C is bypassed.

The NACC-C is bypassed under the following circumstances:

- The NACC-C is removed from the subrack or powered down.
- The LTAC-C has been removed or powered down.

The DSAP is not fitted with bypass relays.

Other features supported by the NACC-C are:

- ▶ Supports ring, DC feed and decadic dialling.
- ▶ Remote Inventory is provided via the LTAC-C to the left of the NACC-C in the subrack.
- ▶ Onboard linear DC converter.

Note *The low pass filter in the NACC-C is limited to the POTS passband. Accordingly:*

- *Metering pulses (12 kHz) are not supported.*
- *Securitel is not recommended on lines which also support ADSL as the NACC-C would degrade the Securitel signal.*

11.5.2 NACC-C – Outline

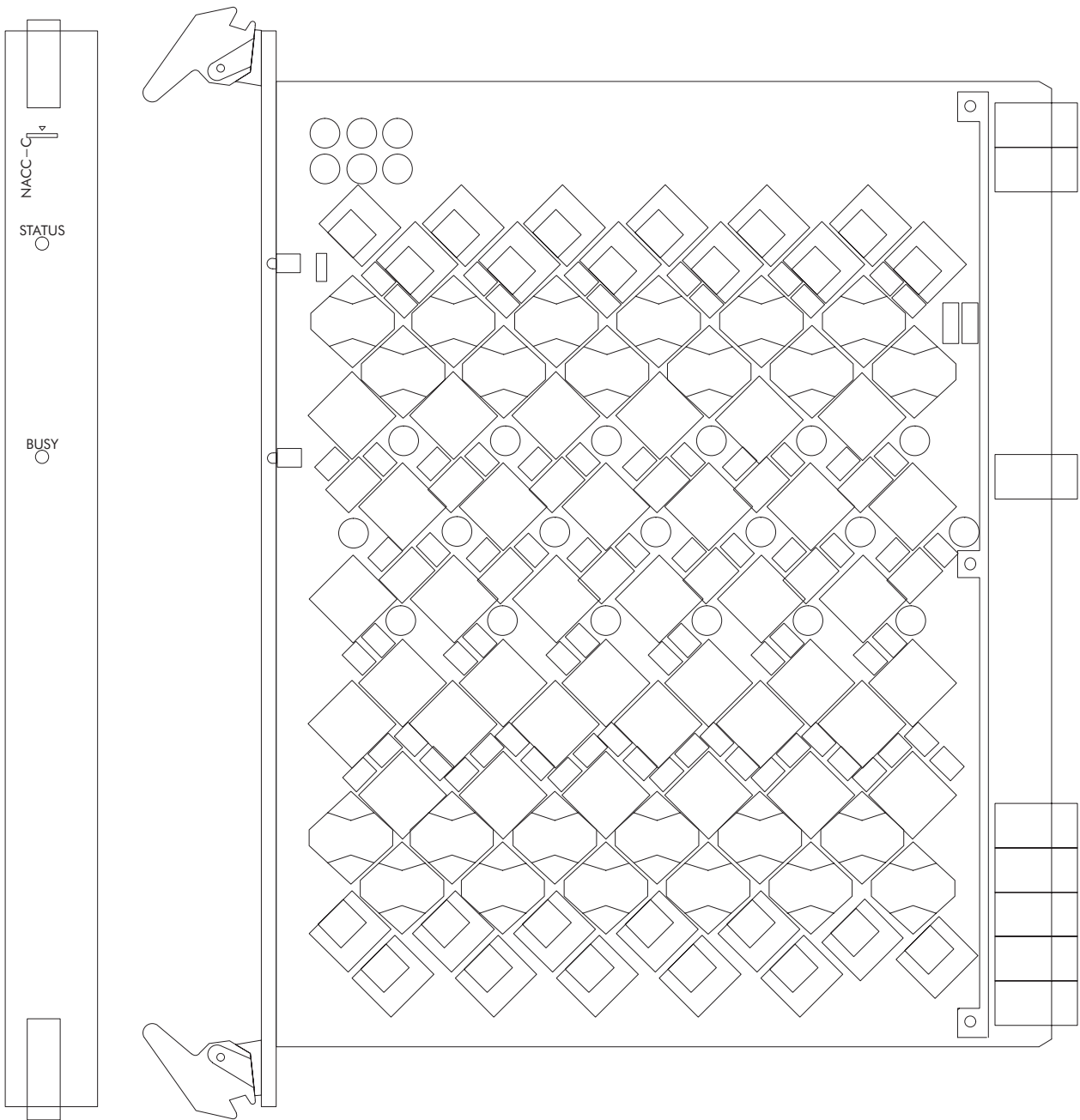


Figure 11–17 NACC-C– Outline and Front Plate

11.5.3 NACC-C – Block Diagram

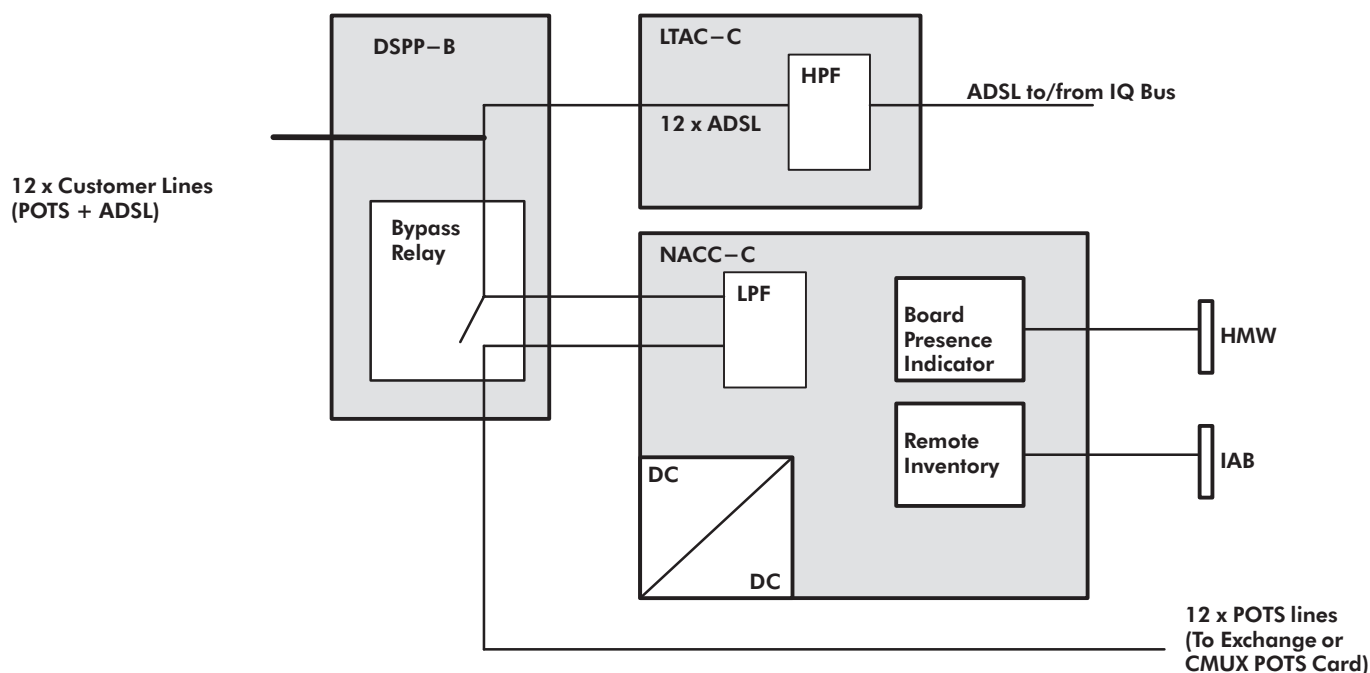


Figure 11–18 NACC-C – Block Diagram with DSPP-B

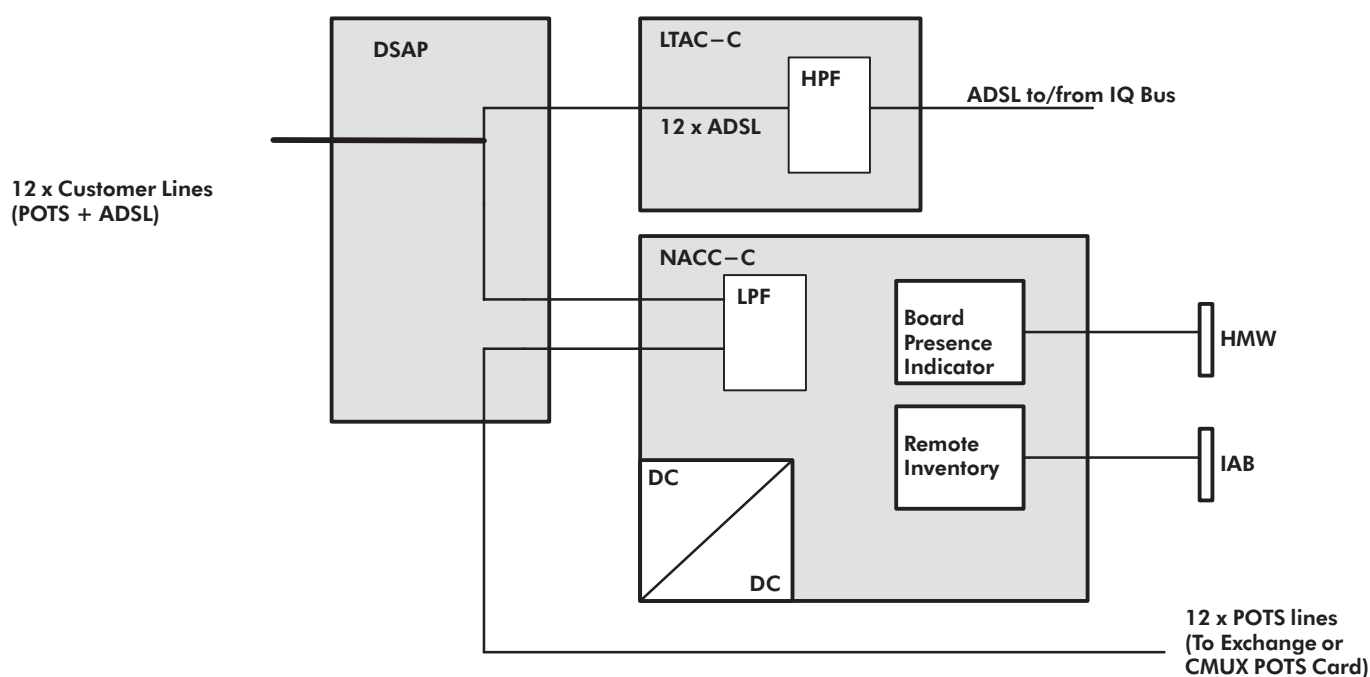


Figure 11–19 NACC-C – Block Diagram with DSAP

11.5.4 NACC–C – Consequences of Unplugging

ATTENTION

If a NACC–C is removed from the subrack (Twin with DSPP–B)

If a NACC–C is removed the bypass relays in the DSPP–B switch the customer lines directly to the POTS lines from the exchange or from a CMUX POTS line card. This has the following effects:

- 1) All twelve ADSL services supported by the LTAC–C associated with the NACC–C are lost.
- 2) If a DSPP is installed, POTS services are maintained by bypassing customer lines directly to the CMUX POTS cards or to the exchange POTS cards. If a DSAP is installed, POTS services are lost.

ATTENTION

If a NACC–C is removed from the subrack (Twin with DSAP)

If a NACC–C is removed all POTS services are lost.

11.5.5 NACC–C – Switches, Links and Sockets

The NACC–C has no user–selectable switches, links or sockets.

11.5.6 NACC–C – LED Description

Two LEDs are fitted to the front plate of the NACC–C.

LED	Indication	Description
Green STATUS LED	ON	NACC–C card is operating correctly
	OFF	NACC–C has been powered down.
Yellow ACTIVITY LED	ON	Always on

11.5.7 NACC–C – Interfaces Electrical

The NACC–C has no connectors on the front plate. All interfaces are via the rear connector to the subrack backplane and then to the external connectors on the DSPP–B or DSAP.

(1) POTS Line Interface

The POTS line interface is a two wire line that connects the NACC–C via the DSPP–B or DSAP to the exchange. The POTS line is the result of low pass filtering on the customer line which removes all of the ADSL signal components from the line.

The NACC–C has provision for twelve POTS line interfaces.

(2) Customer Line Interface

The Customer line interface is a two wire line interface that connects to the two wire line to the customer premises. This line carries both POTS and ADSL signals.

(3) Hardware Management Wire Interface

The Hardware Management Wire (HMW) interface on the NACC–C is only used to notify the broadband controller (BBCC) that the NACC–C is present. It does not utilise other available HMW functions such as board disabling or power down.

(4) Remote Inventory Access Interface

The NACC–C has no processor, and therefore has no means of reading its own remote inventory information.

In an ADSL twin (1 x NACC–C, and 1 x LTAC–C) the LTAC–C reads the NACC–C remote inventory via the subrack backplane and the DSPP–B or DSAP. The LTAC–C sends the NACC–C remote inventory data back to the broadband controller (BBCC) via the OA&M channel in the IQ bus.

11.5.8 NACC–C – Connector Pinouts – Front

There are no front connectors on the NACC–C.

11.5.9 NACC–C – Alarms

For full details of NACC–C alarms and their consequences, refer to the Alcatel AWS Operator's Handbook.

11.6 PAIC – 3EC 40263 AAxx

The PAIC (Primary rate ATM Interface Card) is an inverse multiplexer. It is installed at the CMUX NU to provide line termination for up to four 2 Mbit/s IMA links. These links connect the PAIC at the NUC to an AICC at an AU or subtended NUS.

11.6.1 PAIC – Features and Functions

The PAIC:

- ▶ Interfaces to the IQ bus.
- ▶ Inversely multiplexes the ATM cell stream from the IQ bus onto the four 2 Mbit/s IMA links.
- ▶ Provides line isolation and overvoltage protection for the 2 Mbit/s links.
- ▶ Has an on-board DC/DC converter. This DC/DC converter converts the nominal –48V of the backplane supply rail into 5V and 3.3V on-board rails.

11.6.2 PAIC – Outline

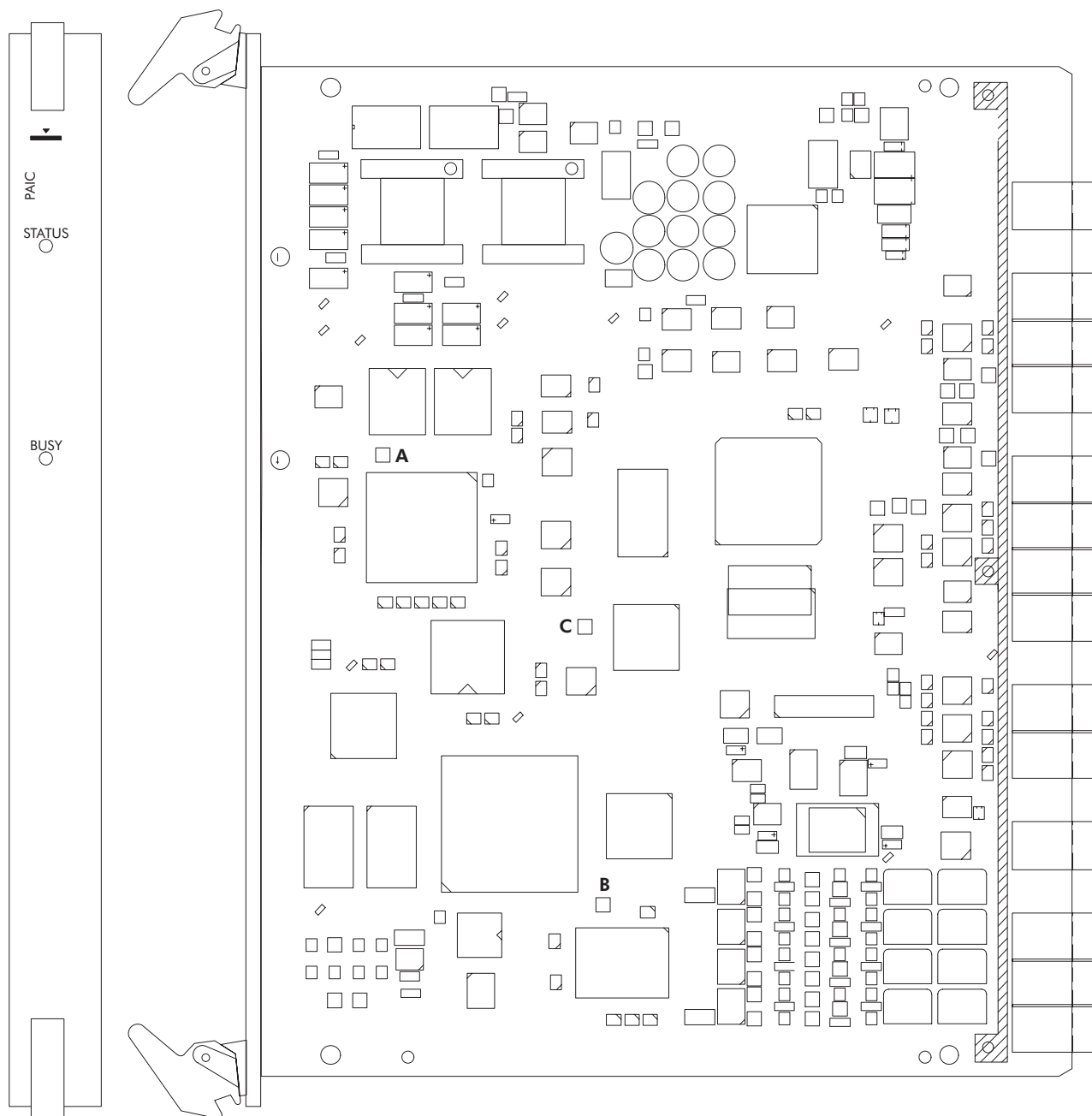


Figure 11–20 PAIC – Outline and Front Plate

11.6.3 PAIC – Block Diagram

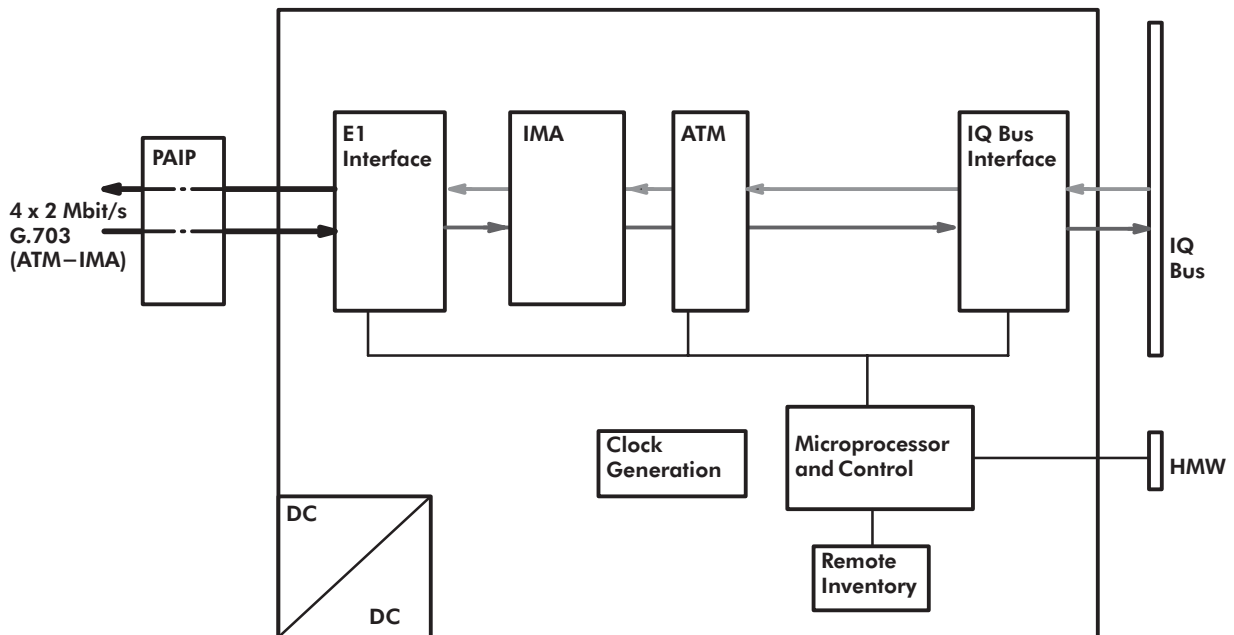


Figure 11–21 PAIC – Block Diagram

11.6.4 PAIC – Consequences of Unplugging

ATTENTION

If PAIC is removed from the subrack

If a PAIC is removed the effect is that all services carried by the PAIC are lost.

These are all broadband services at an AU or Subtended NU which are transported from the Central NU via an IMA link between the PAIC at the Central NU and its matching AICC at the AU or Subtending NU.

11.6.5 PAIC – Switches, Links and Sockets

There are no user-selectable switches, links or sockets on the PAIC.

11.6.6 PAIC – LED Description

Two LEDs are fitted to the front plate of the PAIC.

LED	Indication	Description
Green STATUS LED	ON	PAIC card is operating correctly
	OFF	PAIC has been powered down or disabled.
Yellow BUSY LED	FLASH	PAIC is initialising.

Three red LEDs are surface mounted on the PAIC's PBA. Their locations are shown in Figure 11–20.

LED	Indication	Description
Red LED near OBC. At "A" in Fig 11–20.	OFF	OBC has successfully initialised
Red LED near XILIN FPGA. At "B" in Figure 11–20.	OFF	Download to XILIN FPGA successful
Red "C" LED near ALTERA PLD. At "C" in Figure 11–20.	OFF	PLL is locked to IQ bus clock.

Note Surface Mounted LEDs are shown in Figure 11–20

11.6.7 PAIC – Interface – External

The external interfaces of the PAIC are:

- ▶ E1 Line Interface.
- ▶ IQ Interface.
- ▶ Remote Inventory.
- ▶ Hardware Management Wires (HMW) Interface.

(1) E1 Line Interface (IMA Interfaces)

The PAIC provides four E1 line interfaces via the PAIP.

The PAIC line interface transmit clock is derived from IQ bus clock, and is traceable to network clock. If the network clock is not available, the PAIC 2048 KHz $\pm$ 50 ppm clock is derived from the free running on-board VCXO.

Frequency

2.048 Mbit/s $\pm$ 50ppm.

Line Coding

HDB3 in accordance with ITU-T G.703.

Over-voltage Protection

The PAIC has line isolation and over-voltage protection.

(2) IQ Interface

The IQ interface connects the PAIC to the subrack backplane. It consists of the following busses:

- ▶ IQ_D bus for downstream cells transfer.
- ▶ IQ_U bus for upstream cells transfer.
- ▶ IQ_A for access control of the IQ_U bus.

The PAIC supports redundancy for the IQ Bus.

- ▶ It receives data from either the A or the B IQ bus on the subrack backplane. The IQ bus used is determined by the active broadband controller card.
- ▶ The PAIC transmits data to both IQ busses (A and B).

The IQ clock is transmitted across the subrack backplane by the Broadband Controller Card.

(3) Remote Inventory Interface

The Broadband Controller Card (BBCC) accesses Remote Inventory (RI) information on the PAIC via the IQ bus.

(4) Hardware Management Wires Interface

The PAIC has an interface to the Hardware Management Wires (HMW) in the subrack backplane.

The BBCC (AANC, ASCC–S, AICC or BSEC) controls the HMW. The BBCC can place the PAIC into the following states using the HMW:

Disable State:	The PAIC isolates its drivers from the IQ bus by putting them into high impedance state. All other functions may remain active.
Reset State:	The PAIC hardware and software are in reset state.
Power–off State:	The PAIC DC/DC converter is shut down. Power–off circuitry uses power supply provided by the HMW.
Normal State:	The PAIC card is in its operational state.

11.6.8 PAIC – Connector Pinouts – Front

There are no connectors on the front plate of the PAIC.

- ▶ All external connections are made to connectors on the PAIP.
- ▶ The PAIC is connected to the PAIP via the subrack backplane.

11.6.9 PAIC – Alarms

For full details of PAIC alarms and their consequences, refer to the Alcatel AWS Operator's Handbook.

12 Auxiliary Cards

12.1 DURCC – 3DY 00064 AAxx

The DURCC (DUal Ring Card) is the Dual Ring Generator card for CMUX. It provides ring signal for analogue lines.

- ▶ The ring generator supplies a continuous sine wave. Ring pulses are created by switching the ring relay on each analogue line circuit by the line controller.
- ▶ The DURCC offers self–redundancy via two separate DC supplies and two separate ring generators on the one card. Only one ring generator on the DURCC Card drives all line cards.
 - If a ring generator fails, the DURCC raises an alarm and forwards it to the TARCB. Switchover to the second ringing generator is automatically initiated.
 - If there is an overload condition or a short circuit in the ring bus, an alarm is raised and forwarded to the TARCB. No switchover is initiated.
- ▶ The DURCC is installed in the line card area of a subrack. The DURCC is 40 mm wide, taking two line card slots. It is normally located in slots 19 and 20 in the MLS–hb or slots 21 and 22 of MLS–hbe (future CMUX release).

12.1.1 DURCC – Features and Functions

The DURCC has the following features and functions:

- ▶ Generates sine wave ring signal.
- ▶ Self redundancy:
 - Two ring generators on each DURCC with ringer selector.
 - Two separate onboard DC/DC converters.
- ▶ Alarm generation (towards the Alarm Card).
- ▶ Remote Inventory (RI) accessible by external reader.
- ▶ Status LEDs on front plate.
- ▶ Daisy–chains alarms via relays from other DURCC cards.

When the circuit is closed (normal condition) the alarm output of a DURCC is connected to the alarm input of the next DURCC in the chain. Alarms open the circuit.

12.1.2 DURCC – Provisioning



Multiple DURCC MUST NOT be connected in parallel.

Multiple DURCC may be required in a NE, however they must not be connected in parallel as they cannot load share and equipment damage may occur.

In the subrack backplane the basic ring bus consists of two wires carrying the ring signal to the line card slots.

Where the number of lines in a system exceeds the rating of a single DURCC, two or more DURCC may be installed. The output of the DURCC cards **MUST NOT** be connected in parallel.

Note *The Configuration Tool is used to determine the rack/subrack/slot positions for DURCC(s) in a NU or AU.*

(1) NU Rack

The NU Rack may have up to four subracks which are equipped with ATLCC cards for POTS services.

- ▶ A DURCC is required in each subrack supporting POTS services.
- ▶ A ring extension cable **MUST NOT** be installed between any two subracks where each of the two subracks contains a DURCC.
- ▶ A DURC status cable is required.

(2) ACPA (Customer Premises Rack)

The ACPA may be equipped with up to two subracks which are equipped with ATLCC cards for POTS services.

- ▶ A DURCC is required in each subrack supporting POTS services.
- ▶ A ring extension cable **MUST NOT** be installed between any two subracks where each of the subracks contains a DURCC.
- ▶ A DURC status cable is required.

(3) AGH (Above Ground Housing)

The AGH (AGHA or AGHB) is equipped with two subracks.

- ▶ The main subrack supports broadband and special services cards. It may also contain a small number of ATLCC cards for POTS services associated with ADSL twins in the same subrack.
- ▶ The extension subrack primarily contains ATLCC cards for POTS services. It may also contain cards for other narrowband or broadband services.
- ▶ The extension subrack in the AGH is equipped with a DURCC.
- ▶ The main subrack in the AGH is not equipped with a DURCC.
- ▶ If the main subrack is equipped with ATLCC cards for POTS services, a ring extension cable is connected between the extension subrack and the main subrack.
- ▶ A DURC status cable is required between the extension subrack and the main subrack.

(4) AU in TAH (Telstra Access Housing)

An AU in a TAH is equipped with one or two subracks in a NU Rack.

- ▶ The main subrack supports broadband, narrowband and special services cards.
- ▶ The extension subrack supports broadband, narrowband and special services cards.
- ▶ One DURCC card is installed. This limits the number of installed POTS services to 480.
- ▶ A ring extension cable is connected between the extension subrack and the main subrack.
- ▶ A DURC status cable is required between the extension subrack and the main subrack.

12.1.3 DURCC – Outline

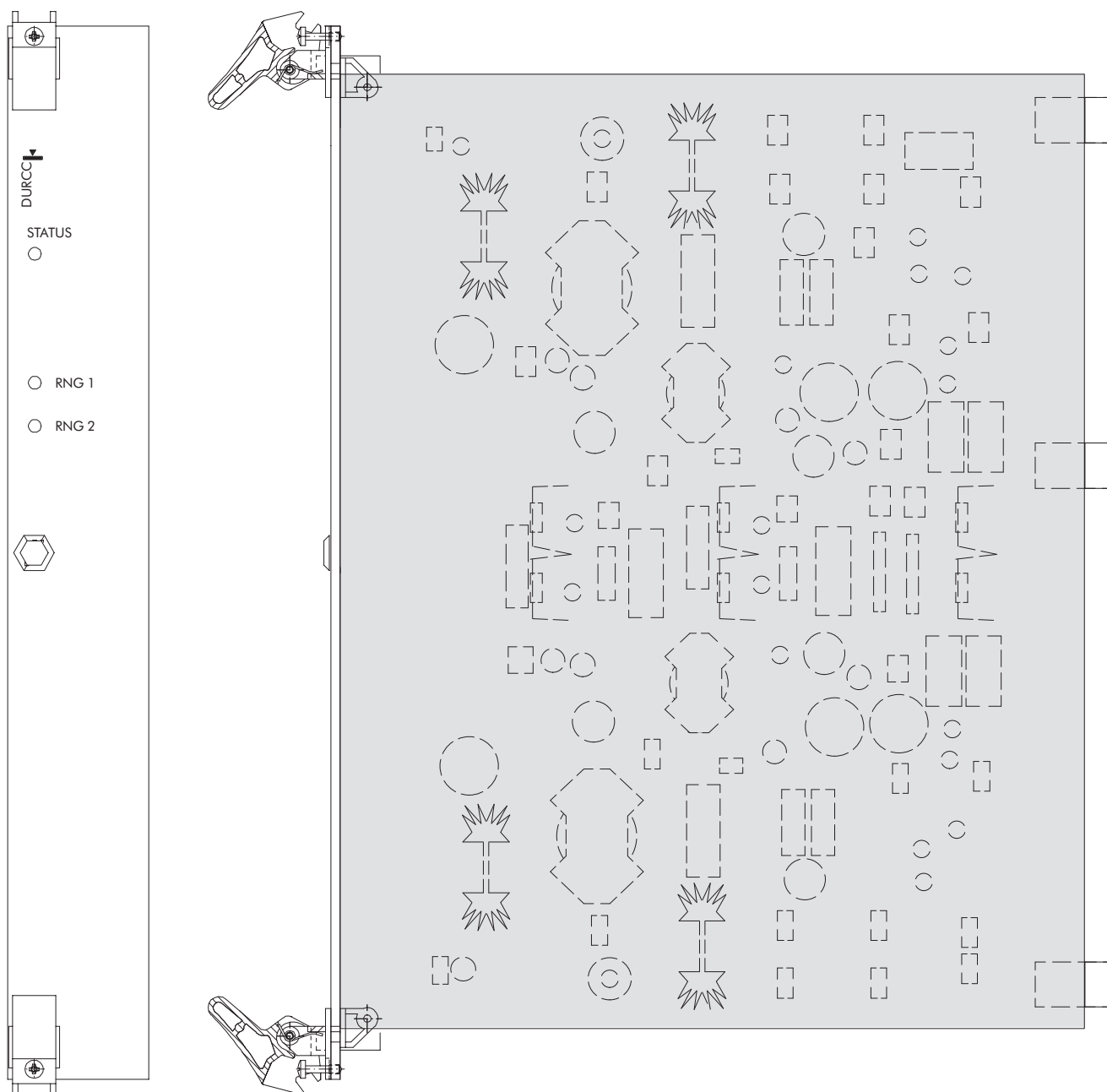


Figure 12-1 DURCC – Outline and Front Plate

Note Components on PBA are behind cover plate.

12.1.4 DURCC – Block Diagram

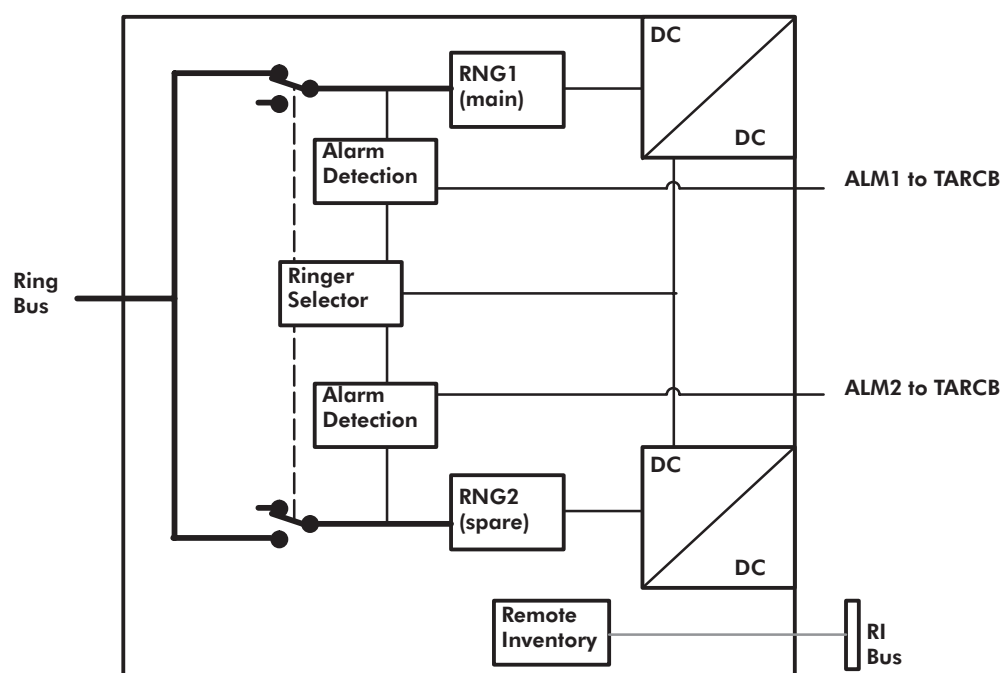


Figure 12–2 DURCC – Block Diagram

12.1.5 DURCC – Consequences of Unplugging

ATTENTION

If DURCC Card is removed from the subrack

If a DURCC card is removed the effects are loss of ring signal to line cards.

12.1.6 DURCC – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the DURCC.

12.1.7 DURCC – LED Description

There are three LEDs on the front plate of the DURCC. Functions of these LEDs are:

LED	Indication	Description
Green STATUS LED	ON	DURCC operating normally
	OFF	DURCC failed
Yellow RNG1 LED	ON	Ringer 1 in use
	OFF	Ringer 1 not in use
Yellow RNG2 LED	ON	Ringer 2 in use
	OFF	Ringer 2 not in use

12.1.8 DURCC – Interface – Electrical

There are no external electrical interfaces on the DURCC. All interfaces are via the subrack backplane to other cards in the CMUX system.

Characteristic	Value
Ring signal frequency	25 Hz $\pm$ 5%
Output voltage	90 V _{rms} $\pm$ 5%
Max load	30 VA
DC Level Bias	45V $\pm$ 5%

Ringer reach (maximum distance at which a ring voltage of 50V across a 3 REN load can be achieved) is 7km of 0.4 mm cable. This corresponds to a line resistance of 1900 Ω

The DURCC can be used to provide ring for up to 480 customer lines with the following assumptions:

- ▶ Average line load of 3 REN.
- ▶ Average traffic of 0.2E.
- ▶ Call duration of 180 seconds.
- ▶ Average ring duration of 20 seconds.

12.1.9 DURCC – Connector Pinouts – Front

There are no front connectors on the DURCC.

All connections are via rear connectors on the DURCC which mate with connectors on the subrack backplane to provide the connection to the DC supply and ring bus. Interconnections are via the DURP plug.

12.1.10 DURCC – Alarms

For full details of DURCC alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

12.2 TACCB – 3EC 40034 ABxx

The Test Access Control Card (TACCB) is a component in the CMUX line testing system shared by part or all the system.

The TACCB card provides detection and diagnosis of faults on subscriber lines, subscriber equipment and line circuits of the subracks. It communicates with the line cards via the test bus on the subrack backplane.

The TACCB may be installed in any subrack in an NU or AU, and in any line card slot within that subrack. However it will usually be installed in Slot 21 in the first subrack in the NU or AU.

12.2.1 TACCB – Features and Functions

Features and functions of the TACCB are:

- ▶ Electrical tests.
 - Foreign DC voltage test.
 - Foreign AC voltage test.
 - Resistance test.
 - Capacitance test.
- ▶ Repeated electrical tests.
 - Continuous tests – all the electrical tests.
 - Block reading tests – all the electrical tests.
- ▶ Combination tests.
 - Package tests.
 - Resistance/capacitance tests.
- ▶ Voice access tests.
 - Loop resistance test.
 - Dialed digit test.
- ▶ Revertive call tests.
 - Revertive call test.
 - Monitor busy line test.
 - Ring and speak to customer.
 - Adaptive hybrid balancing (AHB)
- ▶ Dial tone test.

- ▶ Test to line circuit.
 - Test to line circuit – ATLCC.
 - Test to line circuit – BALCF.
- ▶ ISDN Tests.
 - ISDN Loopback.
 - NT1 reset.
 - Line activation/deactivation
- ▶ HLTCA specific tests.
- ▶ Miscellaneous tests.
 - Battery test.
 - Cable pair ID tone.
- ▶ Onboard controller (OBC).
- ▶ Onboard DC/DC converter.

