C-DOT V5.X INTERFACE

USER MANUAL

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THIS C–DOT SYSTEM PRACTICE REFERS TO THE C–DOT V.5.X INTERFACE (ABBREVIATED AS C–DOT V5.X IN THE REST OF THIS PUBLICATION).

THE INFORMATION IN THIS SYSTEM PRACTICE IS FOR INFORMATION PURPOSES AND IS SUBJECT TO CHANGE WITHOUT NOTICE.

A COMMENT FORM HAS BEEN INCLUDED AT THE END OF THIS PUBLICATION FOR READER'S COMMENTS. IF THE FORM HAS BEEN USED, COMMENTS MAY BE ADDRESSED TO THE DIRECTOR (SYSTEMS), CENTRE FOR DEVELOPMENT OF TELEMATICS, 39, MAIN PUSA ROAD, NEW DELHI - 110 005

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Chapter 1.

Introduction

1.1. PURPOSE

This document gives the general description for the Access Network connectivity with C-DOT Digital Switching Systems over ETSI/ITU V5 interface. The aim of this document is to describe V5 interface, its implementation in C-DOT digital switching systems, hardware and software architecture to support standard V5 interface. The intended users for this document are various access network vendors, DOT, and C-DOT switch manufacturers.

1.2. SCOPE

This document covers the description of C-DOT Digital Switching System with V5 interface capability. It defines the physical connectivity and the hardware to be used for interfacing with Access Network. It also gives the provisioning requirements as well as operations and maintenance aspects of the system.

1.3. NEED FOR V5 INTERFACE

To overcome the complex requirements of network planning of connecting the scarcely distributed villages or to add new subscribers in already congested metros, a new interface has been developed. This interface connects Local Exchange to Access Network and widely known as V5 interface. This is a standard interface based on ETSI/ITU specification. Here subscribers are directly connected to Access Network but logically they are the part of Local Exchange. Numbering plan, billing and other call processing related activities are performed at Local Exchange.

By using this methodology of V5 interface, the physical distribution of subscriber cables from Local Exchange to subscriber premises is reduced to negligible length or totally removed in case of wireless. This makes the whole operation very cost effective and also eliminates the hardship of digging the road and laying down the subscriber cables.

1.4.

ORGANISATION OF THE DOCUMENT

This document has been organised in seven chapters including the present one.

Chapter 2 describes the V5 interface along with definitions of new terminologies used. Further it tells about the advantages of V5 interface over proprietary interfaces and differences between V5.1 & V5.2 interfaces.

Chapter 3 presents the system architecture of C-DOT Digital Switching System in brief. This will help in understanding the fundamental of C-DOT Digital Switching System.

Chapter 4 helps in understanding the implementation of V5 interface in C-DOT Digital Switching System.

Chapter 5 describes hardware architecture of V5 Interface Unit (VU).

Chapter 6 is on software architecture of V5 interface in C-DOT Digital Switching System. It also deals with call processing/handling and different call flow scenarios.

Chapter 7 describes the man machine interface (MMI) for operations and maintenance functions of V5 interface in C-DOT Digital Switching System.

Chapter 2.

V5 Interface

2.1. INTRODUCTION

V5 interface is the connectivity between Local Exchange (MAX) and Access Network based on ETSI/ITU specifications (see reference). Messages are exchanged between Local Exchange and Access Network over V5 interface (Fig. 2.1). This chapter gives brief insight on standard V5 interface protocol.

2.2. DEFINITIONS

(i) ***Access Network (AN) :*** A system implemented between the Local Exchange (LE) and user, replacing part or the whole of the local line distribution network.

(ii) ***Local Exchange (LE) :*** An exchange on which user lines are terminated directly or via an AN.

(iii) ***V5 Interface :*** A general term for the family of V-Interfaces for connections of ANs to the LE, e.g. V5.1 or V5.2 interface. (See 2.3.1 and 2.3.2 for description)

(iv) ***Layer 3 Address (L3 addr) :*** It is an address given to individual subscriber of Access Network. It is included in layer 3 messages to identify the AN subscriber for which the message is meant.

(v) ***PSTN Protocol :*** It is concerned with the path setup for a call, reporting of telephony events during conversation, release of the path on the V5 interface, call collision resolution on the V5 interface and handling of new calls in case of overload conditions in the LE.

(vi) ***Control Protocol :*** It provides control functions which are applicable either for individual PSTN ports or for all the PSTN ports at the same time. The control functions cater to blocking/unblocking of ports meant for maintenance purposes.

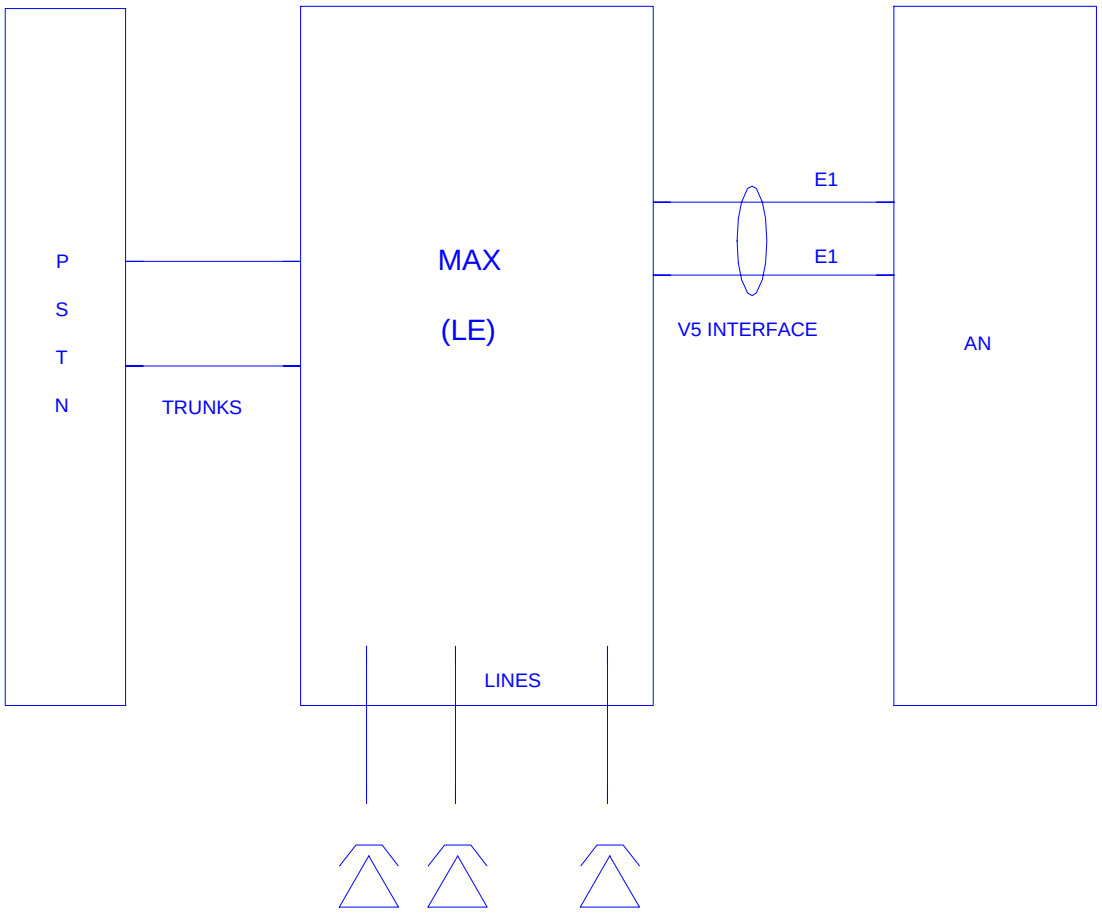


FIG. 2.1
LE-AN CONNECTIVITY

\DESIGN\ANINTRFC\LEANCNV

(vii) Link Control Protocol : It is used to manage multiple links of a V5 interface between AN and LE. The main functionality of this protocol is blocking/unblocking of links and link status report to higher layers.

(viii) BCC (Bearer Channel Connection) Protocol : It provides the means for the LE and the AN to establish and release connections between specified AN user ports and specified V5 interface time slots. It enables V5 interface bearer channels to be allocated or de-allocated on a per call basis.

(ix) Protection Protocol : It is meant for the protection of active C-channels in case of failure of active link.

2.3. V5 INTERFACE

As already discussed V5 interface provides connectivity between Local Exchange and Access Network as shown in Fig. 2.1. Like ISDN and #7 signalling, V5 interface is also a layered protocol. It consists of three layers.

Layer 1 ----> Physical Layer

Layer 2 ----> Data Link Layer ----> LAPV5

Layer 3 ----> Network Layer ----> Call Control, Interface maintenance

At layer 1, standard physical layer protocol for 2Mbps digital link is used. Layer 2 of V5 interface protocol is a subset of layer 2 of ISDN and is called LAPV5 (Link Access Protocol for V5 interface) protocol. The LAPV5 protocol divides the layer 2 into two sublayers namely LAPV5-EF (LAPV5 - Envelope Function sublayer) and LAPV5 - DL (LAPV5 - Data Link sublayer)

All the call control and interface maintenance activities are performed by the layer 3 protocols. Five different type of protocols are present at layer 3. These are PSTN, Control, BCC, Link Control and Protection. The first two are supported by V5.1 interface whereas V5.2 supports all the five protocols.

The responsibility for call control lies with the Local Exchange. The access management in the Access Network and the service management in the Local Exchange each maintain their Finite State Machines and protocol entities and communicate over V5 interface.

Distribution of Local Exchange and Access Network functions are as follows:

Local Exchange

- Call Processing control
- Subscriber Numbering Plan
- Call Detail Record Collection (Billing)

- Supplementary Services (3 Party, Call waiting, Call forwarding etc.)
- Answer Supervision
- Concentration
- Time slot Allocation

Access Networks

- Resource Management and Allocation together with LE
- Physical or Wireless connectivity

V5 interface is classified into two categories

1) V5.1 interface
2) V5.2 interface

2.3.1. V5.1 Interface (Figure 2.2)

V5.1 interface consists of a single 2.048 Mbps link comprising thirty two 64 kbps channels. In a network, V5.1 interface is primarily used to connect multiplexers. In a single V5.1 interface, 30 subscribers can be supported, each having a dedicated 64 kbps channel, called bearer channel. Remaining two channels are used for synchronisation and to carry signalling information.

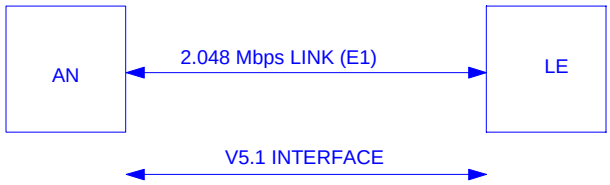
Layer 3 of V5.1 interface consists of two protocols

- PSTN protocol
- Control protocol

Signalling informations are multiplexed at layer 3 and carried over a single layer 2 data link.

2.3.2. V5.2 interface (Figure 2.3)

V5.2 interface consists of multiple 2.048 Mbps (E1) links bundled together. A. single V5.2 interface can consist of a maximum of sixteen 2.048 Mbps links. In the bundle, one E1 link is defined as Primary link & another as secondary. Signalling information for all the subscribers is carried in time-slot 16 of primary or secondary link (whichever is active). On demand TS 15 and TS 31 can also be used for signalling. All the remaining time-slots (except 0^{th} time slot which is used as FAS) of the V5.2 interface are used as bearer channels. V5.2 interface supports concentration, i.e., time-slots are allocated on call by call basis to the subscribers.



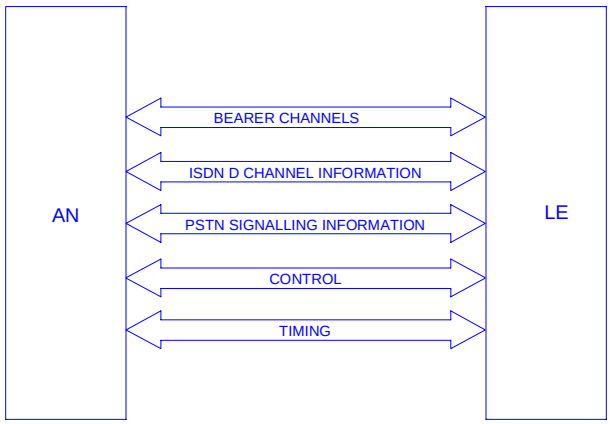
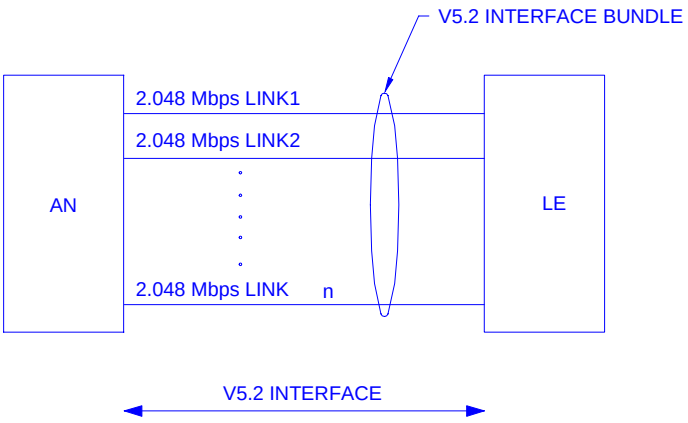


FIG. 2.2

V5.1 INTERFACE

\DESIGN\ANINTRFC\ANIGDV1



NOTE : n CAN VARY FROM 1 TO 16

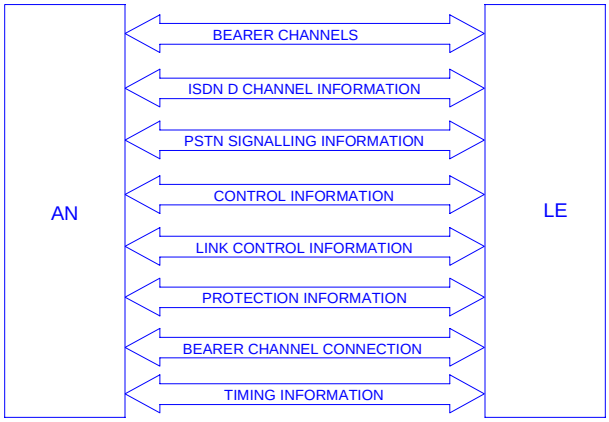


FIG. 2.3

V5.2 INTERFACE

\DESIGN\ANINTRFC\ANIGDV2

Layer 3 of V5.2 interface consists of five protocols

- PSTN protocol
- BCC protocol
- Control protocol
- Link control protocol
- Protection protocol

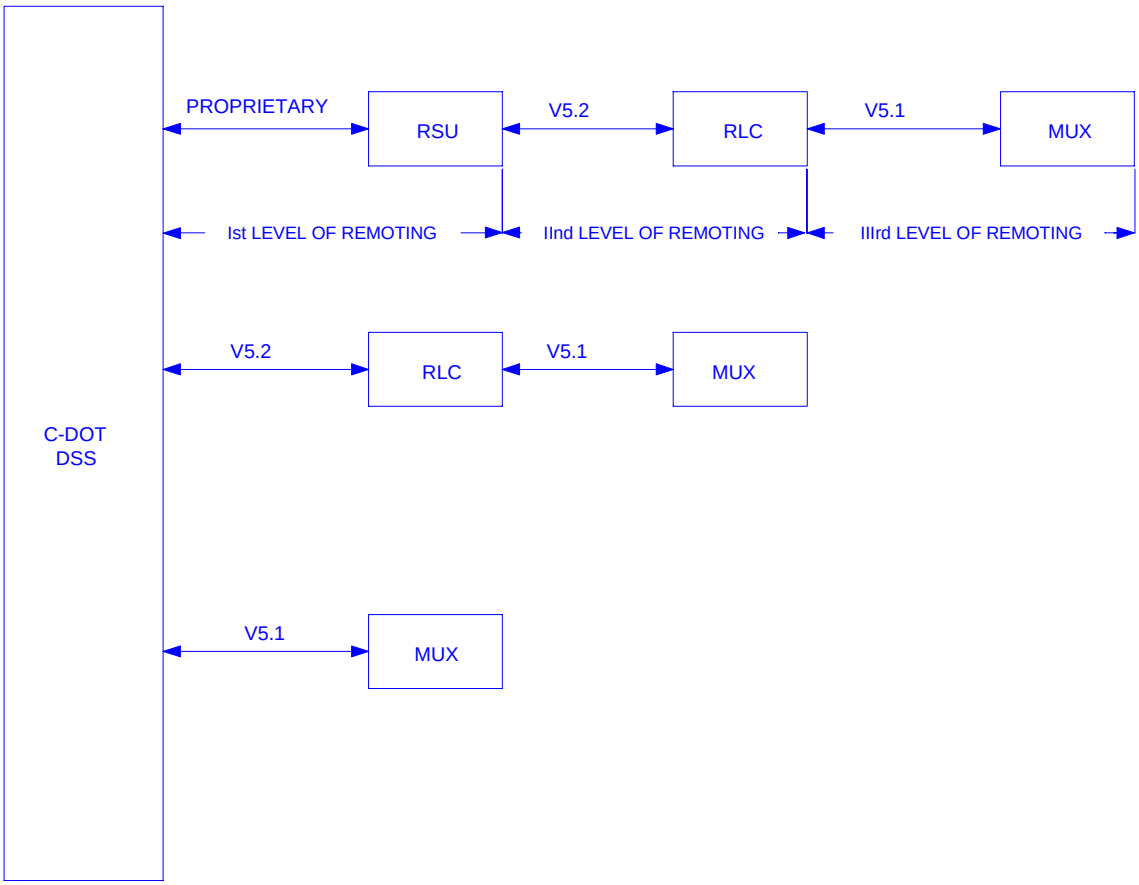
2.4. COMPARISION BETWEEN THE V5.1 INTERFACE AND THE V5.2 INTERFACE

S. No.	Points	Protocol	
		V5.1	V5.2
1.	Standard	complete International Standard	Extension of V5.1 interface protocol
2.	E1 links	single E1 link	Supports upto 16 E1 links
3.	ISDN-PRA	Not supported	Supports
4.	Bearer channel allocation	Nailed up channel for each subscriber	Channel allocation on call by call basis (through BCC protocol)
5.	Protection of C-channel	Not present as it has only one E1 link	Can be protected if the protocol has more than one E1 link and secondary is configured
6.	Link control protocol	Not present as it has only one link	Present

2.5. V5 INTERFACE IN REMOTING

The subscribers may spread over large distances within a local exchange area, requiring longer loops and hence large investment in copper cable. Further, to meet service quality requirements, need for additional equipment may arise in many cases. To provide satisfactory economic solution to this, the digital exchange can be split by provision of a part of the equipment, designated as 'Remote Switching Equipment', placed close to the subscriber premises to minimise the loop lengths.

A maximum of three levels of Remote Switching Equipment may be provided. Fig.2.4 shows a Digital Exchange with different levels of remoting. The following equipment are used for remoting.



RSU --> RSU (REMOTE SWITCH UNIT)
RLC --> RLC (REMOTE LINE CONCENTRATOR)
MUX --> MULTIPLEXER

FIG. 2.4
REMOTING PRINCIPLES

\DESIGN\ANINTRFC\PSTNRMP

i) Remote Switch Unit (RSU) → Used as 1st level remoting equipment in three level remoting.

ii) Remote Line Concentrator (RLC) → Used as Second level remoting equipment in three level remoting and as first level remoting equipment in two level remoting.

iii) Multiplexer (MUX) → Used as last level of remoting equipment.

Interconnection between main switch and RLC/MUX, RSU and RLC/MUX or RLC and MUX is through 2 Mbps digital link using V5.x or proprietary interface.

RSU is connected main exchange through proprietary interface. RLC is connected to Main Switch or RSU through V5.2 interface. MUX is connected to Exchange/RLC through V5.1 interface. The number of E1 (2 Mbps) links in all above depends upon the capacity of Remote switching equipment and traffic considerations.

2.6. APPLICATIONS

WLL is an attractive alternative for rural telephony. Use of V5 interface enhance the cost effectiveness of rural telecom network. Similarly V5 interface has become an essential part of the FITL (Fiber in the Loop) solution where optical fiber is used as a transport medium. The connectivity of the subscribers to the Access Network can thus be through any of the following :

- Subscriber MUX (Landline Copper Wire)
- WLL (Wireless in Local Loop)
- FITL (Fiber in the Loop)

2.6.1. Subscriber MUX (Figure 2.5)

Subscriber MUX supports a maximum of 120 subscribers connected to it through copper wires. To connect 120 subscribers, four V5.1 interfaces will be required as one V5.1 caters to 30 subscribers only.

2.6.2. Wireless in Local Loop (Figure 2.6)

Here Access Network comprises Base Station Controller (BSC) and Base Station (BS). BSC is connected to Local Exchange through V5.2 interface having four E1 links. In the present configuration each BSC can have upto 20 Base Stations and can support upto 1000 wireless subscribers with traffic capacity of 1 erlang at 1% GOS. The figure shows DECT as Access Technology. DECT technology uses frequency band of 1880-1990 MHz with ten carriers each having spacing of 1.728 MHz.

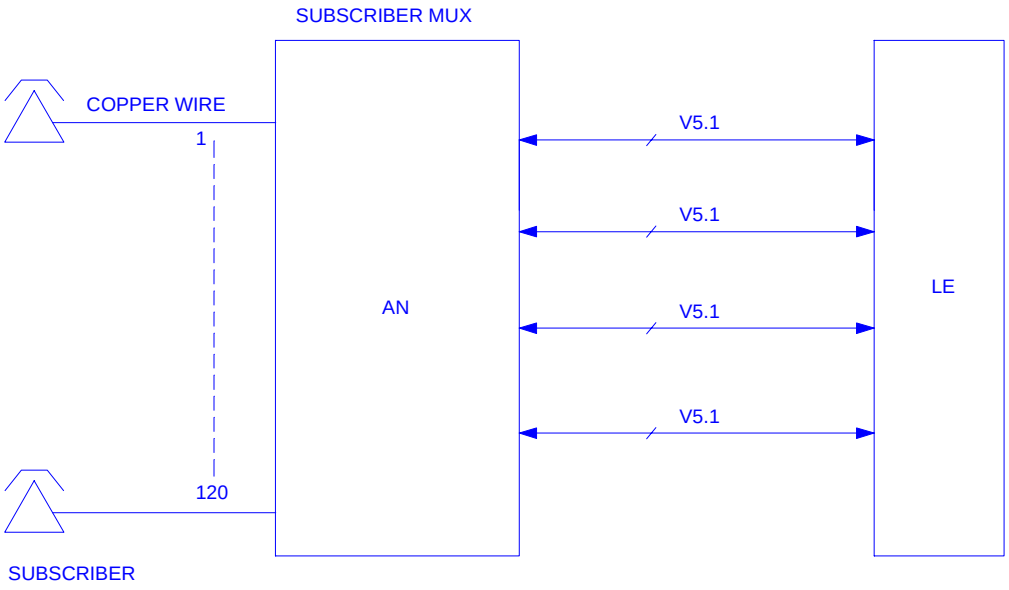


FIG. 2.5
SUBSCRIBER MUX

\DESIGN\ANINTRFC\LLCWR

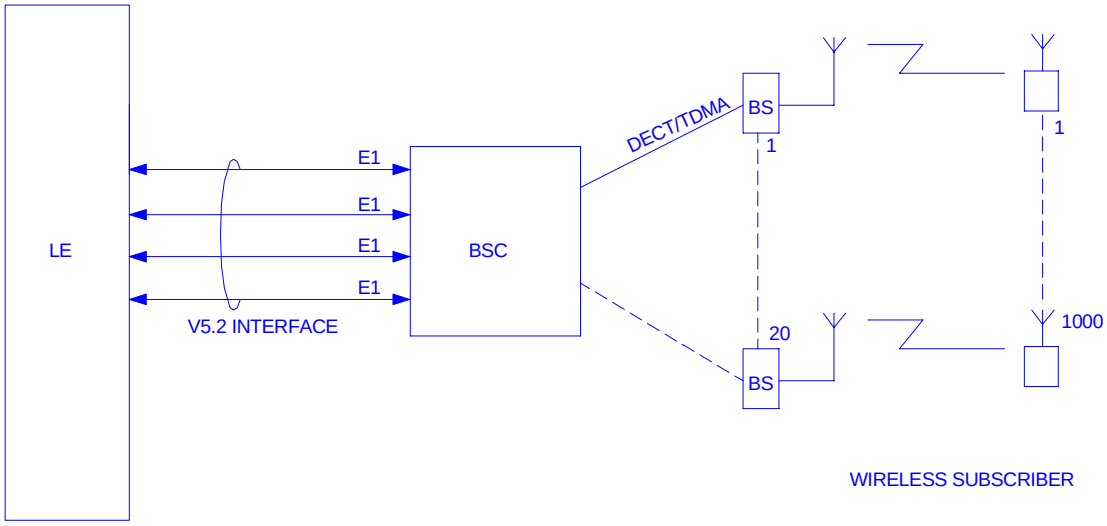


FIG. 2.6

WIRELESS IN LOCAL LOOP

\DESIGN\ANINTRFC\WLLP

2.6.3. Fiber in the Loop (Figure 2.7)

Here Access Network comprises Host Digital Terminal (HDT) and Optical Network Unit (ONU). HDT is connected to Local Exchange through a bundle of 32 E1 links of V5.2 interface(s). HDT can have maximum of four optical networks with each having maximum of 32 ONUs. In each optical network maximum 1024 B channels can be provided. Hence, HDT can support maximum of 4096 (1024 x 4) B - Channels. ONUs are connected to HDT through high capacity optical fiber cables.

2.7. ADVANTAGES OF V5 INTERFACE

1. **Compatibility :** V5 interface has been recognised **Internationally** as standard protocol between Local Exchange and Access Network. In future it should be possible to connect Local Exchange of one vendor to Access Network of another vendor without any changes.

2. **Cost Optimization** : Removal/reduction in subscriber cables as Local Exchange and Access Networks are connected to each other by 2 Mbps (E1) digital links.

3. **Effective Network Planning** : Sparsely populated villages distributed over large areas or congested metros can be connected using wireless in local loop based on V5 interface. Figure 2.8 shows the total network solution using V5 interface.

4. **Simplified Operation & Maintenance** : Subscriber connected to Access Network are controlled from Local Exchange using V5 interface. Billing and other operations are done at Local Exchange.