Note *The Alcatel CMEM Operators Handbook describes the tests available for each type of CMUX line card.*

12.2.2 TACCB – Outline

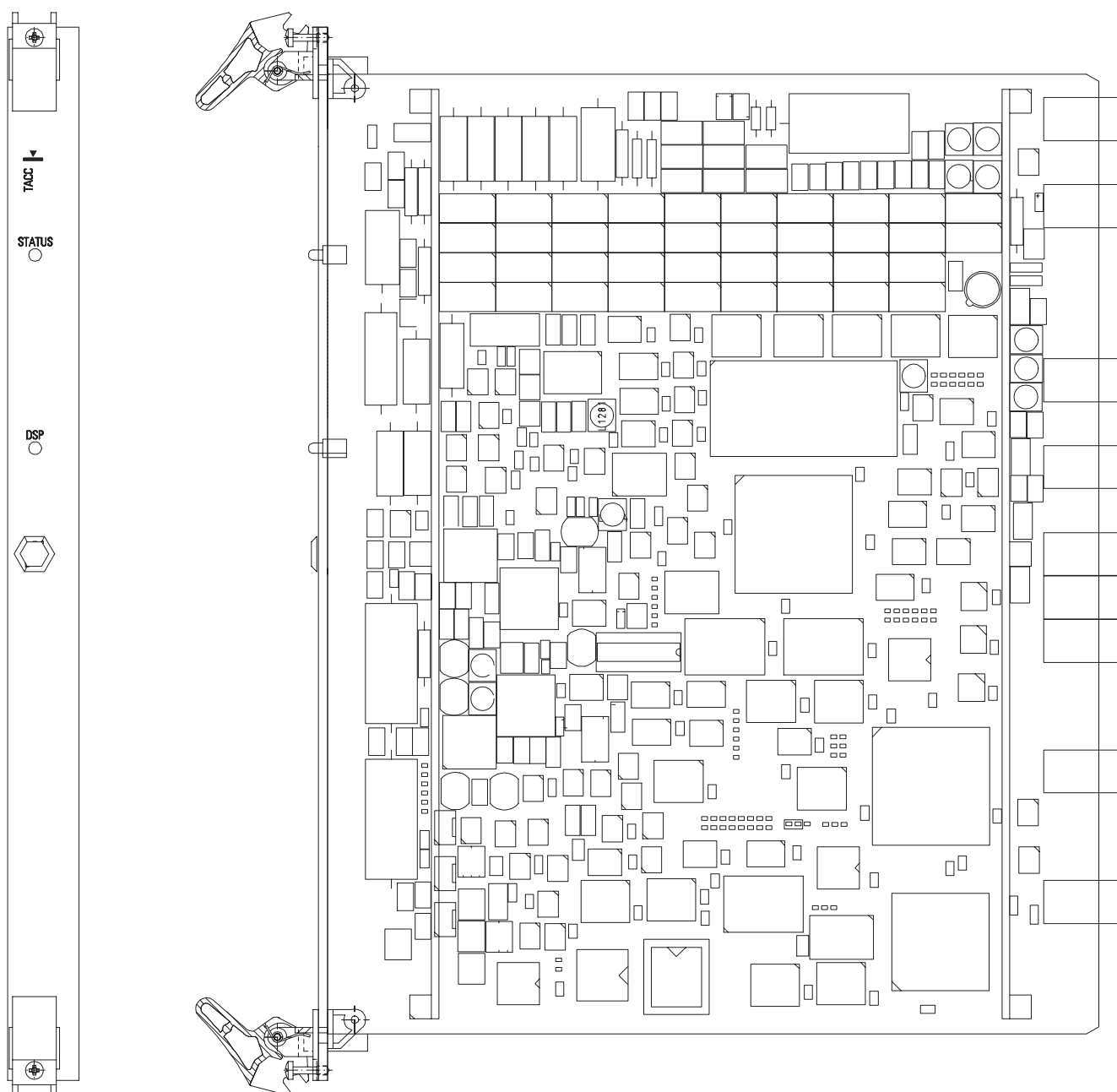


Figure 12–3 TACCB – Outline and Front Plate

12.2.3 TACCB – Block Diagram

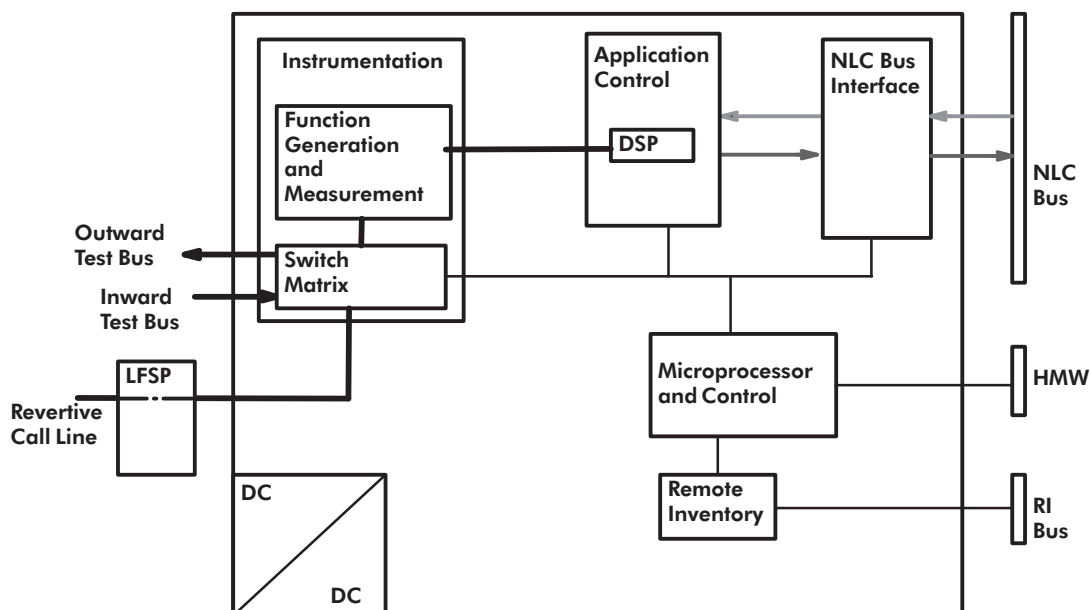


Figure 12–4 TACCB – Block Diagram

12.2.4 TACCB – Consequences of Unplugging

ATTENTION

If TACCB Card is removed from the subrack

If a TACCB card is removed the effect is that line tests cannot be performed.

12.2.5 TACCB – Switches, Links and Sockets

There are no user-accessible switches, links or sockets on the TACCB.

12.2.6 TACCB – LED Description

There is one green Status LED and one yellow DSP LED on the front plate of the TACCB.

LED	Indication	Description
Green STATUS LED	OFF	TACCB is powered down or has a hardware problem
	Fast Flash (0.5s On, 0.5s Off)	Downloading phase
	Medium Flash (2s On, 2s Off)	In operation with/without established communications (Awaiting download)
	Periodic Blink (Blink On/Off every 60s)	VA Alignment (Normal)
Yellow DSP LED	ON	TACCB active – line test in progress
	OFF	TACCB inactive – no line test in progress.

12.2.7 TACCB – Interface – Electrical

There is no external interface on the TACCB. The internal interface is to line cards via the test bus on the subrack backplane.

A revertive call cable must be installed from the subrack to the MDF. This cable is shown in the JCZZA series drawing for the relevant rack or housing. JCZZA drawings are located in the *Drawings and Cabling Diagrams* chapter of the *CMUX Housing, Rack and Cabling Handbook*.

12.2.8 TACCB – Connector Pinouts – Front

There are no front connectors on the TACCB. All connections are via rear connectors which mate with connectors on the subrack backplane.

Revertive call cables are terminated on a LFSPB and the revertive call channel is then carried via the subrack backplane to the DURCC.

12.2.9 TACCB – Alarms

For full details of TACCB alarms and their consequences, refer to the *Alcatel CMEM Operator's Handbook*.

12.3 TARCB – 3EC 40122 AAxx

The TARCB (Test Alarm and Remote inventory Card) has two main categories of functions:

- ▶ Collect and forward alarms from internal or external equipment, including the CMUX Housings.

Urgent (U), Non–Urgent (NU) and Attended (ARA) system alarms are indicated via LEDs on the front of the TARCB. These are also provided as alarm outputs to drive rack alarms, and can be physically accessed via the TARP

Alarm outputs are E–leads, which extend an earth condition during non–alarms conditions. When alarms are active, the earth condition is removed.

The TARCB provides for up to eight external alarm inputs, accessed via the TARP.

The TARP is located below the TARCB in the front access section of the subrack.

- ▶ Provides an external narrowband CRAFT Terminal interface.
- ▶ Supports line card testing.

The TARCB is located in slot 22 of the subrack in the first position in a rack or housing. Slot 22 is the rightmost slot in a MLS–hb. Only one TARCB is required in a CMUX network element (NE).

12.3.1 TARCB – Features and Functions

Features and functions of the TARCB are:

- ▶ Provides an interface for a narrowband CRAFT Terminal.
- ▶ Collects alarms from:
 - Power supply equipment.
 - Housings.
 - Racks.
 - Fans.
 - Batteries.
 - Ring generator alarms from up to four DURCC cards.
 - Absence alarms for MBTPB, NEHPG, AUXPA, AUXPB and POWP plugs.
 - External alarms.
- ▶ External alarm outputs.
- ▶ Collects remote inventory information from the MBTPB, NEHPG, AUXPA, AUXPB and POWP plugs.
- ▶ Provides a communication interface with the broadband controller card (future release).
- ▶ Provides dry contacts for the test bus connection.
- ▶ On board DC/DC converter.

12.3.2 TARCB – Outline

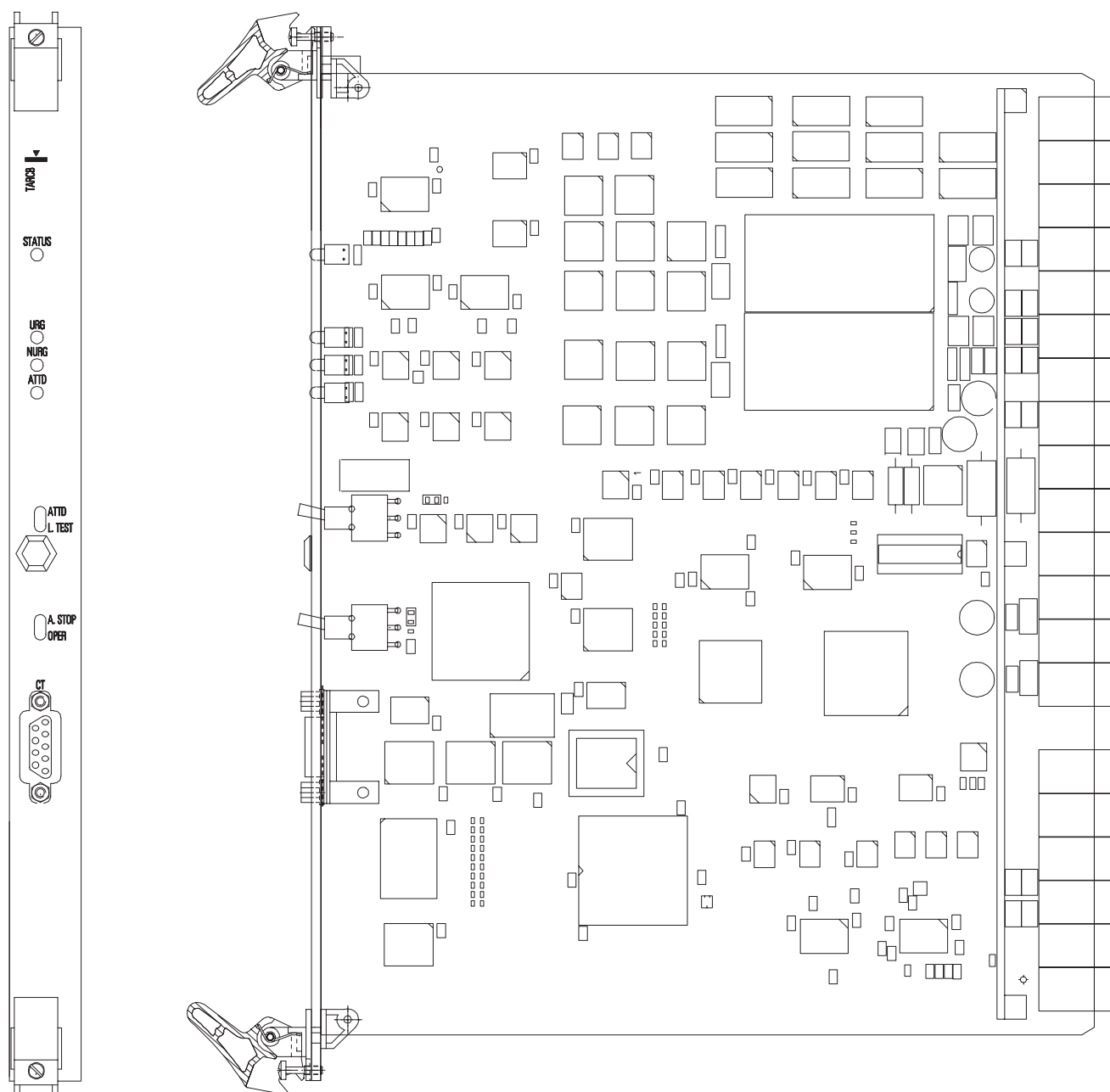


Figure 12–5 TARCB – Outline and Front Plate

12.3.3 TARCB – Block Diagram

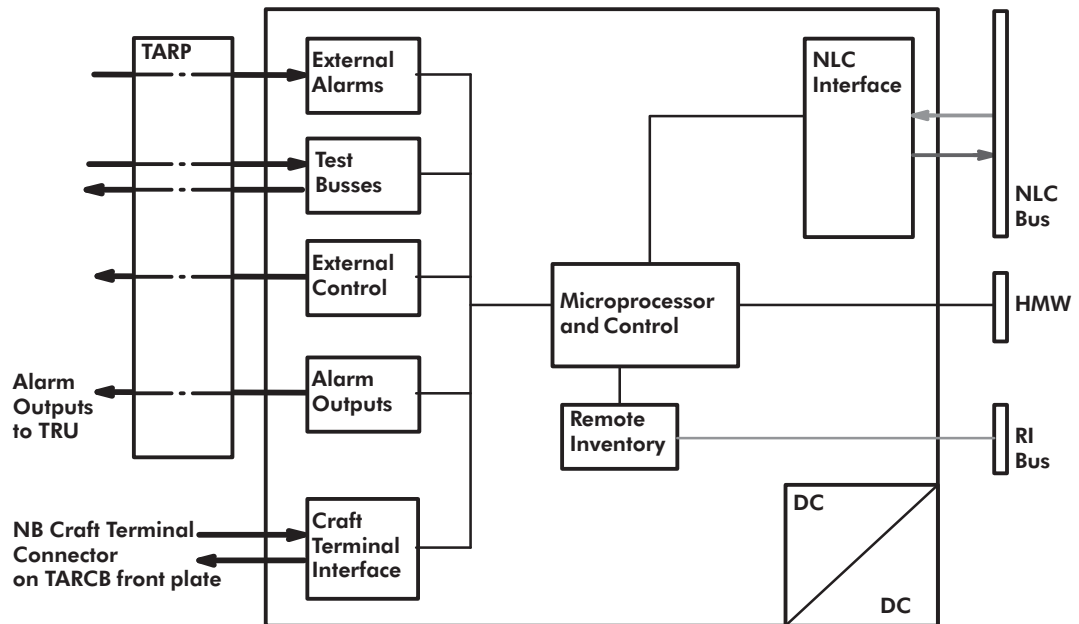


Figure 12–6 TARCB – Block Diagram

12.3.4 TARCB – Consequences of Unplugging

ATTENTION

If TARCB Card is removed from the subrack

If a TARCB card is removed the effects are:

- 1) NB CRAFT terminal is disconnected.
- 2) Loss of communication for environment alarms e.g. Fan Alarms, Door Alarms.
- 3) Loss of communication for power supply alarms e.g. Mains Fail, REGB Fail, CBCC Fail, Transformer Fail, Circuit Breaker Trip.
- 4) Battery test is unavailable.

12.3.5 TARCB – Switches, Links and Sockets

There are two switches on the front plate of the TARCB.

- ▶ The upper switch is the *Attended Alarm / Lamp Test* switch. This switch is labelled *Auto / L Test*. It is a three position switch, spring biased to the centre position.
 - The upper position is labelled *Auto*. If the switch is pushed in this direction all Urgent and Non–urgent alarms are deactivated and an Alarm Receiving Attention indication is raised.
 - The centre position is inactive.
 - The lower position is *Lamp Test*, labelled *L Test*. If the switch is pushed in this direction all LEDs are illuminated. When the switch returns to the centre position the lamps return to their previous indication.
- ▶ The lower switch is the *Alarms Cutoff* switch. The label on this switch is *A Stop / Oper*. It is a two position switch. It is not biased to either position.
 - The lower position is *Operation*, labelled *Oper*. In this position alarms are raised and forwarded normally.
 - The upper position is *Alarm Stop*, labelled *A Stop*. In this position all Urgent and Non–urgent alarms are deactivated and an Alarm Receiving Attention indication is raised.

There is one DB9 connector on the front plate of the TARCB. There are no user–accessible connectors on the printed circuit board.

There are no user–accessible links on the TARCB.

12.3.6 TARCB – LED Description

There are four LEDs on the front of the TARCB:

LED	Indication	Description
Green STATUS LED	ON	TARCB is operating correctly
	OFF	TARCB is powered down or is not functioning correctly
	FAST FLASH (0.5s on, 0.5s off)	Downloading phase
	SLOW FLASH (2s on, 2s off)	In operation with/without established communications (awaiting download)
Red URG LED	FLASH	New U (Urgent) alarm raised.
	ON	All U alarms are receiving attention (ARA)
	OFF	No U alarm.
Red NURG LED	FLASH	New NU (Non–Urgent) alarm raised.
	ON	All NU alarms are receiving attention (ARA).
	OFF	No NU alarm.
Yellow ATD LED	ON	An U or NU Alarm is Receiving Attention (ARA)
	OFF	No ARA

Note

- ▶ *Urgent (U) Alarms*
 - *If a new Urgent (U) alarm is raised the red URG LED flashes. Other U alarms may be receiving attention.*
 - *If the ARA button is pressed the yellow ATD LED lights, and the red URG LED turns ON.*
- ▶ *Non–Urgent (NU) Alarms*

- *If a new Non–Urgent (NU) alarm is raised the red NURG LED flashes. Other NU alarms may be receiving attention.*
- *If the ARA button is pressed the yellow ATD LED lights, and the red NURG LED turns ON.*
- ▶ *When all U alarms are cleared the U LED turns OFF.*
- ▶ *When all NU alarms are cleared the NURG LED turns OFF*
- ▶ *When all NU and U alarms are cleared the ATD LED turns OFF*

12.3.7 TARCB – Interface – Electrical

Electrical interfaces on the TARCB are:

- ▶ Alarm inputs.
- ▶ Alarm outputs to the Alarm and Power Distribution Panel.
- ▶ Command outputs.
- ▶ CRAFT Terminal (CT) connector.

Connector locations are:

- ▶ The CT connector is on the front plate of the TARCB.
- ▶ Connectors for all the other interfaces are on a TARP (TARCB plug), located beneath the TARCB in the MLS–hb.
The TARCB communicates with the TARP via the subrack backplane. Rear connectors on the TARCB and TARP mate with connectors on that backplane.

(1) Alarm Inputs

Alarm inputs have the following characteristics:

Characteristic	Value
ACTIVE (alarm active)	Input open–circuit
INACTIVE (alarm NOT active)	Input grounded

(2) Alarm Outputs

The TARCB has external alarm outputs. In the NURA these are cabled to the alarm inputs on the Alarm and Power Distribution Panel (APDP).

Characteristics of the alarm outputs are:

Characteristic	Value
Maximum current when CLOSED	300mA
Max voltage allowed when OPEN	–72V
Voltage drop towards GND when CLOSED	≤ –2V

(3) Command Outputs

The TARCB has external command outputs.

Characteristics of the command outputs are:

Characteristic	Value
Max sunk current in CLOSED condition.	50mA
Max allowed voltage in OPEN condition.	–72V
Voltage drop towards GND in CLOSED condition.	0.5V

(4) CRAFT Terminal Interface

The CRAFT Terminal (CT) interface is an RS232 DB9 connector on the front plate of the TARCB. Pinouts of this connector are shown in Section 12.3.8.

12.3.8 TARCB – Connector Pinouts – Front

The TARCB has one 9 pin female Sub–D connector on the front plate. All other connections to the TARCB are via rear connectors which mate with connectors on the subrack backplane and then to external connectors on the TARPB in the plug are of the subrack.

The front connector on the TARCB is for the CRAFT Terminal (CT) interface. A straight DB9–DB9 cable connects a CT to the TARCB.

Pin	Signal	Description
1	DCD	Data Carrier Detect
2	CFT–RXD	Receive Data by CRAFT Terminal (Broadband controller card to CT)
3	CFT–TXD	Transmit Data by CRAFT Terminal (CT to Broadband controller card)
4	DTR	Data Terminal Ready
5	SG	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

Note *Metallic shell of connector is safety ground.*

13 Plugs

Plugs are located in the area towards the bottom of the subrack. They provide external connectors for most cabling connected to subracks.

- ▶ The rear of a plug has connectors to mate with the connectors on the subrack backplane.
- ▶ The front plates of plugs have connectors which suit the cabling and terminations to be used for the particular connections. The front connectors on plugs are used for functions such as:
 - DC power supply to the subrack.
 - Connection of cables to an MDF and cabling for customer lines.
- ▶ Plugs connect to cards via the subrack backplane and rear connectors on the cards.
- ▶ Limited types of front connections are made to some cards:
 - Optical fibre cables are connected directly to CMUX optical transport cards and some broadband controller cards.
 - The front plates of some controller cards are fitted with connectors for a Craft Terminal (CT).
- ▶ Plugs may include components to ensure EMC compliance or which have other functions. These are described in the section for each type of plug.

Note *The MBTP (Main Bus Termination Plug) is a special purpose plug located at the right hand end of the cards area in a subrack. The MBTP is described in Section 6.11.*

13.1 Plug Functions and Construction

There are several types of plugs for the connection of external cabling to subracks. The plugs can be basically divided into three types of plug function and two types of plug construction.

13.1.1 Plug Functions

There are three main categories of plug functions:

- ▶ Common plugs
- ▶ Transport Plugs
- ▶ Line Plugs

(1) Common plugs

Common Plugs are associated with controller cards. They are partitioned based on their functions rather than by the cards to which they are connected. Each Common Plug interfaces with more than one card.

Common plugs are located in plug slots 1 to 4 in a subrack (MLS–hb or MLS–hbe). Common Plugs use the Mini–board Plug physical format.

(2) Transport Plugs

Transport cards are normally located in dedicated transport card slots in the main subrack (Rack 1 / Subrack 1). These are slots 5 and 6 in the MLS–hb.

Transport plugs are located beneath the corresponding transport card slots.

Transport Plugs use Flat Plug construction.

(3) Line Plugs

Line Plugs are equipped in the Line Plugs area, which is plug slots 7 to 22 in the MLS–hb or slots 5 to 22 in the MLS–hbe.

- ▶ In most cases each Line Plug plug is related to a single line card.
- ▶ Alternatively, as in the case of the TSPP–A, a combining / protecting plug is related to a limited number of line cards.

Line Plug construction is typically a Flat Plug, as described in Section 13.1.2.

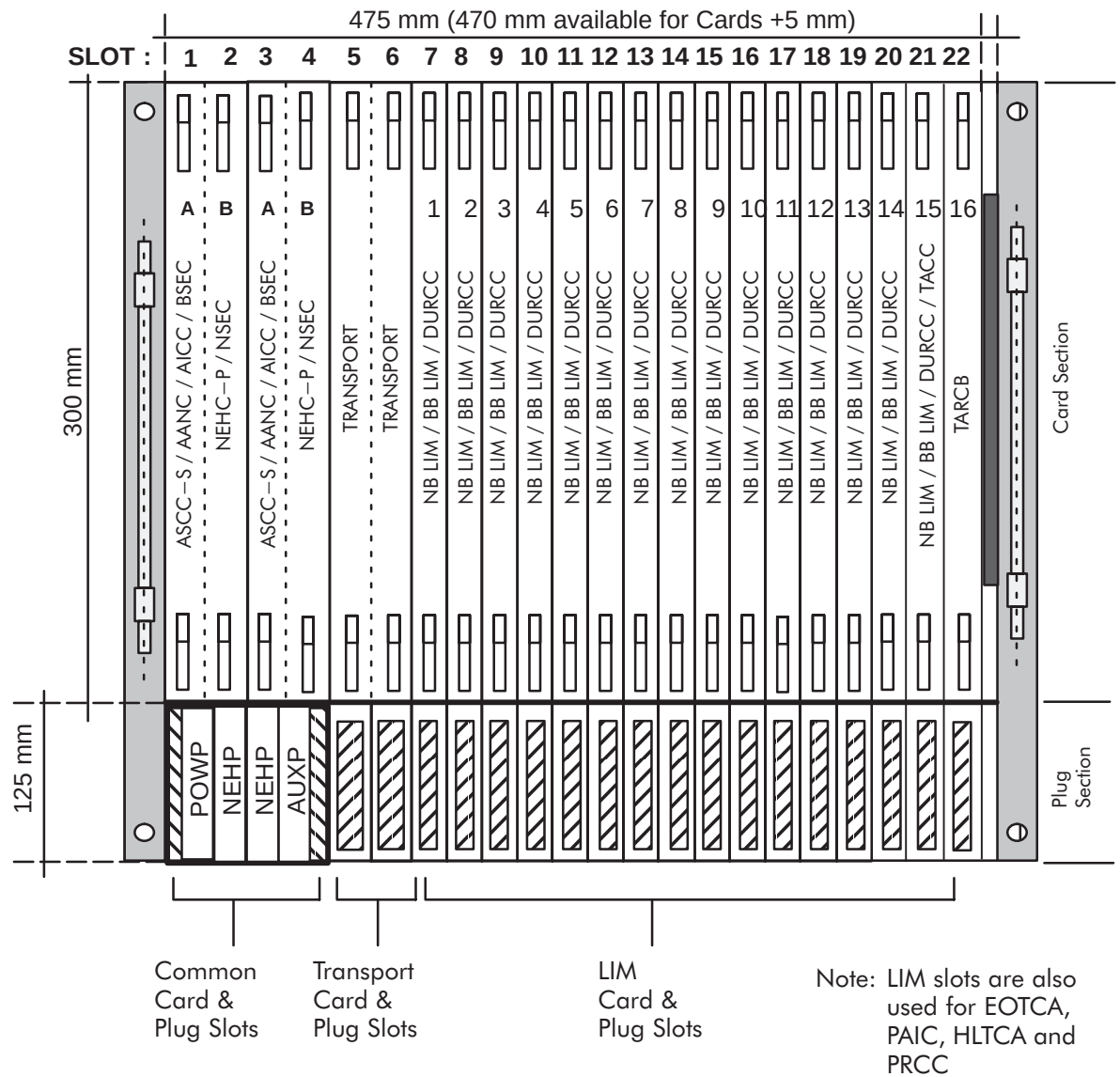


Figure 13-1 MLS-hb

13.1.2 Plug Construction

The two types of plug construction used in CMUX are Flat Plugs and Mini-board Plugs.

► **Flat plugs**

Flat plugs are normally used for Line Plugs and Transport Plugs. They are composed of a PCB with pass-through straight connectors. Their main function is achieving EMC compatibility, including shielding and filtering.

There are four special flat plugs:

- The TSPP-A interconnects the triplet of 2 x LTAC-A and 1 x NACC-A. The TSPP-A is three plug slots wide.
- The DSPP-B interconnects the twin of 1 x LTAC-C and 1 x NACC-C. The DSPP-B is two plug slots wide.
- The DSAP also interconnects the twin of 1 x LTAC-C and 1 x NACC-C. The DSAP is two plug slots wide.
- The TSCP provides external connections for LTAC-D in AU (AGHA, AGHB or ACPA). The TSCP is two plug slots wide.

► **Common plugs:**

Common plugs are small PBAs with a front plate. Common plugs are similar in depth to CMUX cards, but are not as high. This construction is known as mini-board plug.

Common plugs are only used in slots 1 to 4 in the subrack. To ensure EMC compliance these slots are located in a box at the left hand end of the plug area in the subrack. The box is fitted with slides for insertion of the plug.

13.1.3 Plug Installation

To install a plug:

- Select the desired plug and identify the plug slot.
- Align the plug with the slot:
 - Common Plugs have a PBA which is slid into rails in the subrack. Insert the end of the plug into the rails.
 - Transport Plugs and Line Plugs have Metral connectors on the rear. Align these with the backplane connectors.
- Press the plug evenly into place. Do NOT 'rock' the plug into place.

- ▶ Secure the plug with the mounting screws provided.

13.1.4 Plug Extraction – Common Plugs and MBTP

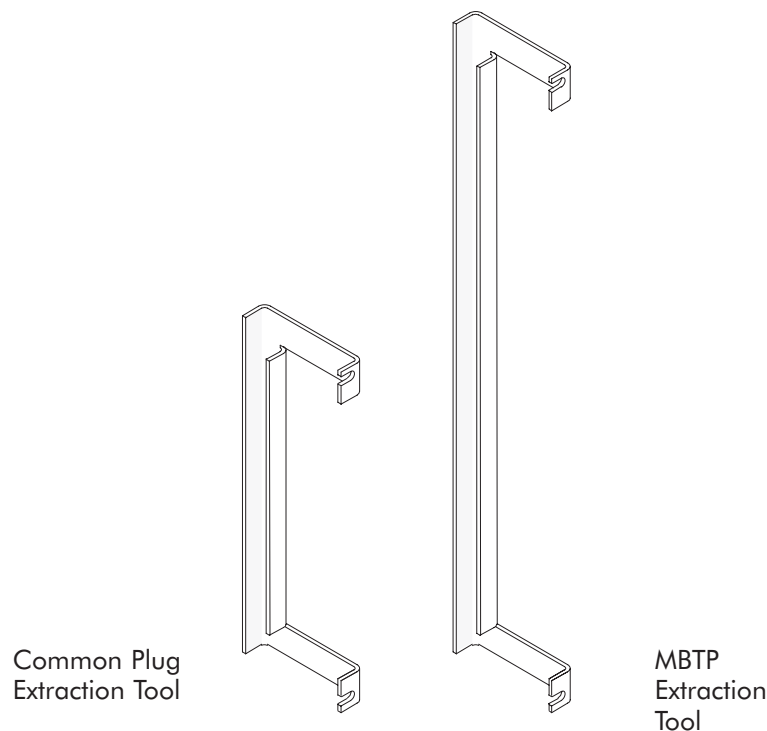


Figure 13–2 Plug Extraction Tools

To minimise the risk of damage to the front plate of a common plug, and to ease the removal of the MBTP, two extraction tools are available. These should be used each time it is necessary to remove these plugs from a subrack.

To extract a plug with these tools:

- ▶ Undo the fasteners which secure the plugs to the subrack. The threads should be disengaged from the subrack but not threaded through the plug.
- ▶ There are a pair of notches, one at each end of the tool. Engage these notches with the stem of the fasteners, under the head of the fasteners.
- ▶ While maintaining contact between the tool and the fasteners, pull the plug out. Do not “rock” the plug or apply excess sideways force.

Part numbers are:

3AN 48542 AAAA HCZZA – Common Plug Extraction Tool

3AN 48453 AAAA HCZZA – MBTP Plug Extraction Tool

13.1.5 EMC Compliance and Blanking Plates

EMC compliance in CMUX is at subrack level.

- ▶ Plug slots 1 to 4 are Common Plug slots. If one of these plug slots is not fitted with a plug, a blanking plate must be fitted to the plug slot to ensure EMC compliance.
- ▶ Empty Transport Plug slots and LIM Plug slots are EMC compliant when empty, fitted with a plug, or when cabling is connected to a plug. These are slots 5 to 22 in a MLS–hb or MLS–hbe.

Blanking plates are not required on these slots to ensure EMC compliance when empty.



EMC Compliance

EMC compliance in CMUX is at subrack level.

To ensure EMC compliance:

- ▶ All Common Plug slots must be fitted with either a plug or a blanking plate.
 - ▶ All empty card section slots must be fitted with either a card or a blanking plate.
-

13.2 Plug/Card Matrix

Interface		Supporting Cards	Plug		Connector
Category	Type		Name	Location	
Customer Interfaces					
Narrowband Customer Interface	POTS 2W VF	ATLCC, PMLCC	LFSPB	Below line card	Metral
	6W VF	ALLC			
	ISDN 2B1Q	BALCF			
Broadband Customer Interface	ADSL	ADSL Triplet 2 x LTAC-A + 1 x NACC-A	TSPP-A	Below line cards	Metral
		ADSL Twin 1 x LTAC-C + 1 x NACC-C	DSPP-B or DSAP	Below CMUX LIM	Metral
			T9APA	MiniMUX Plug Area	Burndy
			LTAC-D	TSCP or 2 x PRCPB	Below CMUX LIM
		T9APB		MiniMUX Plug Area	Burndy
Network Interfaces					
V5.2	2 Mbit/s G.703	NEHC-P	NEHP or HBMP/HBEP	Below NEHC-P	Metral
ATM (IMA)	2 Mbit/s G.703	AICC	NEHP or HBMP/HBEP	Below NEHC-P	Metral
			T9IPA	Beside cards	Metral
ATM (STM-1)	STM-1	AANC	—	—	SC/APC
		ASCC-S	—	—	SC/APC
Special Service	2W VF	PMLC, ATLC	LFSPB	Below LIM	Metral
Other Interfaces					
NU-AU Optical Transport (PDH)	2 Mbit/s G.703	EOTCA	EOTP	Below EOTCA	Metral
	Optical				SC/APC (Front of EOTCA)
BB Subtending Interface (IMA)	2 Mbit/s G.703	PAIC	PAIP	Below PAIC	Metral
Management	X.25	NEHC-P	AUXPA (AAAA)	Below slot 4	Metral
	LAN	NEHC-P	AUXPA (ABAA)	Below slot 4	RJ45 (Front of NEHC-P)
	Inband OAM	LTAC	PRCPB	Below LTAC	Metral
External Alarm Inputs		TARC	TARP	Below TARC	Metral
NB CRAFT	V.24	TARC		Front of TARC	DB9
BB CRAFT	V.24	AANC		Front of AANC	DB9
		AICC		Front of AICC	DB9
48V Battery Supply			POWPA	Below Slot 1	2-Pin D type
			T9IPA	Plug area	3 pin

13.3 AUXPA – 3EC 40225 Axxx

The AUXPA (Auxiliary Plug A) provides access to a variety of busses and interfaces which do not carry traffic. It is located in slot 4 of the plug area of the Main Subrack in the first subrack position in an NU or AU.

The AUXPA provides access to the narrowband management interface for connection to CMEM. Separate versions of the AUXPA are used to provide a LAN interface (RJ45) or an X.25 interface (Metral).

The AUXPA has the following functions:

- ▶ Extends ring bus to the second subrack in the NU or AU.
- ▶ Extends the test bus to the second subrack in an NU or AU.
- ▶ Provides external access to the Inventory Access Bus (IAB).
- ▶ Extends the IAB.
- ▶ Provides an external LAN or X.25 interface for CMEM.

13.3.1 AUXPA – Variants

There are two variants of the AUXPA:

- ▶ Variant AAAA has an X.25 management interface for connection to CMEM.
- ▶ Variant ABAA has a Ethernet management interface for connection to CMEM.

13.3.2 AUXPA Replacement

The AUXPA plug **MUST NOT** be replaced while the system is powered up and a NEHC is installed.

- ▶ If the AUXPA is to be removed or replaced for any reason then it is recommended that the system be powered down and that the AUXPA is replaced while the system is powered down.
- ▶ Alternatively, if powering down the system is not possible:
 - Remove both NEHC cards *BEFORE* the AUXPA is removed.
 - Replace the AUXPA.
 - Re-insert the NEHC cards.