5. **Reduced delays & hardship** : By using V5 interface, activities like digging the road and laying down the subscriber cables will be reduced drastically which in term reduce the delay in giving subscriber connection

6. **No effect from human & natural calamities.**

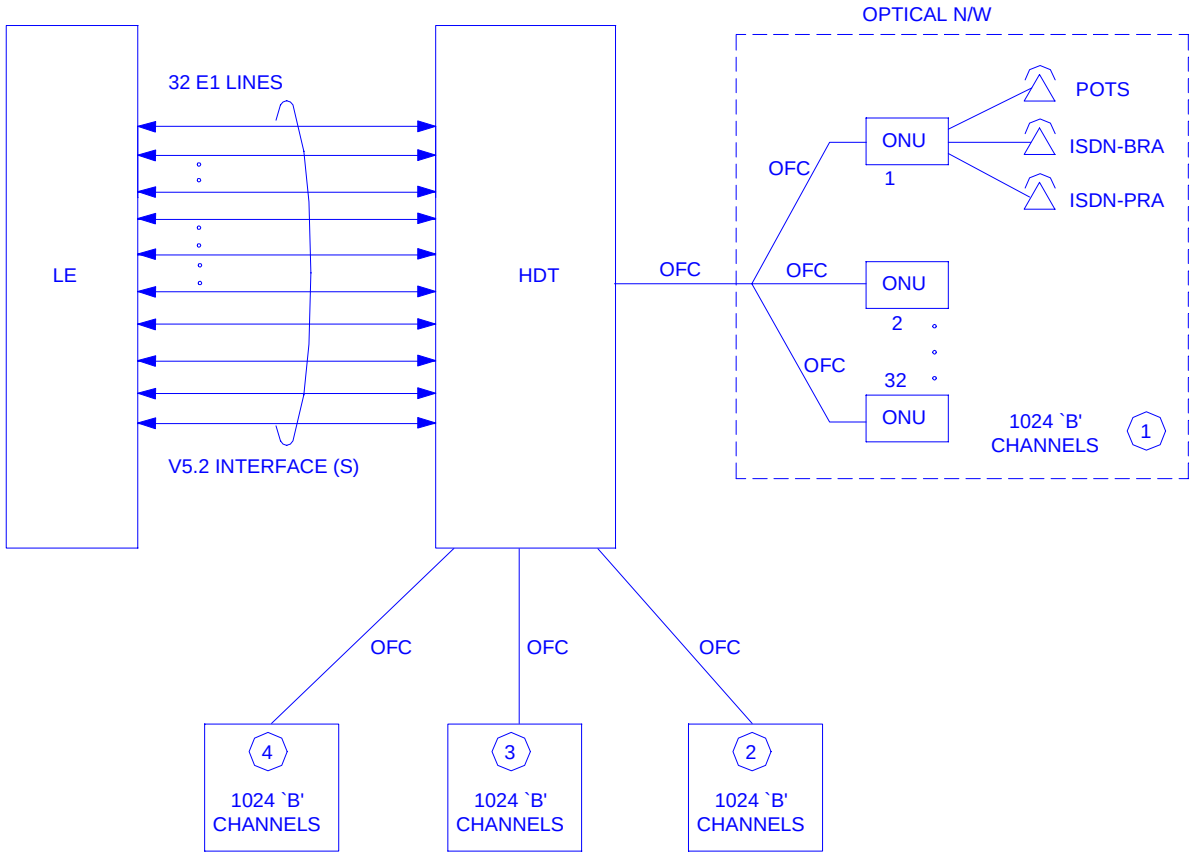


FIG. 2.7

FIBER IN THE LOOP

\DESIGN\ANINTRFC\FBRLP

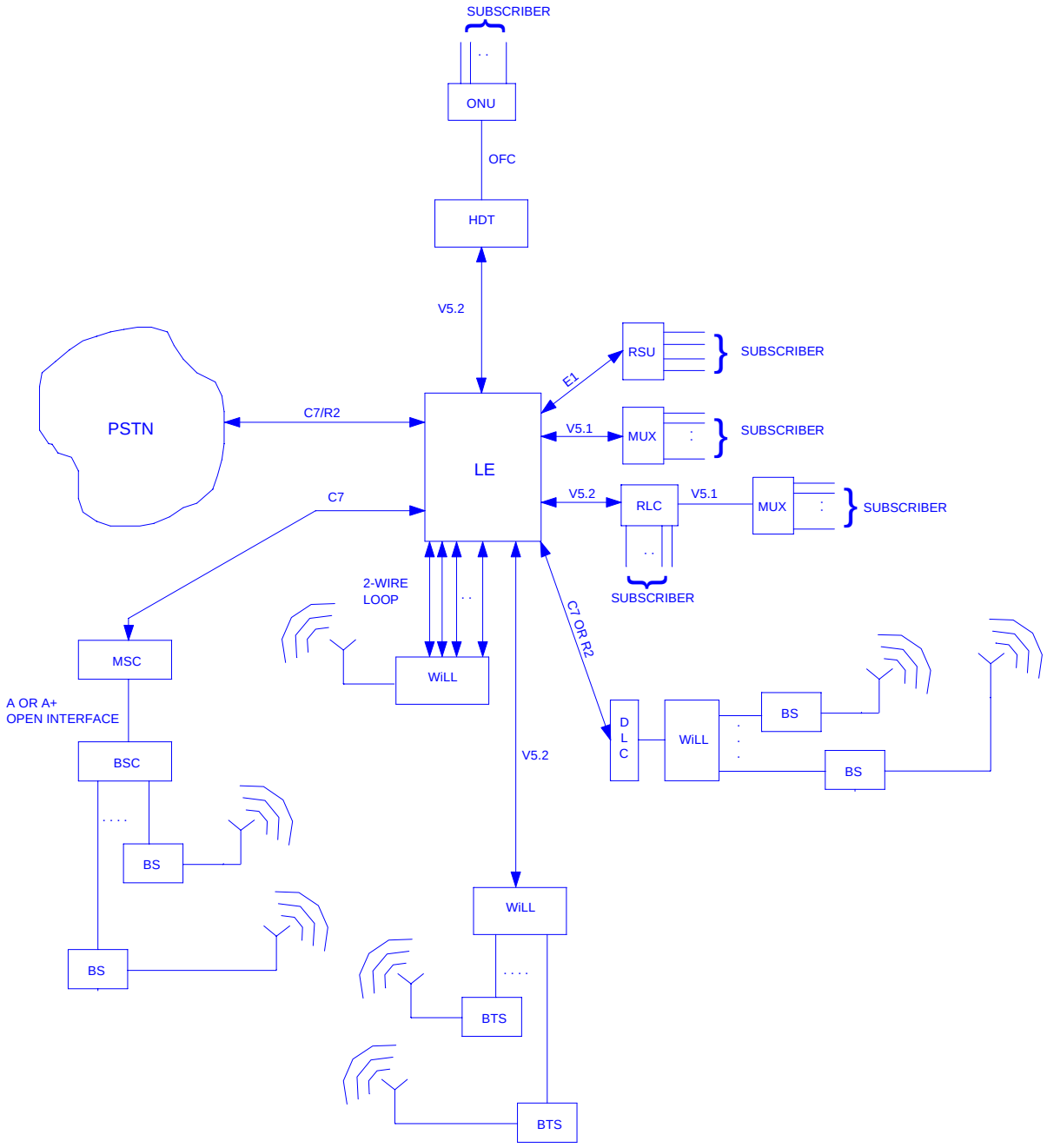


FIG. 2.8
NETWORK SCENARIO (TOTAL SOLUTION)

\DESIGN\ANINTRFC\ANIGDNWS

Chapter 3.

C-DOT Digital Switching System

3.1. INTRODUCTION

C-DOT Digital Switching System provides a total telecom solution to cater to the requirements of modern era communication network because of its modular and flexible nature. It s technically comparable to existing Multinational Digital Switching Systems and has a distinctive advantage in the front of economies, as per-line cost of C-DOT Digital Switching System is very less compared to per line cost of Multinational Digital Switching System.

This chapter gives the brief outline of C-DOT Digital Switching System. For more details refer to "**C-DOT MAX GENERAL DESCRIPTION"** document. [9].

3.2. BASIC MODULES OF C-DOT DIGITAL SWITCHING SYSTEM

C-DOT Digital Switching System is designed using T-S-T switching matrix. C-DOT DSS exchanges can be configured from four basic modules (Figure 3.1)

a. Base Module

b. Central Module

c. Administrative Module

d. Input Output Module

3.2.1. Base Module

Base Module is the basic growth unit of C-DOT DSS. It interfaces the subscribers, trunks and special circuits. The subscribers may be individual, on PBX lines or CCM lines; and the trunks may be Two Way, E&M Four wire or digital. The basic functions of a Base Module are -

- Analog to digital conversion of all signals on analog lines and trunks.
- Interfacing digital trunks.
- Switching calls between terminals connected to the same Base Module.

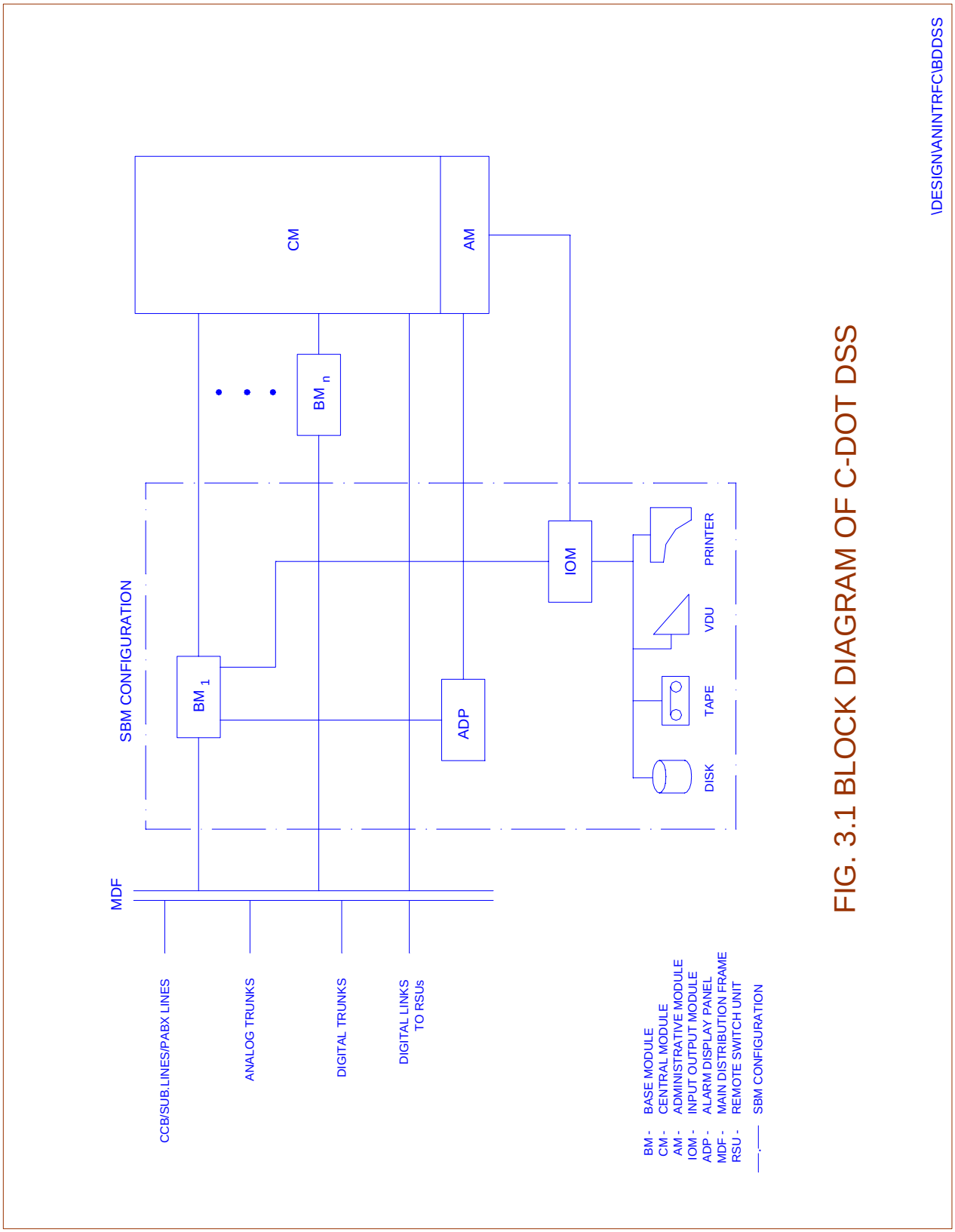


FIG. 3.1 BLOCK DIAGRAM OF C-DOT DSS

- Communication with the Administrative Module via the Central Module for administrative and maintenance functions and also for majority of inter-BM switching (i.e. call processing) functions.
- Provision of special circuits for call processing support e.g. tones, announcements, terminal tester, MF/DTMF controller, etc.
- Provision for local switching and metering in case of Remote Switch Unit application in standalone mode.

For these functions, the Base Module hardware is spread over four types of units -

- ***Terminal Unit -*** for interfacing analog lines and trunks, and providing special circuits like announcements & Terminal tester.
- ***Digital Terminal Unit -*** for interfacing digital trunks.
- ***Time Switch Unit -*** for voice and message switching and provision of service circuits.
- ***Base Processor Unit -*** for control message communication and call processing functions.

3.2.2. Central Module

Central Module is responsible for space switching of inter-Base Module calls, communication between Base Modules and the Administrative Module, providing local clock and network synchronisation. For these functions, Central Module has a Space Switch, Space Switch Controller and a Central Message Switch.

CM Provides connectivity to Base Modules. Each BM interfaces with CM via two 512-channel parallel buses each operating at 4 Mbps. These buses are called bus 0 and bus 1, and each bus carries voice information of 512 subscribers transmitted by the Base Module. In the reverse direction, after space switching has been done in the Space Switch under the control of Space Switch Controller (SSC), two parallel buses carry the switched voice information for 512 subscribers each at 4 Mbps towards the Base Modules.

3.2.3. Administrative Module

Administrative Module consists of a duplicated 16/32-bit controller called the Administrative Processor Controller. It communicates with Base Processors via the Central Message Switch for control messages and with the duplicated Input Output Processors in the Input Output Module for interfacing peripheral devices.

Administrative processor is responsible for global routing, translation, resource allocation and all other functions that are provided centrally in C-DOT Digital Switching System.

3.2.4. Input Output Module

C-DOT IOP (Tower type) is used as front end processor in C-DOT Digital Switching System. It communicates with Digital Switching System on high speed data links. It contains fault tolerance software, a layer above UNIX V2 which ensures data consistency between Digital Switching System and IOP.

IOP basically handles all the input and output functions in Digital Switching System. All the commands from operator are received and analysed by IOP.

The major functions performed by C-DOT IOP are listed below:

a) Down loading and Initialisation of Digital Switching System.

b) Man Machine Interface.

c) Storage of Billing and Traffic data, Exchange data.

d) Exchange Management Functions.

3.2.4.1. IOP-VH Architecture

The IOP-VH is defined as Value Engineered High performance IOP. It is designed on a single card named VHC. The IOP card is not duplicated but IOP as a module is duplicated.

The IOP CPU was 68040 (25 MHz) processor and is housed on the VHC card. It has 16 MB DRAM onboard and 512KB EPROM. All active IOP processes reside in dynamic RAM and hence the data coming from/going to HDLC links, secondary storage device and terminals use dynamic RAM.

The system has provision for 7 HDLC channels, two of these are used to connect the IOP to both copies of AP/BP. The third link is for connection with mate IOP so that both can work in synchronisation in duplex IOP configuration.

Eight channels of RS-232C Serial Links (through ASIO ports) are also implemented for connecting operator terminals and printer to IOP in addition to two ports for console and host. The provision for one X.25 port is also there which can be used for 64 kbps full duplex link via modem with synchronous RS232 support at physical level.

In addition provision for one 10 Mbps Ethernet port is also there in IOP-VH which has AUI or co-axial interface support at physical level.

3.3. REMOTE SWITCH UNIT

Remote Switch Unit (RSU) is an integral part of C-DOT Digital Switching System. In order to realise a RSU, the normal SBM exchange can be modified for remote location and communication with the host exchange is via 2 Mbps digital links. The number of 2 Mbps streams between the host and the RSU is primarily determined by the traffic between them. As far as call processing is concern, RSU is an autonomous exchange capable of local-call completion. Operation and maintenance functions are handled by the host exchange. Remote Switch Unit can work in normal mode or standalone mode. During the normal mode of operation, the control and data links to the host are available. In the event of failure of these links, RSU goes into standalone mode of operation. During the transition from one mode to another intra-RSU calls are maintained and fresh call requests are accepted. In case it is not possible to process a call request due to unavailability of links to the host, the subscriber is connected to appropriate tone or announcement.

During standalone mode of operation, metering information of all the subscribers is stored in the RSU and sent to the host whenever the links are available again.

3.4. ALARM DISPLAY PANEL

Alarm Display Panel (ADP) is a unit which is attached to the BP (in SBM configuration) or AP (in MBM configuration) via HDLC links for providing audio-visual indication of system faults. A matrix of LEDs is provided to indicate the maintenance status of the switch units and their level of Initialisation. A seven-segment display shows the count of links and trunks currently faulty. Keys are provides for manual acknowledgment, initiating self test and selective audio disable / enable.

3.5. SIGNALLING SYSTEM NO.7

SS7 capability in C-DOT exchanges is implemented in a separate unit called SS7 Signalling Unit (7SU).

The 7SU hardware is packaged into a standard frame. The equipage of the frame is similar to that of a terminal unit. In a Base Module rack, the 7SU frame can be placed in any TU frame position i.e. principal frame or concentration frame position. In case it is equipped in the principal frame position, it interfaces with the Time Switch via a 128 channel PCM link operating at 8 Mbps.

Thus from an architecture point of view, the placement of 7SU in a BM is similar to that of a TU and it communicates with the outside world via the Terminal Unit Controller (TUC). This is a depicted in Fig. 3.2. Similar to a TU, 7SU has SS7 terminal cards i.e. Protocol Handler Cards (PHCs). Each PHC supports upto 8 signalling terminals in the present implementation. PHC is also know as SHM (Signalling Handler Module) card.

The PHC terminals can be configured as SS7 terminals or C.85 (C-DOT proprietary protocol, a variation of X.25 protocol) terminals for internal control message communication. One PHC terminal is configured as C.85 terminal at the time of 7SU initialisation in order to enable code and data downloading from the Input Output Module.

The communication with the Base Processor and between PHCs is handled by the 7SU CPU (7CPU) complex which has the same hardware as the BPC complex in the Base Processor Unit. 7CPU is the central control of the 7SU.

The SS7 protocol software is distributed over PHCs (Level 2), 7CPU (Level 3) and BPC (part of Level 3 and Level 4).

The design goal for 7SU traffic capacity has been to cater for busy hour message traffic equivalent of 16000 trunks (in the case of TAX being a node in an IDN) each handling, say, 30-40 BHCA. A minimum of two SS7 links per route, may be provided for reliability. While each SS7 link may ideally carry message traffic equivalent of maximum of 1000 voice circuits, in practice however, there may be more routes with much less number of voice circuits, thus increasing the number of SS7 links, with a total message traffic equivalent of 16000 trunks.

3.6. NETWORK SYNCHRONISATION

Network synchronisation in C-DOT DSS is implemented in the following two ways :

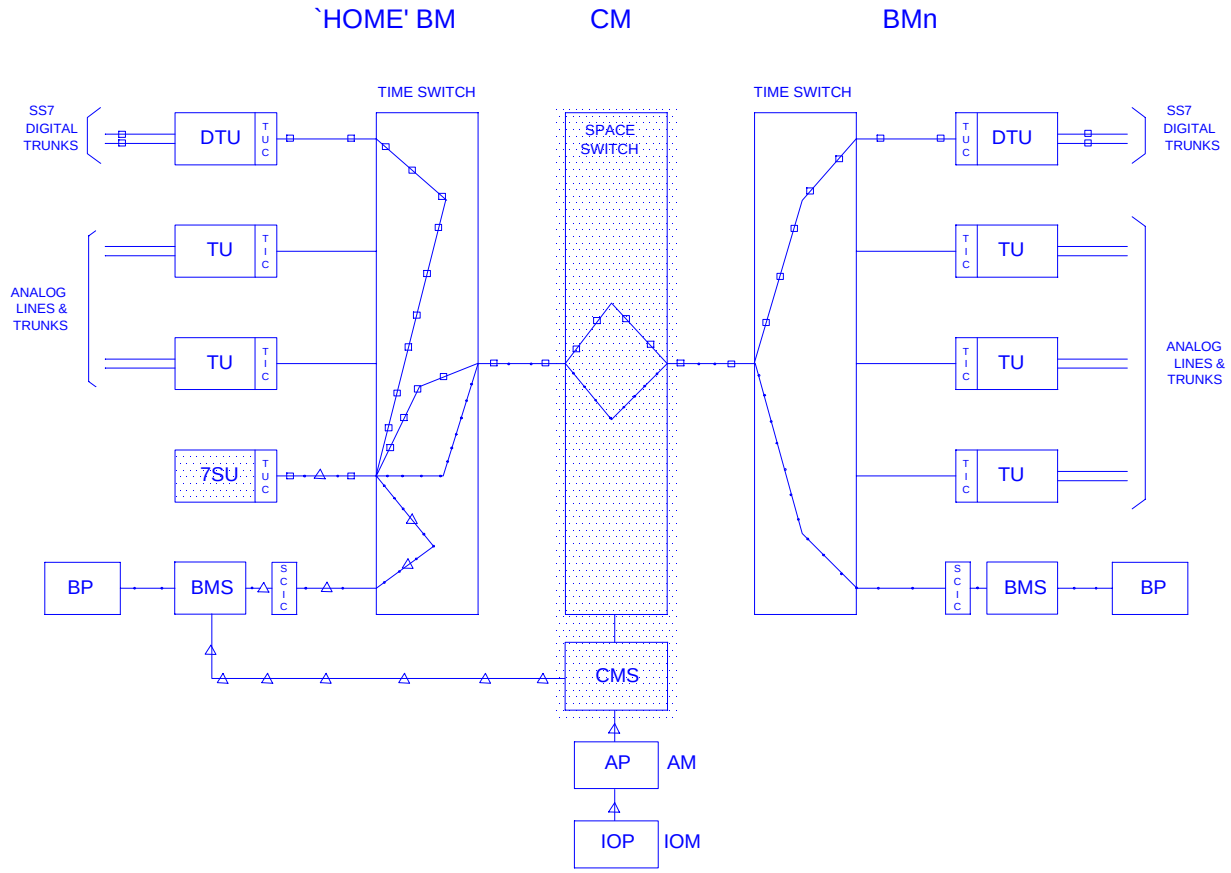
- Network Synchronisation Controller (NSC) card in MAX-XL.
- Network Synchronisation Equipment (NSE) is SBM or MBM

3.6.1. Network Synchronisation Clock Card (NSC)

The NSC card is placed in the SCU (Space Switch Controller Unit) frame of the CM-XL cabinet. It interfaces on the CPU bus of SSC (Space Switch Controller) and shares the bus with CBX (CPU Bus Extender Card) and memory card.

The functions of the card include :

- NSC card forms the interface between DTS (Digital Trunk System) and the CCK (Central Clock Cards).
- It receives the 2.048 MHz reference input clock from DTS and converts it into 16.384 MHz clock.
- It generates a sync signal (8KHz) and feeds it to the CCKs.
- It generates the real time clock for the system using Time-of-Day (TOD) block.



LEGEND :

7SU	-	SS7 SIGNALLING UNIT
AM	-	ADMINISTRATIVE MODULE
AP	-	ADMINISTRATIVE PROCESSOR
BM	-	BASE MODULE
BMS	-	BASE MESSAGE SWITCH
BP	-	BASE PROCESSOR
CM	-	CENTRAL MODULE
CMS	-	CENTRAL MESSAGE SWITCH
DTU	-	DIGITAL TERMINAL UNIT
IOM		INPUT OUTPUT MODULE
IOP	-	INPUT OUTPUT PROCESSOR
SCIC	-	SERVICE CIRCUITS INTERFACE CONTROLLER
TIC	-	TERMINAL INTERFACE CONTROLLER
TU	-	TERMINAL UNIT
TUC	-	TERMINAL UNIT CONTROLLER

CODE/DATA DOWNLOADING PATH
NAILED-UP #7 SIGNALLING LINKS
NAILED-UP INTERNAL MESSAGE LINKS

FIG. 3.2
SS7 SIGNALLING UNIT IN
C-DOT DSS MAX

\DESIGN\ANINTRFC\ANIGDSSU

- The NSC has an On Board Micro Processor to take care of PLL functions, diagnostics, communication with SSC.

The NSC card is duplicated and forms a security block with the CBX card.

3.6.2. Network Synchronisation Equipment (NSE)

Network Synchronisation Equipment (NSE) is a standalone unit which is capable of receiving the network reference clock, synchronising to the reference and supplying stable output clocks to a number of exchanges. The input clocks are received from higher level nodes in the synchronisation network hierarchy. Similarly, the output clocks are supplied to lower level nodes.

The C-DOT Network Synchronisation Equipment (NSE) consists of a PC type cabinet which houses duplicated controller card, duplicated I/O interface card, and one each display card, keyboard card and mother board. The controller card has a software controlled digital Phase Locked Loop (PLL), microprocessor and related memory, the non-standard output clock interface, display and keyboard interface. The NSE I/O card has the various types of input interfaces to take in the Network Clock. It also extracts clock from input digital trunks. It has the standard G.703/10 interface for the output clocks.

NSE gives out two duplicated 16.384 MHz clock for C-DOT MBM and three duplicated 8.192 MHz and equal number of duplicated 8 KHz sync. Signals for use in C-DOT SBM exchanges. The NSE connectivity with C-DOT SBM/MBM is explained as follows.

NSE Connectivity with C-DOT SBM

The duplicated Time Switch Controller (TSC) is the time base of a SBM exchange and it require an input of 8.192 MHz. Digital trunks carrying timing information are trapped to NSE and synchronised output is fed to SBM.

TSC0 is fed 8.192 MHz clock and 8 KHz synch. Input from NSE0 while TSC1 receives similar input from NSE1.

NSE Connectivity with C-DOT MBM

In the MBM exchange, while the digital trunks carrying timing information are tapped in the same fashion as in SBM, 16 MHz output of NSE is given to the duplicated Space Switch Clock (SCK) Card of the Central Module (CM) which is the master time base of the exchange. SCK distributes timing to all the BMs.