Note *Powering down the system is service affecting (NB and BB).
Removing the NEHC is service affecting (NB).*

13.3.3 AUXPA – Outline

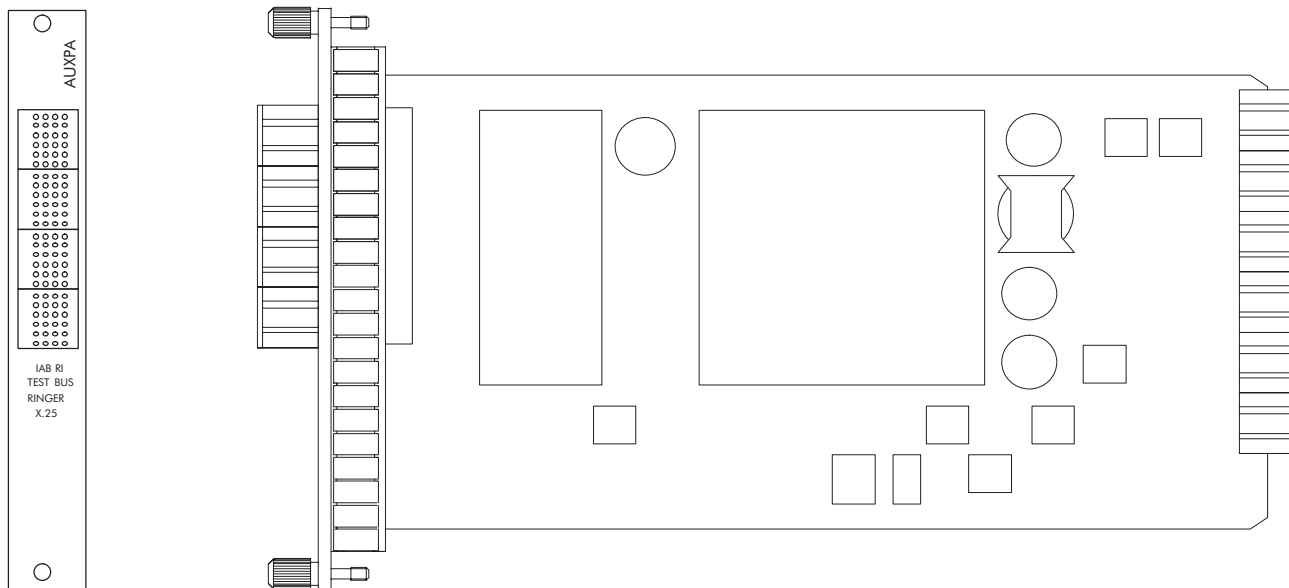


Figure 13–3 AUXPA – Outline (Variant AAAA – X.25 interface)

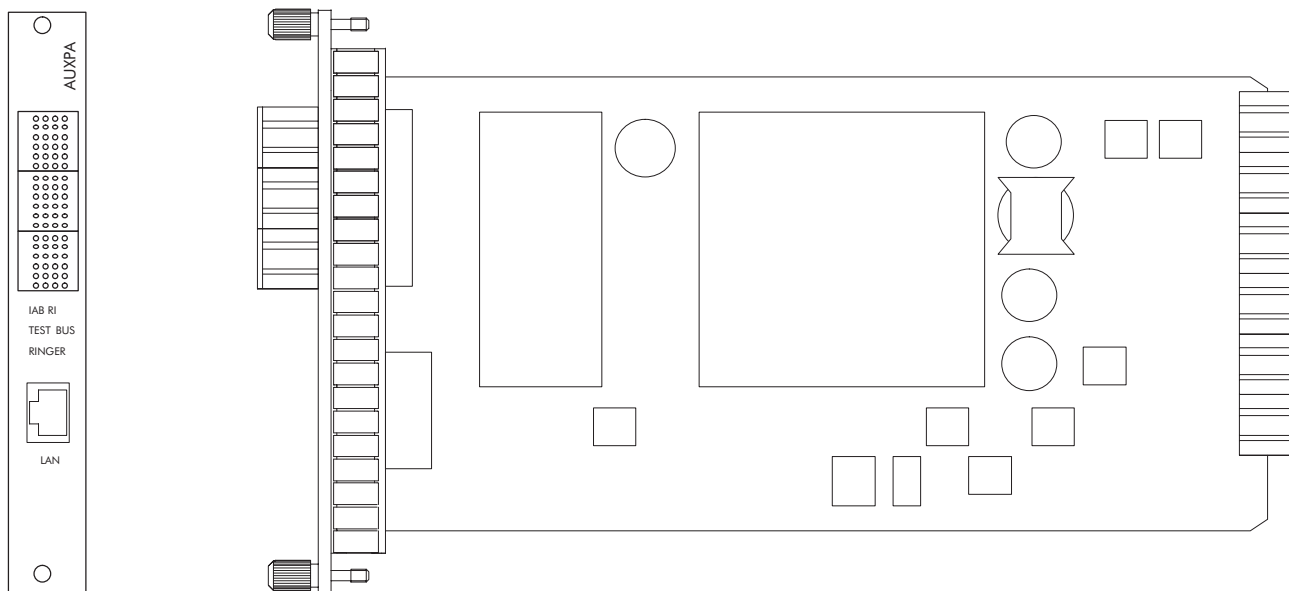


Figure 13–4 AUXPA – Outline (Variant ABAA – LAN interface)

13.3.4 AUXPA – Connector Pinouts – Front

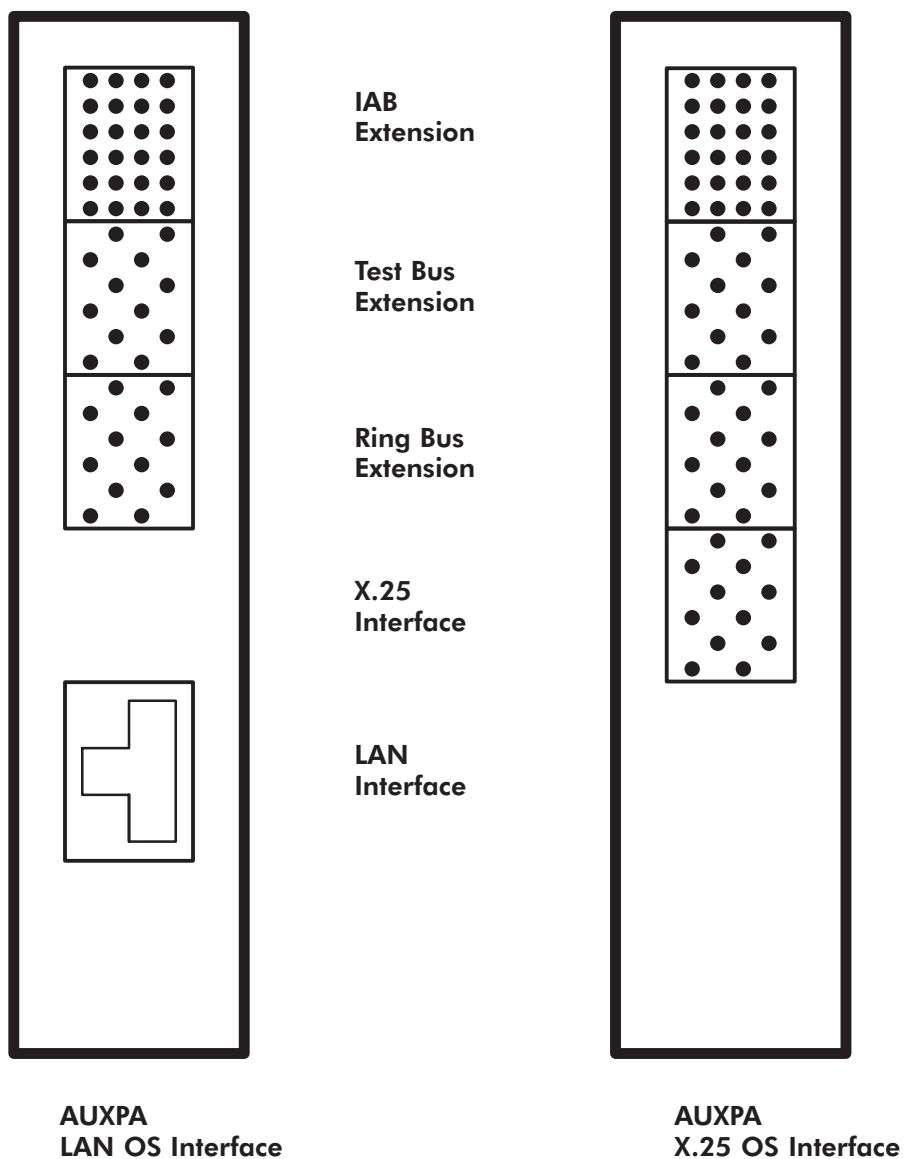


Figure 13–5 AUXPA – Front Connectors

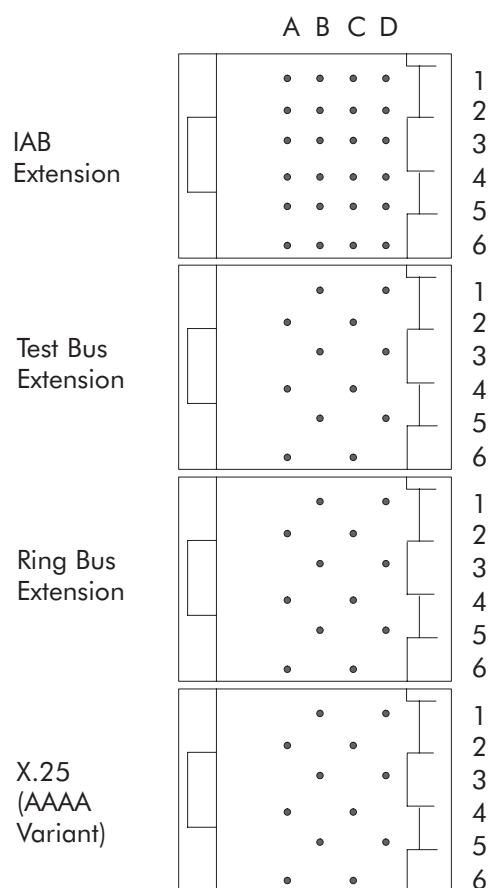


Figure 13–6 AUXPA – Front Connector Pinouts

IAB Extension				
	A	B	C	D
1	R1_DOUT	CSCLEAR1	CSCLEAR2	RI_DOUT
2	R1_DIN	CSCLEAR3	CSCLEAR4	RI_DIN
3	RI_PE	RICS_1	RI_CS2	RI_PE
4	RI_CLK	RICS_3	RI_CS4	RI_CLK
5	RI_3VO	RICS_5	RI_CS6	RI_3VO
6	RI_5VO	EG	EG	RI_5VO

Test Bus Extension				
	A	B	C	D
1	—	—	—	—
2	—	—	—	—
3	—	T*DPD3OE	—	T*DPD1OE
4	T*DPD2OE	—	T*DPD0OE	—
5	—	T*DPD3IE	—	T*DPD1IE
6	T*DPD2IE	—	T*DPD0IE	—

Note In the table describing pinouts for the Test Bus Extension connector, the second last and third last characters have the following meanings:

- The second last character may be O or I.
If it is O it is an outwards pin (towards subscriber).
If it is I it is an inwards pin (towards line card).
- The third last character may be 0, 1, 2 or 3.
These refer to legs 'a', 'b', 'c', or 'd' respectively.

Ring Bus				
	A	B	C	D
1	—	T*RINGA	—	T*RINGA
2	T*RINGA	—	T*RINGA	—
3	—	T*RINGB	—	T*RINGB
4	T*RINGB	—	T*RINGB	—
5	—	SG_SALT	—	SG_SALT
6	—	—	—	—

X.25 (Variant AAAA)

	A	B	C	D
1	—	EG	—	EG
2	TXD (o)	—	RXD (i)	—
3	—	RTS(o)	—	CTS (i)
4	DSR (i)	—	DCD (i)	—
5	—	TXCK (i)	—	RXCK (i)
6	DTR (0)	—	EG	—

LAN (RJ-45 Ethernet) (Variant ABAA)

Pin	Function
1	TPTxP
2	TPTxN
3	TPRxP
4	—
5	—
6	TPRxN
7	—
8	EG

13.4 AUXPB – 3EC 41196 AAxx

The AUXPB (Auxiliary Plug B) provides access to a variety of busses and interfaces which do not carry traffic. It is located in plug slot 4 in the subrack in the second and subsequent subrack positions in an NU or AU.

The AUXPB has the following functions:

- ▶ Ring bus input from the previous subrack in an NU or AU.
- ▶ Extends ring bus to the next subrack in the NU or AU.
- ▶ Test bus input from the previous subrack in the NU or AU.
- ▶ Extends the test bus to the next subrack in an NU or AU.
- ▶ DURCC management wires from the previous subrack and to the next subrack.

13.4.1 AUXPB – Outline

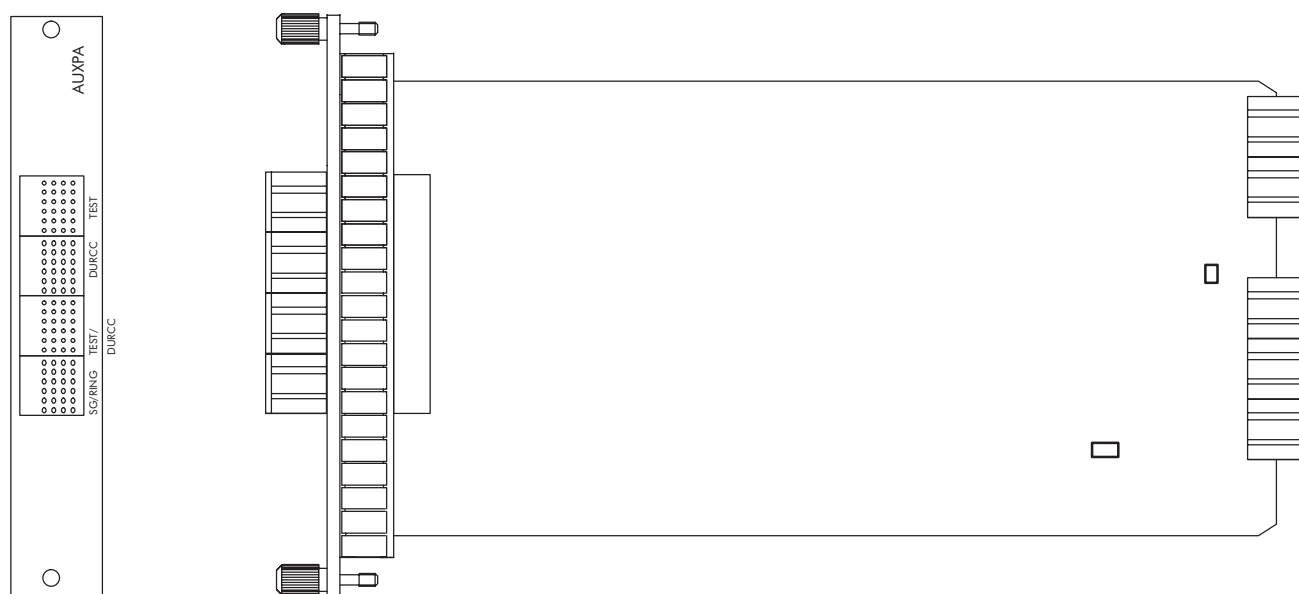


Figure 13–7 AUXPB – Outline

13.4.2 AUXPB – Connector Pinouts – Front

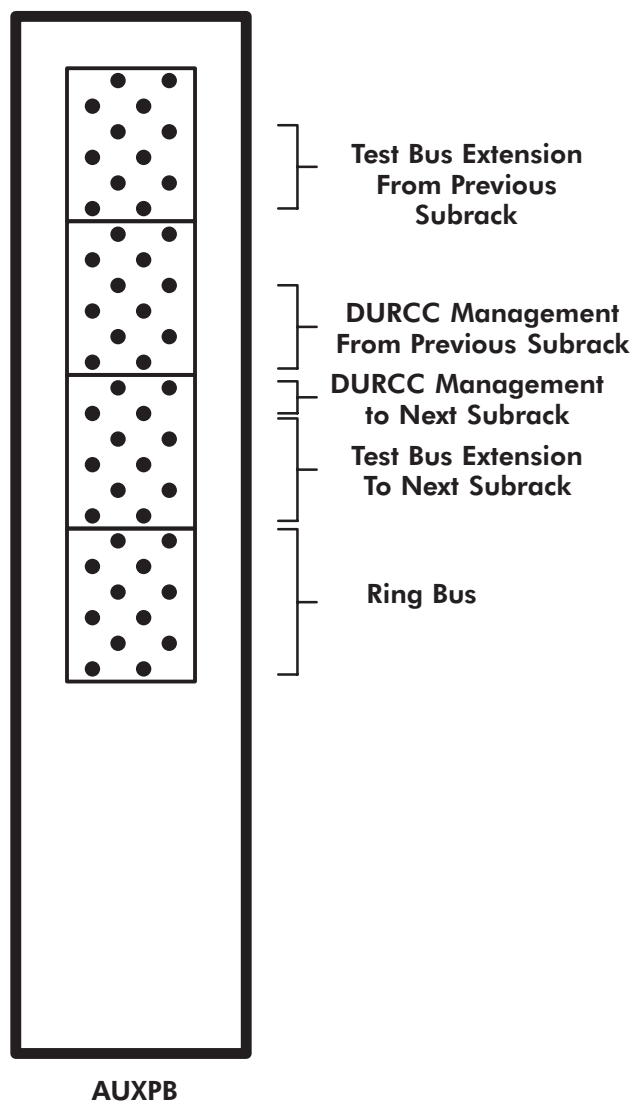


Figure 13–8 AUXPB – Front Connector

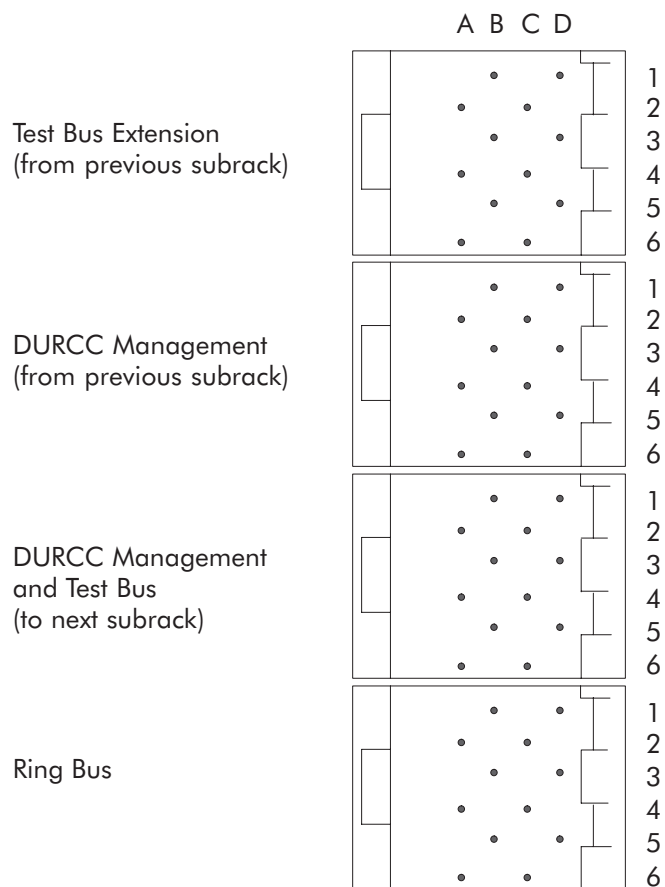


Figure 13–9 AXPB – Front Connector Pinouts

Test Bus Extension (from previous subrack)

	A	B	C	D
1				
2				
3		T*DPD3OE_U		T*DPD1OE_U
4	T*DPD2OE_U		T*DPD0OE_U	
5		T*DPD3IE_U		T*DPD1IE_U
6	T*DPD2IE_U		T*DPD0IE_U	

DURCC Management (from previous subrack)

	A	B	C	D
1				
2				
3		DURCC2_LOC		
4	DURCC1_LOC			
5		DURCC2_UP1		DURCC2_UP2
6	DURCC1_UP1		DURCC1_UP2	

DURCC Management and Test Bus (to next subrack)

	A	B	C	D
1		DURCC2_LOW1		DURCC2_LOW2
2	DURCC1_LOW1		DURCC1_LOW2	
3		T*DPD3OE_L		T*DPD1OE_L
4	T*DPD2OE_L		T*DPD0OE_L	
5		T*DPD3IE_L		T*DPD1IE_L
6	T*DPD2IE_L		T*DPD0IE_L	

Ring Bus

	A	B	C	D
1		T*RINGA		T*RINGA
2	T*RINGA		T*RINGA	
3		T*RINGB		T*RINGB
4	T*RINGB		T*RINGB	
5		SG_SALT		SG_SALT
6				

13.5 DSAP – 3EC 43418 AAAA

The DSAP (Dual Slot Attenuator Plug) is a combined ADSL attenuator and plug. It is based upon the DSPP–B and the T9AP.

The DSAP resides in the front connector access area of the CMUX MLS–hb or MLS–hbe subracks.

- ▶ The DSAP provides the front connections for subscriber lines for an ADSL Twin (one LTAC–C and one NACC–C) which implement ADSL–over–POTS access for twelve customer lines.
 - Each LTAC–C provides high–pass filtering for twelve ADSL services.
 - The NACC–C provides low–pass filtering for twelve POTS lines.
 - The DSAP connects one NACC–C and one LTAC–C to twelve customer lines.
 - POTS services from exchange POTS cards or from CMUX POTS cards are connected to a front connector on the DSAP.
 - Subscriber lines plug into front connectors on the DSAP.
- ▶ The DSAP also provides attenuation in the ADSL path equivalent to the nominated cable loss between the exchange and the remote unit for a parallel service.

There are 5 variants of the DSAP, each with a different level of attenuation from 7dB to 35dB. These are listed in the table in Section 13.5.2.

13.5.1 DSAP – Features and Functions

The DSAP:

- ▶ Routes twelve lines from the POTS line card in the exchange or the POTS line card in CMUX to a low pass filter in the NACC–C.
- ▶ Superimposes the ADSL signal onto the POTS signal output by the NACC–C, thus obtaining the subscriber side ADSL+POTS line.
- ▶ Is two plug slots wide.
- ▶ Interfaces with the twin of one LTAC–C and one NACC–C via rear connectors to the subrack backplane.
- ▶ Provides EMC shielding and filtering.
- ▶ Provides attenuation of the ADSL signal equivalent to the nominated cable loss using a parallel cable between the exchange and the location of AU.

Note *If the DSAP is removed, POTS and ADSL services associated with it are lost.*

13.5.2 DSAP – Variants

Variant code	Nom. Attenuation (300kHz)	Equivalent length 0.4mm PIUT
Use DSPP (3EC 40569 ABAA)	0dB	0 km
3EC 43418 ABAA	7dB	0.5 km
3EC 43418 ACAA	14dB	1 km
3EC 43418 ADAA	21dB	1.5 km
3EC 43418 AEAA	28dB	2 km
3EC 43418 AFAA	35dB	2.5 km

13.5.3 DSAP – Exterior View

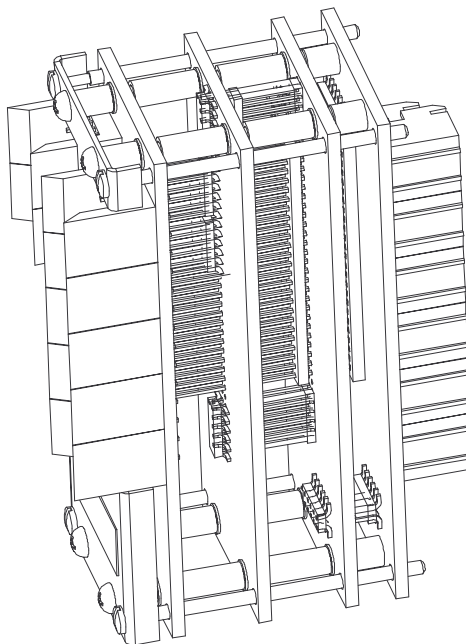
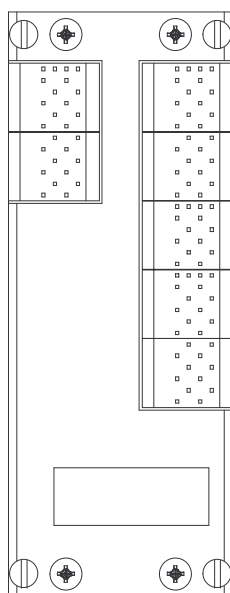
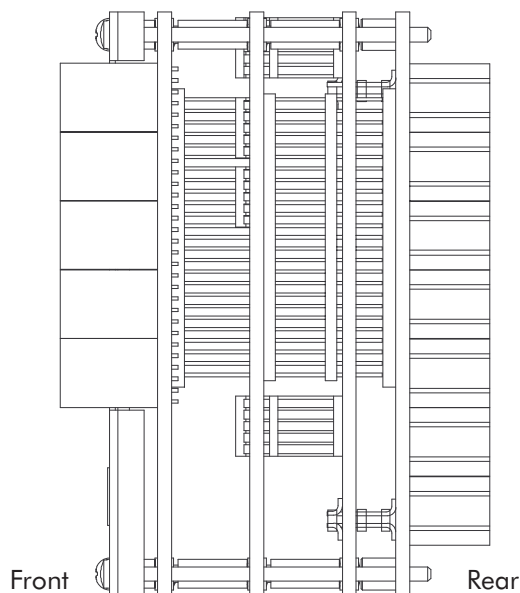


Figure 13–10 DSAP – Exterior View

13.5.4 DSAP – Outline



Front View



View from Right Hand Side

Figure 13–11 DSAP – Outline

13.5.5 DSAP – Block Diagram

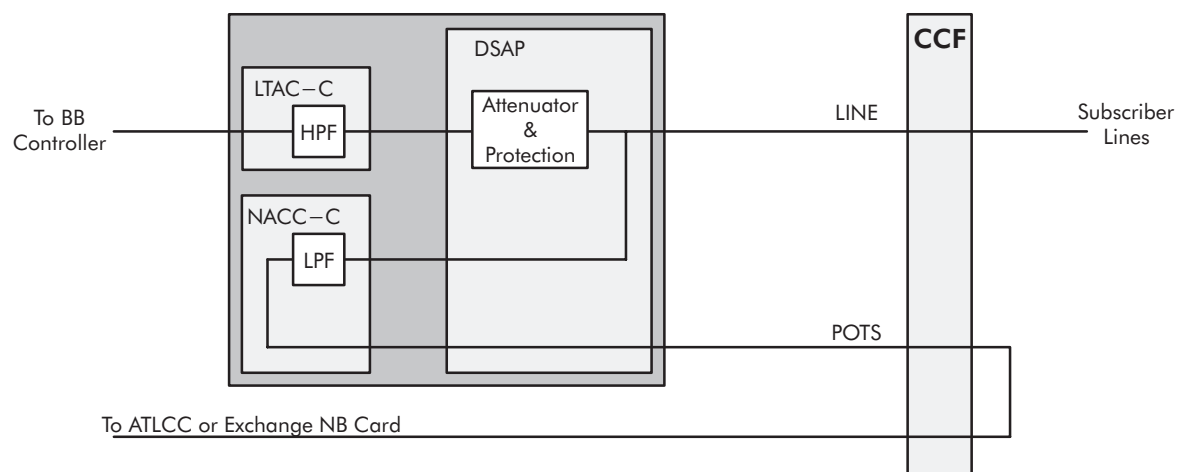


Figure 13–12 DSAP – Block Diagram

13.5.6 DSAP – Connector Pinouts – Front

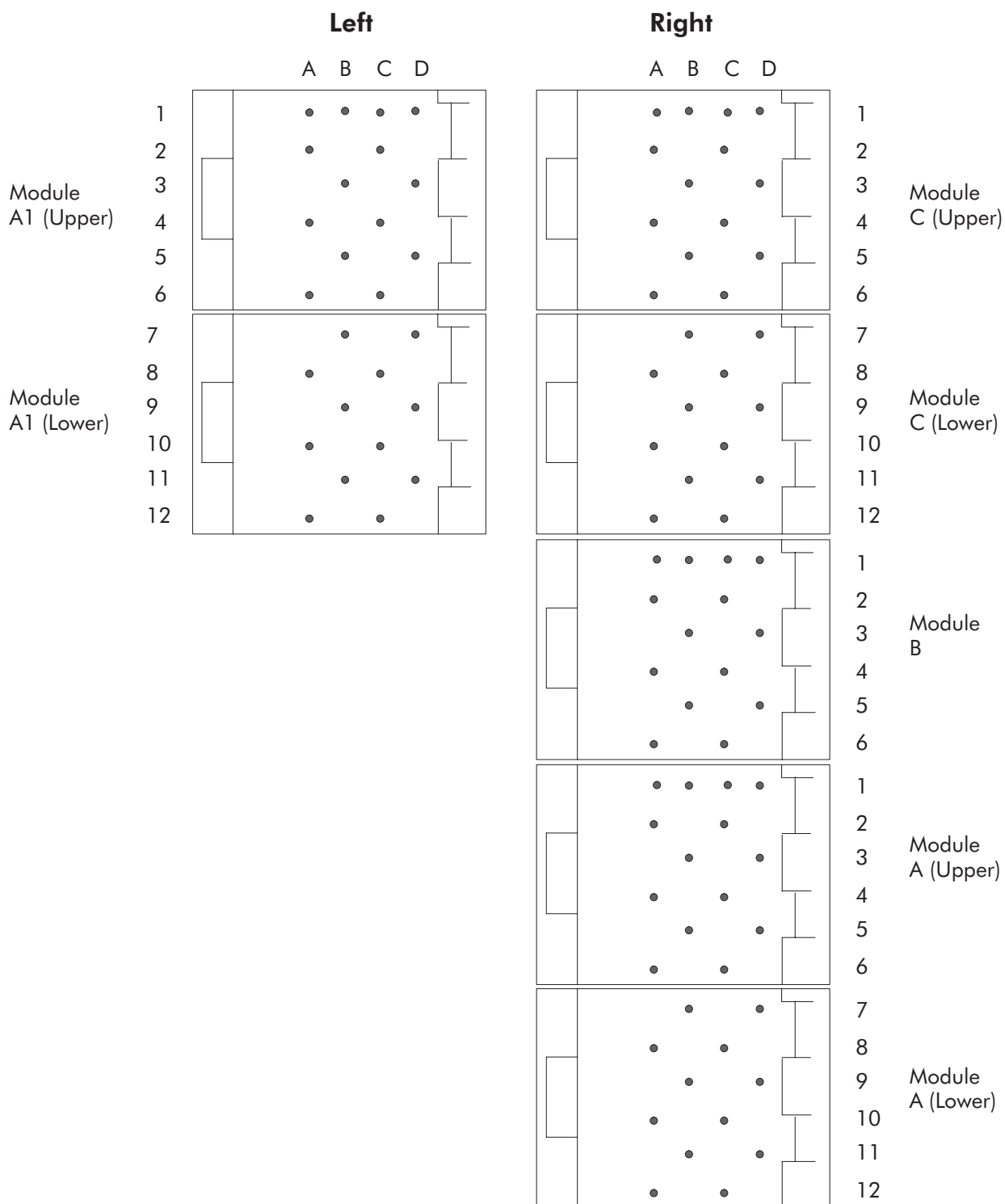


Figure 13–13 DSAP – Front Connector Pinouts

(1) Connectors A and B – POTS (X Pairs)

POTS Line connectors on the DSAP terminate POTS lines from the exchange, POTS lines from a CMUX POTS line card, or exchange–side POTS lines from other equipment.

Connector A – POTS (X Pairs)

Module	Row	Column			
		A	B	C	D
A (Upper)	1	Ground	POTS 8A	Ground	POTS 8B
	2	POTS 7A		POTS 7B	
	3		POTS 6A		POTS 6B
	4	POTS 5A		POTS 5B	
	5		POTS 4A		POTS 4B
	6	POTS 3A		POTS 3B	
A (Lower)	7		POTS 2A		POTS 2B
	8	POTS 1A		POTS 1B	
	9				
	10				
	11				
	12				

Connector B – POTS (X Pairs)

Module	Row	Column			
		A	B	C	D
B	1	Ground		Ground	
	2				
	3		POTS 12A		POTS 12B
	4	POTS 11A		POTS 11B	
	5		POTS 10A		POTS 10B
	6	POTS 9A		POTS 9B	

(2) Connectors C and A1 – Customer Lines (C Pairs)

Customer Line connectors on the DSAP terminate lines from the CMUX to the customer which carry ADSL and POTS traffic.

Lines 9 to 12 appear on both Connector C and Connector A1. Usage of these connectors depends on the cable used. This may be 3AU 26874 xxxx or 3AU 26875 xxxx. Refer to the table in Section 13.5.6 (3) for connector/cable usage.

Connector C – Customer Lines (C Pairs)

Module	Row	Column			
		A	B	C	D
C (Upper)	1	Ground	Line 12A	Ground	Line 12B
	2	Line 11A		Line 11B	
	3		Line 10A		Line 10B
	4	Line 9A		Line 9B	
	5		Line 8A		Line 8B
	6	Line 7A		Line 7B	
C (Lower)	7		Line 6A		Line 6B
	8	Line 5A		Line 5B	
	9		Line 4A		Line 4B
	10	Line 3A		Line 3B	
	11		Line 2A		Line 2B
	12	Line 1A		Line 1B	

Connector A1 – Customer Lines (C Pairs)

Module	Row	Column			
		A	B	C	D
A1 (Upper)	1	Ground		Ground	
	2				
	3		Line 12A		Line 12B
	4	Line 11A		Line 11B	
	5		Line 10A		Line 10B
	6	Line 9A		Line 9B	
A1 (Lower)	7				
	8				
	9				
	10				
	11				
	12				

(3) DSAP – Front Connector Usage

The MDF cables which may be used for customer lines are either the 3AU 26874 xxxx or the 3AU 26875 xxxx. Only one cable is required per DSAP.

The following table indicates the connectors used with each of these cables.

Cable required	Connector	Signals
3AU 26874 XXXX (Note: one only required per DSAP)	A	POTS exchange pairs 1–8
	B	POTS exchange pairs 9–12
	C	Line pairs 1–12
3AU 26875 XXXX (Note: one only required per DSAP)	C	Line pairs 1–8
	A1	Line pairs 9–12

Typical LTAC–C/NACC–C interconnections are:

- Direct (Cable 530 – 3AU 48642 AAAA), as shown in Figure 13–14.

In this arrangement a cable connects from the LFSPB below an ATLC to two ADSL Twins (1 x DSAP, 1 x LTAC–C, plus 1 x NACC–C)

- Via the MDF or CCC

For additional information refer to the *Cabling* chapter of the *CMUX Housings, Racks and Cabling Handbook*.

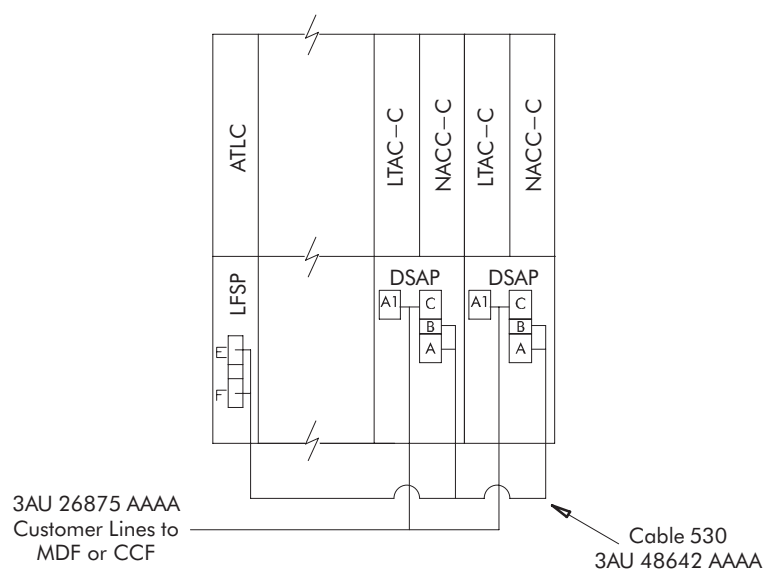


Figure 13–14 DSAP – Typical Direct Cabling

13.6 DSPP-B – 3EC 40569 ABAA

The DSPP-B (Dual Slot Position Plug) provides the front connections for subscriber lines for an ADSL Twin (one LTAC-C and one NACC-C) which implement ADSL-over-POTS access for twelve customer lines.

- ▶ Each LTAC-C provides high-pass filtering for twelve ADSL services.
- ▶ The NACC-C provides low-pass filtering for twelve POTS lines.
- ▶ The DSPP-B connects one NACC-C and one LTAC-C to twelve customer lines.
- ▶ POTS services from exchange POTS cards or from CMUX POTS cards are connected to a front connector on the DSPP-B.
- ▶ Subscriber lines plug into front connectors on the DSPP-B.

13.6.1 DSPP–B – Features and Functions

The DSPP–B:

- ▶ Routes twelve lines from the POTS line card in the exchange or the POTS line card in CMUX to a low pass filter in the NACC–C.
- ▶ Superimposes the ADSL signal onto the POTS signal output by the NACC–C, thus obtaining the subscriber side ADSL+POTS line.
- ▶ Is two plug slots wide.
- ▶ Interfaces with the twin of one LTAC–C and one NACC–C via rear connectors to the subrack backplane.
- ▶ Provides EMC shielding and filtering.
- ▶ Provides bypass relays for POTS traffic. These maintain POTS service if a NACC–C, LTAC–C or DSPP–B is removed.
 - Circuitry in the DSPP–B detects the removal of the NACC–C and closes bypass relay contacts to connect exchange POTS lines to customer lines. In this configuration the LPF (Low Pass Filter) in the NACC–C is not in circuit.
 - If the LTAC–C is removed while the NACC–C remains, the NACC–C is bypassed. ADSL services via the LTAC–C are affected until the LTAC–C is reinserted.
 - If the DSPP–B is removed with the cables still connected to the plug, the bypass relays close to connect the exchange POTS lines to the customer lines. If the cables are disconnected from the DSPP–B before removal of the DSPP–B, the connection between the exchange POTS lines and the customer lines is broken.