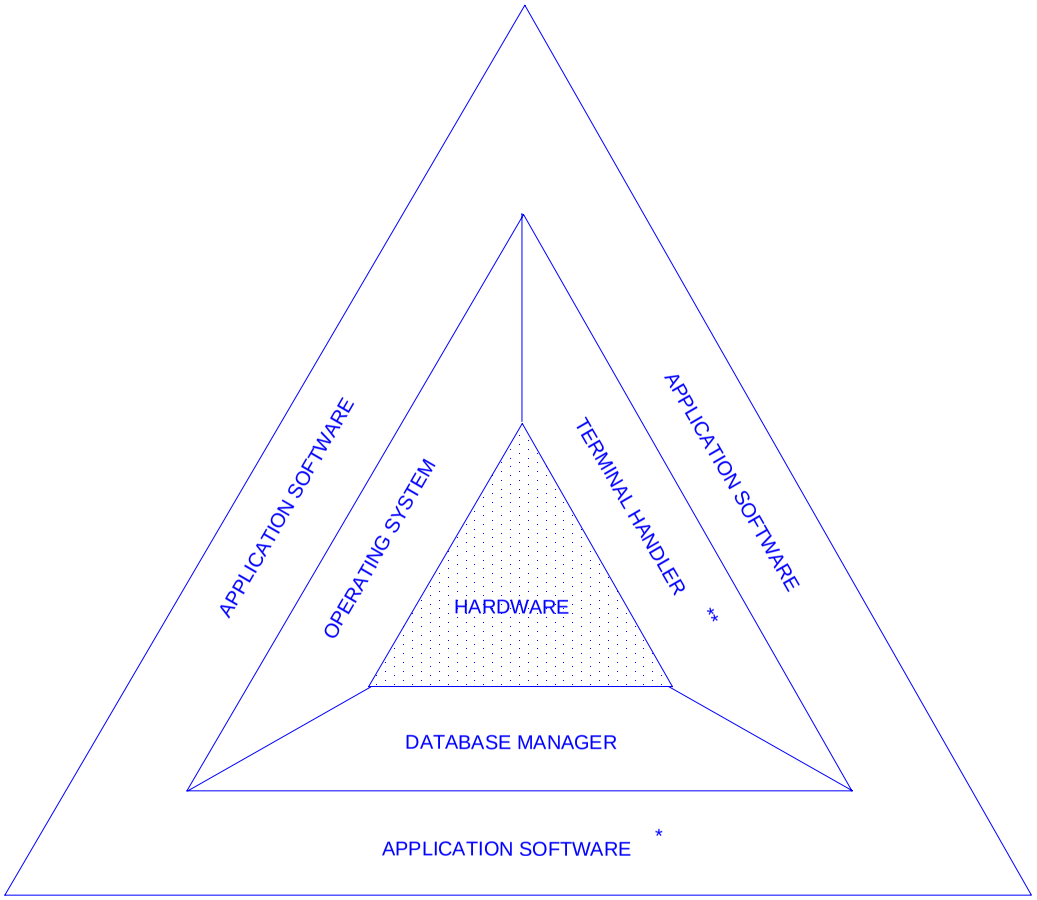
3.7. SOFTWARE ARCHITECTURE

The software architecture of C-DOT Digital Switching System is distributed in nature and has been designed to map onto the distributed control architecture of the system. The switch hardware is surrounded by a number of software layers, each of which presents higher levels of abstractions for the successive upper layer of software.

3.7.1. Software Subsystems

The main subsystems of C-DOT Digital Switching system software are (Figure 3.3)

1. C-DOT Real-Time Operating System (CDOS)
2. Peripheral Processors Subsystem
3. Call Processing Subsystem
4. Maintenance Subsystem
5. Administrative Subsystem
6. Data base Subsystem
7. Input Output Processor (IOP) Subsystem



* APPLICATION SOFTWARE CONSISTS OF CALL PROCESSING, MAINTENANCE, AND ADMINISTRATION SOFTWARE SUBSYSTEMS.

** TERMINAL HANDLER SOFTWARE IS A PART OF THE PERIPHERAL PROCESSORS SUBSYSTEM.

FIG. 3.3
C-DOT DSS MAX LAYERED SOFTWARE ARCHITECTURE

\DESIGN\ANINTRFC\ANIGDLSA

Chapter 4.

System Architecture of V5 Interface Unit

4.1. INTRODUCTION

V5.x capability in C-DOT DSS exchanges is implemented by using a new hardware unit called VU (V5 interface unit) (Fig. 4.1).

The VU hardware is packaged into a standard Terminal equipment frame (TU). In a Base Module rack, the VU frame can be placed in any TU frame position, i.e., principal frame or concentration frame position. In case it is equipped in the principal frame position, it interfaces with the Time Switch via a 128 channel PCM link operating at 8Mbps. The hardware description of VU is given in Chapter 5.

V5 subscribers are connected to LE through E1 links of V5 interface. Each of these E1 links are terminated on DTU. One DTU can support maximum of 4 E1 links. If the DTU is equipped with its maximum capacity, i.e., with 4 E1 links for V5.X interface(s) then no further concentration is allowed as all the 128 time-slots are nailed up between DTU and TSC. However, if a DTU is not catering to 4 E1 links of V5.X interfaces, then it can be used in concentration as it has free time slots which can be used in on-demand basis only.

The VU requires maximum of 32 time-slots, so remaining 96 time slots of that TUC (called VUTUC) can be used to support V5 or other subscribers connected through DTU or ATU which can be placed in concentration with VU.

In C-DOT Digital Switching System, one BM can support maximum of 3072 V5 subscribers connected through one or more V5.2 interfaces. Each V5 subscriber is identified uniquely by its directory number and AISUB-ID (see sec. 7.1.7 for description), whereas as each land-line subscriber is identified by its directory number and TEN. All the processing of signalling data of V5 subscribers is carried out in VU.

SU and VU both can not be concentrated together.

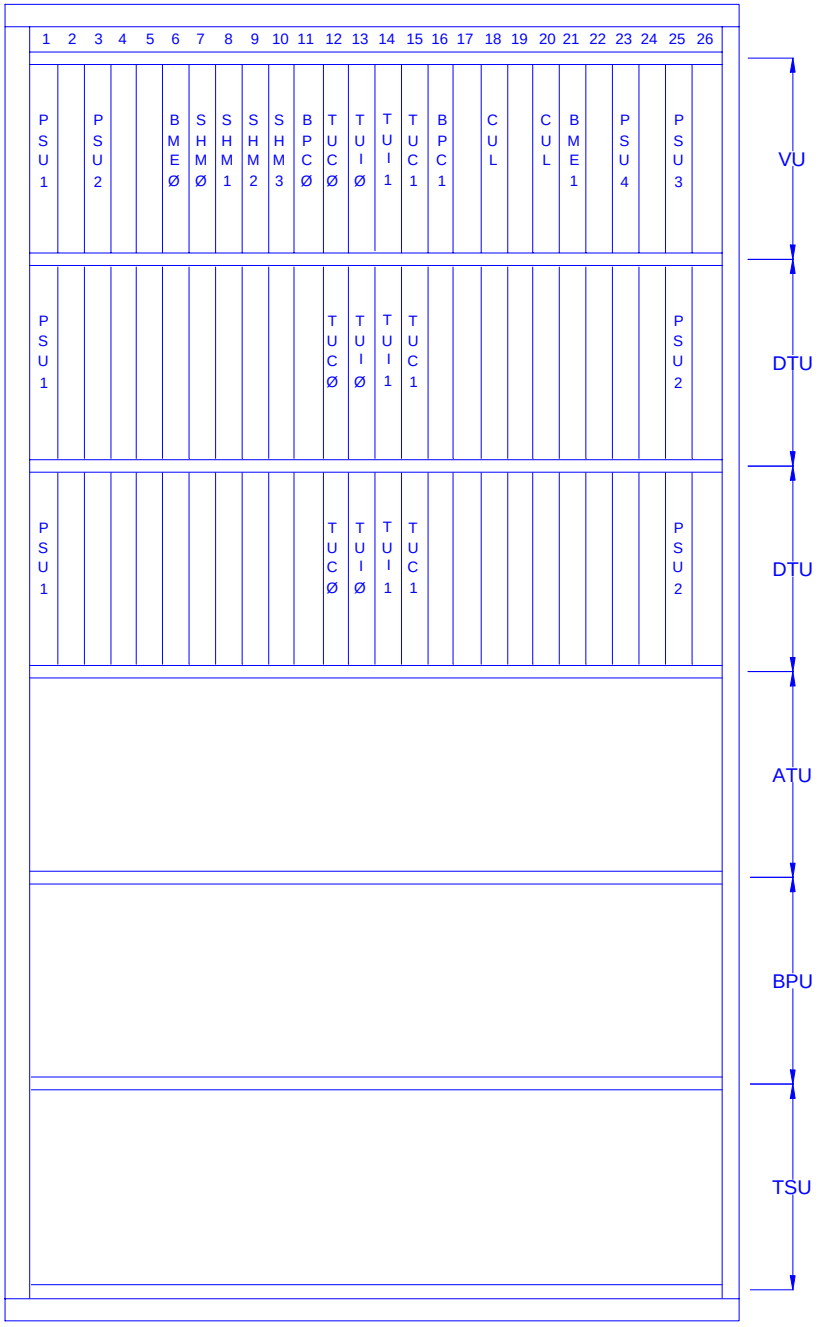


FIG. 4.1 BASE MODULE WITH VU AND DTU

\DESIGN\ANINTRFC\BMVUDTU

4.2. V5.2 INTERFACE IN SBM

C-DOT SBM exchange can support maximum number of five V5.2 interfaces / ten V5.1 interfaces with total number of E1 links cannot be more than 10. The restriction on number of E1 links is because SBM require time-slots for announcements and networking also. Fig. 4.1 shows the general SBM architecture supporting V5.X interface. In SBM both VU and SU can be configured together in different frames. This means it is possible to connect SBM to network on #7 signalling, R2 signalling or decadic signalling. Maximum of 3072 V5 subscribers are supported.

4.3. V5.2 INTERFACE IN MBM

C-DOT MAX-L or MAX-XL exchanges support maximum of seven V5.2 interfaces/ fourteen V5.1 interfaces per BM with total number of E1 links cannot be more than 14. The number is more than that for SBM because here one complete BM can be dedicated to V5 subscriber and none of the links from this BM is required for networking. Announcement card can be inserted in one of the available TU and will consume 16 time slots. In MBM VU and SU both can not be configured in same Base Module. SU is configured in trunk BM only, whereas VU is configured in line BM. Maximum of 3072 V5 subscribers per BM is supported. It is possible to configure VU in Remote BM also.

Chapter 5.

Hardware Architecture of V5 Interface Unit

5.1. INTRODUCTION

To support V5.x interface in C-DOT Digital Switching System, a new hardware unit called VU (V5 Interface unit) is required. All the layer 2 and layer 3 software for V5 interface resides in this unit. VU works in conjunction with DTU, which in turn extends the 2.048 Mbps digital link (E1) towards Access Network. Following sections describe the hardware architecture of VU and its interconnection with Digital terminal unit.

5.2. HARDWARE ARCHITECTURE OF VU

Hardware architecture of VU (V5 unit) is same as that of SU (SS7 unit). SU contains software for SS7 signalling whereas VU contains software for V5 interface. VU consists of PHC, CUL, CPU, memory, TUC, TUI and power supply cards (see Fig. 5.1). PHC card is also known as SHM (Signalling Handler Module) Card.

5.2.1. Signalling Handler Module (SHM)

The function of Signalling Handler Module (SHM) is to perform protocol processing on the received messages from eight 64Kbps links as well as to transmit on these links the appropriate protocol messages. The SHM supports two protocols i.e., C.85 and V5 interface protocol. For V5 interface protocol, the SHM scans the layer 1 and layer 2 whereas for the C.85 protocol, the SHM scans the 'link level' and the 'ete level' functions. The SHM interfaces with two duplicated CPU cards through the processor bus running on the backplane. It also interfaces with two duplicated terminal unit controller cards (TUC) through PCM link.