13.6.2 DSPP-B – Exterior View

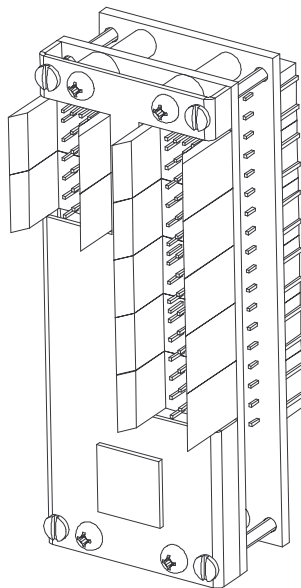


Figure 13–15 DSPP-B – Exterior View

13.6.3 DSPP-B – Outline

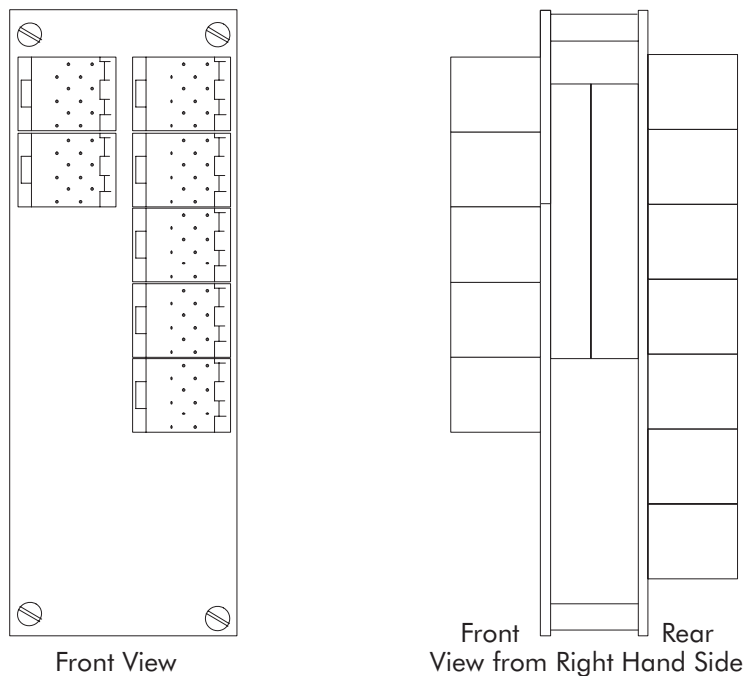


Figure 13–16 DSPP-B – Outline

13.6.4 DSPP-B – Block Diagram

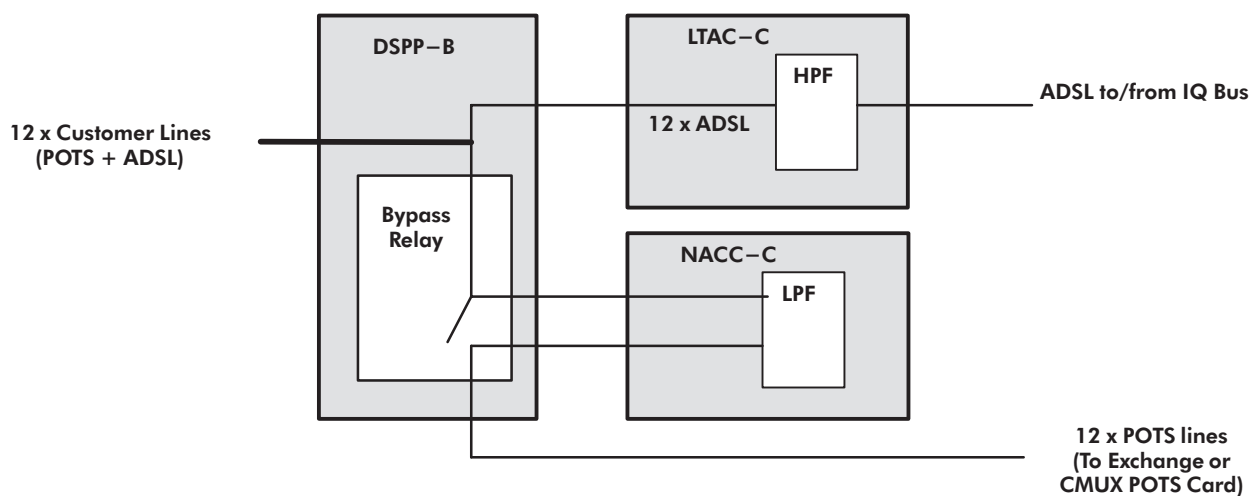


Figure 13–17 DSPP-B – Block Diagram

13.6.5 DSPP-B – Connector Pinouts – Front

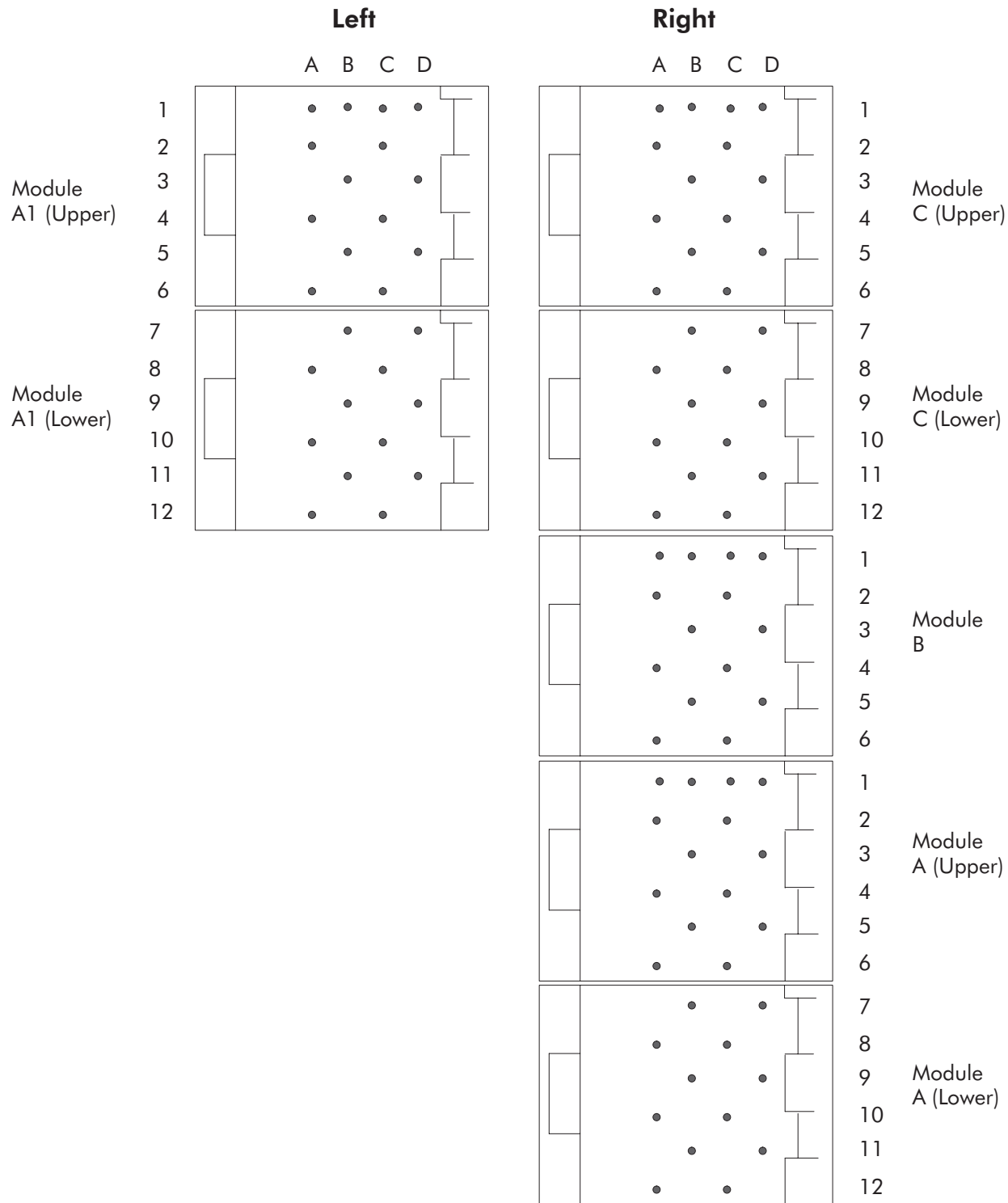


Figure 13–18 DSPP-B – Front Connector Pinouts

POTS Line connectors on the DSPP–B terminate POTS lines from the exchange, POTS lines from a CMUX POTS line card, or exchange–side POTS lines from other equipment.

(1) Connectors A and B – POTS (X Pairs)

Connector A – POTS (X Pairs)

Module	Row	Column			
		A	B	C	D
A (Upper)	1	Ground	POTS 8A	Ground	POTS 8B
	2	POTS 7A		POTS 7B	
	3		POTS 6A		POTS 6B
	4	POTS 5A		POTS 5B	
	5		POTS 4A		POTS 4B
	6	POTS 3A		POTS 3B	
A (Lower)	7		POTS 2A		POTS 2B
	8	POTS 1A		POTS 1B	
	9				
	10				
	11				
	12				

Connector B – POTS (X Pairs)

Module	Row	Column			
		A	B	C	D
B	1	Ground		Ground	
	2				
	3		POTS 12A		POTS 12B
	4	POTS 11A		POTS 11B	
	5		POTS 10A		POTS 10B
	6	POTS 9A		POTS 9B	

(2) Connectors C and A1 – Customer Lines (C Pairs)

Customer Line connectors on the DSPP–B terminate lines from the CMUX to the customer which carry ADSL and POTS traffic.

Lines 9 to 12 appear on both Connector C and Connector A1. Usage of these connectors depends on the cable used. This may be 3AU 26874 xxxx or 3AU 26875 xxxx. Refer to the table in Section 13.6.5 (3) for connector/cable usage.

Connector C – Customer Lines (C Pairs)

Module	Row	Column			
		A	B	C	D
C (Upper)	1	Ground	Line 12A	Ground	Line 12B
	2	Line 11A		Line 11B	
	3		Line 10A		Line 10B
	4	Line 9A		Line 9B	
	5		Line 8A		Line 8B
	6	Line 7A		Line 7B	
C (Lower)	7		Line 6A		Line 6B
	8	Line 5A		Line 5B	
	9		Line 4A		Line 4B
	10	Line 3A		Line 3B	
	11		Line 2A		Line 2B
	12	Line 1A		Line 1B	

Connector A1 – Customer Lines (C Pairs)

Module	Row	Column			
		A	B	C	D
A1 (Upper)	1	Ground		Ground	
	2				
	3		Line 12A		Line 12B
	4	Line 11A		Line 11B	
	5		Line 10A		Line 10B
	6	Line 9A		Line 9B	
A1 (Lower)	7				
	8				
	9				
	10				
	11				
	12				

(3) DSPP-B – Front Connector Usage

The MDF cables which may be used for customer lines are either the 3AU 26874 xxxx or the 3AU 26875 xxxx. Only one cable is required per DSPP-B.

The following table indicates the connectors used with each of these cables.

Cable required	Connector	Signals
3AU 26874 XXXX (Note: one only required per DSPP-B)	A	POTS exchange pairs 1–8
	B	POTS exchange pairs 9–12
	C	Line pairs 1–12
3AU 26875 XXXX (Note: one only required per DSPP-B)	C	Line pairs 1–8
	A1	Line pairs 9–12

Typical LTAC-C/NACC-C interconnections are:

- Direct (Cable 530 – 3AU 48642 AAAA), as shown in Figure 13–19.

In this arrangement a cable connects from the LFSPB below an ATLC to two ADSL Twins (1 x DSPP-B, 1 x LTAC-C, plus 1 x NACC-C)

- Via the MDF or CCC

For additional information refer to the *Cabling* chapter of the *CMUX Housings, Racks and Cabling Handbook*.

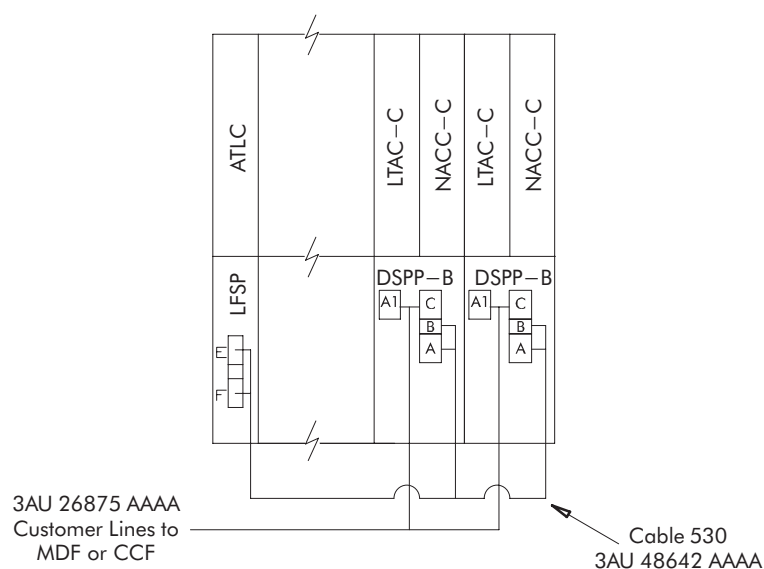


Figure 13–19 DSPP-B – Typical Direct Cabling

13.7 DURPB – 3EC 41250 Axxx

This plug is a single-width flat plug that is used to collect the alarms and Remote Inventory (RI) from the DURCC.

The DURPB is located in the plug area beneath the DURCC. The DURPB is a single width plug while the DURCC is a double-width. The plug slot used for the DURPB is the left slot of the two plug slots beneath the DURCC.

Features and functions of the DURPB are:

- ▶ Daisy-chains alarms between DURCC cards in a NU or AU.
- ▶ IAB bus routing to DURCC.
- ▶ Alarm routing to TARCB

13.7.1 DURPB – Outline

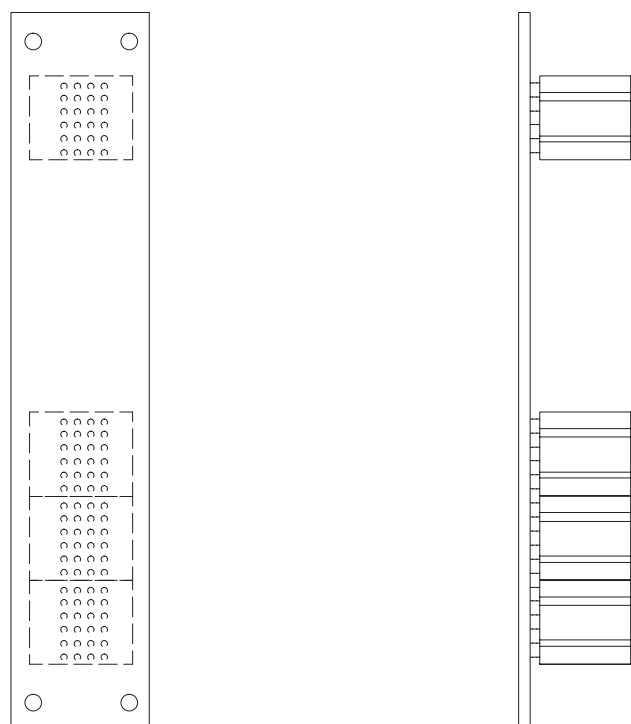


Figure 13–20 DURPB – Outline

13.7.2 DURPB – Connector Pinouts – Front

There are no front connectors on the DURPB.

All connectors are on the rear and mate with the connectors on the subrack backplane.

13.8 EOTP – 3EC 41280 ABxx

The EOTP is the plug for the EOTCA optical transport card. This card has sixteen 2 Mbit/s electrical interfaces which are multiplexed onto an optical fibre.

Where optical transmission is used between an NUC and a NUS or AU, an EOTCA and its associated EOTP is required at each end of the link.

The EOTP is a single slot flat plug. It has straight-through connections for the 16 x 2 Mbit/s G.703 signals from the EOTCA.

The EOTP is located below the EOTCA in the Main Subrack and contains capacitors for improved EMC performance.

13.8.1 EOTP – Outline

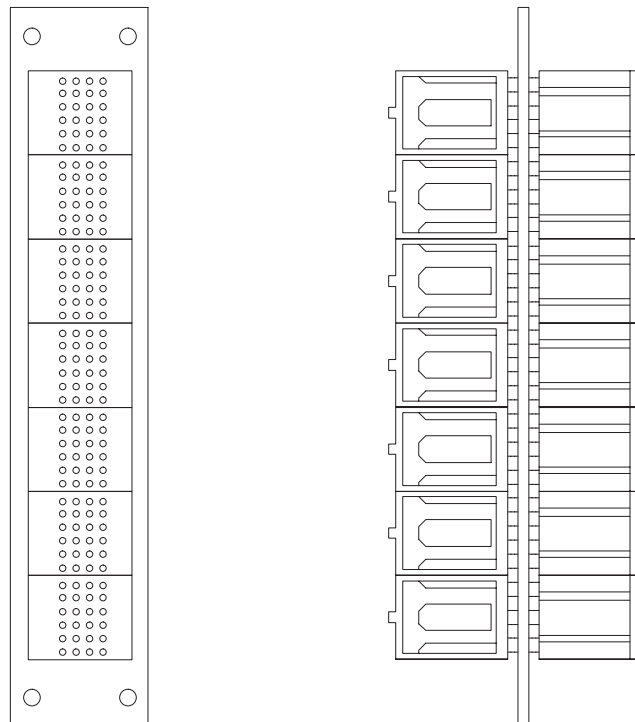


Figure 13–21 EOTP – Outline

13.8.2 EOTP – Interface – Electrical

The front connector on the EOTP supports sixteen 120Ω balanced G.703 links.

13.8.3 EOTP – Connector Pinouts – Front

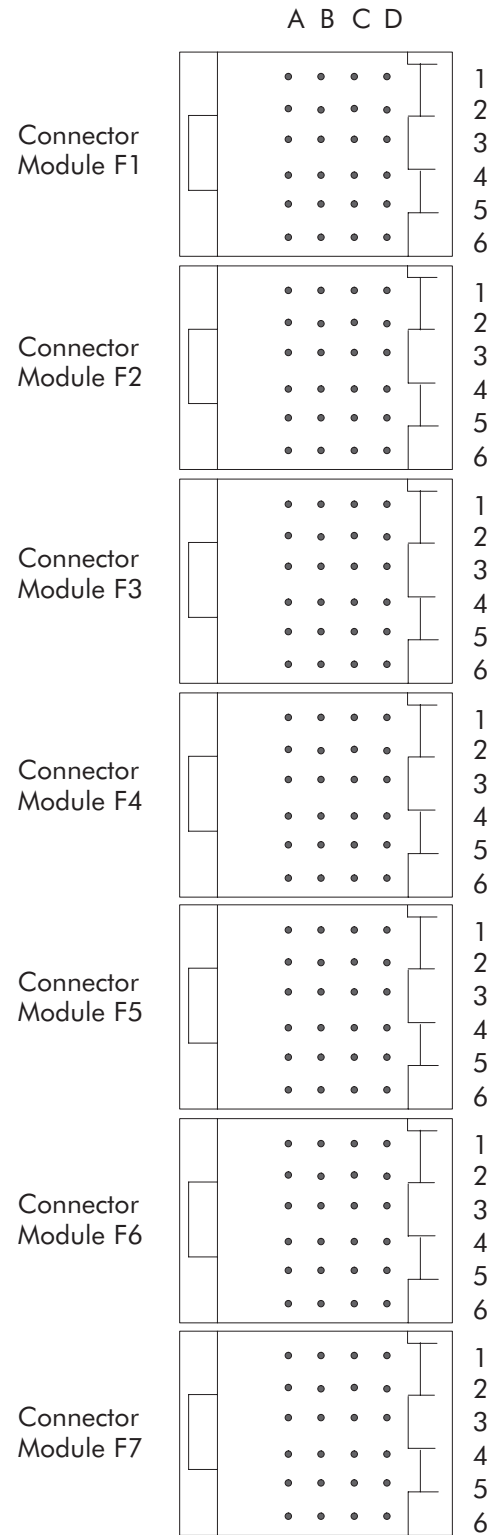


Figure 13–22 EOTP – Front Connector Pinouts

MODULE F1

	A	B	C	D
1		RXP_0		RXN_0
2	TXP_0		TXN_0	
3		RXP_1		RXN_1
4	TXP_1		TXN_1	
5		RXP_2		RXN_2
6	TXP_2		TXN_2	

MODULE F2

	A	B	C	D
1		RXP_3		RXN_3
2	TXP_3		TXN_3	
3		RXP_4		RXN_4
4	TXP_4		TXN_4	
5		RXP_5		RXN_5
6	TXP_5		TXN_5	

MODULE F3

	A	B	C	D
1		RXP_6		RXN_6
2	TXP_6		TXN_6	
3		RXP_7		RXN_7
4	TXP_7		TXN_7	
5		RXP_8		RXN_8
6	TXP_8		TXN_8	

MODULE F4

	A	B	C	D
1		RXP_9		RXN_9
2	TXP_9		TXN_9	
3		RXP_10		RXN_10
4	RXP_11		RXN_11	
5		RXP_12		RXN_12
6	RXP_13		RXN_13	

MODULE F5

	A	B	C	D
1		RXP_14		RXN_14
2				
3				
4	RXP_15		RXN_15	
5				
6				

MODULE F6

	A	B	C	D
1		TXN_15		
2	TXP_15			
3		TXP_11		TXN_11
4	TXP_12		TXN_12	
5		TXP_10		TXN_10
6			TXP_13	

MODULE F7

	A	B	C	D
1				
2				
3		TXN_13	TXP_14	TXN_14
4				
5				
6				

13.9 HBEP – 3EC 40826 AAAA

The HBEP–A (High Band Extension Plug) is a Common Function Mini–board Plug. It provides connections for narrowband and broadband extension controller cards.

The HBEP–A is used in plug slots 2 and 3 of the MLS–hb or MLS–hbe subrack when used in an Extension Panel position.

Main functions implemented in the HBEP are:

- ▶ NB Lower and Upper Extension of NLC Bus via twisted pair cables.
- ▶ Secondary assembly NB Lower and Upper Extension of NLC Bus via twisted pair cables
- ▶ BB Lower and Upper Extension of IQ Bus

Internal Functions:

- ▶ Line decoupling and Line termination for the NB and BB G703 120 Ohms ports. The internal interface towards the NB and BB controllers is single ended with common TX and RX ground.

Internal NE control:

- ▶ Presence Signal generation towards NSEC.

13.9.1 HBEP – Outline

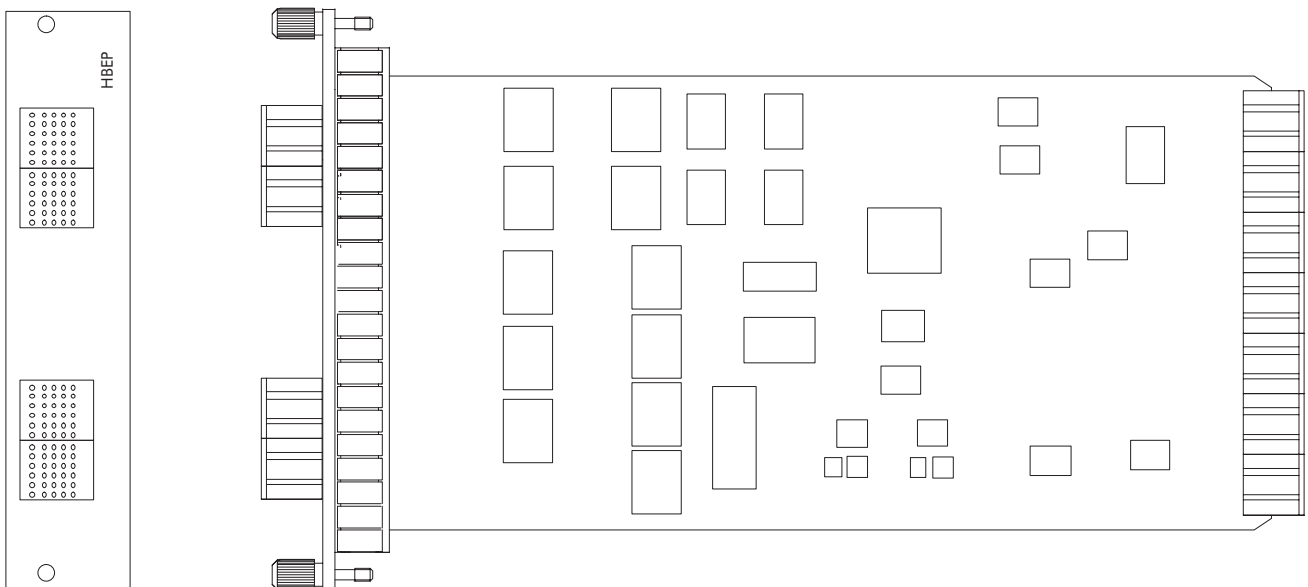


Figure 13–23 HBEP – Outline

13.9.2 HBEP – Connector Pinouts – Front

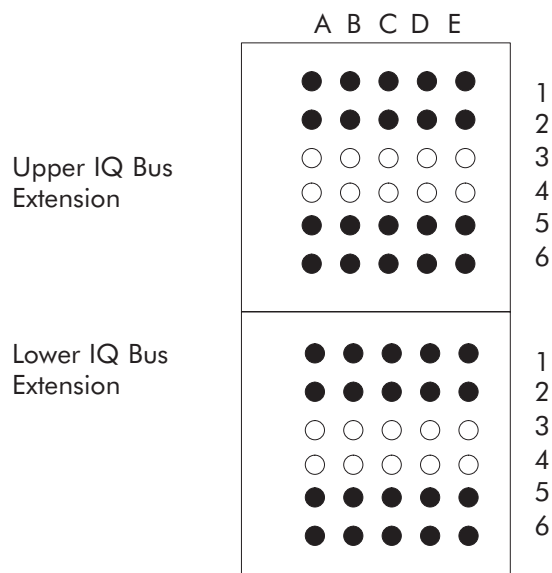
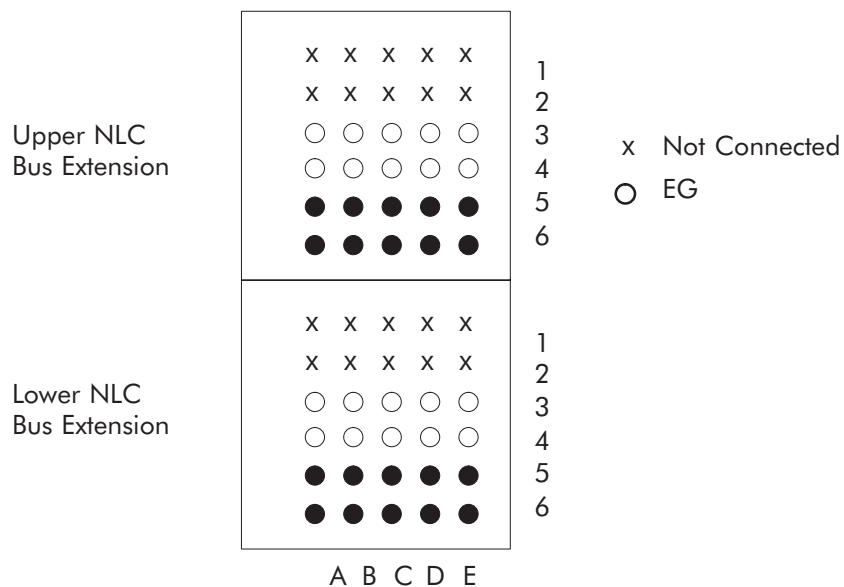


Figure 13–24 HBEP Front Panel Connections

Lower NLC bus extension module (slot 2/3) – Connector Module

	A	B	C	D	E
1					
2					
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	ckdn_sn	dtdn_sn	cksn_sn	ckup_sn	dtup_sn
6	ckdn_sp	dtdn_sp	cksn_sp	ckup_sp	dtup_sp

Upper NLC Bus extension module (slot 2/3) – Connector Module

	A	B	C	D	E
1					
2					
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	ckdn_pn	dtdn_pn	cksn_pn	ckup_pn	dtup_pn
6	ckdn_pp	dtdn_pp	cksn_pp	ckup_pp	dtup_pp

lower IQ bus extension module (slot 2) – Connector Module

	A	B	C	D	E
1	uclk_An	ucon_An	usync_An	udata_high_An	udata_low_An
2	uclk_Ap	ucon_Ap	usync_Ap	udata_high_Ap	udata_low_Ap
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	dclk_An	dcon_An	dsync_An	ddata_high_An	ddata_low_An
6	dclk_Ap	dcon_Ap	dsync_Ap	ddata_high_Ap	ddata_low_Ap

lower IQ bus extension module (slot 3) – Connector Module

	A	B	C	D	E
1	uclk_Bn	ucon_Bn	usync_Bn	udata_high_Bn	udata_low_Bn
2	uclk_Bp	ucon_Bp	usync_Bp	udata_high_Bp	udata_low_Bp
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	dclk_Bn	dcon_Bn	dsync_Bn	ddata_high_Bn	ddata_low_Bn
6	dclk_Bp	dcon_Bp	dsync_Bp	ddata_high_Bp	ddata_low_Bp

upper IQ bus extension module (slot 2) – Connector Module

	A	B	C	D	E
1	u_uclk_An	u_ucon_An	u_usync_An	u_udata_high_An	u_udata_low_An
2	u_uclk_Ap	u_ucon_Ap	u_usync_Ap	u_udata_high_Ap	u_udata_low_Ap
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	u_dclk_An	u_dcon_An	u_dsync_An	u_ddata_high_An	u_ddata_low_An
6	u_dclk_Ap	u_dcon_Ap	u_dsync_Ap	u_ddata_high_Ap	u_ddata_low_Ap

upper IQ bus extension module (slot 3) – Connector Module

	A	B	C	D	E
1	u_uclk_Bn	u_ucon_Bn	u_usync_Bn	u_udata_high_Bn	u_udata_low_Bn
2	u_uclk_Bp	u_ucon_Bp	u_usync_Bp	u_udata_high_Bp	u_udata_low_Bp
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	u_dclk_Bn	u_dcon_Bn	u_dsync_Bn	u_ddata_high_Bn	u_ddata_low_Bn
6	u_dclk_Bp	u_dcon_Bp	u_dsync_Bp	u_ddata_high_Bp	u_ddata_low_Bp

13.10 HBMP–A – 3EC 40823 AAAA

The HBMP–A (High Band Main Plug–A 120 Ohm) is a Common Function Mini–board Plug. It provides connections for narrowband and broadband controller cards.

The HBMP–A is used in plug slots 2 and 3 of the MLS–hb subrack when it is used in a Main Panel position.

Main functions implemented in the HBMP–A are:

- ▶ NB 8x2Mbit/s 120Ω G.703 Interfaces.
- ▶ IMA 2x2Mbit/s 120Ω G.703 Interfaces.
- ▶ E3/DS3 34/44Mbit/s 75Ω G.703 Interface.
- ▶ T3 120Ω G.703 Compliant Synchronization Input
- ▶ T4 120Ω G.703 Compliant Synchronization Output
- ▶ NB Lower Extension of NLC Bus via twisted pair cabling
- ▶ BB Lower Extension of IQ Bus

Internal Functions:

- ▶ Line decoupling and Line termination for the NB and BB G703 120 Ohms ports. The internal interface towards the NB and BB controllers is single ended with common TX and RX ground.
- ▶ Line decoupling and line termination for th E3/DS3 75 Ω Tx and Rx ports. Relay selection (controlled by ASCC) connects these ports to either the main of standby ASCC board.
- ▶ T3 signal distributed to SYNTH, BB and NB controller (NB selectable via on–plug switch).

Internal NE control:

- ▶ Presence Signal generation towards TARC–B.

13.10.1 HBMP-A – Outline

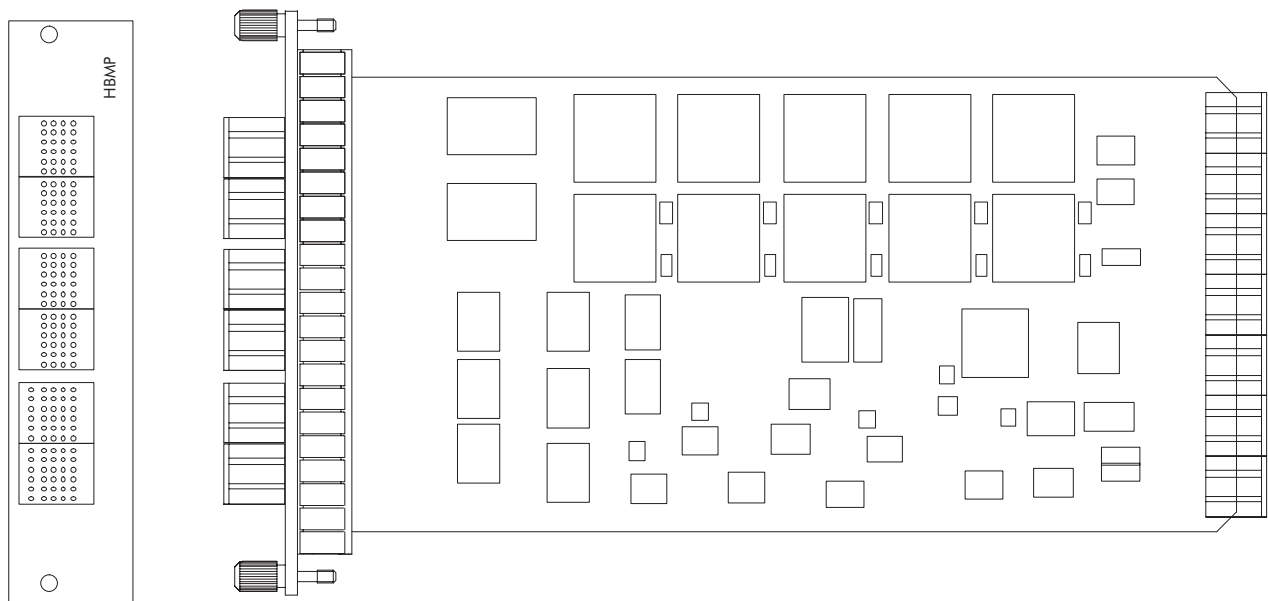


Figure 13–25 HBMP-A – Outline

13.10.2 HBMP–A – Connector Pinouts – Front

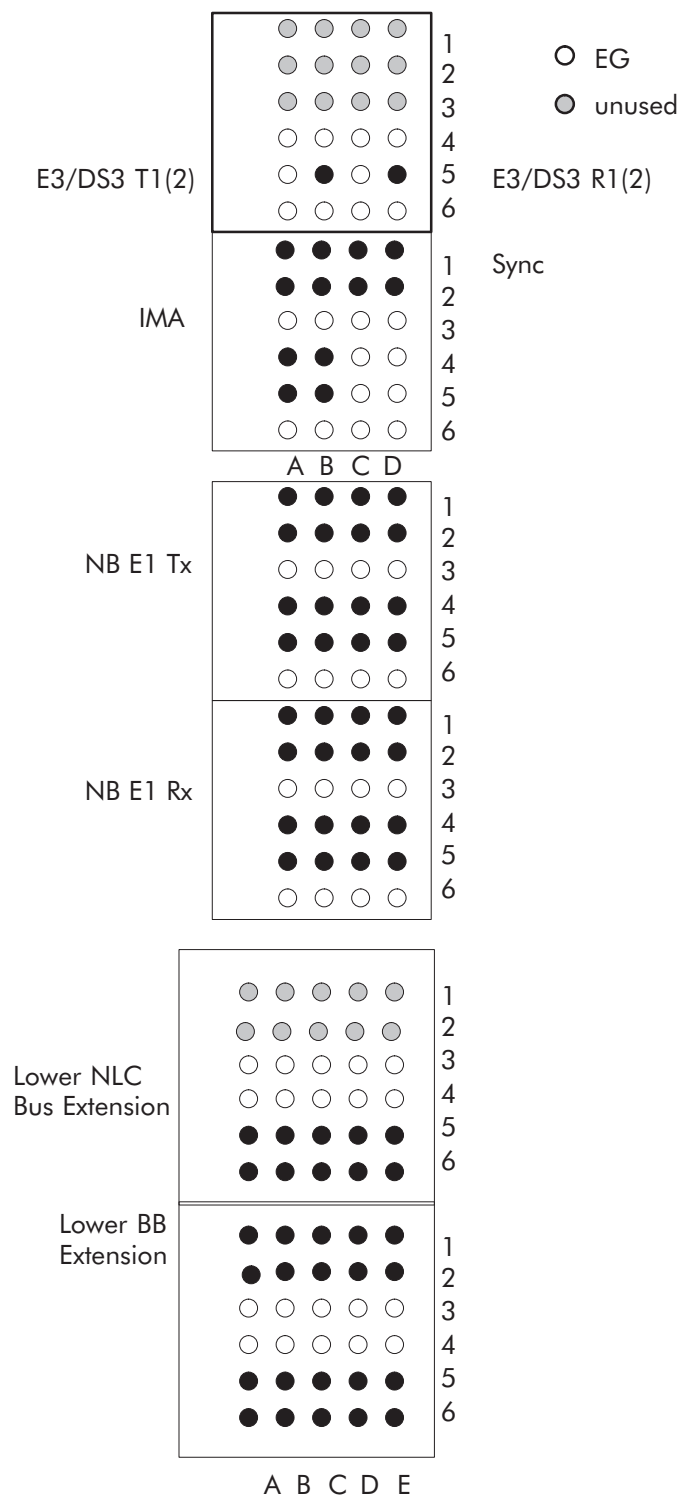


Figure 13–26 HBMP–A Front Panel Connections

E3/DS3 module (slot 2) – Connector Module

	A	B	C	D
1	NOT ROUTED	NOT ROUTED	NOT ROUTED	NOT ROUTED
2	NOT ROUTED	NOT ROUTED	NOT ROUTED	NOT ROUTED
3	NOT ROUTED	NOT ROUTED	NOT ROUTED	NOT ROUTED
4	EG	EG	EG	EG
5	EG	E3/DS3 T1active	EG	E3/DS3 R1active
6	EG	EG	EG	EG

E3/DS3 module (slot 3) – Connector Module

	A	B	C	D
1	NOT ROUTED	NOT ROUTED	NOT ROUTED	NOT ROUTED
2	NOT ROUTED	NOT ROUTED	NOT ROUTED	NOT ROUTED
3	NOT ROUTED	NOT ROUTED	NOT ROUTED	NOT ROUTED
4	EG	EG	EG	EG
5	EG	E3/DS3 T2	EG	E3/DS3 R2
6	EG	EG	EG	EG

IMA and Sync module (slot 2) – Connector Module

	A	B	C	D
1	2M_T1_IMA_N	2M_T2_IMA_N	T4_N	T3_1N
2	2M_T1_IMA_P	2M_T2_IMA_P	T4_P	T3_1P
3	EG	EG	EG	EG
4	2M_R1_IMA_N	2M_R2_IMA_N	EG	EG
5	2M_R1_IMA_P	2M_R2_IMA_P	EG	EG
6	EG	EG	EG	EG

IMA and Sync module (slot 3) – Connector Module

	A	B	C	D
1	2M_T3_IMA_N	2M_T4_IMA_N	T4_N	T3_2N
2	2M_T3_IMA_P	2M_T4_IMA_P	T4_P	T3_2P
3	EG	EG	EG	EG
4	2M_R3_IMA_N	2M_R4_IMA_N	EG	EG
5	2M_R3_IMA_P	2M_R4_IMA_P	EG	EG
6	EG	EG	EG	EG

NB E1 Tx module (slot 2) – Connector Module

	A	B	C	D
1	2M_T1_N	2M_T2_N	2M_T3_N	2M_T4_N
2	2M_T1_P	2M_T2_P	2M_T3_P	2M_T4_P
3	EG	EG	EG	EG
4	2M_T5_N	2M_T6_N	2M_T7_N	2M_T8_N
5	2M_T5_P	2M_T6_P	2M_T7_P	2M_T8_P
6	EG	EG	EG	EG

NB E1 Tx module (slot 3) – Connector Module

	A	B	C	D
1	2M_T9_N	2M_T10_N	2M_T11_N	2M_T12_N
2	2M_T9_P	2M_T10_P	2M_T11_P	2M_T12_P
3	EG	EG	EG	EG
4	2M_T13_N	2M_T14_N	2M_T15_N	2M_T16_N
5	2M_T13_P	2M_T14_P	2M_T15_P	2M_T16_P
6	EG	EG	EG	EG

NB E1 Rx module (slot 2) – Connector Module

	A	B	C	D
1	2M_R1_N	2M_R2_N	2M_R3_N	2M_R4_N
2	2M_R1_P	2M_R2_P	2M_R3_P	2M_R4_P
3	EG	EG	EG	EG
4	2M_R5_N	2M_R6_N	2M_R7_N	2M_R8_N
5	2M_R5_P	2M_R6_P	2M_R7_P	2M_R8_P
6	EG	EG	EG	EG

NB E1 Rx module (slot 3) – Connector Module

	A	B	C	D
1	2M_R9_N	2M_R10_N	2M_R11_N	2M_R12_N
2	2M_R9_P	2M_R10_P	2M_R11_P	2M_R12_P
3	EG	EG	EG	EG
4	2M_R13_N	2M_R14_N	2M_R15_N	2M_R16_N
5	2M_R13_P	2M_R14_P	2M_R15_P	2M_R16_P
6	EG	EG	EG	EG

Lower NLC bus extension module (slot 2/3) – Connector Module

	A	B	C	D	E
1					
2					
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	ckdn_sn	dtdn_sn	cksn_sn	ckup_sn	dtup_sn
6	ckdn_sp	dtdn_sp	cksn_sp	ckup_sp	dtup_sp

IQ bus extension module (slot 2/3) – Connector Module

	A	B	C	D	E
1	euclkn	euconn	eusyncn	eudatahin	eudatalon
2	euclkp	euconp	eusyncp	eudatahip	eudatalop
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	edclkn	edconn	edsyncn	eddatahin	eddatalon
6	edclkp	edconp	edsyncp	eddatahip	eddatalop

13.11 LFSPB – 3EC 40015 ACxx

The Line Filtering Single Plug (LFSPB) is a straight-through plug with 30 pairs. It provides external connections for the following cards:

- ▶ ALLC.
- ▶ ATLCC.
- ▶ BALCF.
- ▶ PMLC.
- ▶ TACCB.