Functionally, SHM card can be divided into four blocks (Fig. 5.2)

i) Processor Complex
ii) CPU Interface
iii) TUC Interface
iv) ACIA block

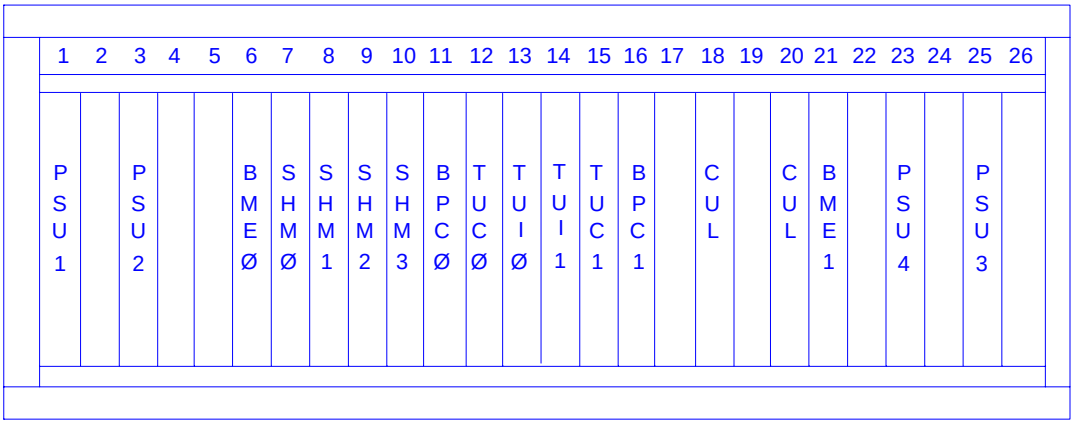


FIG. 5.1 VU CONFIGURATION

\DESIGN\ANINTRFC\VUCNF

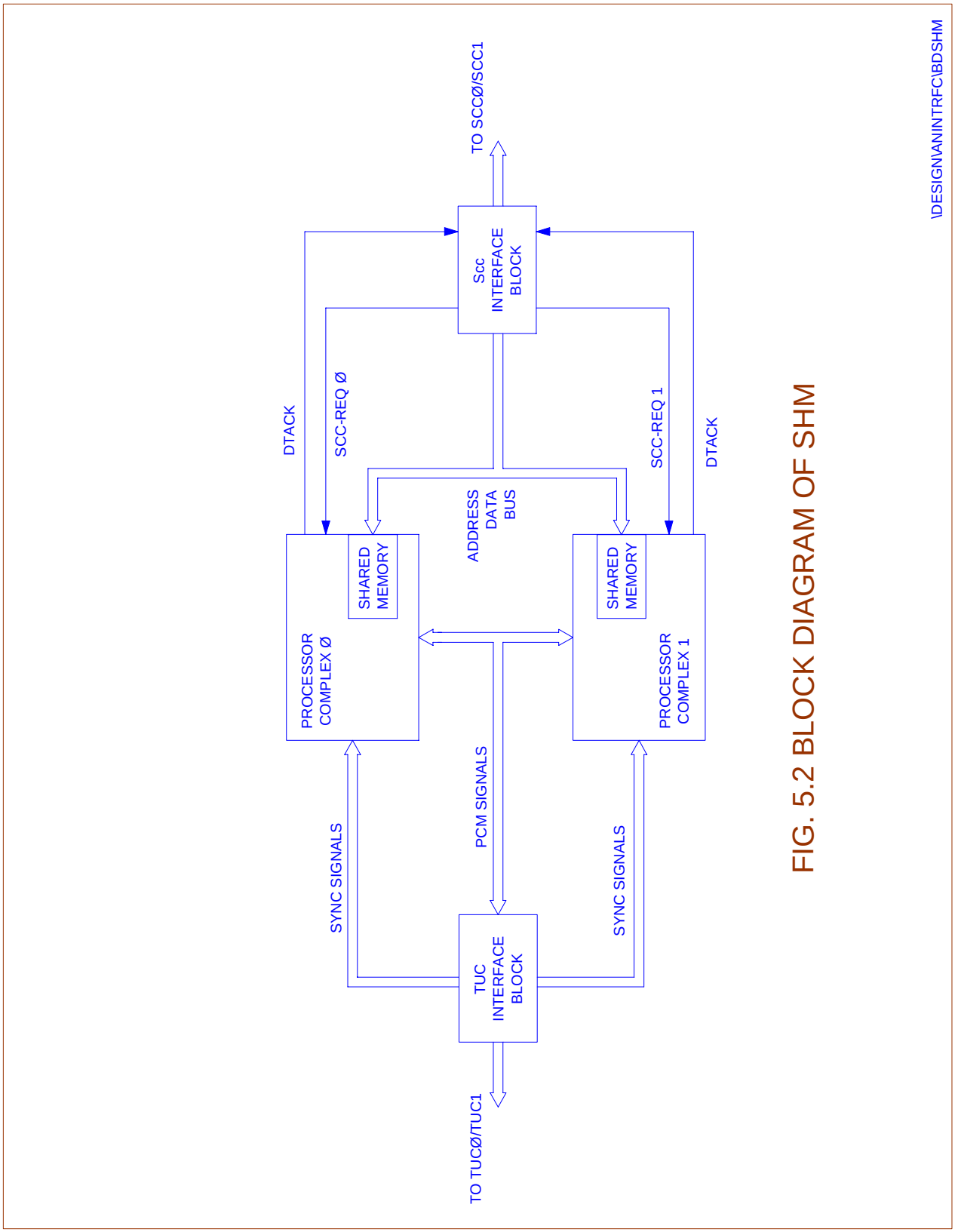


FIG. 5.2 BLOCK DIAGRAM OF SHM

5.2.1.1. *Processor Complex*

The SHM has been split into two identical halves called Processor Complex 0 and Processor Complex 1.

Each Processor Complex handles four serial links of 64 kbps. Each link provides one PHC terminal which can be configured either as C.85 or V5.

Each processor complex contains a 68302 device. This contains a 68000 processor. The 68302 contains three serial links, which can be programmed to HDLC protocol. The serial link can work in PCM mode. Since, each processor complex handles four serial links, one more slave 68302 device is used. The processor within this 68302 is disabled. The appropriate SYNC signals required for synchronizing all the serial PCM links are obtained from the 'TUC Interface' block of the card.

In addition to the RAM and ROM, the arbitration logic for the shared memory also resides in the respective complex. The shared memory access has been implemented by multiplexing the address and the data bus of the Processor Complex and the CPU using buffers. The shared memory is available to both the SCC and the SHM cards with equal priority. The address of the shared memory depends upon the id of SHM card. Each SHM card has three id bits which are hard programmed and depends upon its slot in the VU.

5.2.1.2. *CPU Interface*

SHM card communicates with the CPU card through CPU interface (also called SCC interface). This interface buffers all the signals from both the copies of CPU. It is also responsible for the selection of the active CPU from the two copies.

5.2.1.3. *TUC Interface*

SHM card communicates with TUC via this interface. This interface buffers all the signals from the TUCs. It also have 'SYNC generation logic' which generates sync signals. The sync signals are used by processor complexes, for identification of slots in PCM link. This interface multiplexes all the transmit signal emerging from the processor complexes into a single PCM stream.

5.2.1.4. *ACIA Block*

The ACIA Block is used while testing the SHM card. Since each Processor Complex is independent, two separate ACIA links are required to communicate with both of the complexes. In addition, one more link has been provided for debugging software.

In each processor complex ACIA link is provided in the slave 68302. The Processor Complex 0 has one extra ACIA link for software debugging purposes.

5.2.2. CUL Card

The CSU load card (CUL) can be used in VU as a dummy card. This card is to be inserted in the slot where no SHM cards are jacked in, i.e., on the copy 1 side. Two CUL cards are required per VU.

The CUL card is used to consume the minimum amount of current so that the power supplies on the copy 1 side will assert an error when its mate goes bad. The requirement is that the amount of current drawn should be more than 10 amperes. The resistance value in CUL are fixed in such a manner that one CUL consumes approximately 2.3 amperes. Hence to meet the requirements by the power supplies, two CUL will be required.

5.2.3. CPU Card

CPU card is known as Signalling Controller Card (SCC) which can be either BPC or the HPC card. SHM can interface with both the cards. The shared memory in SHM card is available to both the SCC and SHM cards. The size of the shared memory is 256 KB (when interfaced with BPC) or 512 KB (when interfaced with HPC).

The BPC card is the controller card for VU. It provides variety of I/O's and capable of interfacing through a standard 68010 bus to BME card. The BPC card is designed to operate with two memory cards (BME cards) for duplex read and write. It uses motorola 68010, a 16 bit processor, with on board 32 k RAM and 128 k ROM. The BPC also provides six HDLC links to the outside world, one of which is reserved for communication with the mate.

HPC card is the advanced version of BPC card which uses, 68040, a 32 bit processor which is powerful than 68010 used in BPC. It has on board 512K ROM and 16 MB RAM.

5.2.4. Terminal Unit Controller (TUC) Card

The TUC in VU acts as an interface between PHC terminal and time switch. All the signalling messages on V5 interface (on TS16 of active link) come to PHC card via TS-TUI-TUC path. So the basic function of TUC card in VU is to pass signalling message from time-switch to PHC terminals. It interacts with PHC card on one side and with TUI on other side. The connectivity of PHC terminal, configured as C.85 terminal, to BP is also through TUC card.

All PHC cards in VU, together can use maximum of 32 TS (One per PHC terminals) of 128 TS PCM stream available on TUC towards time-switch. So, remaining 96 time-slots, which are not utilised by VU can be used by another TU equipped in concentration with the VU frame.

5.2.5. Terminal Unit Interface (TUI) Card

The terminal unit interface card (TUI) primarily acts as an interface between TUC and Time Switch Interface (TSI) card of TSU. It also interfaces with other TUIs in the concentration mode. In order to cater to both the copies of TUCs, the TUI is also duplicated.

The basic function of TUI is the conversion of TTL type signal to ECL type and vice-versa.

5.2.6. Base Memory Extender (BME) Card

This card is used to provide increased memory of 16 MBs for the processors used in different modules like BPU, APU, SCU & #7 SU and VU. The card has been implemented by using 4 modules of 4MB each. The card has on board interface logic to support hot standby redundancy and cross bus addressing capability.

5.2.7. Power Supply

VU is equipped with duplicated power supply card (PSU-II) in each plane. So in all, 4 PSU-II cards are available on VU, two in each plane in active hot standby made.

The input voltage vary between -44V and -56V and it provides on its output +5V, +12V, -12V and -9V unregulated. The card uses SMPs technique to provide all these voltages at output.

5.3. INTERCONNECTIONS OF VU

VU is hardwavewise equivalent to a terminal unit (TU). Interconnections of VU with other TUs in a BM is shown in Fig. 5.3 and position of VU in MBM configuration is shown in Fig. 5.4.

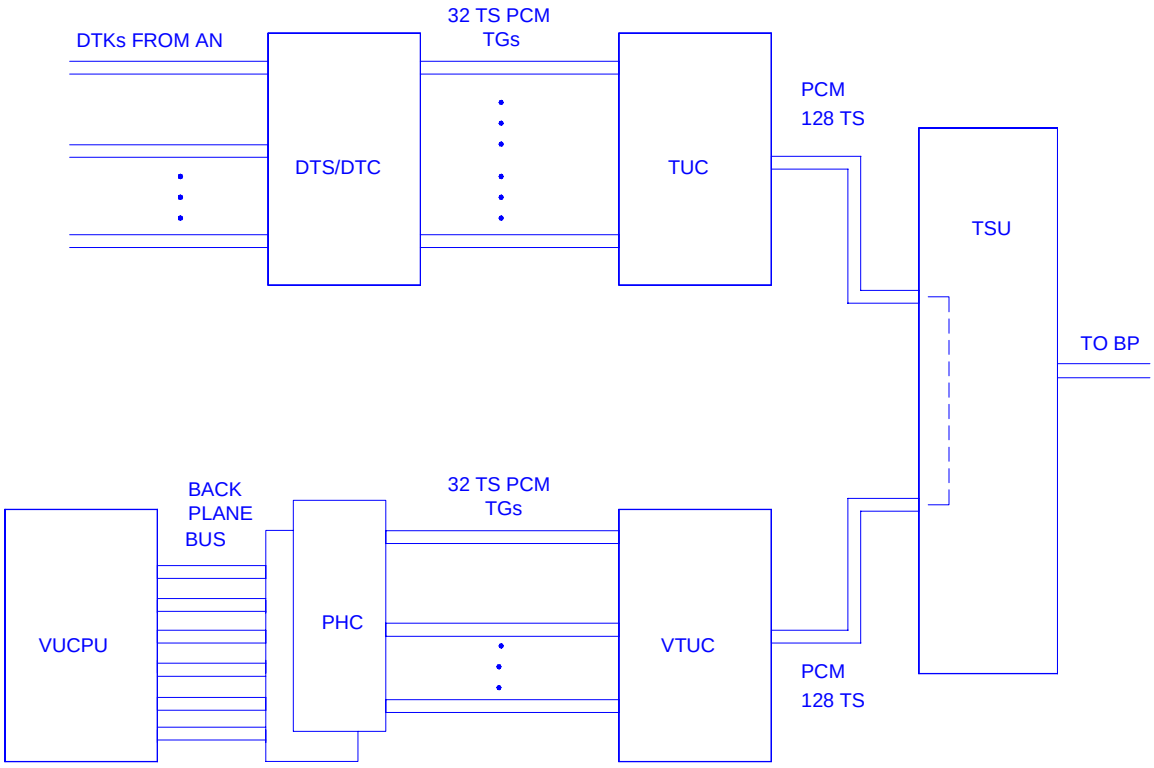


FIG. 5.3 INTER CONNECTION OF VU

\DESIGN\ANINTRFC\VUINBM

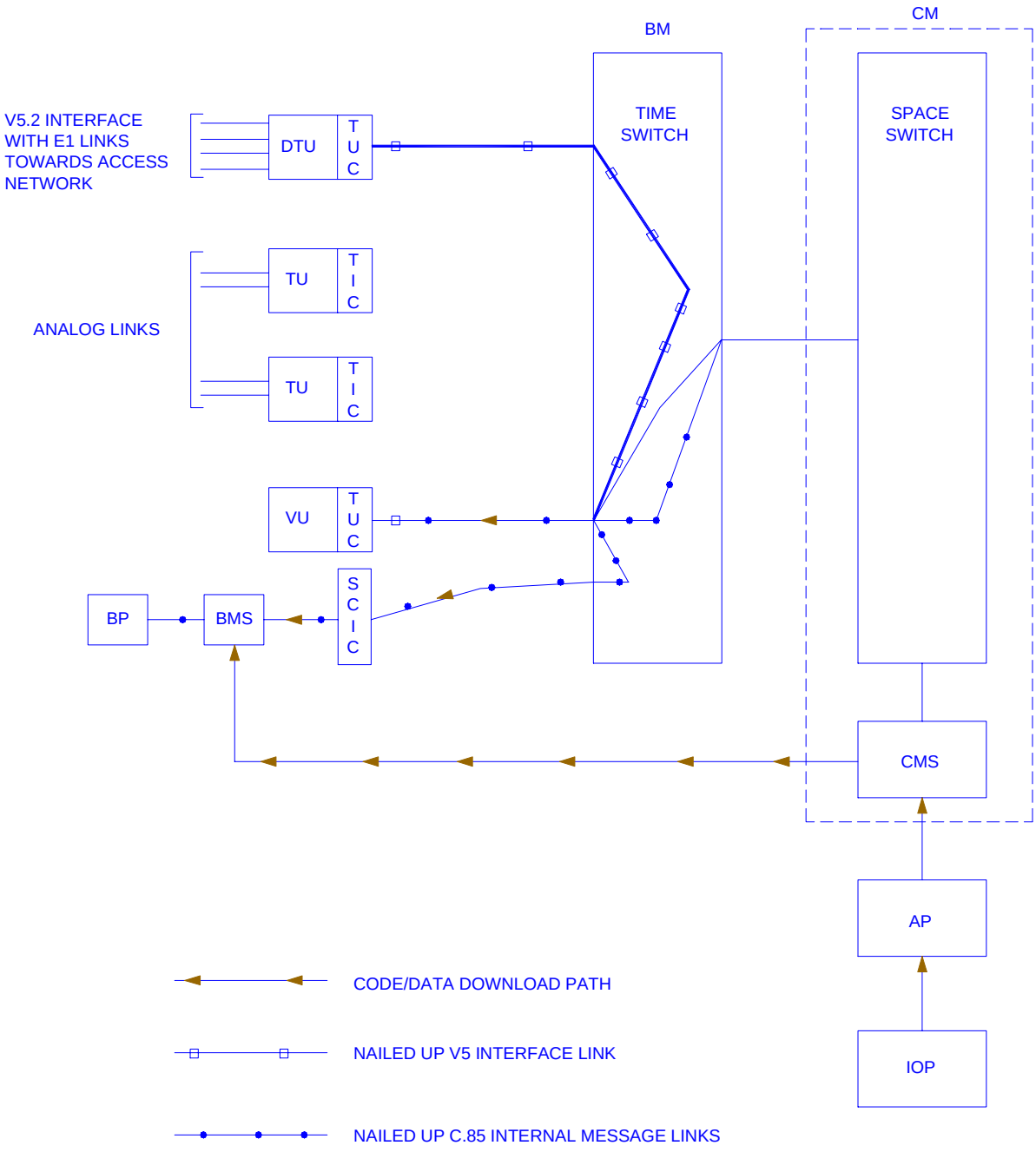


FIG. 5.4
VU PATH WITH OTHER UNITS

\DESIGN\ANINTRFC\BMCM

Chapter 6.

Software Architecture

6.1. INTRODUCTION

Software for supporting V5 interface in MAX is distributed over IOP, AP, BP and VU. All existing software in BP, AP and IOP has been modified to cater to `V5' subscribers also. VU software consist of layer 2 and layer 3 functions. These functions are distributed over SHM and CPU cards of VU. Software of layer 2 resides in the SHM card, whereas layer 3 function software distributed over CPU card and Base Processor.

6.2. FUNCTIONAL ARCHITECTURE

The V5 Interface Software architecture has been divided into the following subsystems :

- Administration sub-system
- Call processing sub-system
- Maintenance sub-system

6.2.1. Administration Sub-System

The processes of this sub-system are responsible for AN interface data updation, traffic observations of AN interface and billing of AN subscribers.

Administration subsystem is responsible for maintaining a large number of traffic records on the basis of the information received by it through Call Event Records and a large number of traffic related commands. Billing processes provide billing records for AN subscribers.

6.2.2. Call Processing Sub-system

Call processing sub-system is involved in establishment of V5 calls, checking line-status of subscriber during conversation, allocation/deallocation of resources to subscriber.

6.2.3. Maintenance Subsystem

The Maintenance Subsystem is responsible for maintenance of AN interface, AI links, AI channels and AN ports. It is also responsible for VU Initialisation and downloading of data to VU. All the processes of this subsystem reside in AP, BP, VCPU and PHC.

6.3. MESSAGES AND THEIR FLOW IN V5 PROTOCOL

As we know, V5 protocol is `message based', i.e., any information between LE and AN is exchanged through messages available in different protocol. The list of messages available in different protocols is given below.

a) PSTN PROTOCOL

i. ESTABLISH

ii. ESTABLISH ACK

iii. SIGNAL

iv. SIGNAL ACK

v. STATUS

vi. STATUS ENQUIRY

vii. DISCONNECT

viii. DISCONNECT COMPLETE

b) CONTROL PROTOCOL

i. PORT CONTROL

ii. PORT CONTROL ACK

iii. COMMON CONTROL

iv. COMMON CONTROL ACK

c) BCC PROTOCOL

i. ALLOCATION

ii. ALLOCATION COMPLETE

iii. ALLOCATION REJECT

iv. DE-ALLOCATION

v. DE-ALLOCATION COMP

vi. DE-ALLOCATION REJECT

vii. AUDIT

viii. AUDIT COMPLETE

ix. AN FAULT

x. AN FAULT ACK

xi. PROTOCOL ERROR

d) LINK CONTROL PROTOCOL

i. LINK CONTROL

ii. LINK CONTROL ACK

e) PROTECTION PROTOCOL

i. SWITCH OVER REQUEST

ii. SWITCH OVER ACK

iii. SWITCH OVER COM

iv. SWITCH OVER REJECT

v. PROTOCOL ERROR

vi. RESET SN COM

vii. RESET SN ACK

6.3.1. Message Flow

Message flow between AN and LE is explained in sec. 6.3.1.1 & 6.3.1.2 with the help of examples. Further, message flows in different call scenario is given at the end of this chapter.

6.3.1.1. Call Initiated from LE

On receiving a call request from the network for a particular AN port, LE feeds call routing tone to calling subscriber and proceed to get a bearer channel for this call by sending an ALLOCATION message to AN and starts a timer. After getting on ALLOCATION COMPLETE message from AN, LE sends on ESTABLISH message to AN with cadenced ringing parameter to connect the ring to user port and starts a timer. AN sends ESTABLISH ACK message and call enter into ringing phase.

In case AN subscriber has caller-id feature in which directory number of calling subscriber is to be sent to user's equipment. LE shall send ESTABLISH message to AN without cadenced ringing parameter. LE shall send the digits either in signal message or in-band in case subscriber has DTMF receiver and thereafter send a SIGNAL message with Cadenced Ringing to AN to connect ring to user port.

Call enters into conversation phase when answer is received from the AN subscriber, answer should be communicated across V5 interface by sending SIGNAL (Off Hook) message to the other end.

Various subscriber features can be initiated by the subscriber by doing Hook Switch Flash when the call is in the conversation phase.

If the release of the call is initiated from LE, parking tone should be fed to AN subscriber, parking tone timer shall be run at LE and disconnection from AN subscriber be awaited. AN subscriber disconnects before the expiry of parking tone timer, this indication comes in the form of SIGNAL (On Hook) message across V5 interface. Call clearing is started by sending DEALLOCATION message and on getting DEALLOCATION COMPLETE, PSTN protocol is cleared by DISCONNECTION/DISCONNECTION COMPLETE message.

6.3.1.2. Call Initiated from AN

AN on detecting an origination from user port should send ESTABLISH message to LE. LE shall send ESTABLISH ACK message in response, gets a bearer channel by ALLOCATION/ALLOCATION COMPLETE and connect dial tone to the channel.

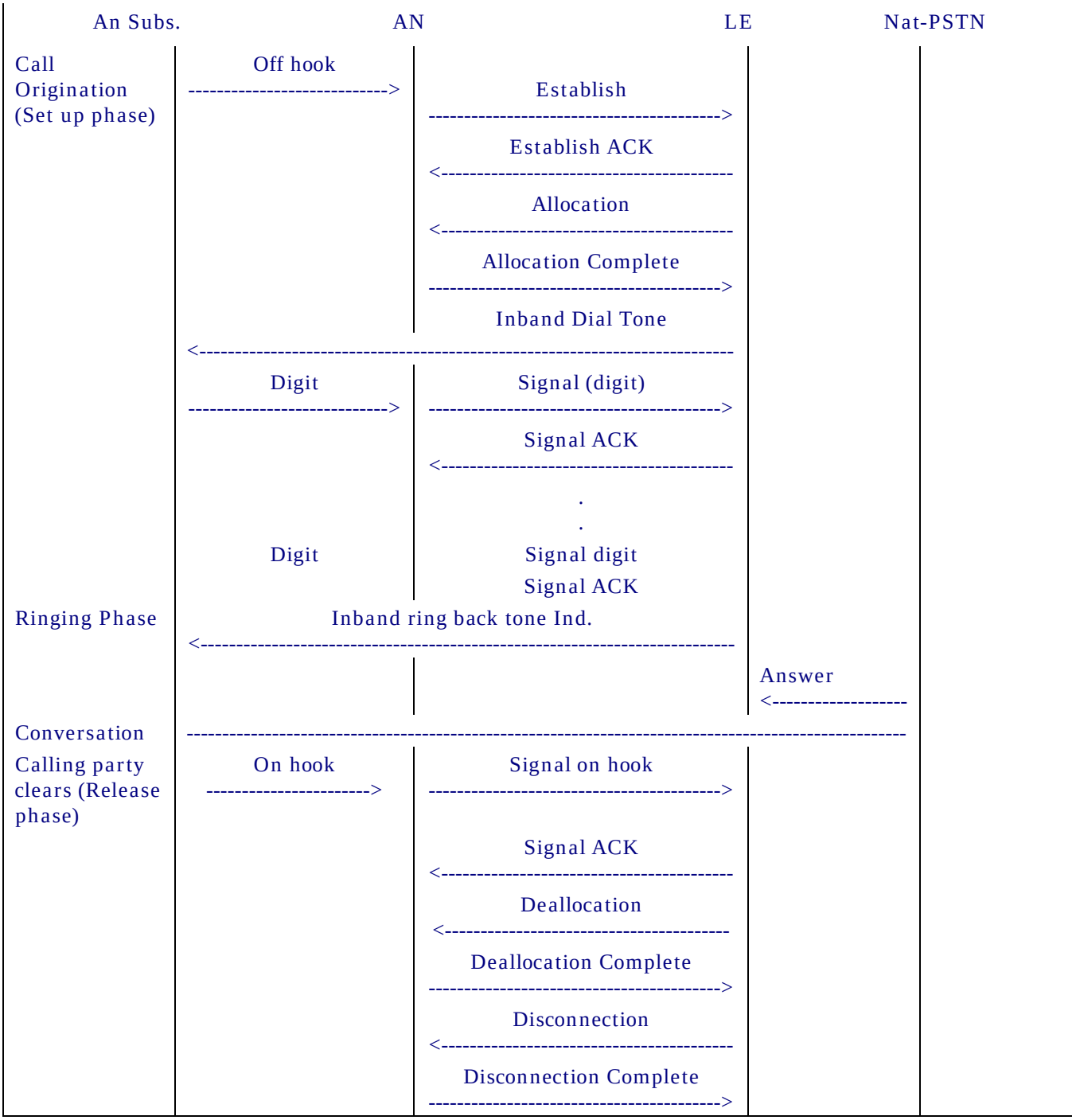
When answer is received from PSTN subscriber, call will enter into conversation phase. For AN originated calls from subscribers with home metering facility, metering pulses shall be reported to AN in the form of SIGNAL (Meter Pulse) message over the V5 interface.

Call clearing procedure is same as described in 6.3.1.1

DIFFERENT CALL SCENARIOS

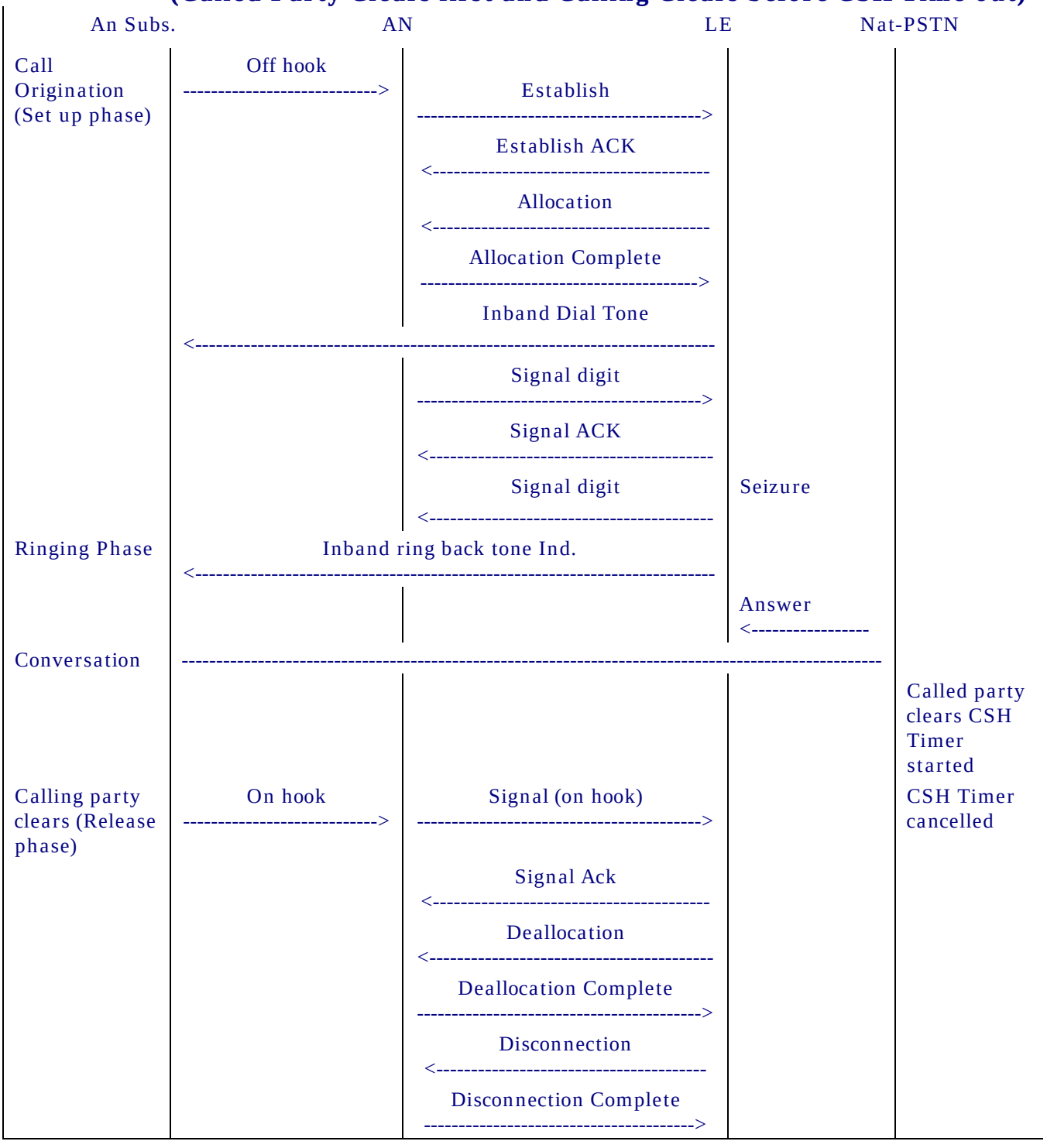
AN ORIGINATED CALL

(Calling Party Clears)