The plug includes filter capacitors to improve EMC performance.

The LFSPB allows for connection of up to 30 pairs of wires by means of a metal connector. To achieve isolation every second pin is used in a zig-zag configuration. The pairs are normally connected to an MDF.

Note *Section 7.6.4 contains a table which describes the mapping of channels on different types of cards to LFSPB pins.*

Note *The LFSPB is generally similar to the LFSPA with the addition of ground pins in position A1 in each block. These pins ground the drain wires in cable 3AU 26874 xxxA. Grounding of the drain wires at the LFSPB enhances EMC compliance.*

For details of cable 3AU 26874 xxxA, refer to the CMUX Housings, Racks and Cabling Handbook.

13.11.1 LFSPB – Outline

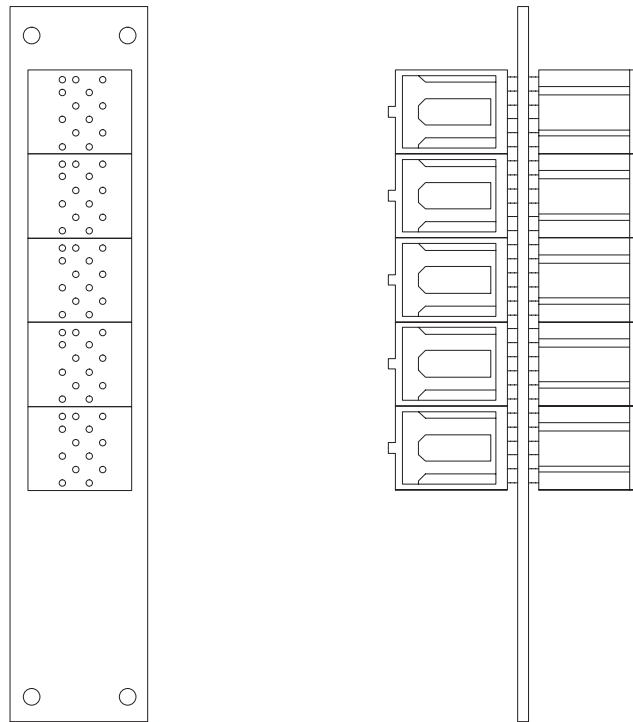


Figure 13–27 LFSPB – Outline

13.11.2 LFSPB – Connector Pinouts – Front

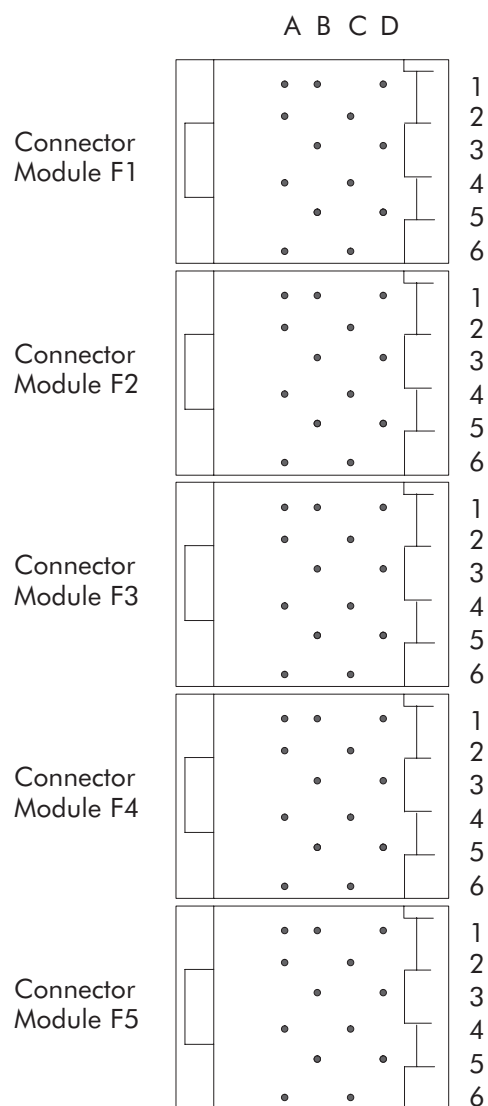


Figure 13–28 LFSPB – Front Connector Pinouts

Customer Lines – Connector Module F1				
	A	B	C	D
1	Ground (LFSPB only)	LN30A	—	LN30B
2	LN29A	—	LN29B	—
3		LN28A	—	LN28B
4	LN27A		LN27B	—
5	—	LN26A	—	LN26B
6	LN25A	—	LN25B	—

Customer Lines – Connector Module F2

	A	B	C	D
1	Ground (LFSPB only)	LN24A	–	LN24B
2	LN23A	–	LN23B	–
3	–	LN22A	–	LN22B
4	LN21A	–	LN21B	–
5	–	LN20A	–	LN20B
6	LN19A	–	LN19B	–

Customer Lines – Connector Module F3

	A	B	C	D
1	Ground (LFSPB only)	LN18A	–	LN18B
2	LN17A	–	LN17B	–
3	–	LN16A	–	LN16B
4	LN15A	–	LN15B	–
5	–	LN14A	–	LN14B
6	LN13A	–	LN13B	–

Customer Lines – Connector Module F4

	A	B	C	D
1	Ground (LFSPB only)	LN12A	–	LN12B
2	LN11A	–	LN11B	–
3	–	LN10A	–	LN10B
4	LN9A	–	LN9B	–
5	–	LN8A	–	LN8B
6	LN7A	–	LN7B	–

Customer Lines – Connector Module F5

	A	B	C	D
1	Ground (LFSPB only)	LN6A	–	LN6B
2	LN5A	–	LN5B	–
3	–	LN4A	–	LN4B
4	LN3A	–	LN3B	–
5	–	LN2A	–	LN2B
6	LN1A	–	LN1B	–

Note

- Mapping of line card channels to MDF positions and LFSPB pinouts is shown in the table in Section 7.6.4 of this handbook.
- Revertive Call uses Pins B1 and D1 in Connector Module F5.

13.12 NEHPG – 3EC 41352 AAxx/ABxx

The NEHPG (Network Element Handler Plug) is Common Plug, located in slots 2 and 3 in the Common Plug area of a MLS–hb or MLS–hbe. The NEHPG is used in:

- ▶ Main subrack
- ▶ Broadband–only extension subracks.

The NEHPG provides external connections for the following:

- ▶ 2 Mbit/s IMA links from the AICC to an external DDF.
- ▶ 2 Mbit/s V5.2 connections from the external DDF.
- ▶ T3 120Ω G.703 Compliant Synchronization Input
- ▶ T4 120Ω G.703 Compliant Synchronization Output
- ▶ In the first subrack in an NU or AU, the NEHPG extends the narrowband (NB) and/or broadband (BB) busses to the next subrack.
- ▶ In subsequent broadband–only subracks in an NU or AU:
 - Connects to the BB bus extension from the subrack above it in the system.
 - Extends the BB bus to the next subrack.

Note

- *The NEHPGE is used in narrowband extension panels and in combo (NB+BB) extension panels. The NEHPGE is described in Section 13.13.*
- *Until late 2003, new CMUX installations used NEHP plugs for interconnecting cables between subracks. Subsequent deliveries of CMUX use HBMP plugs in the Main Subrack and HBEP plugs in the Extension Subrack.*

13.12.1 NEHPG/NEHPGE Usage

- ▶ In any Main Panel containing NB and BB cards, NEHPG 3EC 41352 AAAA must be replaced by NEHPG 3EC 41352 ABAA to ensure EMC and G.703 compliance.
- ▶ Associated with change to ABAA variant of NEHPG, any BSEC cables that terminate on the upgraded plug must be upgraded from 3AU 26636 XXXA to 3AU 26636 XXXB.
- ▶ All NU NB Extension Panels must be fitted with NEHPGE 3EC 41352 ACAA and not NEHPG 41352 ABAA to support extension of the NU to four NB panels and NEHC redundancy.

13.12.2 NEHPG – Outline

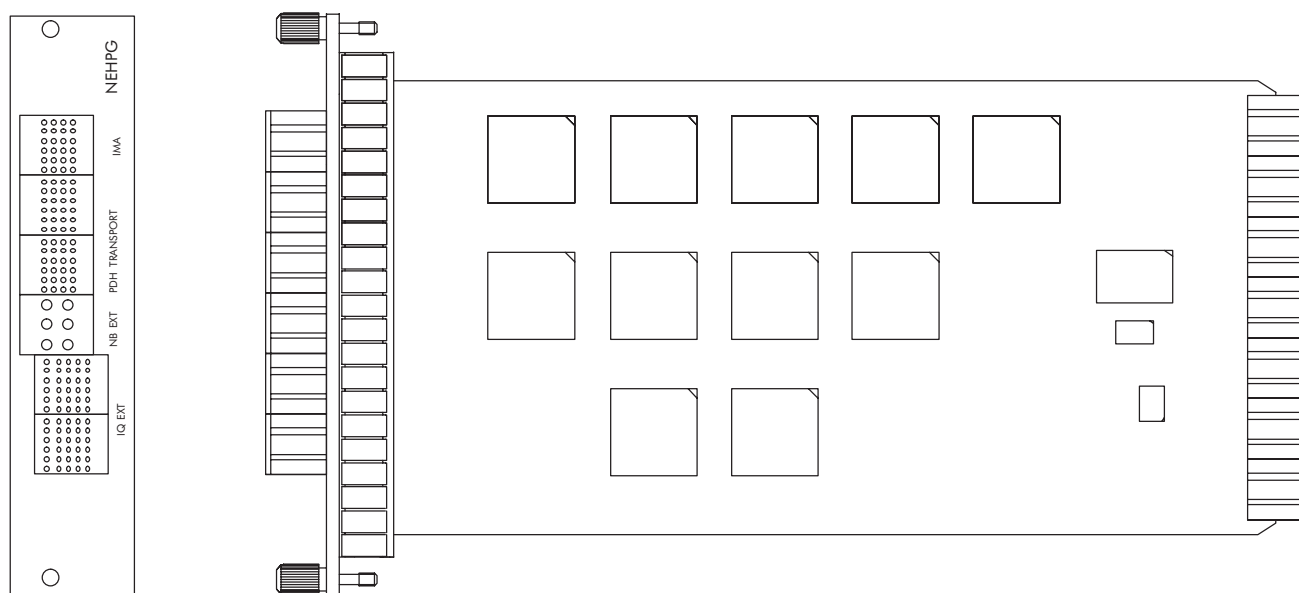


Figure 13–29 NEHPG – Outline

13.12.3 NEHPG – Connector Pinouts – Front

Front connectors on the NEHPG are arranged in six modules.

- ▶ The functions of these modules in NEHPG are shown in Figure 13–30.
- ▶ Pin numbering is shown in Figure 13–31.

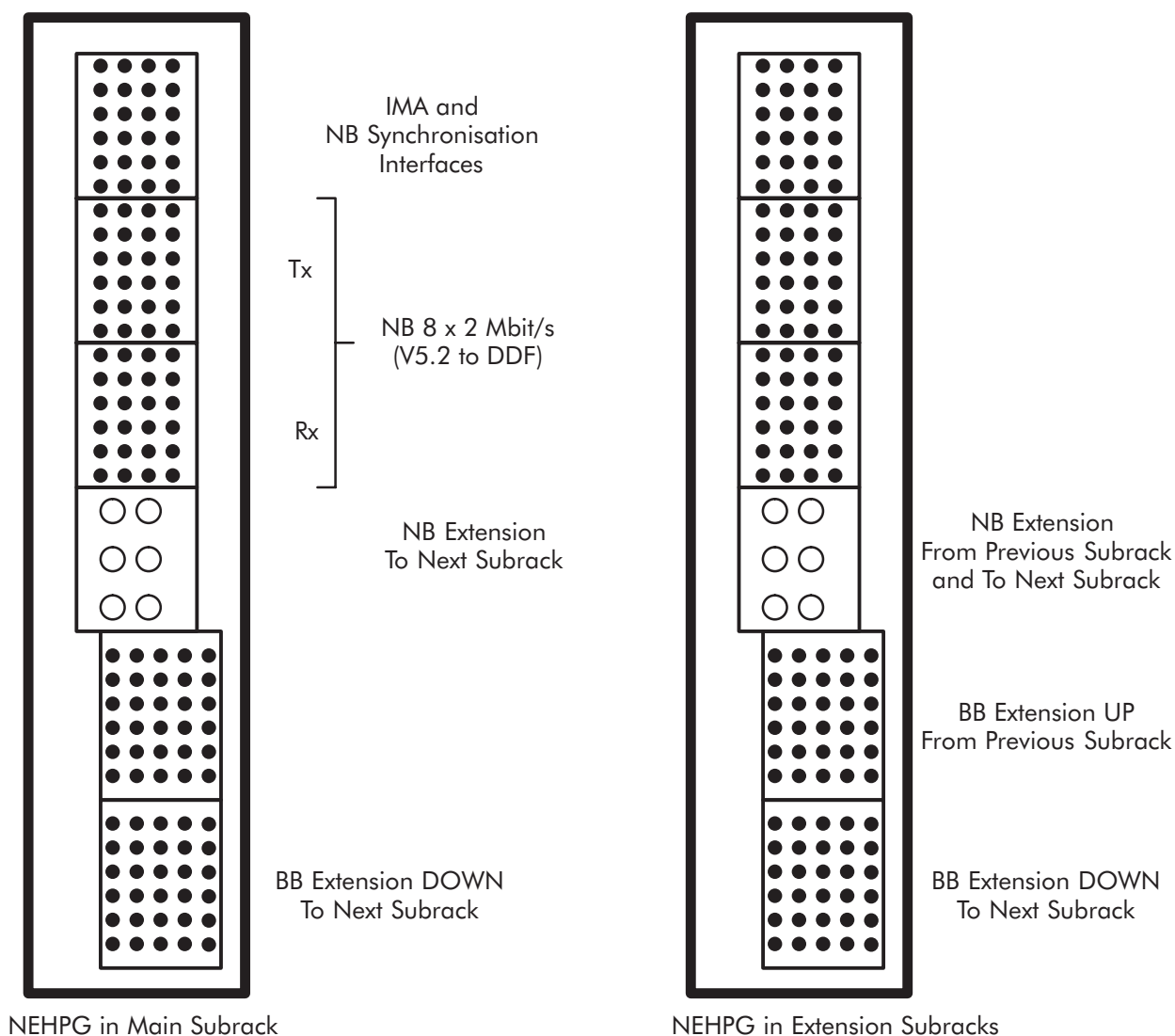


Figure 13–30 NEHPG – Front Connector Functions

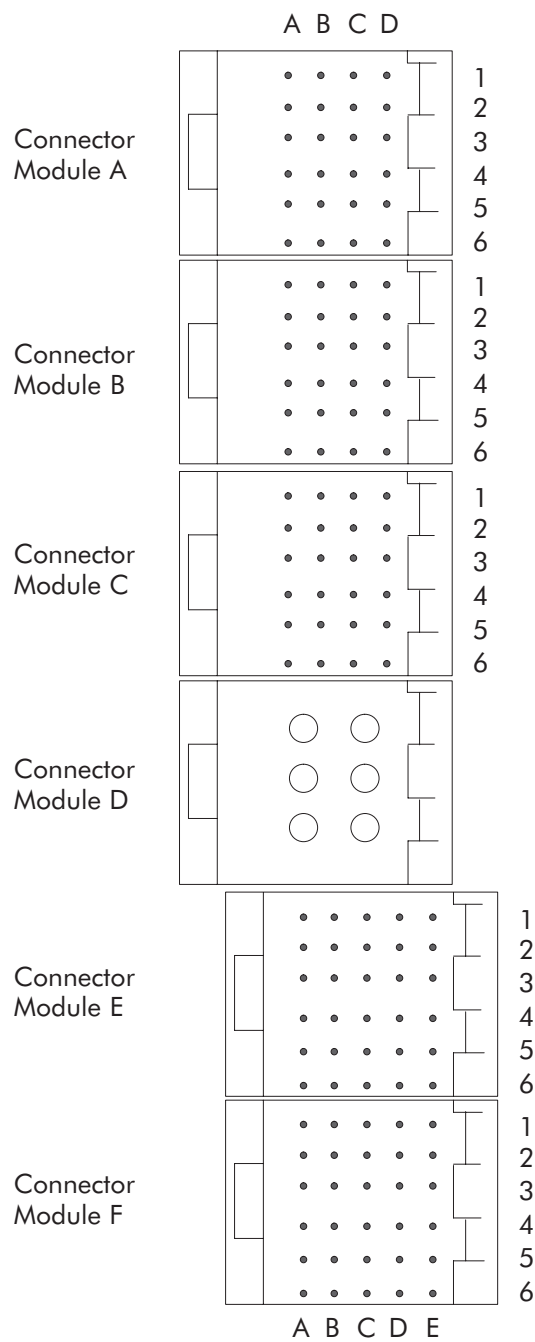


Figure 13–31 NEHPG – Pin Numbering

(1) Pinouts – Modules A to C – NEHPG in Plug Slot 2.

The following tables show the pinouts in the 6 x 4 connectors A to C when the NEHPG is plugged into slot 2. These connectors are the top three connectors on the NEHPG.

IMA Interface and NB Synchronization – Connector Module A				
	A	B	C	D
1	2M_T1_IMA_N	2M_T2_IMA_N	T4_O_N	T3A_IN_N
2	2M_T1_IMA_P	2M_T2_IMA_P	T4_O_P	T3A_IN_P
3	EG	EG	EG	EG
4	2M_R1_IMA_N	2M_R2_IMA_N	EG	EG
5	2M_R1_IMA_P	2M_R2_IMA_P	EG	EG
6	EG	EG	EG	EG

NB Interface Tx – Connector Module B				
	A	B	C	D
1	2M_T1_N	2M_T2_N	2M_T3_N	2M_T4_N
2	2M_T1_P	2M_T2_P	2M_T3_P	2M_T4_P
3	EG	EG	EG	EG
4	2M_T5_N	2M_T6_N	2M_T7_N	2M_T8_N
5	2M_T5_P	2M_T6_P	2M_T7_P	2M_T8_P
6	EG	EG	EG	EG

NB Interface Rx – Connector Module C				
	A	B	C	D
1	2M_R1_N	2M_R2_N	2M_R3_N	2M_R4_N
2	2M_R1_P	2M_R2_P	2M_R3_P	2M_R4_P
3	EG	EG	EG	EG
4	2M_R5_N	2M_R6_N	2M_R7_N	2M_R8_N
5	2M_R5_P	2M_R6_P	2M_R7_P	2M_R8_P
6	EG	EG	EG	EG

(2) Pinouts – Modules A to C – NEHPG in Plug Slot 3.

The following tables show the pinouts in the 6 x 4 connectors A to C when the NEHPG is plugged into slot 3. These connectors are the top three connectors on the NEHPG.

IMA Interface and NB Synchronization Interface – Connector Module A

	A	B	C	D
1	2M_T3_IMA_N	2M_T4_IMA_N	T4_O_N	T3B_IN_N
2	2M_T3_IMA_P	2M_T4_IMA_P	T4_O_P	T3B_IN_P
3	EG	EG	EG	EG
4	2M_R3_IMA_N	2M_R4_IMA_N	EG	EG
5	2M_R3_IMA_P	2M_R4_IMA_P	EG	EG
6	EG	EG	EG	EG

NB Interface Tx – Connector Module B

	A	B	C	D
1	2M_T9_N	2M_T10_N	2M_T11_N	2M_T12_N
2	2M_T9_P	2M_T10_P	2M_T11_P	2M_T12_P
3	EG	EG	EG	EG
4	2M_T13_N	2M_T14_N	2M_T15_N	2M_T16_N
5	2M_T13_P	2M_T14_P	2M_T15_P	2M_T16_P
6	EG	EG	EG	EG

NB Interface Rx – Connector Module C

	A	B	C	D
1	2M_R9_N	2M_R10_N	2M_R11_N	2M_R12_N
2	2M_R9_P	2M_R10_P	2M_R11_P	2M_R12_P
3	EG	EG	EG	EG
4	2M_R13_N	2M_R14_N	2M_R15_N	2M_R16_N
5	2M_R13_P	2M_R14_P	2M_R15_P	2M_R16_P
6	EG	EG	EG	EG

(3) Pinouts – Module D – NEHPG in Plug Slot 2 or 3.

Figures 13–32 and 13–33 show the pinouts in the 3 x 2 coaxial connector D when the NEHPG is plugged into slot 2 or slot 3.

This connector is the fourth connector from the top of the NEHPG.

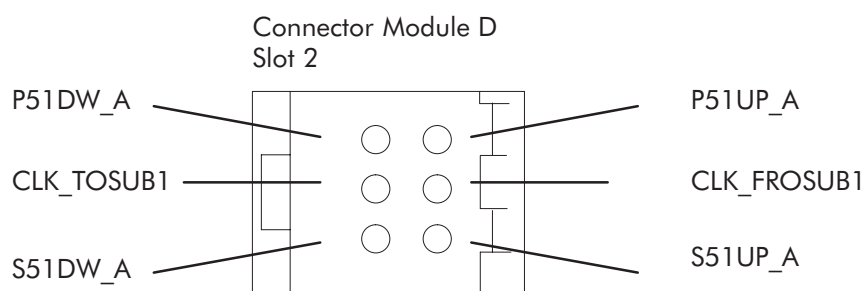


Figure 13–32 NEHPG – Slot 2 – Module D Pinouts

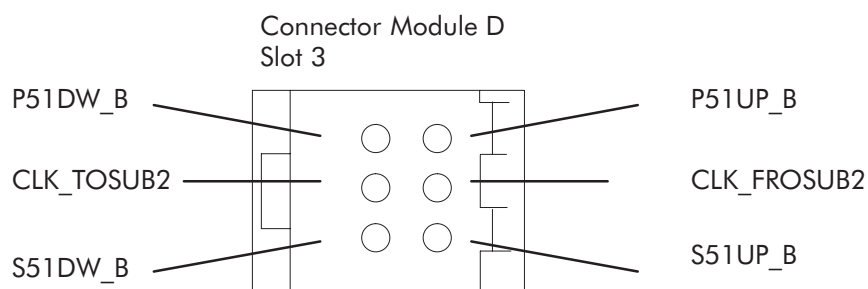


Figure 13–33 NEHPG – Slot 3 – Module D Pinouts

(4) Pinouts – Module E – NEHPG in Plug Slot 2 or 3.

Uext External 6x5 Shielded Connector					
	A	B	C	D	E
1	Uext_uclk_xn	Uext_ucon_xn	Uext_usync_xn	Uext_udata_high_xn	Uext_udata_low_xn
2	Uext_uclk_xp	Uext_ucon_xp	Uext_usync_xp	Uext_udata_high_xp	Uext_udata_low_xp
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	Uext_dclk_xn	Uext_dcon_xn	Uext_dsync_xn	Uext_ddata_high_xn	Uext_ddata_low_xn
6	Uext_dclk_xp	Uext_dcon_xp	Uext_dsync_xp	Uext_ddata_high_xp	Uext_ddata_low_xp

(5) Pinouts – Module F – NEHPG in Plug Slot 2 or 3.**Lext External 6x5 Shielded Connector**

	A	B	C	D	E
1	Lext_uclk_xn	Lext_ucon_xn	Lext_usync_xn	Lext_udata_high_xn	Lext_udata_low_xn
2	Lext_uclk_xp	Lext_ucon_xp	Lext_usync_xp	Lext_udata_high_xp	Lext_udata_low_xp
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	Lext_dclk_xn	Lext_dcon_xn	Lext_dsync_xn	Lext_ddata_high_xn	Lext_ddata_low_xn
6	Lext_dclk_xp	Lext_dcon_xp	Lext_dsync_xp	Lext_ddata_high_xp	Lext_ddata_low_xp

13.13 NEHPGE – 3EC 41352 ACxx

The NEHPGE (Network Element Handler Plug) is Common Plug, located in slots 2 or 3 in the Common Plug area of a MLS–hb or MLS–hbe.

It is used in all extension subracks that support narrowband services to extend NB and/or BB busses from the previous subrack and to the next subrack:

- ▶ Narrowband extension subracks
- ▶ Combo (NB/BB) extension subracks.
- ▶ NEHPG (3AU 41352 ABAA) is used in:
 - Main subrack
 - Broadband–only extension subracks.

Note *The NEHPG is used in the Main subrack and in broadband–only extension subracks. It is described in Section 13.12*

13.13.1 NEHPG/NEHPGE Usage

- ▶ In any Main Panel containing NB and BB cards, NEHPG 3EC 41352 AAAA must be replaced by NEHPG 3EC 41352 ABAA to ensure EMC and G.703 compliance.
- ▶ Associated with change to ABAA variant of NEHPG, any BSEC cables that terminate on the upgraded plug must be upgraded from 3AU 26636 XXXA to 3AU 26636 XXXB.
- ▶ All NU NB Extension Panels must be fitted with NEHPGE 3EC 41352 ACAA and not NEHPG 41352 ABAA to support extension of the NU to 4 NB panels and NEHC redundancy.

Note *Until late 2003, new CMUX installations used NEHP plugs for interconnecting cables between subracks. Subsequent deliveries of CMUX use HBMP plugs in the Main Subrack and HBEP plugs in the Extension Subrack.*

13.13.2 NEHPGE – Outline

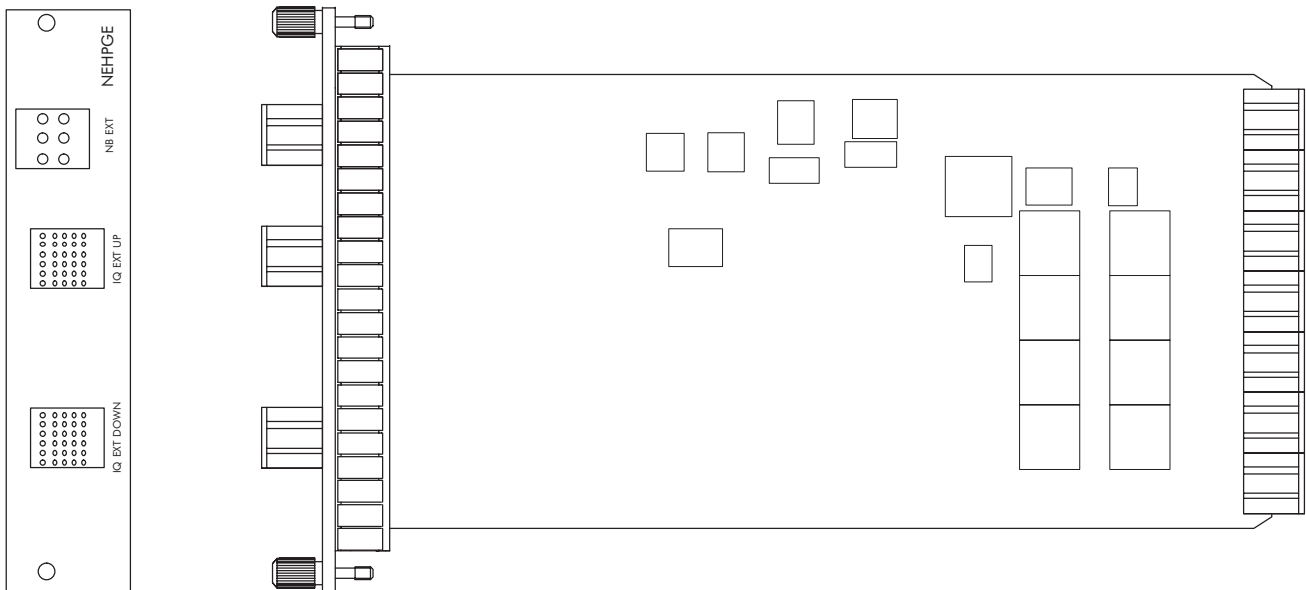


Figure 13–34 NEHPGE – Outline

13.13.3 NEHPGE – Connector Pinouts – Front

Front connectors on the NEHPG are arranged in three modules.

- ▶ The functions of these modules in NEHPGE are shown in Figure 13–35.
- ▶ Pin numbering is shown in Figure 13–36.

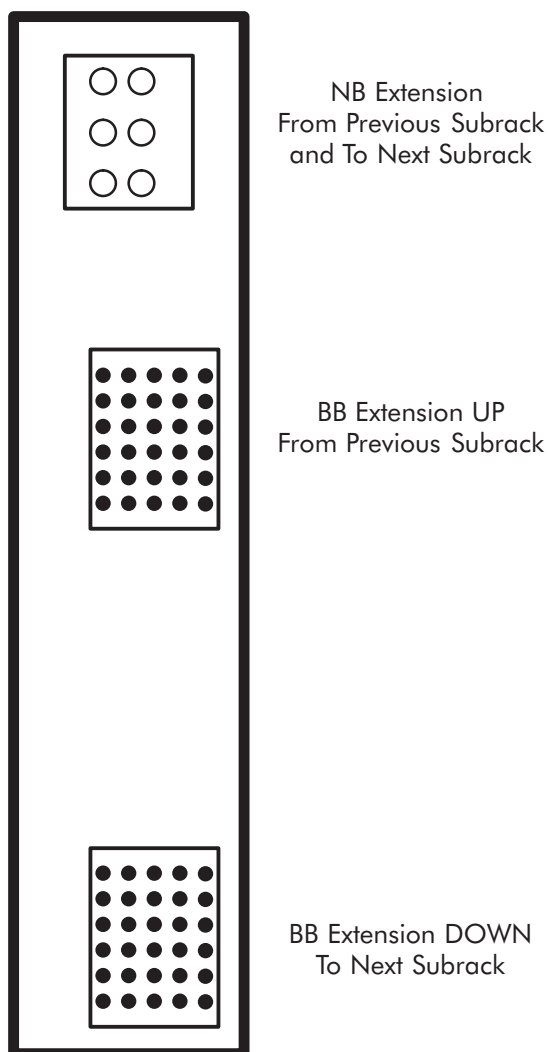
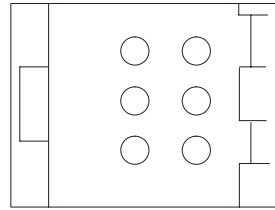
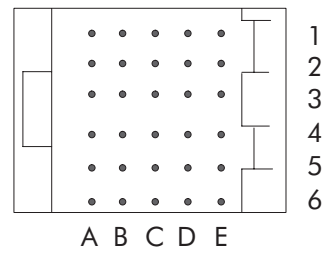
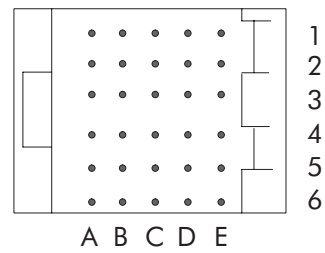


Figure 13–35 NEHPGE – Front Connector Functions

Connector
Module AConnector
Module CConnector
Module F*Figure 13–36 NEHPGE – Pin Numbering*

(1) Pinouts – Module A – NEHPGE in Plug Slot 2 or 3.

Figures 13–37 and 13–38 show the pinouts in the 3 x 2 coaxial connector D when the NEHPGE is plugged into slot 2 or slot 3.

This connector is the top connector of the NEHPGE.

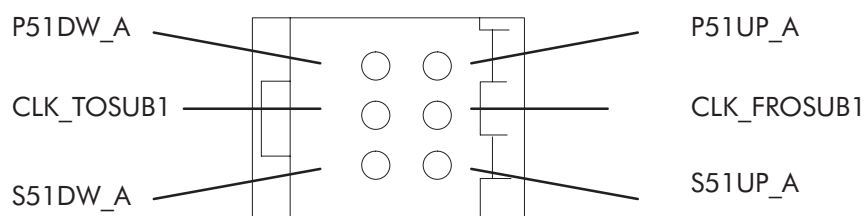


Figure 13–37 NEHPGE – Slot 2 – Module D Pinouts

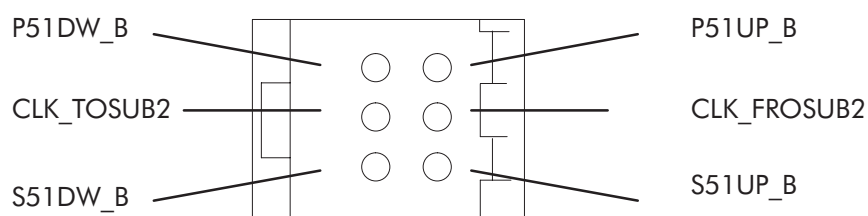


Figure 13–38 NEHPGE – Slot 3 – Module D Pinouts

(2) Pinouts – Module C – NEHPGE in Plug Slot 2 or 3.

Lext External 6x5 Shielded Connector					
	A	B	C	D	E
1	Lext_uclk_xn	Lext_ucon_xn	Lext_usync_xn	Lext_udata_high_xn	Lext_udata_low_xn
2	Lext_uclk_xp	Lext_ucon_xp	Lext_usync_xp	Lext_udata_high_xp	Lext_udata_low_xp
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	Lext_dclk_xn	Lext_dcon_xn	Lext_dsync_xn	Lext_ddata_high_xn	Lext_ddata_low_xn
6	Lext_dclk_xp	Lext_dcon_xp	Lext_dsync_xp	Lext_ddata_high_xp	Lext_ddata_low_xp

(3) Pinouts – Module F – NEHPGE in Plug Slot 2 or

Uext External 6x5 Shielded Connector					
	A	B	C	D	E
1	Uext_uclk_xn	Uext_ucon_xn	Uext_usync_xn	Uext_udata_high_xn	Uext_udata_low_xn
2	Uext_uclk_xp	Uext_ucon_xp	Uext_usync_xp	Uext_udata_high_xp	Uext_udata_low_xp
3	EG	EG	EG	EG	EG
4	EG	EG	EG	EG	EG
5	Uext_dclk_xn	Uext_dcon_xn	Uext_dsync_xn	Uext_ddata_high_xn	Uext_ddata_low_xn
6	Uext_dclk_xp	Uext_dcon_xp	Uext_dsync_xp	Uext_ddata_high_xp	Uext_ddata_low_xp

13.14 PAIP – 3EC 40265 AAxx

The PAIC Plug (PAIP) is the plug associated with the PAIC. It is a straight-through plug with eight pairs which connects four IMA links to a PAIC via the subrack backplane.

- ▶ The rear of the PAIP has two metal modules for connection to the subrack backplane.
- ▶ The PAIP has two metal modules on the front for connection of the external cabling for up to four 2 x 2 Mbit/s 120Ω IMA links.

The PAIP includes filter capacitors to improve EMC performance.

13.14.1 PAIP – Outline

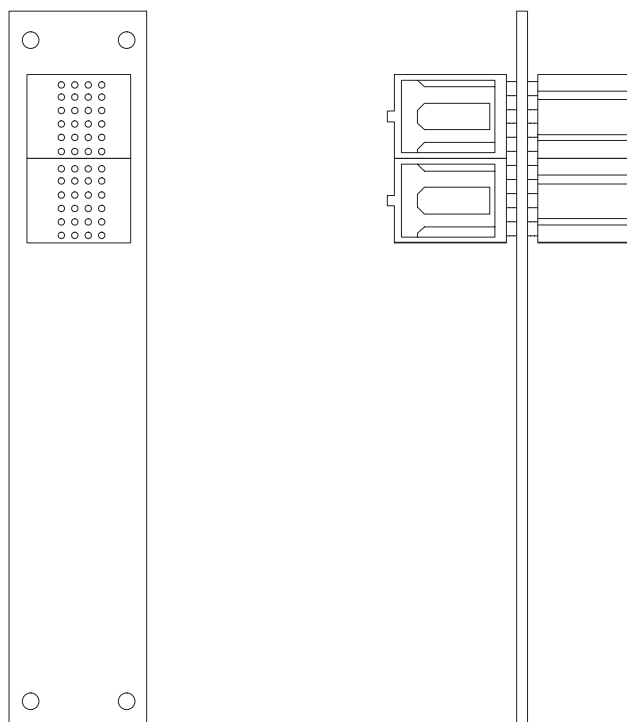


Figure 13–39 PAIP – Outline

13.14.2 PAIP – Connector Pinouts – Front

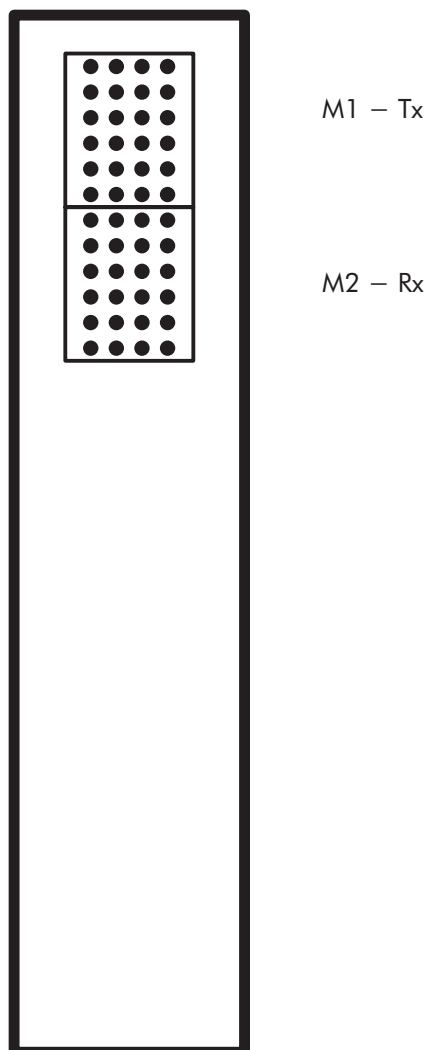


Figure 13–40 PAIP – Front Connectors

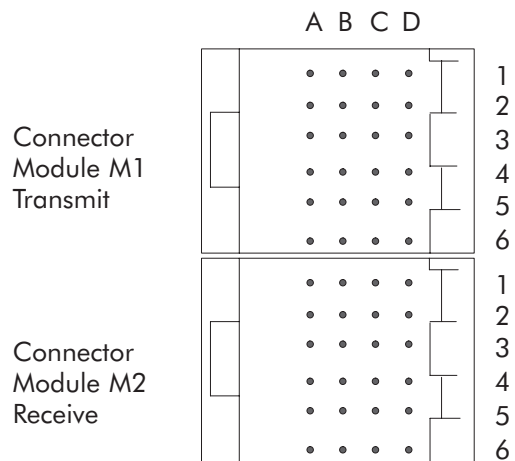


Figure 13–41 PAIP – Pin Numbering

Connector Module M1 – Transmit				
	A	B	C	D
A1		TxP_0		TxN_0
A2	TxP_1		TxN_1	
A3		EG		EG
A4	EG		EG	
A5		TxP_2		TxN_2
A6	TxP_3		TxN_3	

Connector Module M2 – Receive				
	A	B	C	D
A1		RxP_0		RxN_0
A2	RxP_1		RxN_1	
A3		EG		EG
A4	EG		EG	
A5		RxP_2		RxN_2
A6	RxP_3		RxN_3	

13.15 POWP – 3EC 40084 ADxx

The POWP (Powering and Filtering Plug) is the connection point for incoming DC supply to a subrack (MLS–hb or MLS–hbe).

The POWP is installed in plug slot 1, in the common plug area of each subrack.

13.15.1 POWP – Features and Functions

Features and functions of the POWP are:

- ▶ Provides a connection point for one or two incoming battery supplies to a subrack.
 - ▶ Constructed as a common plug.
 - ▶ Located in plug slot 1, in the common plug area at the left hand end of the subrack.
 - ▶ External interfaces are two 3–pole sub–D connectors for two incoming DC supplies, with one battery per connector, as shown in Figure 13–43. The pinouts of each of these connectors (from top to bottom) are:
 - Battery Negative (–48 Vdc).
 - Electrical ground.
 - Battery return (0 Vdc).
 - ▶ Internal functions of the POWP are:
 - AND/OR alarm function.
 - An alarm is raised when both battery supplies are missing.
 - An alarm is raised when at least one battery is missing.
 - Overvoltage protection.
- Provides battery filtering for EMC compliance (additional to the filtering already present on the boards).

13.15.2 POWP – Outline

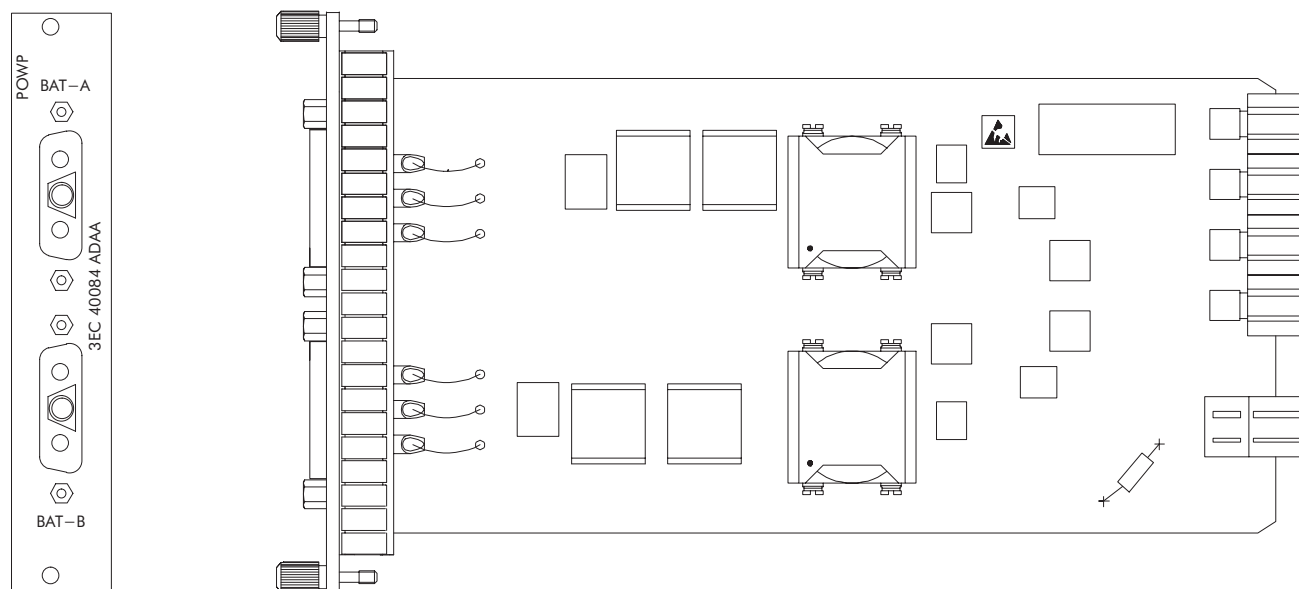


Figure 13–42 POWP – Outline

13.15.3 POWP – Interface – Electrical

The interfaces on the POWP are:

► **Front plate:**

There are two DC power input connectors on the POWP front plate. These are used for one or two incoming 48 Vdc supplies.

Each connector is a three-way D-sub connector, with two female contacts and one male contact.

The POWP front plate and connectors are shown in Figure 13–43.

► **Rear:**

The connectors on the rear of the POWP are:

- Connectors for redundant DC supplies to the subrack.
- Connectors for alarms.

13.15.4 POWP – Connector Pinouts – Front

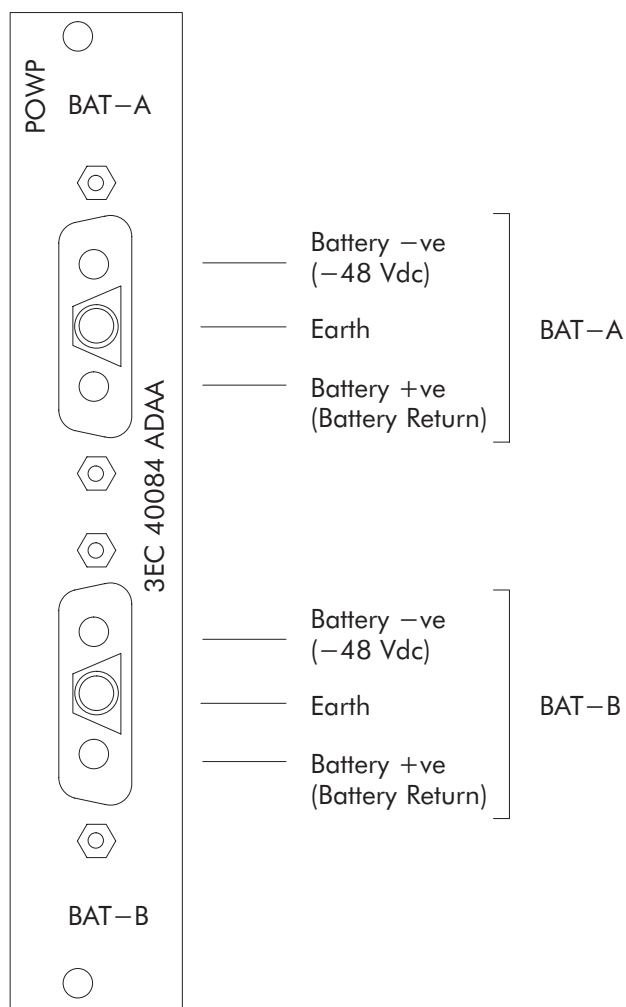


Figure 13–43 POWP – Front Connectors

13.16 PRCPB – 3EC 40142 ACxx

The PRCPB is a straight-through plug with 30 pairs. Filter capacitors provide enhanced EMC performance.

The PRCPB is generally similar to the PRCPA. In addition a grounding pin is fitted to position A1 in each of the connectors on the PRCPB. These pins ground shields in cables connected to the PRCPB. Grounding the shields at the PRCPB provides enhanced EMC compatibility.

The PRCPB allows for connection of up to 30 pairs of wires by means of a metal connector. To achieve isolation every second pin is used in a zig-zag configuration.

The PRCPB is used with the following cards:

- ▶ HLTCA
- ▶ LTAC–A (for OA&M via inband ATM with dedicated LTAC–A).
- ▶ LTAC–D in NU rack or in AGHB equipped as NUS–AGH (Adjunct Housing).

13.16.1 PRCPB – Outline

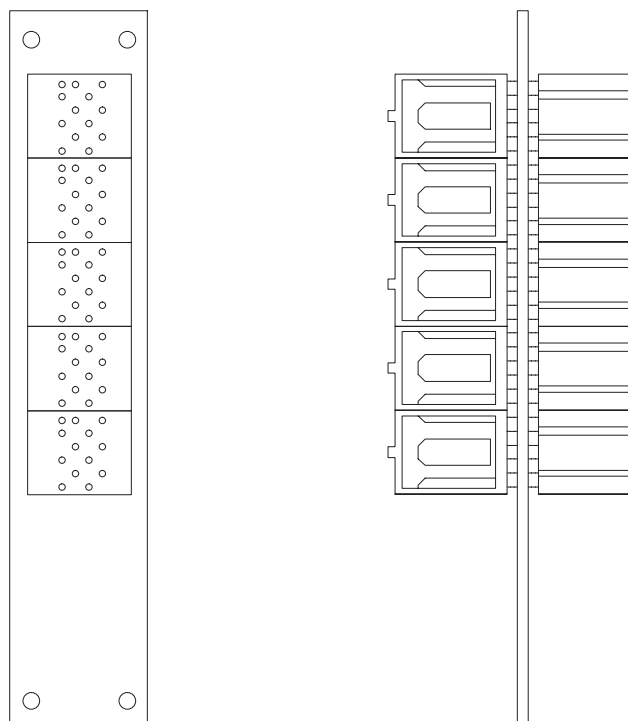


Figure 13–44 PRCPB – Outline

13.16.2 PRCPB – Connector Pinouts – Front

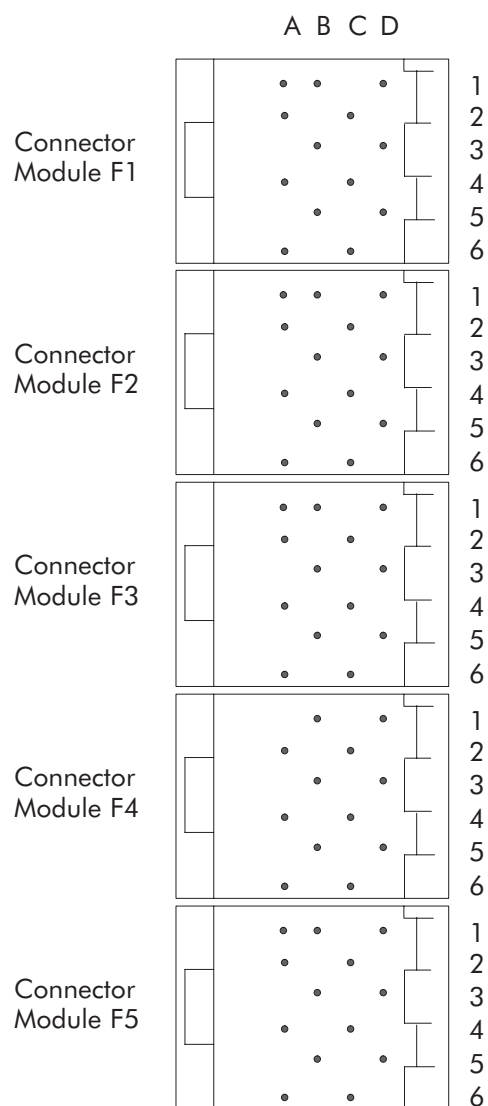


Figure 13–45 PRCPB – Front Connector Pinouts

Customer Lines – Connector Module F1				
	A	B	C	D
1	GND	LN30A (L16A)	–	LN30B (L16B)
2	LN29A (L15A)	–	LN29B (L15B)	–
3		LN28A (L14A)	–	LN28B (L14B)
4	LN27A (L13A)		LN27B (L13B)	–
5	–	LN26A (L12A)	–	LN26B (L12B)
6	LN25A (L11A)	–	LN25B (L11B)	–

Customer Lines – Connector Module F2

	A	B	C	D
1	GND	LN24A (L10A)	–	LN24B (L10B)
2	LN23A (L9A)	–	LN23B (L9B)	–
3	–	LN22A (L15C)	–	LN22B (L16C)
4	LN21A (LL13C)	–	LN21B (L14C)	–
5	–	LN20A (L11C)	–	LN20B (L12C)
6	LN19A (L09C)	–	LN19B (L10C)	–

Customer Lines – Connector Module F3

	A	B	C	D
1	GND	LN18A	–	LN18B
2	LN17A	–	LN17B	–
3	–	LN16A	–	LN16B
4	LN15A	–	LN15B	–
5	–	LN14A	–	LN14B
6	LN13A	–	LN13B	–

Customer Lines – Connector Module F4

	A	B	C	D
1	GND	LN12A (L07C)	–	LN12B (L08C)
2	LN11A (L05C)	–	LN11B (L06C)	–
3	–	LN10A (L03C)	–	LN10B (L04C)
4	LN9A (L01C)	–	LN9B (L02C)	–
5	–	LN8A (L08A)	–	LN8B (L08B)
6	LN7A (L07A)	–	LN7B (L07B)	–

Customer Lines – Connector Module F5

	A	B	C	D
A1	GND	LN6A (L06A)	–	LN6B (L06B)
A2	LN5A (L05A)	–	LN5B (L05B)	–
A3	–	LN4A (L04A)	–	LN4B (L04B)
A4	LN3A (L03A)	–	LN3B (L03B)	–
A5	–	LN2A (L02A)	–	LN2B (L02B)
A6	LN1A (L01A)	–	LN1B (L01B)	–

Note Mapping of line card channels to MDF positions and LFSPB pinouts is shown in the table in Section 7.6.4 of this handbook.

13.17 TARPB – 3EC 41249 AAxx

The TARPB is a flat plug which provides external connections for the alarm signals managed by the TARC. It is located below the TARC in a subrack.

Seven Metral connectors are provided on the front of the TARPB. Improved EMC performance is achieved by means of capacitors on the TARPB.

Front connections on the TARPB support the following inputs and outputs which are described in Section 12.3.7:

- ▶ External alarm inputs.
- ▶ Alarm outputs for Urgent (U), Non—urgent (NU) and Alarm Receiving Attention (ARA).
- ▶ Command outputs.

13.17.1 TARPB – Outline

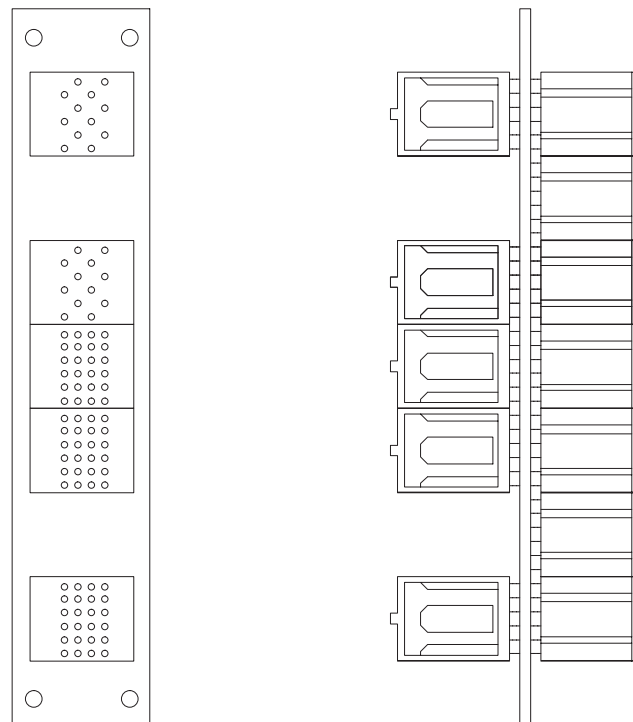


Figure 13–46 TARPB – Outline

13.17.2 TARP B – Connector Pinouts – Front

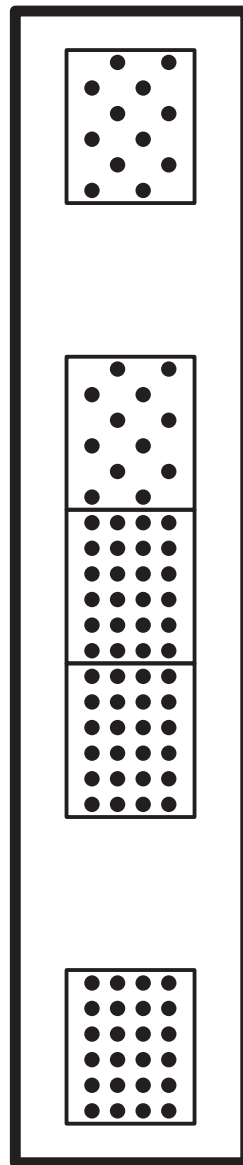


Figure 13–47 TARP B – Front Connectors

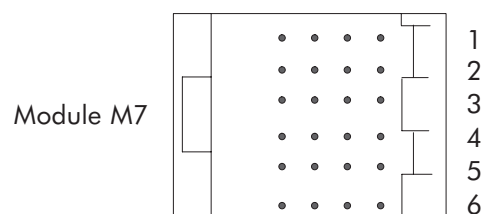
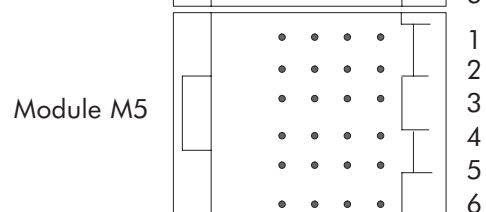
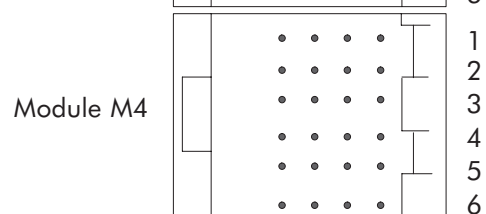
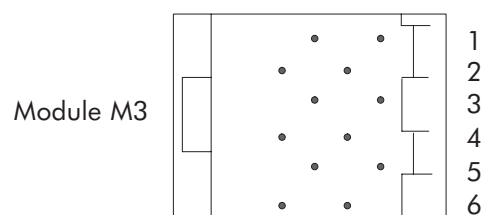
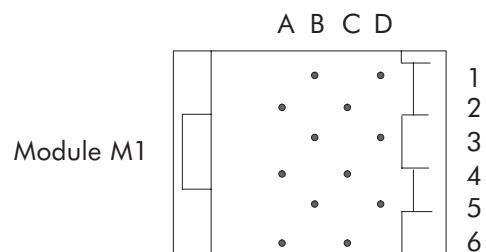


Figure 13–48 TARP B – Pin Numbering

TARPB – Module M1

Pin	A	B	C	D
1		Overcurrent		ALBAT41
2	ANDOR_FAIL		OR_BAT	
3		FAIL_TRU		TRU_TAND
4	MAINS_DIF		ORBAT_TRU	
5		GEN1_RNG		GEN2_RNG
6	OVVOL_RNG		OVER_RNG	

TARPB – Module M3

Pin	A	B	C	D
1		ALVUR1		ALINTR
2	ALDOORE		ALNUR3	
3		TRU_TINT		ALDOORP
4	TRU_TUP		TRU_LOSQ2	
5		TRU_TIND		TRU_TORC
6	TRU_TURG		TRU_TNURG	

TARPB – Module M4

Pin	A	B	C	D
1	ALBAT41	ALBAT_AC	COM_SPA1	MAINS_DIS
2	ALOUT_AC	COM_SPA3	VSERV–	COM_SPA2
3	ALSTOBA	PRES_AC	COM_SPA6	ALIN_AC
4	TRU_RATTD	EG	VSERV+	COM–SPA5
5	CTSONB	TRU_RC	COM_SPA4	TRU_RCH
6	TRU_RURG	BATINS	TRU_NURG	DISBIN

TARPB – Module M5

Pin	A	B	C	D
1	OVER_RNG	CVON1	TESTBA	CVON2
2	ALTEMP2	ALVUR3	ALTEMP3	ALNUR3
3	CRISCON1	ALRIS3	CRISCON2	ALTEMP1
4	ALRIS1	CRISCON3	ALRIS2	ALINTR
5	EG	ALNUR1	EG	ALNUR2
6	ALVUR1	MAINS_DIS	ALVUR2	MAINS_DIF

TARPB – Module M7 – External Alarm Inputs

Pin	A	B	C	D
1	PCB_POS0	COM_SPA1	COM_SPA2	ALTEMPURG
2	PCB_POS1	CINIBI	CVON3	CDISBI
3	PCB_POS2	AL_SPA4	AL_SPA5	AL_SPA6
4	PCB_POS3	AL_SPA1	AL_SPA2	AL_SPA3
5	PCB_POS4	EG	AL_SPA8	AL_SPA7
6	ALIMSP	BATR–IN	BAT_A	BAT_B

13.18 TSCP – 3EC 44194 AAAA

The TSCP (Triple Slot Combo Plug) is a triple slot plug that interconnects a LTAC–D with an ATLC–C.

The LTAC–D/TSCP combination provides:

- ▶ 24 lines of Combo ADSL (ADSL plus POTS)
- ▶ 6 lines of plain POTS. These lines are available as the ATLCC card supports 30 POTS lines while the LTAC–D only supports 24 ADSL lines.

A metal plate covering the TSCP minimises contact with the pins. A pull ring is provided for removal of the TSCP from the subrack.

13.18.1 TSCP – Exterior View

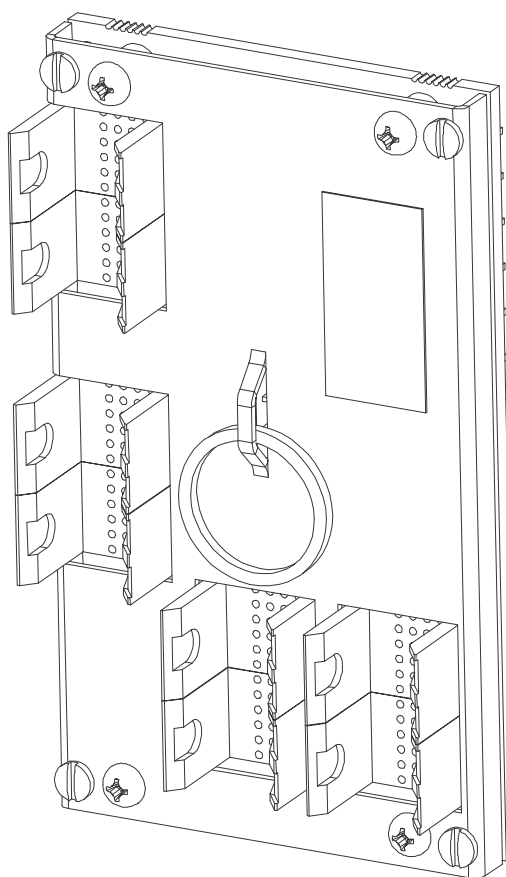


Figure 13–49 TSCP – Exterior View

13.18.2 TSCP Context Diagram

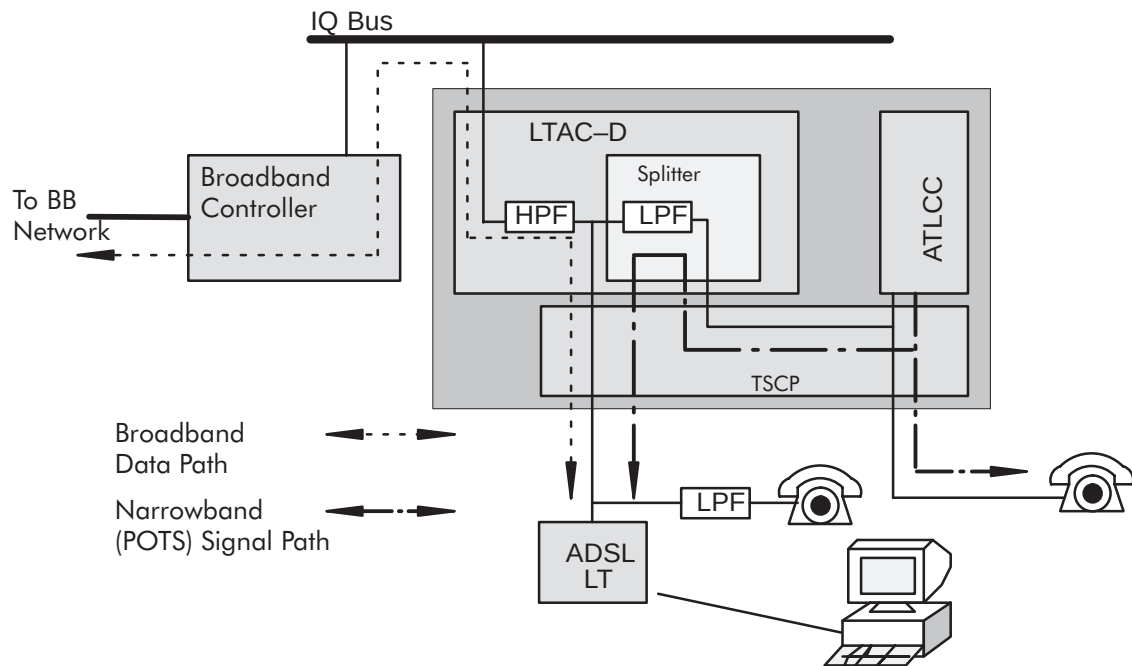


Figure 13–50 TSCP – Context Diagram

13.18.3 TSCP – Outline

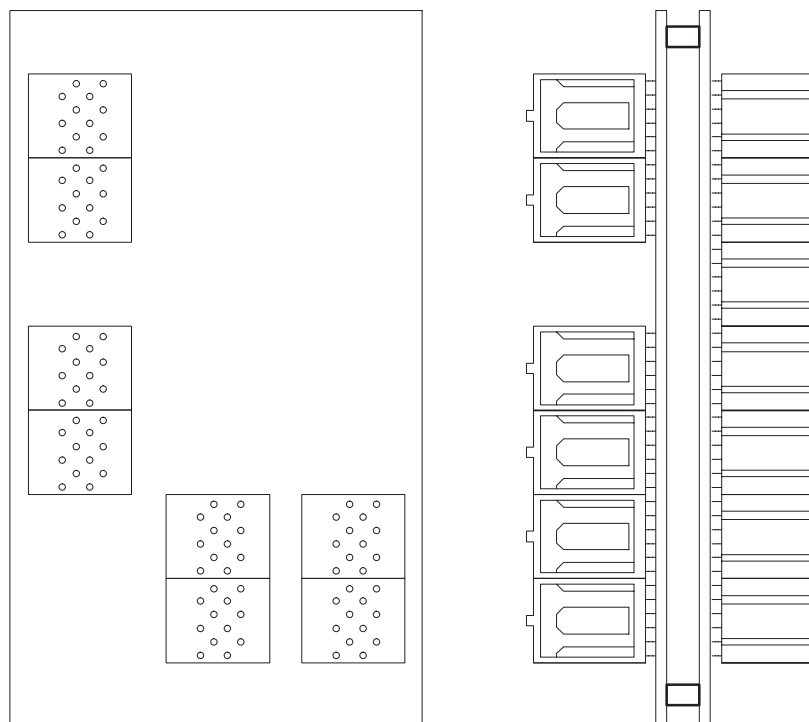


Figure 13–51 TSCP – Outline

13.18.4 TSCP – Block Diagram

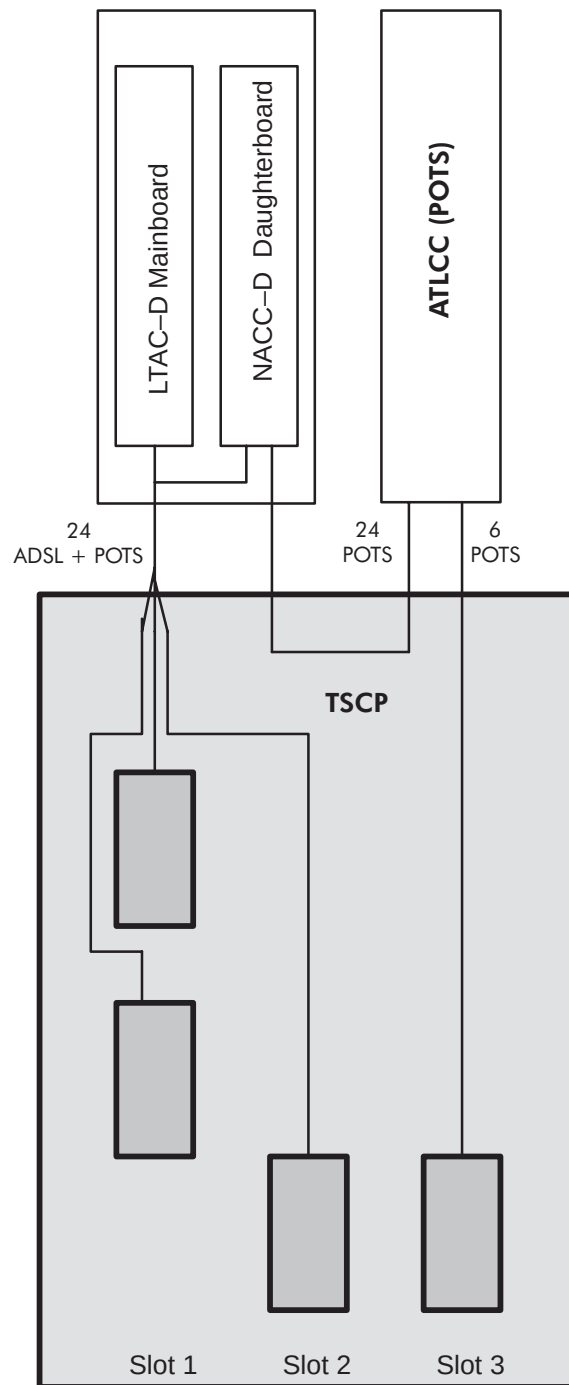


Figure 13–52 TSCP Position in the System

13.18.5 TSCP – Connector Pinouts – Front

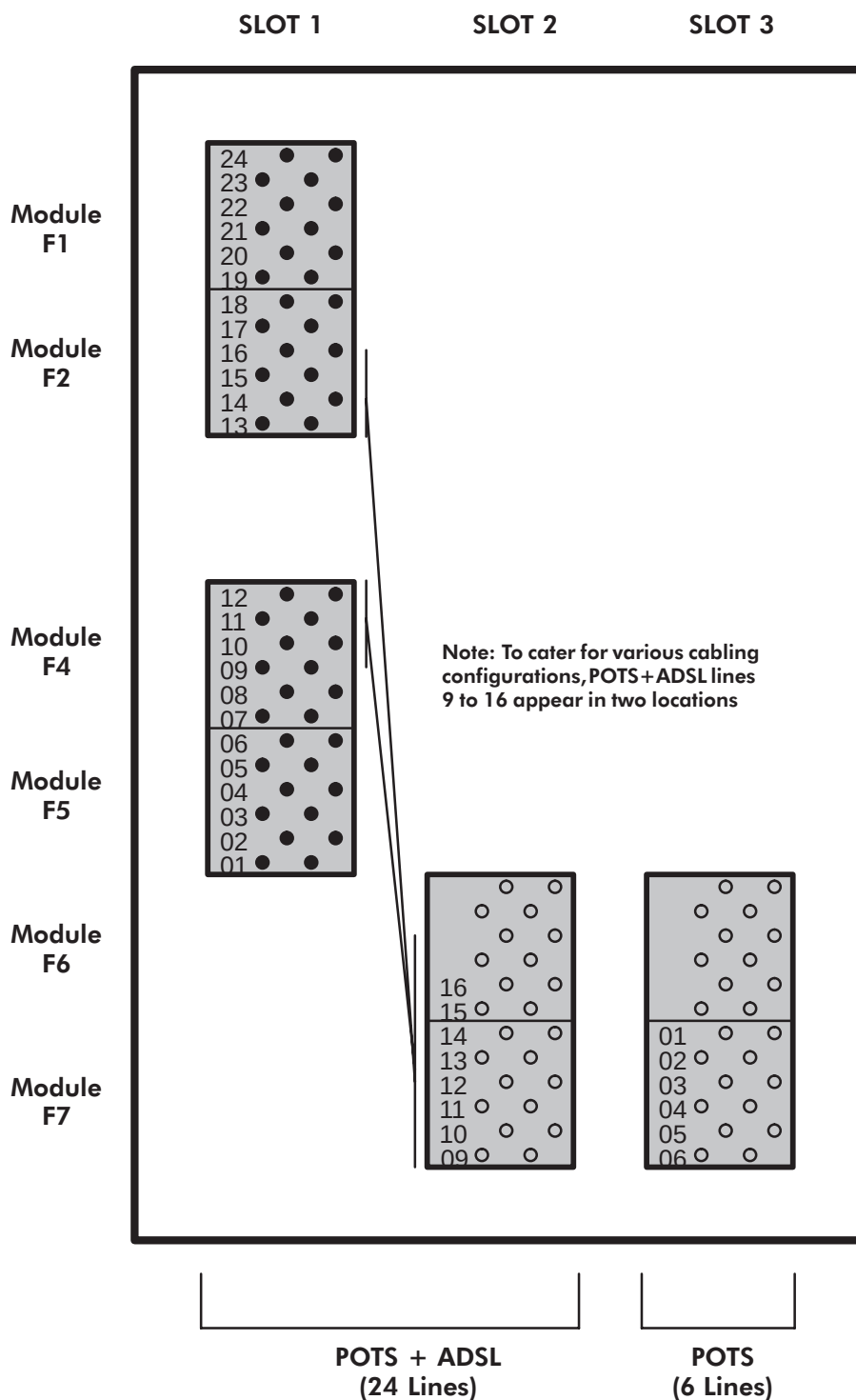


Figure 13–53 Basic Outline

Table 13–1 Module F1 Slot 1 – Customer Lines – ADSL+ POTS

F1	A	B	C	D
1		ADSL+POTS 24		ADSL+POTS 24
2	ADSL+POTS 23		ADSL+POTS 23	
3		ADSL+POTS 22		ADSL+POTS 22
4	ADSL+POTS 21		ADSL+POTS 21	
5		ADSL+POTS 20		ADSL+POTS 20
6	ADSL+POTS 19		ADSL+POTS 19	

Table 13–2 Module F2 Slot 1 – Customer Lines – ADSL+ POTS

F2	A	B	C	D
1		ADSL+POTS 18		ADSL+POTS 18
2	ADSL+POTS 17		ADSL+POTS 17	
3		ADSL+POTS 16		ADSL+POTS 16
4	ADSL+POTS 15		ADSL+POTS 15	
5		ADSL+POTS 14		ADSL+POTS 14
6	ADSL+POTS 13		ADSL+POTS 13	

Table 13–3 Module F4 Slot 1 – Customer Lines – ADSL+ POTS

F4	A	B	C	D
1		ADSL+POTS 12		ADSL+POTS 12
2	ADSL+POTS 11		ADSL+POTS 11	
3		ADSL+POTS 10		ADSL+POTS 10
4	ADSL+POTS 9		ADSL+POTS 9	
5		ADSL+POTS 8		ADSL+POTS 8
6	ADSL+POTS 7		ADSL+POTS 7	

Table 13–4 Module F5 Slot 1 – Customer Lines – ADSL+ POTS

F5	A	B	C	D
1		ADSL+POTS 6		ADSL+POTS 6
2	ADSL+POTS 5		ADSL+POTS 5	
3		ADSL+POTS 4		ADSL+POTS 4
4	ADSL+POTS 3		ADSL+POTS 3	
5		ADSL+POTS 2		ADSL+POTS 2
6	ADSL+POTS 1		ADSL+POTS 1	

Table 13–5 Module F6 Slot 2 – Customer Lines – ADSL+ POTS

F6	A	B	C	D
16		ADSL+POTS 16		ADSL+POTS 16
15	ADSL+POTS 15		ADSL+POTS 15	

Table 13–6 Module F7 Slot 2 – Customer Lines – ADSL+ POTS

F7	A	B	C	D
14		ADSL+POTS 14		ADSL+POTS 14
13	ADSL+POTS 13		ADSL+POTS 13	
12		ADSL+POTS 12		ADSL+POTS 12
11	ADSL+POTS 11		ADSL+POTS 11	
10		ADSL+POTS 10		ADSL+POTS 10
09	ADSL+POTS 09		ADSL+POTS 09	

Table 13–7 Module F6 Slot 3 – Customer Lines – POTS Only

F6	A	B	C	D

Table 13–8 Module F7 Slot 3 – Customer Lines – POTS Only

F7	A	B	C	D
1		POTS 1		POTS 1
2	POTS 2		POTS 2	
3		POTS 3		POTS 3
4	POTS 4		POTS 4	
5		POTS 5		POTS 5
6	POTS 6		POTS 6	

13.18.6 Cable Pinout

The TSCP may be used in installations with either 16 pair or 30 pair cables.

- ▶ If 16 pairs are used per slot:
 - The A connector is used in slot 1 only.
 - The B connector is not used in any slot.
 - The C connector is used in all slots.
- ▶ When 30 pair cables are used all the signals that appear on slot 2 also appear on slot 1 on ADSL signals 9 to 16.

Table 13–9 Cable Pinout (Whites not shown)

Cable Information (Pair, Connector Name, Connector pin, Colour for 16 pair cable)	Slot 1 Combo	Slot 2 Combo	Slot 3 POTS
1 (C 12 Blue)	ADSL 1 (POTS 07)	ADSL 9 (POTS 27)	POTS 6
2 (C 11 Orange)	ADSL 2 (POTS 08)	ADSL 10 (POTS 28)	POTS 5
3 (C 10 Green)	ADSL 3 (POTS 17)	ADSL 11 (POTS 29)	POTS 4
4 (C 09 Brown)	ADSL 4 (POTS 18)	ADSL 12 (POTS 30)	POTS 3
5 (C 08 Grey)	ADSL 5 (POTS 19)	ADSL 13 (POTS 21)	POTS 2
6 (C 07 Blue/White)	ADSL 6 (POTS 20)	ADSL 14 (POTS 22)	POTS 1
7 (C 06 Blue/Orange)	ADSL 7 (POTS 25)	ADSL 15 (POTS 23)	
8 (C 05 Blue/Green)	ADSL 8 (POTS 26)	ADSL 16 (POTS 24)	
9 (A 08 Blue/Brown)	ADSL 17 (POTS 9)		
10 (A 07 Blue/Grey)	ADSL 18 (POTS 10)		
11 (A 06 Orange/White)	ADSL 19 (POTS 11)		
12 (A 05 Orange/Green)	ADSL 20 (POTS 12)		
13 (A 04 Orange/Brown)	ADSL 21 (POTS 13)		
14 (A 03 Orange/Grey)	ADSL 22 (POTS 14)		
15 (A 02 Green/White)	ADSL 23 (POTS 15)		
16 (A 01 Green/Brown)	ADSL 24 (POTS 16)		

Note

The LTAC–D cable pair assignments in NU, AU and MiniMUX applications are shown in the **CMUX Housing Rack and Cabling Handbook**. Refer to the **LTAC–D – Cable Pair Assignments** section of the **Drawings and Cable Diagrams** chapter of that handbook.

13.19 TSPP–A – 3EC 40140 AAxx

The TSPP–A (Triple Slot Position Plug) provides the front connections for subscriber lines for the triplet (two LTAC–A and one NACC–A) which implement ADSL–over–POTS access.

- ▶ Each LTAC–A provides high–pass filtering for four ADSL services.
- ▶ The NACC–A provides low–pass filtering for eight POTS lines.
- ▶ The TSPP–A connects the NACC–A and LTAC–As to eight customer lines.

13.19.1 TSPP–A – Features and Functions

The TSPP–A:

- ▶ Routes eight lines from the POTS line card in the exchange or the POTS line card in CMUX to a low pass filter in the NACC–A.
- ▶ Superimposes the ADSL signal onto the POTS signal output by the NACC–A, thus obtaining the subscriber side ADSL+POTS line.
- ▶ Is three plug slots wide.
- ▶ Interfaces with the triplet of two LTAC–A and one NACC–A via rear connectors to the subrack backplane.
- ▶ Provides EMC shielding and filtering.
- ▶ Provides bypass relays for POTS traffic. These maintain POTS service if an LTAC–A, NACC–A or TSPP–A is removed:
 - If an LTAC–A is removed the bypass relays switch the corresponding four customer lines directly to the POTS lines from the exchange or from the CMUX POTS card.
 - If the NACC–A is removed the bypass relays switch all eight lines to the POTS services from the exchange or the CMUX POTS card.
 - If the TSPP–A is removed with the cables attached the bypass relays connect the customer lines to the POTS lines from the exchange or from a CMUX POTS card. If the cables are disconnected from the TSPP–A this connection is broken.

13.19.2 TSPP-A – Exterior View

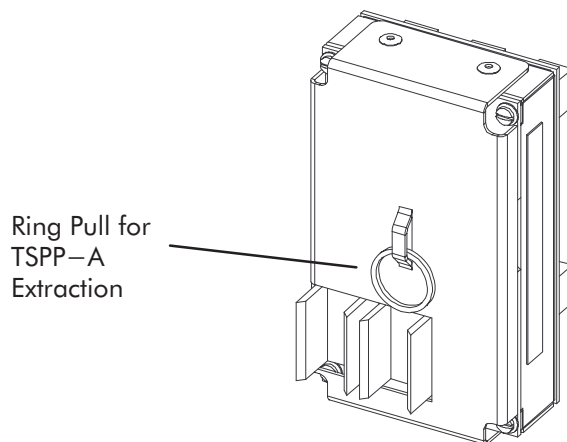


Figure 13–54 TSPP-A – Exterior View

13.19.3 TSPP-A – Outline

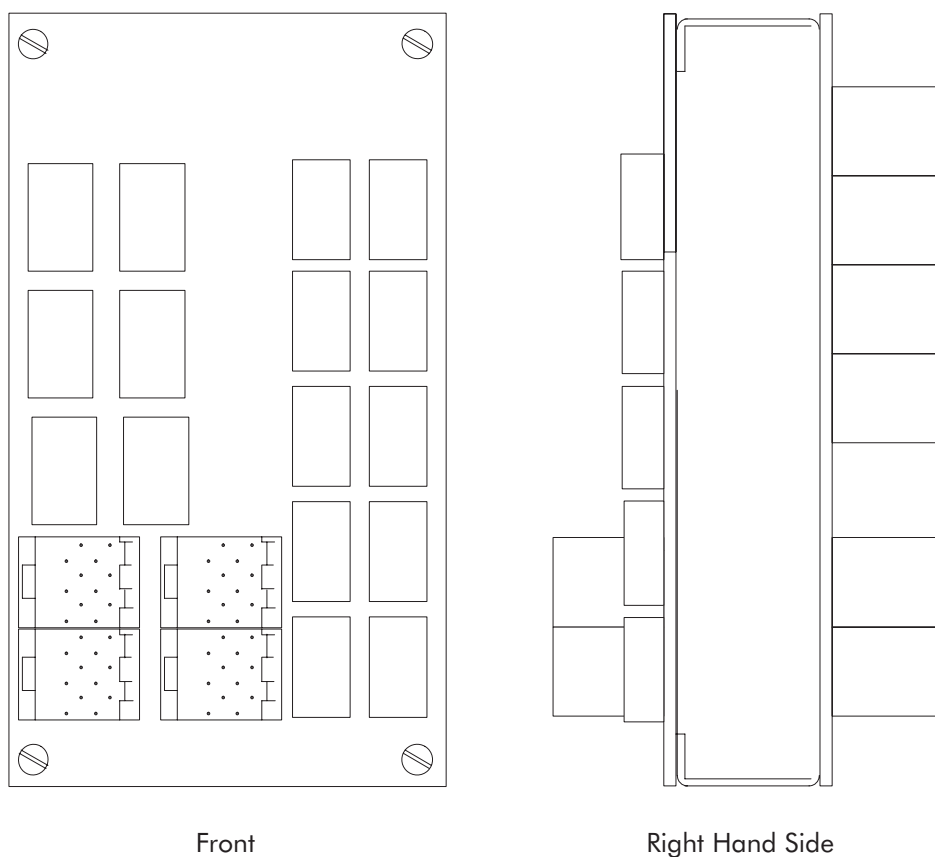


Figure 13–55 TSPP-A – Outline, Cover Removed

13.19.4 TSPP-A – Block Diagram

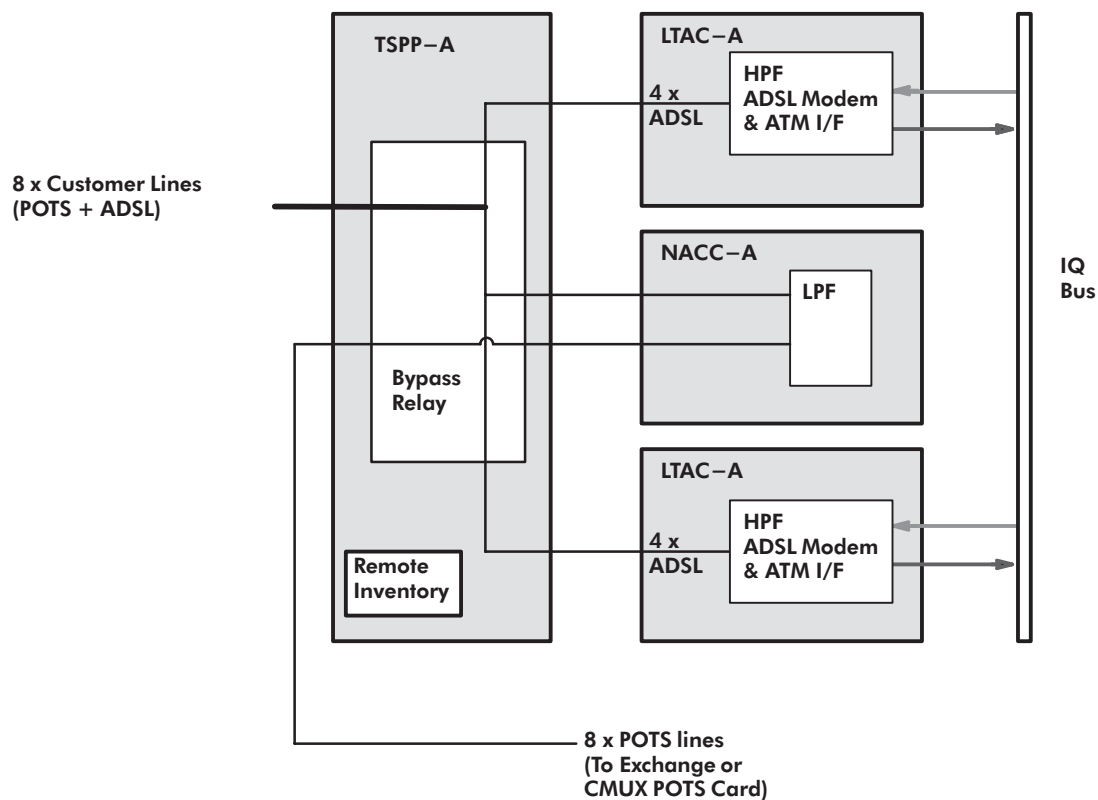


Figure 13–56 TSPP-A – Block Diagram

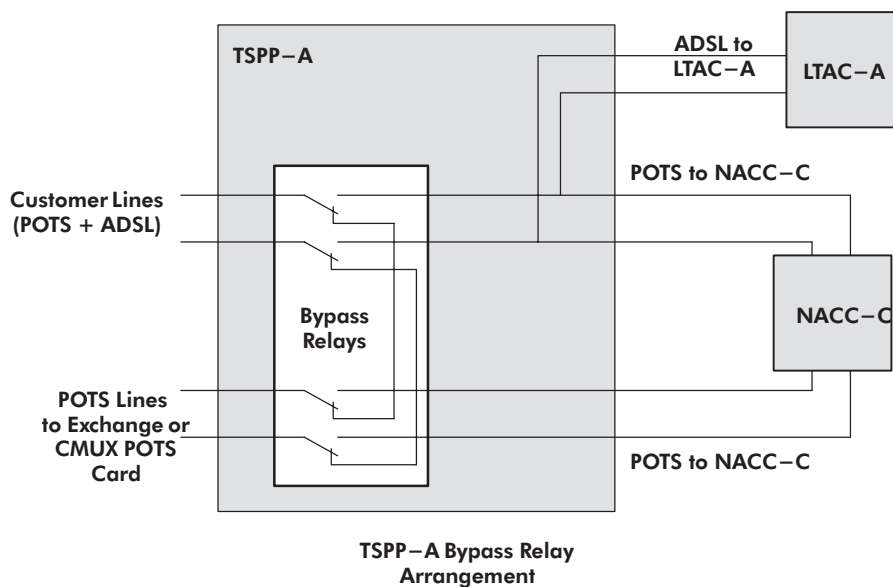


Figure 13–57 TSPP-A – Bypass Relay Arrangement

13.19.5 TSPP–A – Connector Pinouts – Front

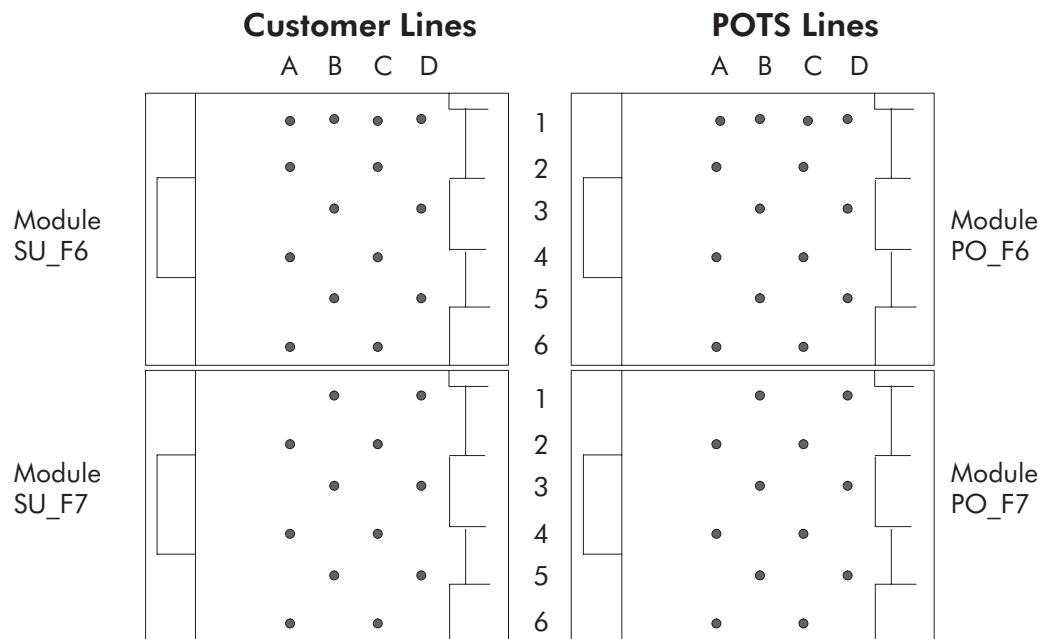


Figure 13–58 TSPP–A – Front Connector Pinouts

(1) POTS Lines (X Pairs)

POTS Lines connectors on the TSPP–A terminate POTS lines from the exchange, POTS lines from a CMUX POTS line card, or exchange–side POTS lines from other equipment.

Module	Row	Column			
		A	B	C	D
PO_F6	1	SG	POTS 8A	SG	POTS 8B
	2	POTS 7A		POTS 7B	
	3		POTS 6A		POTS 6B
	4	POTS 5A		POTS 5B	
	5		POTS 4A		POTS 4B
	6	POTS 3A		POTS 3B	
PO_F7	1		POTS 2A		POTS 2B
	2	POTS 1A		POTS 1B	
	3		–		–
	4	–		–	
	5		–		–
	6	–		–	

(2) Customer Lines (C Pairs)

Customer Lines connectors on the TSPP–A terminate lines from the CMUX to the customer which carry ADSL and POTS traffic.

Module	Row	Column			
		A	B	C	D
SU_F6	1	SG	–	SG	–
	2	–		–	
	3		–		–
	4	–		–	
	5		SUBS 8A		SUBS 8B
	6	SUBS 7A		SUBS 7B	
SU_F7	1		SUBS 6A		SUBS 6B
	2	SUBS 5A		SUBS 5B	
	3		SUBS 4A		SUBS 4B
	4	SUBS 3A		SUBS 3B	
	5		SUBS 2A		SUBS 2B
	6	SUBS 1A		SUBS 1B	

(3) Connector Usage

Typical LTAC–A/NACC–A interconnections are:

- ▶ Direct (Cable 516 – 3AU 26892 AAAA)
- ▶ Via the MDF or CCF (Cable 523 – 3AU 26875 XXXA)

For additional information refer to the *Cabling* chapter of the *CMUX Housings, Racks and Cabling Handbook*.

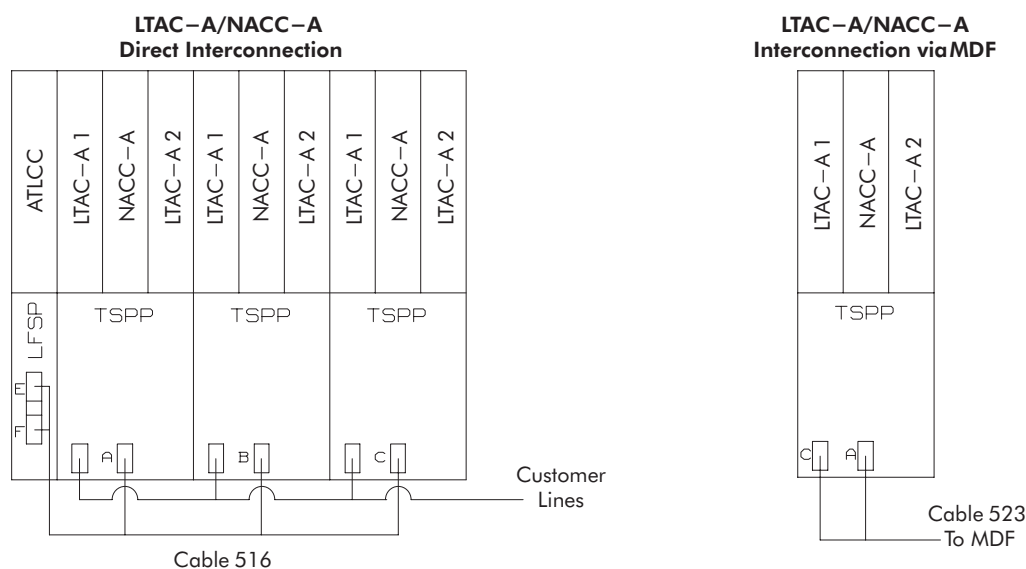


Figure 13–59 TSPP–A – Typical Cabling

Appendix A Abbreviations

AAD	ATM Access Device
AAL	Alcatel Australia Ltd.
AANC	ADSL ATM NT Card
ABR	Available Bit Rate
AC	Alternating Current
AC/DC	Alternating Current to Direct Current (converter)
ACPA	AU Customer Premises Rack A
ACSE	Association Control Service Element
ACT	Active
ACTP	AC Transformer Panel
ADFE	Adaptive Decision Feedback Equaliser
ADM	Access Domain Manager
ADMux	Add / Drop Multiplexer
ADSL	Asymmetric Digital Subscriber Line
AG	Above Ground
AGH	Above Ground Housing. See AGHA and AGHB
AGHA	Above Ground Housing (Type A)
AGHB	Above Ground Housing (Type B)
AICC	ATM IMA Controller Card
AIS	Alarm Indication Signal
ALLC	Analog Leased Line Card
ALS	Automatic Laser Shutdown
AMI	Alcatel Management Interface Alternate Mark Inversion
AN	Access Network
ANd	Access Node
ANDR	ANIBAL ASIC DRIver
ANR	Access Network Release
ANSI	American National Standards Institute
APDP	Alarm and Power Distribution Panel

APS	Alarm Point Scanner
ARA	Alarm Receiving Attention
AS	Australian Standard
ASAM	ADSL Subscriber Access Multiplexer (Alcatel DSLAM)
ASAN	Alcatel Subscriber Access Network
ASCC	ATM Shelf Controller Card
ASIC	Application—Specific Integrated Circuits
ATLCC	Analog Telephone Line Card (30 line POTS LIM)
ATM	Asynchronous Transfer Mode
ATMF	ATM Forum
ATMP	ATM Processor IC
ATR—C	ADSL Transmission Unit — Central Office
ATR—R	ADSL Transmission Unit - Remote
AU	Access Unit: A CMUX parented by a NUC via the CAN.
AUXPA	AUXiliary Plug — A
AUXPB	AUXiliary Plug — B
AWS	ADSL Work Station
B3ZS	Binary with 3 Zero Substitution
BA	Basic Access
BALC	Basic Access Line Card (ISDN card)
BALF	BALCF Firmware
BB	Broadband
BBCC	BroadBand Controller Card. (Generic term which includes AICC and AANC)
BBK	Building Block
BCC	Bearer Channel Connection
BEP	Building Entry Point
BER	Bit Error Rate
BLVDS	Bus Low Voltage Differential Signal (technology)
BOOTP	Bootstrap Protocol
BSEC	BroadBand Shelf Extender Card.
BTL	Bus Transceiver Logic

BW	BandWidth
CAC	Connection Admission Control
CAFE	CAMINA Front End
CAMINA	Common Alcatel Management Interface for Nodes in the Access network
CAN	Customer Access Network
CAS	Channel Associated Signalling
CB	Circuit Breaker
CBCC	CMUX Battery Controller Card
CBMA	CMUX Battery Monitor
CBR	Constant Bit Rate
CC	Communication Channel
CCC	Cross Connect Compartment
CCEL	Central Controller Equipment Layer
CCF	Cross Connect Frame
CCFE	Craft terminal Central controller Front End
CCP	Channel Change Protocol
CCT	CMUX Craft Terminal
CDE	Customer Design Engineering
CFPA	CPP Front Panel Assembly
CHDR	CHDLC ASIC Driver
CIE	Command / Indication Element
CMEM	Customer Multiplexer Element Manager
CMIP	Common Management Information Protocol
CMUX	Customer Multiplexer
CMISE	Common Management Information Services Element
CNCL	Central controller Narrowband Connection Layer
CNDR	CNOSSO ASIC DRiver
CNTL	Central controller Narrowband Transmission Layer
COGV	COmmon Graphical View
CP	Customer Premises
CPB	CPP Power Backplane

CPE	Customer Premises Equipment
CPEC	CPP Power Extender Board
CPNT	Customer Premises Network Termination
CPP	CMUX Power Panel
CRC	Cyclic Redundancy Check
CRU	Clock Reference Unit
CSMA/CR	Carrier Sense Multiple Access / Collision Resolution
CT	CRAFT Terminal
CTB	Customer Terminal Box
CTCS	CT Communication Subsystem
CTOV	CT Object View
CTP	Connection Termination Point
CU	Customer Unit
DC	Direct Current
DC/UAS	Downstream Cell / Upstream Arbitration Start
DCC	Data Communication Channel
DC/DC	Direct Current to Direct Current (converter)
DCE	Data Circuit–Terminating Equipment
DDF	Digital Distribution Frame
DDI	Direct Dial In
DECT	Digital European Cordless Telecommunication
DHCP	Dynamic Host Configuration Protocol
DHN	Digital Home Network
DL	Data Link
DLC	Digital Loop Carrier
DMO	Digital Mode of Operation
DMT	Discrete Multi Tone (modulation)
DPU	Distributed Power Unit
DREF	Downstream REference (voltage)
DSAP	Dual Slot Attenuator Plug
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Multiplexer

DSP	Digital Signal Processing
DSPP	Dual Slot Position Plug
DTMF	Dual Tone Multi Frequency
DTS	Distributed Time Switch
DURCC	Dual Ringer Card
DURPB	DURCC Plug
EEPROM	Electrically Erasable Programmable Read Only Memory
E1	2 Mbit/s G.703 service
E2	8 Mbit/s transport rate supporting 4 x E1 channels
E3	34 Mbit/s transport rate supporting 16 x E1 channels
EBT	Earth Bonding Terminal
EF	Envelope Function
EFA	Envelope Function Address
EFCI	Explicit Forward Congestion Indication
EG	Electrical Ground
EM	Element Manager
EMC	ElectroMagnetic Compatibility
ENT	Electrical Network Terminal
EOC	Embedded Operation Channel
EOTCA	Electro–Optical Transport Card A
EOTPB	EOTCA Plug B
EP	CMUX Extension Panel: See also MLS–hbe
EPLD	Erasable Programmable Logic Device
EPROM	Erasable Programmable Read Only Memory
ESA	Exchange Service Area
ESD	Electrostatic Discharge
ETSI	European Telecommunication Standards Institute
EUT	Equipment Under Test
FAW	Frame Alignment Word
FCS	Frame Check Sequence
FEPROM	Flash EPROM

FFLC	Full Feature (POTS) Line Card
FFS	For Further Study
FITL	Fibre In The Loop
FPGA	Field Programmable Gate Array
FR	Frame Relay
FSM	Finite State Machine
FW	FirmWare
GCC	Global Connect Contracts (formerly CMU)
GCI	General Circuit Interface
GPO	General Purpose Outlet
GOC	Global Operation Centre
GPO	General Purpose Outlet
GICI	Generic Internal Card Interface
GPS	Global Positioning System
GTL	Gunning Transceiver Logic
GUI	Graphical User Interface
HBEP	High Band Extension Plug
HBMP	High Band Main Plug
HDLC	High–level Data Link Control
HDSP	Hex DSP ASIC
HDSL	High speed Digital Subscriber Line
HDSP	Hex DSP ASIC
HEC	Heat Exchanger Compartment
HLTCA	HDSL Line Termination Card
HLTP	HLTCA Plug
HEC	Header Error Check
HMW	Hardware Management Wires
HO	High–Order (Path)
HOD	High Ohmic Distribution
HP	Homes Passed
HPF	High Pass Filter

HW	HardWare
IAB	Inventory Access Bus
IACC	Internet Access Competency Center
ICB	Internal Control Bus
ICF	Intermediate Connection Frame
ID	IDentifier
IDL	Internal Data Link
IDT	Insulation Displacement Terminal
IEC	International Electrotechnical Commission
IECB(–x)	Intra–Equipment Control Bus (–L = Local, –N = Network)
IEN	Inter Exchange Network
IMA	Inverse Multiplexing for ATM
IOBS	Serial Bus between Broadband Controller and TARCB
IONS	Serial bus between Broadband Controller and TACC
IP	Internet Protocol
IQ	Internal QoS for ATM
IS/ES	Intermediate System to End System (protocol)
IS/IS	Intermediate System to Intermediate System (protocol)
ISDN	Integrated Services Digital Network
ITL	Internal Transport Layer
ITU–T	International Telecommunication Union – Telecommunication
I/O	Input / Output
LAPp	Link Access Protocol (for protocol p)
LAS	Local Access Switch
LC	Line Card
LCIA	Line Card Interface ASIC
LCP	Line Card Pattern
LE	Local Exchange
LED	Light Emitting Diode
LFSP	Line Filtering Single Plug
LHS	Left Hand Side

LIM	Line Interface Module (NB or BB Line Card)
LIM Card	See LIM
LIM Plug	NB or BB plug associated with NB or BB LIM
LLC	Logical Link Control
LLSA	Liquid Level Sensing Assembly
LMEL	Log Management Equipment Layer
LO	Low–Order (Path)
LOD	Low Ohmic Distribution
LOS	Loss Of Signal
LPF	Low Pass Filter
LT	Line Termination
LTAC	Line Terminating ADSL Card
LTCS	LTS platform Communication Subsystem
LTH	Local Transmission Hub
LTKS	LTS platform Kernel Subsystem (GBOS)
LTSL	Line Testing Service Layer
LVD	Low Voltage Disconnect
LVDS	Low Voltage Differential Signal (technology)
LVT	Low Voltage Technology
MAC	Medium Access Control
MBC	Mounted Board Converter
MBTP	Main Bus Termination Plug
MCB	Miniature Circuit Breaker
MDF	Main Distribution Frame
MEC	Main Equipment Compartment
MEDR	MEDUSA ASIC DRiver
MIB	Management Information Base
MIF	Master IQ termination Function
MLS–hb	Multiservice Line Shelf – High Band
MLS–hbe	Multiservice Line Shelf – High Band Extension
MOC	Management Object Class
MP	CMUX Main Panel: See also MLS–hb

MS	Multiplex Section
MSOH	Multiplex Section OverHead
MTH	Major Transmission Hub
MTIE	Maximum Time Interval Error
NACC	Narrowband ADSL Combiner Card (POTS splitter)
NB	NarrowBand
NBCP	NarrowBand line card Common Part (software)
NBGV	NarrowBand Graphical View
NE	Network Element
NEBS	Network Equipment Building System
NEC	Network Element Controller
NEF	NE Function
NEHC–P	Network Element Handler Card – PDH
NEHC–P–S	Network Element Handler Card – SDH
NEHP	Network Element Handler Plug
NLC	Narrowband Line Card
NLC	Narrowband Line Card (bus)
NMDS	Narrowband Multi–service Delivery System
nrt–VBR	non real time Variable Bit Rate
NRZ	Non–Return to Zero
NSCE	Narrowband Signalling Central Engine
NSEC	Narrow Band Shelf Extender Card.
NT	Network Termination
NTN	Network Terminating Node
NTU	Network Terminating Unit
NU	Network Unit: A CMUX that interfaces to a core network (IEN, SDN, PSTN (LAS))
NUC	Central NU: A NU that parents subtended NUS or AU
NUS	Subtended NU: A NU that is parented by a NUC
NURA	Network Unit Rack A
NVCC	Narrowband VDSL Combiner Card

OA&M	Operation And Maintenance
OASP	Octal Analog Signal Processor
OBC	On Board Controller
ODAS	Operator Domain Access Subnetwork
OFDF	Optical Fibre Distribution Frame
OFST	Optical Fibre Storage Tray
OFSU	Optical Fibre Storage Unit
OH&S	Occupational Health and Safety
OLS	On—Line Services
ONT	Optical Network Terminal
ONU	Optical Network Unit
ORB	Object Request Broker
OS	Operation System
OSI	Open System Interconnection
OTRP	Object—oriented Transaction, Redundancy and Persistency
PAIC	Primary rate ATM Interface Card
PB	Printed Board
PBA	Printed Board Assembly
PC	Personal Computer
PC	Power Compartment
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PDH	Plesiochronous Digital Hierarchy
PHDC	Primary rate HDB3 Driver Card
PHY	PHYsical medium
PM	Performance Monitoring
PMLCC	POTS Mirror Line Card
PNNI	Private Network Node Interface
PNNI	Private Network—to—Network Interface
POC	Position Code
POH	Path OverHead
PON	Passive Optical Network

POTS	Plain Old Telephone Service
POWP	POWer Plug
PPP	Point-to-Point Protocol
PRA	Primary Rate Access
PRC	Priority Code
PRCC	Primary Rate Channel Card
PSCN	Primary Scan Carrier Number
PSD	Power Spectral Density
PSP	Power Supply Panel (AGHA)
PSTN	Public Switched Telephone Network
PTSL	PSTN Service Layer
PVC	Permanent Virtual Circuit
QA	Q-Adaptor
QAF	Q-Adaptor Function
QOS	Quality Of Service
RAI	Remote Alarm Indication
RAM	Random Access Memory
RAMI	Remote Alcatel Management Interface
RAN	Remote Access Node
RAU	Remote Access Unit
RCD	Residual Current Device
RDI	Remote Defect Indication
REGB	REGulator-B
REM	REMotizer
REN	Ringer Equivalent Number
RF _n	Rack Feed <i>n</i> (DC supply to NURA)
RHS	Right Hand Side
RI	Remote Inventory
RM	Resource Management (cell)
ROSE	Remote Operation Service Element
RPC	Remote Procedure Call

RS	Reed—Solomon code
RSOH	Regenerator Section OverHead
RSU	Remote Subscriber Unit
RTD	Round Trip Delay
rt—VBR	real time Variable Bit Rate
Rx	Receive, Reception
Scanner	A monitoring unit at the exchange
SDH	Synchronous Digital Hierarchy
SDN	Switched Data Network
SDRAM	Synchronous Dynamic Random Access Memory
SLIC	Subscriber Line Interface Circuit
SMC	Service Management Centre
SMEL	Software Management Equipment Layer
SN	Service Node
SNAP	Sub Network Access Protocol
SNCP	SubNetwork Connection Protection
SNI	Subscriber—Network Interface
SNMP	Simple Network Management Protocol
SOH	Section OverHead
SPV	SuPerVision (byte)
SSN	Special Services Network
STM	Synchronous Transfer Mode
STM—n	Synchronous Transport Module of order n
STU	Subscriber Terminal Unit
SU	System Unit (1 SU – 25mm, equipment rack mounting)
SULTAN	SUBscriber Line Test Access Network
SW	Software
SWBB	SoftWare Building Block
SWP	SoftWare Package
TACCB	Test ACcess Card
TACF	TAC Firmware

TAH	Telstra Access Housing
TAP	Telstra Access Point
TARC	Test Alarm and Remote inventory Card
TARPB	TARC Plug
TBC	To Be Confirmed
TBD	To Be Defined
TC	Transmission Convergence (sublayer)
TCP	Transmission Control Protocol
TCXO	Temperature controlled VCXO
TDEV	Time DEVIation
TDM	Time Division Multiplexing
TE	Terminal Equipment
TLB	Timed Loop Break
TMN	Telecommunication Management Network
TNV	Telecommunications Network Voltage
TO	Telecommunications Outlet
TP	Transmission Path, Twisted Pair
TS	Time Slot
TSD	Transmission System Division (Alcatel)
TSCP	Triple Slot Combiner Plug
TSPP–A	Triple Slot Position Plug
TTL	Transistor Transistor Logic
TTP	Transmission Termination Point
TU–n	Tributary Unit of order n
TUG–n	Tributary Unit Group of order n
TV	TeleVision
Tx	Transmit, Transmission
UAA	Upstream Access Arbitration
UART	Universal Asynchronous Receiver Transmitter
UBR	Undefined Bit rate
UCS	Upstream Cell Start
UDP	User Datagram Protocol

UG	Under Ground
UI	Unnumbered Information
UID	U–Interface Device
ULS	Universal Line Shelf
ULSA	ULS Assembly
UNI	User–Network Interface
UP	UPstream
UPC	Usage Parameter Control
UPF	User Port Function
US	United States (of America)
UTP	Unshielded Twisted Pair
UWP	Upstream Winning Priority
V	Volts
Vac	Volts AC
Vdc	Volts DC
V5.x	V type signalling interface
V5SL	V5.x Service Layer
VA	V–Alcatel signalling interface
VA*	V–Alcatel simplified signalling interface
VACS	V–Alcatel Communication Service
VADL	VA for SW DownLoad
VB5.x	V signalling interface for Broadband
VBR	Variable Bit Rate
VC	Virtual Channel
VCI	Virtual Channel Identifier
VCO	Voltage Controlled Oscillator
VCXO	Voltage Controller crystal Oscillator
VDSL	Very high speed Digital Subscriber Line
VF	Voice Frequency
VoIP	Voice over IP
VP	Virtual Path
VPI	Virtual Path Identifier

VRSL V5.2R S12 RSU signalling Service Layer

Appendix B Technical Specifications

B.1 System Interfaces

B.1.1 PDH Optical Transport (EOTCA)

PDH Multiplexing structure	G.742 and G.751
Electrical connections	G.703

B.1.2 HDSL Transport (HLTCA)

Line interface	ETR152
Line rate	2320 kbit/s (single pair) or 1160 kbit/s (two pair)
Line coding	2B1Q
Local Traffic Interface	2Mbit/s G.703

B.1.3 Network Interfaces

V5.2	ETSI V5.2 Edition 2
ATM (STM-1)	ITU-T I.150, I.361, I.413, I.432.5,
ATM (IMA)	ITU-T G.703, G.704 ATM Forum af-phy-0086.001 ITU-T I.150, I.361, I.413, I.432.5
DDN	ITU-T G.703

B.1.4 Management**Narrowband**

Craft Interface	F proprietary (RS232)
Remote Interface (OS)	X.25 (Q.811) Ethernet (Q.811) Inband ATM – CMIP over ATM

Broadband

Craft Interface	TL1
Remote Interface (OS)	SNMP via inband ATM

B.1.5 Customer Interfaces**Narrowband**

2W PSTN	TP00152 DA.009 DA.013
ETSI ISDN BRA	ETS 300 012 ITU-T I.430 ETR 080
ETSI ISDN PRA	ETS 300 233 ITU-T G.703
DDN 2 Mbit/s, Nx64	ITU-T G.703

Broadband

ADSL	ANSI T1.413 Issue 2 G.992.1 (G.dmt) G.992.2 (G.lite)
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B.1.6 Synchronisation Signal

Input	ITU-T G.703 2 Mbit/s
Output	ITU-T G.703 2 Mbit/s

B.2 Mechanical Dimensions

Subracks	Shelf dimensions
MLS–hb	300 mm (+125 mm connector area) H 475 mm W 250 mm D
MLS–hbe	300 mm (+125 mm connector area) H 475 mm W 250 mm D
Backpanel	Protected with rear cover. Thickness : 5.3 +/– 0.2 mm. No electrical components or devices are soldered onto the backpanel. Connectors for the card area are metral, male, 4 or 5 rows. Connectors for the plug area are metral, male, 4 or 5 rows.

Card Functions	Cards	Card Dimensions (HxDxW)
Transport	EOTCA, HLTCA	265 mm x 213 mm x 20 mm
Narrowband Line cards	ATLCC, PMLC, ALLC, BALCF	265 mm x 213 mm x 20 mm
Broadband Line cards	LTAC–A, LTAC–C NACC, PAIC	265 mm x 213 mm x 20 mm
	LTAC–D	265 mm x 213 mm x 40 mm
Narrowband Controller and Extender	NEHC–P, NSEC	265 mm x 213 mm x 25 mm
Broadband Controllers and Extender	AANC, AICC, ASCC–S BSEC	265 mm x 213 mm x 25 mm
Ringer card	DURCC	265 mm x 213 mm x 40 mm
Test card	TACCB	265 mm x 213 mm x 20 mm
Alarm card	TARCB	265 mm x 213 mm x 20 mm

Appendix C ADSL Customer Premises Filters

C.1 Introduction

ADSL and POTS services share a single customer line. The POTS services use voice frequencies. ADSL uses frequencies above voice frequency.

Filters are required to separate the frequencies.

- ▶ High pass filters are located within ADSL modems. The filters block POTS frequencies, preventing POTS equipment and POTS frequencies from interfering with ADSL services.
- ▶ Low pass filters are required between the line and any POTS equipment. These prevent any ADSL signals from interfering with POTS equipment. They also block some transients caused by POTS equipment which may adversely affect ADSL services.

The low pass filters which are available from Alcatel are:

- Speed Touch Inline Filter.

One Speed Touch Inline Filter is required for each telephone outlet. These filters are plug-in and can be installed by the customer.

One Inline Filter is installed at each socket outlet to which POTS CPE is connected.

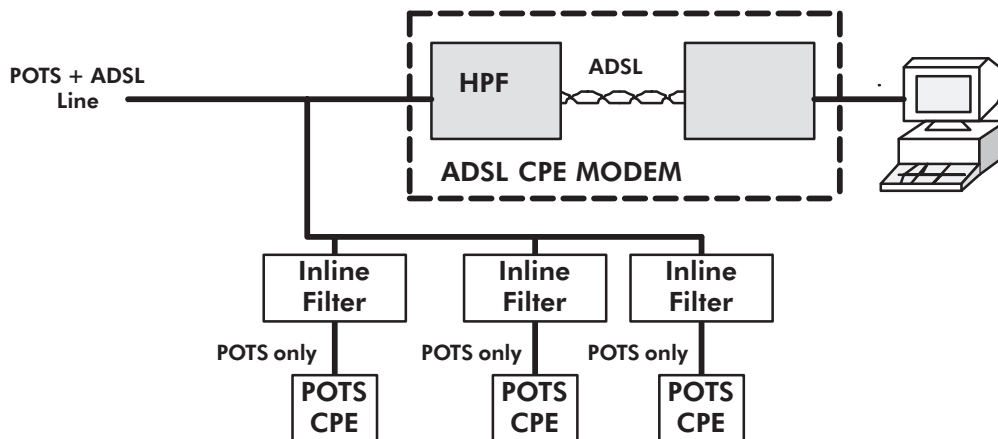


Fig C–1 Inline Filter (CPE End) – Context diagram

- Central Filter.

One Central Filter is required for each incoming telephone line which carries ADSL and POTS services. These filters are installed by licenced installers near the point at which the line enters the premises.

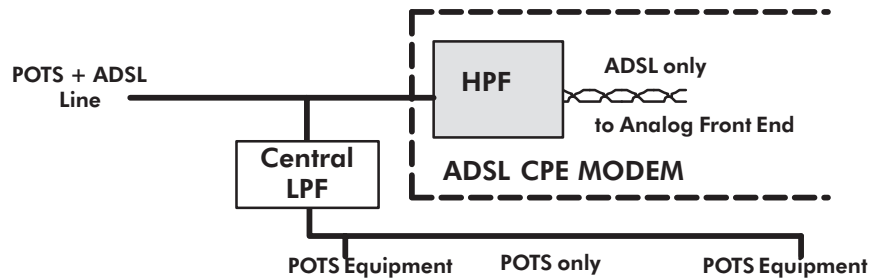


Fig C–2 Central Splitter (CPE End) – Context diagram

The Central Filter has three connectors:

- A *Line* connector for the incoming telephone line.
- A *Telephone* connector for the telephone wiring within the premises.
- An *ADSL* connector for ADSL wiring within the premises. Within the Central Filter this is directly connected to the *Line* connector.

Note A *Central Filter* and *Inline Filters* are not simultaneously installed on a single telephone line.

- If a *Central Filter* is installed on the incoming telephone line, *Inline Filters* are NOT installed.
- If a *Central Filter* is NOT installed, one or more *Inline Filters* are required. One *Inline Filter* is installed at each telephone outlet to which telephone equipment is connected.

C.2 Context Diagrams – ADSL Filters

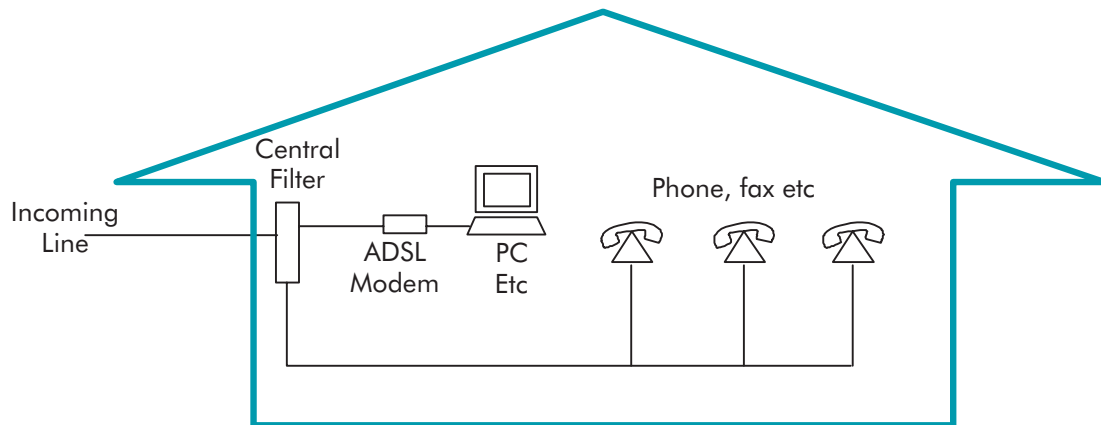


Fig C–3 ADSL Central Filter – Context Diagram

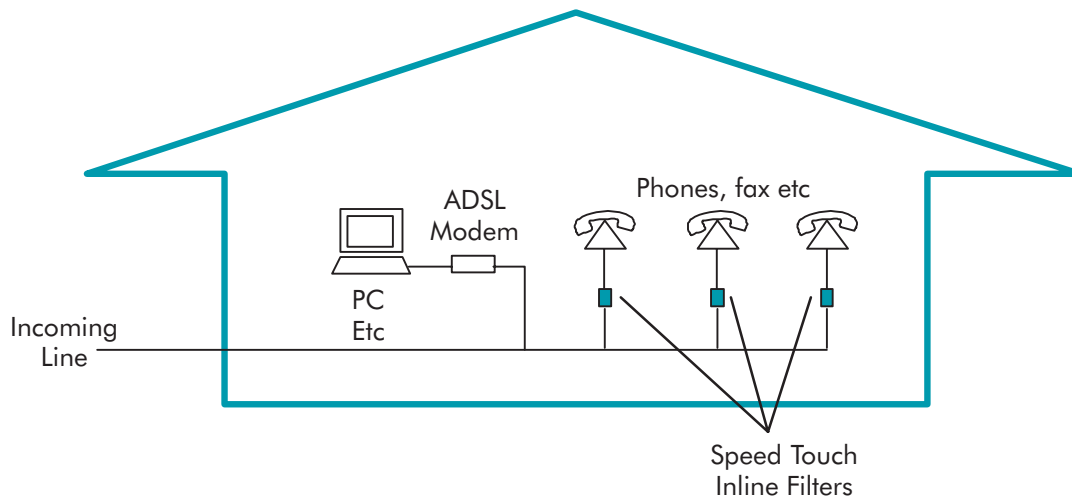


Fig C–4 ADSL Inline Filters – Context Diagram

C.3 Speed Touch Inline Filter



Fig C–5 Speed Touch Inline Filter

The Alcatel Speed Touch Inline Filter is a compact device approximately the same size as a matchbox. One filter is required for each telephone outlet. Part number is 3AU 04805 ABAA.

An RJ11 socket is located on each end of the filter, and symbols on the label identify the line and telephone sockets.

The filter is packaged with a short RJ11–RJ11 cable for connection to the line and a piece of double–sided adhesive tape to mount the filter on the wall.

The filter may also be mounted on the rear of some telephones when they are wall mounted. These telephones are Telstra Touchphone TF200, TF300, TF400 or TFCND.

To connect an inline filter to an RJ11 wall socket, or to an RJ11 socket on a Series 600 to RJ11 adaptor:

- ▶ Disconnect the telephone cord from the wall socket or adaptor.
- ▶ Use the short RJ11–RJ11 cable to connect the *Line* socket on the filter to the wall socket.
- ▶ Plug the telephone into the *Telephone* socket on the inline filter.
- ▶ Mount the filter on the wall or on the rear of a wall–mounted telephone.

Note *A detailed installation leaflet is packaged with each filter, detailing the method of connection for various types of wall sockets and telephone plugs.*

An optional adaptor kit (part number 3AU 48117 AAAA) may be required to connect an inline filter if the telephone is connected an RJ45 wall socket or if a Series 600 plug is permanently fitted to the telephone cord.

C.4 Central Filter

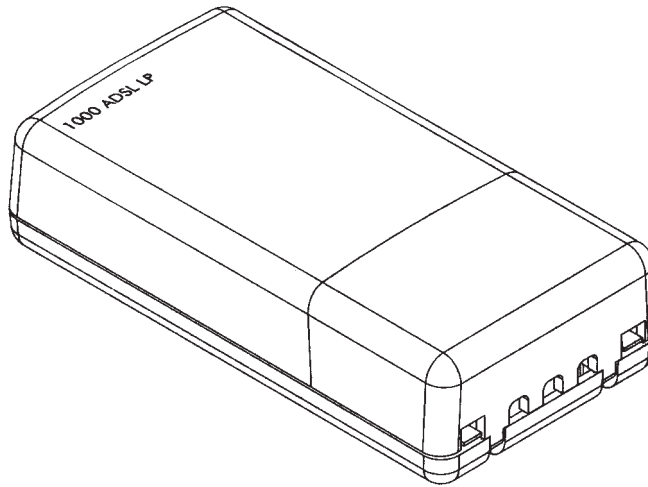


Fig C–6 ADSL Central Filter

The ADSL Central Filter (part number 3AU 04804 AAAA) is installed in a weather protected location on customer premises or within an external weatherproof housing.

One filter is required for each incoming telephone line that carries ADSL and POTS services.

The installation process is:

- ▶ Place the filter in a suitable internal location or in a weatherproof housing.
- ▶ Strip the cable ends and prepare them for termination.
- ▶ Open the connector area.
- ▶ Connect the incoming subscriber line to the *Line* connector.
- ▶ Connect cable from ADSL service outlet to the *ADSL* connector.
- ▶ Connect the cable from the premises telephone wiring to the *Telephone* connector.
- ▶ Secure cables.
- ▶ Refit the connector cover.

Note A detailed installation leaflet is packaged with the filter.

Appendix D Setup – CMUX to AWS Communication

In normal operation all OA&M for the broadband part of CMUX is performed by AWS. The use of AWS is described in the *AWS Operator's Handbook*.

In this appendix a Network Element (NE) refers to a CMUX Central Network Unit (NUC), a CMUX Subtended Network Unit (NUS), or a CMUX Access Unit (AU).

A newly installed NE may be preconfigured to a level where AWS can communicate with the NE. Alternatively a newly installed or repaired NE may not be able to communicate with AWS.

- ▶ If AWS can communicate with the NE, use AWS to configure the CMUX.
- ▶ If AWS cannot communicate with a NUC:
 - Use the process described in Section D.3 of this appendix to establish communication between AWS and the NUC.
 - Use AWS to complete the configuration of the CMUX NUC.
- ▶ If AWS cannot communicate with a NUS or an AU:
 - Use the process described in Section D.4 of this appendix to establish communication between AWS and the NUS or AU.
 - Use AWS to complete the configuration of the CMUX NUS or AU.

D.1 Configuration Outline

The configuration process is:

- ▶ Determine a unique physical address for the NE. This must be unique within the network.
- ▶ Connect a terminal to the DB9 port on the ASCC–S, AANC or AICC at a NUC or an AICC at a NUS or AU.
- ▶ Use the terminal to enter TL1 commands to establish communications between AWS and the broadband controller (ASCC–S, AANC or AICC) in the NE.
- ▶ Enter the IP address and reset the broadband controller.
- ▶ Use AWS to configure the NE via the network.

D.2 Broadband Craft Terminal

The Broadband Craft Terminal (BBCT) is a personal computer running terminal emulation software, such as the Windows HyperTerminal program.

The BBCT is connected to a Broadband Controller Card (BBCC) such as the ASCC–S, AANC or the AICC.

The BBCC has a female DB9 terminal on the front plate for connection of the BBCT.

- ▶ If the computer has a DB9 connector on its serial port, use a DB9 female to DB9 male cable to connect the BBCT to the DB9 connector on the ASCC–S, AANC or AICC. A straight-through DB9 to DB9 cable is required.
- ▶ If the computer has a 25 pin serial port, use a DB25 female to DB9 male cable to connect the CT to the DB9 connector on the front plate of the BBCC.

After connecting the BBCT to the BBCC, start the terminal emulation program (e.g. Windows HyperTerminal).

Configure the communications parameters to be:

Communications Parameter	Value
Bits per second (baud rate)	9600
Data bits	8
Parity	None
Stop Bits	1
Flow control	None

D.3 Central NU – NUC

D.3.1 Determine NUC Physical Address

Each NUC must have a unique physical address within the network. The physical address consists of eight hexadecimal numbers, using the following format:

nn–nn–nn–nn–nn–nn–nn–nn

This is a series of sixteen hexadecimal digits, in groups of two digits separated by dashes.

D.3.2 Connect Broadband Craft Terminal

The following procedure is used to connect the BBCT to the ASCC–S or AANC:

- ▶ Connect a cable from the serial port on the BBCT to the DB9 connector on the front plate of the ASCC–S or AANC.
- ▶ Start the terminal emulation program on the BBCT. If the terminal emulation program is HyperTerminal running under Microsoft Windows, start Windows then start HyperTerminal.
- ▶ Set the parameters of the communications link to the settings listed in the table in Section D.2.

D.3.3 ASCC–S or AANC – Basic Configuration

When a Broadband Craft Terminal (BBCT) is connected to an ASCC–S or AANC, a TL1 command line is displayed in the BBCT.

Manually enter the TL1 commands at the TL1 command prompt to configure the ASCC–S or AANC for communication with AWS:

```
/* Assign a hardware address to the CMUX */
ent-ipport::atm-1::manual:PHYADDR=,IPADDR=xxx.xxx.xxx.xxx,NETMASK=xxx.xxx.xxx.xxx;

/* Enter the IP address of the connecting AWS workstation */
ent-atmarmpent::atm-1::yyy.yyy.yyy.yyy,0,32:BITRATE=128000;

/* Set CMUX position as well as the VPI and VCI values for the BOOTP requests */
set-ne-ALL::COM:::BOOTPVPI=0,BOOTPVC=32,MEMALM=,SNTP=,DEFROUTER=,POTSTSTDUR=,TZOFFSET=,NETPOS=hub;
```

Note

- Enter the CMUX IP address and netmask immediately after IPADDR= and NETMASK= respectively.
- Replace yyy.yyy.yyy.yyy with the IP address of the AWS workstation.

D.3.4 Create ATM Connection

To create an ATM connection to the NUC:

- ▶ Create a NE (Network Element) on the AWS, making sure that the hardware address is the same as that entered in the BBCT terminal, but without the dashes between groups of digits (e.g. *nnnnnnnnnnnnnnnnnn*).
- ▶ Ensure that the IP addresses of the NUC and the ATM card (on the AWS workstation) belong to the same network.
- ▶ For the ATM OA&M connection the NE default settings are VP=1 and VCI=32.
- ▶ Create a subrack in the NE, then configure an NT card in it.
- ▶ Once the NUC is running, ping the NUC. A successful reply means that IP communication is available to the NUC.

D.3.5 Configure NUC

When communication has been established between AWS and the NUC, use AWS to complete the configuration of the NUC.

D.4 CMUX Subtended NU (NUS) or Access Unit (AU)

A NUS or AU is subtended from a NUC via one to four 2 Mbit/s links.

- ▶ If two to four 2 Mbit/s links are used they form an IMA link.
- ▶ If one 2 Mbit/s link is used it may be an IMA link or an E1 link.

Communication from AWS to a NUS or AU can only be done after the parenting NUC is properly configured and communicating with AWS.

The process is:

- ▶ Configure the NUC as detailed in Section D.3.
- ▶ Use AWS to declare and configure a PAIC at the NUC. To do this set up a cross-connect via AWS and create management connections on the PAIC.
- ▶ Configure the AICC.
The process below is for configuring a NUS or AU with an IMA link of 4 x 2 Mbit/s to the NUC.
Refer to Alcatel where the link to the NUC has IMA with one to three 2 Mbit/s links or a single E1 link.
- ▶ Use AWS to complete the configuration of the NUS or AU.

D.4.1 Determine NUS or AU Physical Address

Each NUS or AU must have a unique physical address within the network. The physical address consists of eight hexadecimal numbers, using the following format:

nn–nn–nn–nn–nn–nn–nn–nn

This is a series of sixteen hexadecimal digits, in groups of two digits separated by dashes.

D.4.2 Connect Broadband Craft Terminal

The following procedure is used to connect the BBCT to the AICC:

- ▶ Connect a cable from the serial port on the BBCT to the DB9 connector on the front plate of the AICC.
- ▶ Start the terminal emulation program on the BBCT.
If the terminal emulation program is HyperTerminal running under Microsoft Windows, start Windows then start HyperTerminal.
- ▶ Set the parameters of the communications link to the settings listed in the table in Section D.2.

D.4.3 AICC – Basic Configuration

When a Broadband Craft Terminal (BBCT) is connected to an AICC, a TL1 command line is displayed in the BBCT. The IP address is manually entered.

Manually enter the following TL1 commands at the TL1 command prompt to configure the AICC for communication with AWS:

```
ent-imagrp::ntima::1:TXGRPID=1,CACPROFDN=2,CACPROFDNNM=,CACPROFUP=2,CACPROFUPNM=,ATMACCPROF=2,
ATMACCPROFNM=,QOSCLASS=CBRUBR:IS
ent-e1::nte1-1&&-4:::LINETYPE=DSX1E1CRC,CACPROFDN=,CACPROFUP=,ATMACCPROF=,IMAGRP=NTIMA,QOSCLASS=,
PORTID=:IS

/* Assign a hardware address to the CMUX */

ent-ipport::atm-1:::manual:PHYADDR=,IPADDR=xxx.xxx.xxx.xxx,NETMASK=xxx.xxx.xxx.xxx;

/* Enter the IP address of the connecting AWS workstation */

ent-atmarmpent::atm-1:::yyy.yyy.yyy.yyy,0,32:BITRATE=128000;

/* Set the CMUX position as well as the VPI and VCI values for the BOOTP requests */

set-ne-ALL::COM:::BOOTPVPI=0,BOOTPVCI=32,MEMALM=,SNTP=,DEFROUTER=,POTSTSTDUR=,TZOFFSET=,NETPOS=hub;
```

Note Each of the commands above is one line.

- Do NOT enter a line feed or space between **ATMACCPROF=2**, and **ATMACCPROFNM=**
- Do NOT enter a line feed or space between **QOSCLASS=**, and **PORTID=:IS**
- Replace *yyy.yyy.yyy.yyy* with the IP address of the AWS workstation.
- Enter the IP address, replace *xxx.xxx.xxx.xxx* with the IP address and netmask of the CMUX.

D.4.4 Create ATM Connection

To create an ATM connection to the NUS or AU:

- ▶ Create a NE (Network Element) on the AWS, making sure that the hardware address is the same as that entered in the BBCT terminal without the dashes between groups of digits (e.g. *nnnnnnnnnnnnnnnnnn*).
- ▶ Ensure that the IP addresses of the NUS or AU and the ATM card (on the AWS workstation) belong to the same network.
- ▶ For the ATM OAM connection the NE must have VP=1 and VCI=32.
- ▶ Create a subrack in the NUS or AU, then configure an NT card in it.
- ▶ Once the NUS or AU is running, ping the NUS or AU. A successful reply means that an IP connection to the NUS or AU has been successfully configured.

D.4.5 Complete Configuration Of NUS or AU

When communication has been established between AWS and the NUS or AU, use AWS to complete the configuration of the NUS or AU.

D.5 Additional Information

- ▶ For additional information on AWS, refer to the AWS Operator's Handbook
- ▶ For additional information on TL1, refer to the following documents:
 - 3EC 16048 AAAA ACZZA
 - 3EC 15772 0408 RKZZA

Appendix E ADSL NT (ADSL Modem)

The ADSL modem terminates the ADSL line for connection to customer premises equipment.

Variants of the modem exist with the following interfaces:

- ▶ ATMF 25.6 Mbit/s.
- ▶ 10BaseT Bridged.
- ▶ 10BaseT PPTP.
- ▶ ATMF & 10BaseT.
- ▶ PC NIC (PC–based Network Interface Card).

At initialisation the ADSL system measures the maximum achievable bit rate, with predetermined margin, and initialises at either the maximum possible rate, or the maximum rate set through the service management. The stand–alone unit is mains powered.

Many different types of ADSL modems are compatible with CMUX. These include:

- ▶ Standard ADSL modems.
- ▶ ADSL G.LITE modems.
- ▶ Four port Ethernet router (e.g. Speedtouch Pro 4 port ethernet router).
- ▶ Ethernet over 802.11b wireless LAN (e.g. Speedtouch Wireless ADSL).

Note *For details of a particular ADSL modem, refer to the handbook for the specific unit.*

Appendix F Line Tests

CMUX can perform an extensive range of line tests to identify and locate faults in customer lines, customers equipment and in CMUX line cards.

Line test functions are provided by the TACCB, which may be located in any line card slot.

The TACCB accesses the lines for testing by the use of a test bus and test access relays on the line cards.

Separate test busses are provided for inward tests (towards equipment) and outward tests (towards customer line). When multiple panels are used, the test busses are extended from the first panel to the extension panels.

Tests supported for different types of lines/line circuits are shown in the table in Section F.2.

Note *Line tests are initiated from SULTAN via the Cross Domain Manager (XDM) and CMEM. They may also be initiated by CMEM.*

For further details on initiation of line tests and interpretation of results of tests refer to the Alcatel CMEM Operator's Handbook.

F.1 Test Board Selection

CMEM displays two types of test boards that the operator can select to perform line testing:

- ▶ TACC
- ▶ TACCB

Selection of the test board will depend on the card that has been configured in the CMUX.

The TACCB contains a superset of the line tests available in the TACC card. In most cases the TACCB will be the card that is equipped in CMUX.

To select a test board for testing:

- ▶ Click on *Line Testing*—>*Select Test Board*
A sub—menu will appear containing TACC and TACCB
- ▶ Select the same test board type installed in CMUX.

Note *TACC can be selected when TACCB is configured, however only a subset of tests will be available. The opposite is not possible.*

F.2 Line Test Summary

Tests	Service	Line Cards	Definition	Returned Value	Comment
Electrical Measurement Tests					
DC Voltage Tests (Foreign Battery)					
a-b	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	This outwards measurement is used to detect foreign DC voltage on the customer line.	DC Voltage 0..+/-150V	Uses 200 kΩ termination. 'c' and 'd' leg measurements are only applicable to Analog LL User Ports configured in 4W mode.
a-g (b float)					
b-g (a float)					
a-g (b gnd)					
b-g (a gnd)					
c-d	Leased Line	ALLC			
c-g (d float)					
d-g (c float)					
AC Voltage Tests					
a-b	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	This outwards measurement is used to detect AC voltage on the customer line.	AC Voltage 0..300Vrms	'c' and 'd' leg measurements are only applicable to Analog LL User Ports configured in 4W mode.
a-g (b float)					
b-g (a float)					
a-g (b gnd)					
b-g (a gnd)					
c-d	Leased Line	ALLC			
c-g (d float)					
d-g (c float)					
Resistance Tests					
a-b	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	This outwards measurement is used to measure the integrity of a line. Shorts to ground/battery will reduce the insulation resistance between terminals.	Resistance 0..10MΩ	Low voltage measurement. 'c' and 'd' leg measurements are only applicable to Analog LL User Ports configured in 4W mode.
b-a					
a-g (b float)					
b-g (a float)					
a-g (b gnd)					
b-g (a gnd)					
c-d	Leased Line	ALLC			
d-c					
c-g (d float)					
d-g (c float)					
Capacitance Tests					
a-b	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	This outwards measurement returns the line capacitance of the customers line.	Capacitance 0..10,000nF	
a-g (b float)					
b-g (a float)					
a-g (b gnd)					
b-g (a gnd)					
c-d	Leased Line	ALLC			
c-g (d float)					
d-g (c float)					
Feeding Voltage/Current Tests					
Feeding Current Test	POTS, ISDN, Mirror	ATLCC BALCF	This inwards measurement is used to check the feeding capability of the line circuit.	Current 0.+/-100mA	
Feeding Voltage Test	POTS, ISDN, Mirror	ATLCC BALCF	This inwards measurement is used to verify the correct polarity and feed voltage of the line circuit.	DC Voltage 0..+/-128V	

Tests	Service	Line Cards	Definition	Returned Value	Comment
Block Reading Tests					
	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	Any of the above DC/AC/Resistance/Capacitance test results can be obtained. Measurements are made every 50ms for up to 1 second (20 measurements)	Returns values for up to 20 measurements.	This does not include Feeding Current and Voltage tests
Continuous Reading Tests					
	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	Any of the above DC/AC/Resistance/Capacitance test results can be obtained. CMEM sends a series of block reading commands to CMUX. With every command, measurements are made every 200ms for 4 seconds (20 measurements).	Returns (to CMEM) values for 20 measurements, continuously.	This is a permanently activated test. This test must be manually aborted. This does not include Feeding Current and Voltage tests
Package Test					
DC b-g (a float) a-g (b float) Resistance b-g (a gnd) a-g (b gnd) Capacitance: b-g (a gnd) a-g (b gnd)	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	The Package Test performs the combination of DC Voltage, Resistance and Capacitance Tests as specified.	As specified in the corresponding tests above.	CMEM/ADM converts package test request into individual test requests for CMUX.
Resistance/Capacitance Test					
Resistance b-g (a gnd) a-g (b gnd) Capacitance b-g (a gnd) a-g (b gnd)	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	The Resistance/Capacitance Test performs the combination of Resistance and Capacitance Tests as specified.	As specified in the corresponding tests above.	CMEM/ADM converts combination test request into individual test requests for CMUX.
Loop Resistance Test					
Loop Resistance Test	POTS	ATLCC	Measures the outwards loop resistance while the customer is off-hook.	Resistance 0–10kΩ for both a–b and b–a leg combinations.	Voice Access Test (See Note 1)
Dialled Digit Test					
Dialled Digit Test	POTS Mirror	ATLCC	This test combines a number of measurements to check that the customers telephone is performing correctly. The test concurrently monitors for, and detects, DTMF digits, decadic digits, register recall, on-hook and off hook events. Up to 20 events can be detected.	DTMF Dial: Digit (1☐9, 0, *, #) Low tone freq (Hz) Low tone level (dBm) High tone freq (Hz) High tone level (dBm) Decadic Dial: Digit (1☐9, 0) Avg make time (ms) Avg break time (ms) Register Recall: Break length (ms) Non-digit events: on-hook off-hook	Voice Access Test (See Note 1) Results are returned after the requested number of events have been detected.

Tests	Service	Line Cards	Definition	Returned Value	Comment
Subscriber Private Metering Pulse Test					
Subscriber Private Metering Pulse Test	POTS	ATLCC	This is a customer assisted test that applies a single metering pulse on the customers line (generated by the line circuit) which will allow an operator/subscriber to confirm whether the pulse has been detected by a customers home meter unit.		Voice Access Test
Ring Subscriber Test					
Ring Subscriber Test	POTS	ATLCC	This is a customer assisted test that is carried out by applying continuous ring signal to the customers line and checking the answer of the subscriber.		Voice Access Test
Cable Pair Identification Test					
Cable Pair Identification Tone	POTS, ISDN, Mirror, Leased Line	ATLCC BALCF ALLC	This outwards measurement is used to search for a particular pair within a cable binder. This test applies 48V feed and an 800Hz (–3dB) tone onto the line, to allow an operator to locate a customers cable pair using analogue test equipment.		This is a permanently activated test. This test must be manually aborted.
Dial Tone Test					
Dial–tone Test	POTS	ATLCC	This inward measurement tests the ability of the line circuit to detect and process a call start. An off–hook condition is simulated in the TACC. The measurement determines the time from going off–hook to the onset of dial tone.	Time to dial–tone. 10ms..10,000ms	Automatic only
Test To Line Circuit					
NOTE: This single test returns the combined results of the tests listed below					
Feeding voltage	POTS ISDN Mirror	ATLCC BALCF	This inwards measurement is used to verify the correct polarity and feed voltage of the line circuit.	DC Voltage 0..+/-128V	
Feeding current	POTS ISDN Mirror	ATLCC BALCF	This inwards measurement is used to check the feeding capability of the line circuit.	Current 0..+/-100mA	
Loop / Ring Trip Detection	POTS Mirror	ATLCC	This inwards measurement confirms that a loop condition can be detected on the line circuit while the line circuit is idle and ringing.	Time to detect ring trip (ms)	
Private meter Pulses	POTS Mirror	ATLCC	This inward test verifies that the line circuit is able to send a meter pulse with the correct level and duration.	Pulse Duration (mSec) Pulse Voltage Level (V)	

Tests	Service	Line Cards	Definition	Returned Value	Comment
Ring Signal	POTS Mirror	ATLCC	This inward test verifies that the line circuit is able to generate a ring signal with the correct DC/AC voltage level and frequency.	Ring DC Voltage (V) Ring AC Voltage (Vrms) Ring Frequency (Hz)	
Codec Test: Rx Gain	POTS Mirror	ATLCC	The codec receive test measures the receive path through the line card, i.e. in the direction toward the subscriber line from the exchange. The measurement involves the TACC transmitting a digit (PCM) test tone from the line card and analysing the tone generated by the line card on the inwards test bus.	Receive Gain –40.0dB.. +3.0dB	
Revertive Call Tests					
Revertive Call Start	POTS Mirror	POTS Mirror	A Revertive Call establishes a voice connection between the test card and test operator. This connection is required for specific line tests to be performed. Decadic dialling is used to establish the call to the operator.		Used for operator assisted tests. As defined in ITU–T Q.835 using <i>parallel voice path method</i> . Requires a separate V5.2 PSTN line.
Monitor a Busy Line	POTS Mirror	ATLCC	This test allows the operator to listen to a conversation on a customer line.		A Revertive Call must be established before this test is performed.
Ring and Speak to Customer	POTS Mirror	ATLCC	After establishing revertive call, operator can choose a particular customer line and commands ring signal on that line. When the customer answers the call, a voice path is established between the customer and the operator. This voice path doesn't use the customer's line circuit.		A Revertive Call must be established before this test is performed.
Revertive Call Stop	POTS	ATLCC			
Adaptive Hybrid Balancing (AHB)					
Balance Port Coefficients	POTS Mirror	ATLCC	After a Ring and Speak to Customer test, AHB training can be initiated. Customer is expected to cover the mouth piece during AHB training.	AHB parameters and training successful / unsuccessful flag.	A Ring and Speak to Customer test must be in progress for this test can be performed. The TACC performs Balance Return Loss test by sending low, middle, and high frequency tones on the subscriber line and measuring its leakage into the return path. This test will determine the effectiveness of AHB coefficients.
Set coefficients to default	POTS Mirror	ATLCC	Facility to restore default hybrid coefficients.		A Revertive Call does not need to be established to restore the default hybrid coefficients.

Tests	Service	Line Cards	Definition	Returned Value	Comment
ISDN Quick Tests					
NT1 Reset	ISDN	BALCF	Performs an NT1 reset by removing power from line for 30 seconds.		
Layer 1 Activation	ISDN	BALCF	This test confirms whether Layer 1 Line Activation is possible on the selected line under test.	Pass/Fail	
ISDN Loopback	ISDN	BALCF	Performs a complete loopback (all channels) first in the line card (LT) and then in the NT1.	Pass/Fail	
Power Feed	ISDN	BALCF	This test verifies that the line circuit is capable of providing feed to the line.	Pass/Fail	
FUNCTION: Layer 1 Activation ISDN Loopback Power Feed	ISDN	BALCF	The Function Test performs the combination of ISDN related Tests as specified.	As specified in the corresponding tests above.	
ISDN Loopback Tests					
LT Loopback	ISDN	BALCF	Loopback of B1/B2/B1B2D with a pattern	Error ratio	
NT Loopback	ISDN	BALCF	Loopback of B1/B2/B1B2D with a pattern	Error ratio	

F.3 Adaptive Hybrid Balancing

The line circuit of each POTS line is equipped with a DSP based electronic 2W/4W hybrid circuit. When a line is configured to use a selected balance impedance, the coefficients of the DSP are set to pre-calculated values which provide optimum Balance Return Loss against the specified balance impedance. When used with real lines however, the achieved Balance Return Loss may be less than optimum.

Adaptive Hybrid Balancing is the process of adjusting the digital filter coefficients to improve the achieved Balance Return Loss against actual customer lines. The process involves the use of the TACCB and is implemented as a customer assisted test. This requires the tester to call the customer (Ring And Speak To Customer) and ask the customer to cover the handset microphone before proceeding with the process.

When Hybrid Balancing is initiated, the current Balance Return Loss is measured at three frequencies (low end, middle and top end of VF band) using sine waves generated by the TACCB. If the measured results do not achieve a set threshold, the training process continues.

This involves the TACCB generating a digital impulse which applied to the customers line via the line circuit with the digital hybrid disabled. The returned digital impulse response is captured and used to calculate new digital coefficients. The Balance Return Loss is measured again to verify the improvement in performance and the new coefficients are stored in non-volatile memory. If the result does not achieve an improvement, the default coefficients are restored.

When a customers line is configured to support a Securitel service, the adaptive hybrid balance function is not supported. A request to initiate hybrid balancing of a line which is supporting Securitel will be rejected.

F.4 ADSL Testing

When a customer line supports a POTS service and an ADSL service, the physical line tests are carried out using the procedures normally used for testing the POTS service. If the POTS line is provided by CMUX, the line is tested as a POTS line using the TACCB. If the line is provided by an exchange line card, the line is tested using the exchange line test card.

The ADSL filter (NACC) which is used for combining a POTS service and an ADSL service on a single line, appears in series with the POTS line being tested.

When performing outwards tests, such as line resistance and capacitance, the POTS service is interrupted because the line is disconnected from the POTS line circuit. The ADSL service however, is not interrupted because the ADSL line circuit of the LTAC is still connected to the line while performing line tests.

F.5 Subscriber Private Metering Pulse Test

The Subscriber Private Metering line test can be used to confirm that a customers home meter unit is operating correctly. This is done by injecting a single meter pulse onto the customers line. It is a customer assisted line test (voice access test, as defined in ITU–T Recommendation Q.835 9 using *existing call method*).

To perform Subscriber Private Metering line test, the customer must be conversing (connected) with the operator via a standard line (i.e. not via a revertive call). While the customer is on–line, the *Subscriber Private Metering Pulse Test* can be run.

CMUX instructs the line circuit to generate a single meter pulse onto the customers line. The meter pulse is generated in the same manner as if the request was initiated by the LE, i.e. the pulse is not generated by the TACC card, but by the actual line circuit.

The customer can then immediately inform the operator whether or not the meter pulse was registered on the home meter unit.

F.6 Ring Subscriber Test

The Ring Subscriber line test can be used to confirm that a ring signal can be applied to a customers line. It is a customer assisted line test (voice access test, as defined in ITU–T Recommendation Q.835 9 using *existing call method*).

To perform the test, the customer must be conversing (connected) with the operator via a standard line (i.e. not via a revertive call). While the customer is on-line, the Ring Subscriber test can be run.

At this point, when CMUX detects that the customers phone has gone on-hook, CMUX applies a continuous ring signal to the line. The ring signal is applied in the same manner as if the request was initiated by the LE, i.e. the ring signal is not generated by or through the TACC card, but by the actual line circuit, albeit continuously.

When CMUX detects that the customer has gone back off-hook, CMUX stops applying the ring signal and re-connects the customer to the operator.

F.7 Loop / Ring Trip Detection Test

The Loop / Ring Trip Detection test can be used to confirm that CMUX is capable of detecting a looped line and ring trip. It forms part of a suite of inward line tests that are performed when the Test to Line Circuit test is run.

The Loop / Ring Trip Detection test confirms that CMUX is capable of detecting an off-hook condition on the line. It does this by firstly disconnecting the customers line and connecting the line circuit to the TACC in an inwards fashion. The TACC then simulates a looped line.

With the same set-up, the test also confirms that while the line is ringing, CMUX is capable of detecting a ring trip.

This test returns a pass/fail test result, together with the time it spent to detect the ring trip.

Appendix G Installing Subracks In NU Racks

This appendix contains an example of a procedure for installing CMUX subracks. It is based on Workability Ergonomic Reports using NIOSH Guidelines for Manual Handling.

G.1 Introduction

The maximum weight that individuals can safely lift varies greatly depending on their health, physical abilities, experience, environmental conditions and site conditions.

Recommend Weight Limits described in Section G.4 are indicative. They only apply to 90% of healthy individuals and only under perfect conditions as defined in Section G.3.

G.2 Job Specific Risk Assessment

A specific risk assessment should be carried out for each job as actual environmental and site conditions may differ from perfect conditions or individuals' health, physical abilities or experience may differ from similar characteristics in a standard population.

Job specific risk assessments will identify the most appropriate control measures to be implemented to ensure the lift will not cause injury.

Job specific risk assessments and the implementation of control measures are the responsibility of the site supervisor and should be documented in writing following company's approved procedures.

G.3 Perfect Conditions:

Perfect conditions are defined as conditions where:

- ▶ the lift involves no twisting,
- ▶ there is sufficient space to bend down fully (i.e. 1 metre),
- ▶ the load is distributed evenly between both hands,
- ▶ the load is lifted with 2 hands,
- ▶ the distance between the hands is 63cm or less,
- ▶ the hands are in front of the torso,

- ▶ the hands are at the same height or level,
- ▶ a smooth or continuous motion is used,
- ▶ the person has a good footing with both feet on the ground,
- ▶ the lifting environment is of moderate temperature (19–26 degrees Centigrade and 35–50% humidity),
- ▶ the task is done infrequently,
- ▶ the height of the top platform is 1.5m.

When actual conditions differ from perfect conditions, the weight people can lift will be less. The risk assessment will identify control measures to be established to minimise the effects of non–perfect conditions.

G.4 Recommended Weight Limit

The table below shows the Recommended Weight Limit under perfect conditions and for 90% of healthy individuals:

	RWL 1 person lift	RWL 2 people lift
Lifting to the top subrack position	15.4kg	30.8kg
Lifting to the medium subrack position	18.3kg	36.6kg
Lifting to the bottom subrack position	18.8kg	37.6kg

These guidelines are indicative only and do not apply to all situations. A job specific risk assessment shall be carried out to identify control measures to be established to ensure the lift will not cause any injury.

G.5 Estimation of actual weight to be lifted

All subracks shall be labelled with their estimated weights to enable installers to better assess the risk involved in lifting the equipment.

G.6 Example of possible control measures

The following is a list of possible controls to be implemented. The type of controls to be implemented will depend on the type and level of risks to be controlled. Controls will also depend on the extent and type of resources (human and material) available on the particular site.

Possible controls:

- ▶ using support brackets and support screws to assist in holding the subrack in place while it is fixed on the rack,
- ▶ raising work floor to make access to top platform easier (be careful to use a stable platform),
- ▶ modifying environmental conditions (e.g. provide shade, provide air/conditioning),
- ▶ implementing job rotation or longer breaks,
- ▶ removing circuit boards from subrack prior to installation until weight is acceptable (be careful to follow recommended procedure to avoid damaging equipment),
- ▶ using mechanical aids, if available and safe to do so,
- ▶ requiring additional personnel to assist, if available and safe to do so.

G.7 Recommended Weight Limit for other equipment

The above RWL were calculated for the lifting of CMUX NU subracks into racks.

They do not apply for equipment other than CMUX NU subracks or for tasks other than lifting these subracks into racks.

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