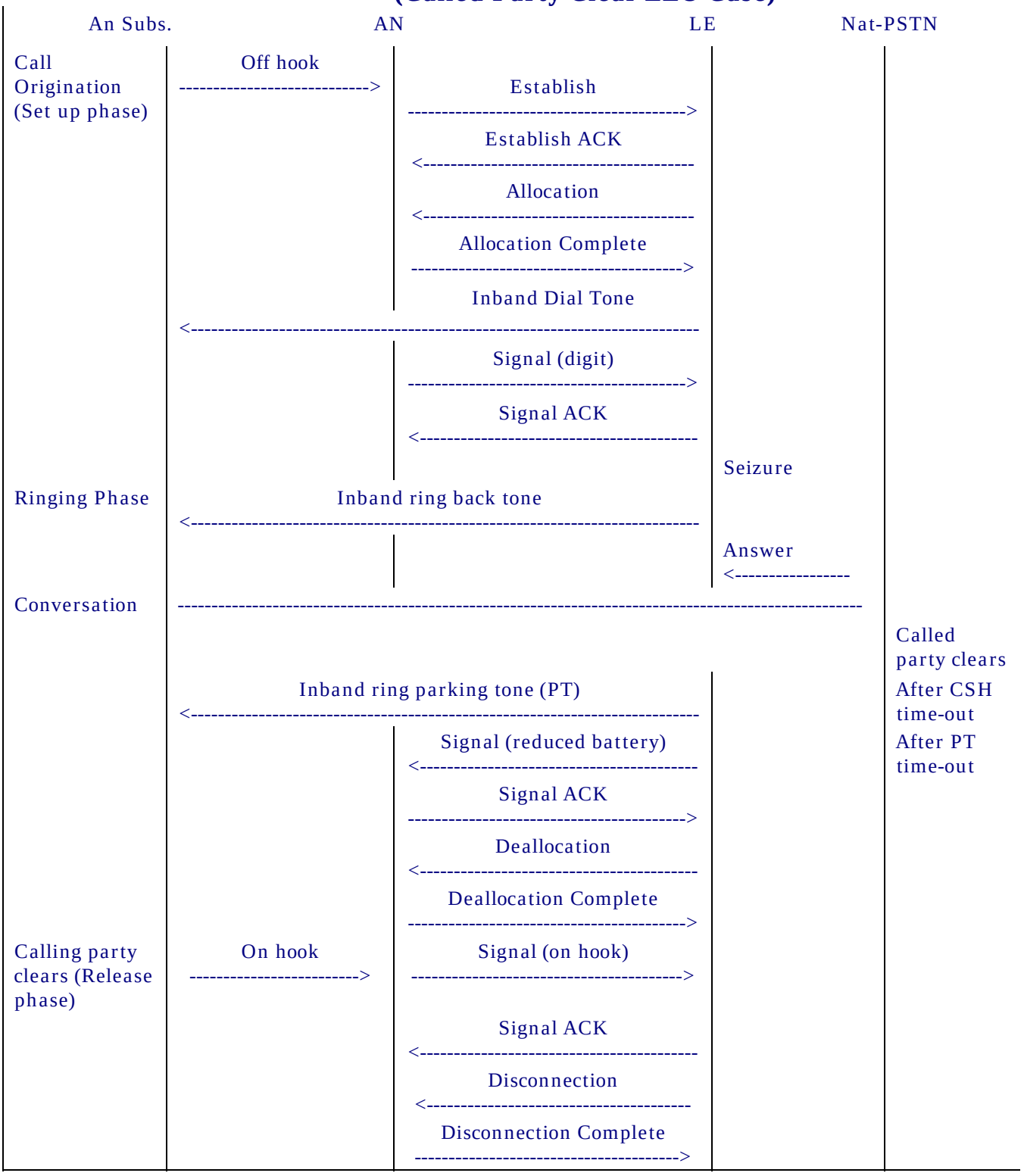
AN ORIGINATED CALL

(Called Party Clears first and Calling Clears before CSH Time-out)



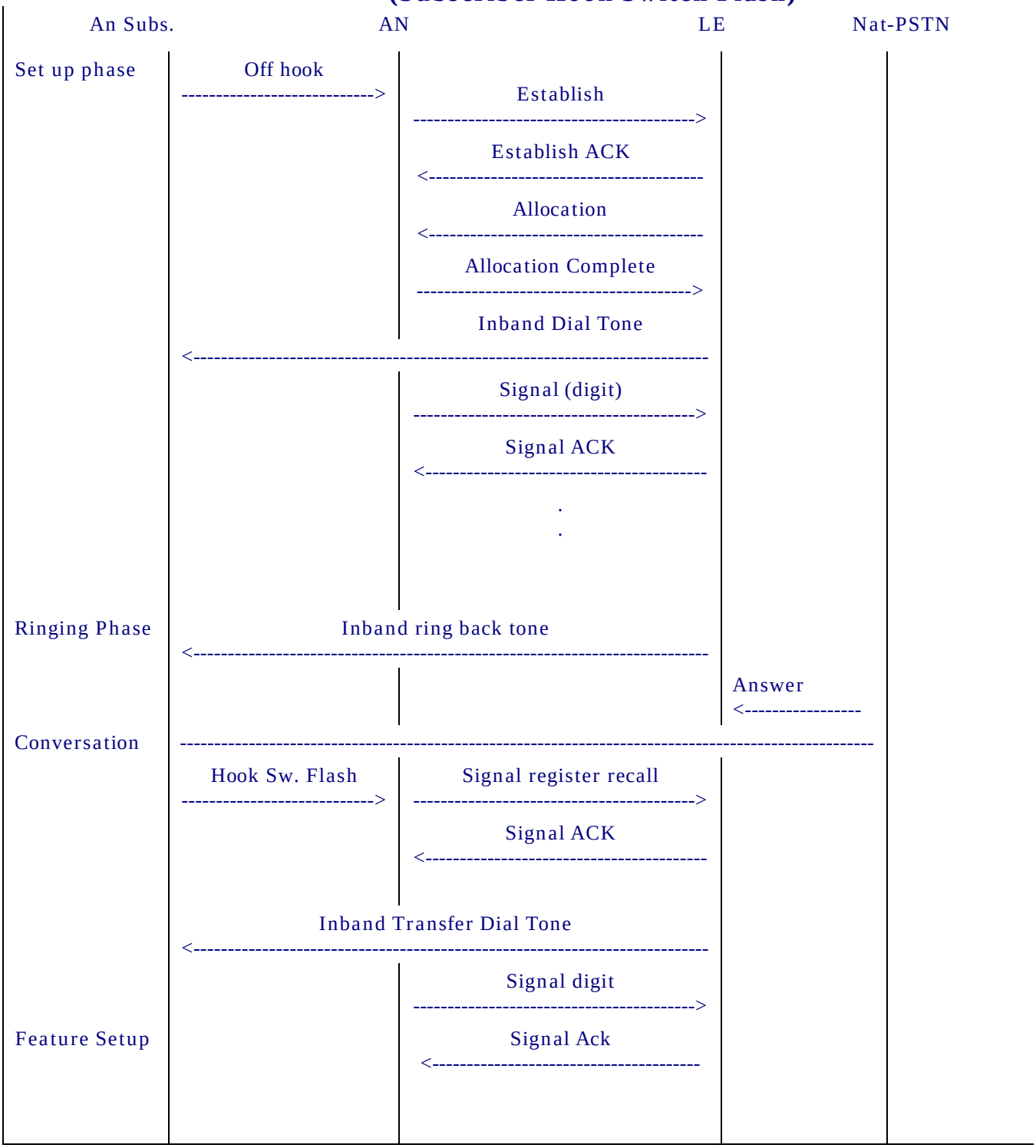
AN ORIGINATED CALL

(Called Party Clear LLO Case)



AN ORIGINATED CALL

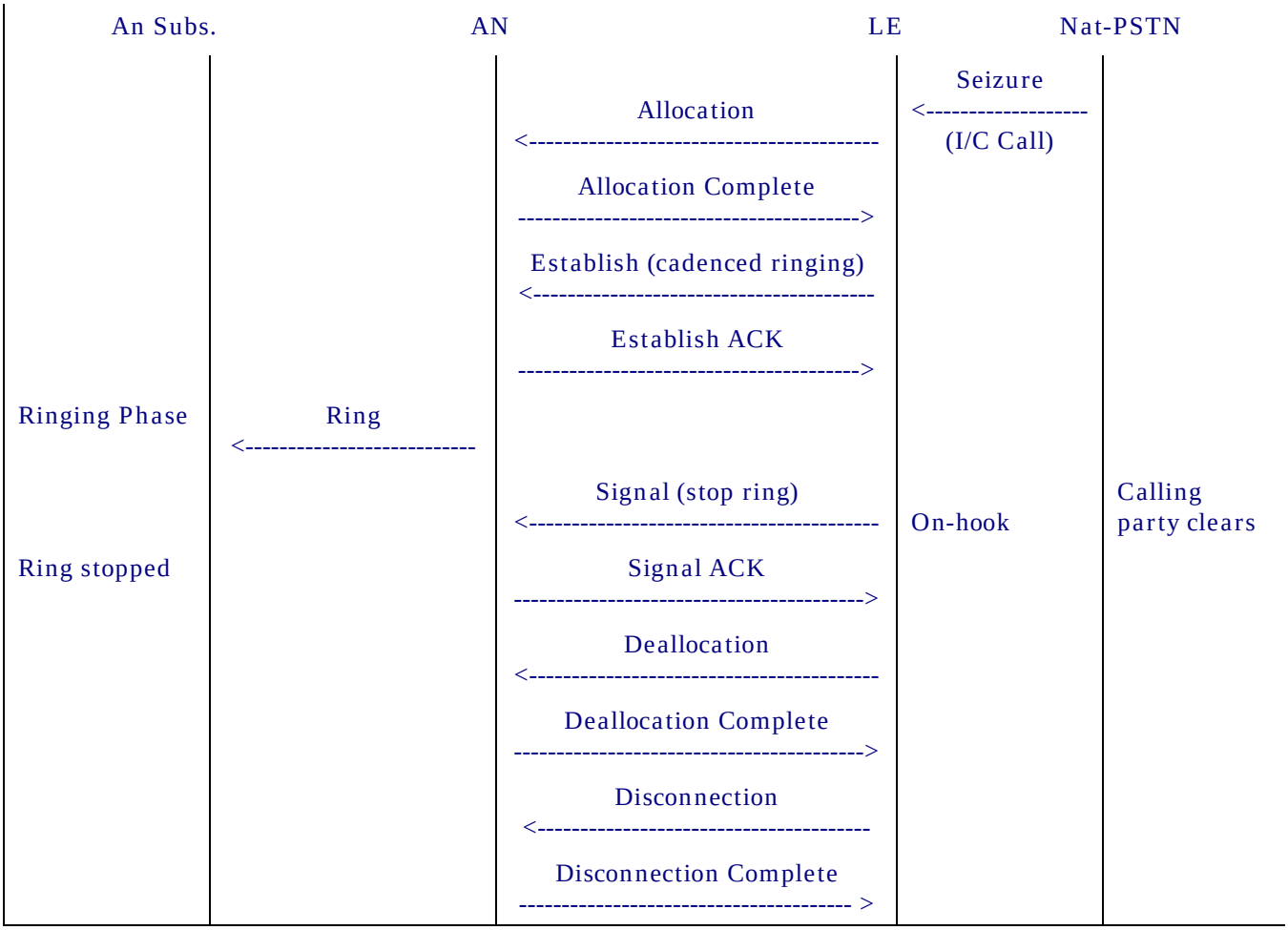
(Subscriber Hook Switch Flash)



Rest steps are same as ~ AN originated call (calling party clears)

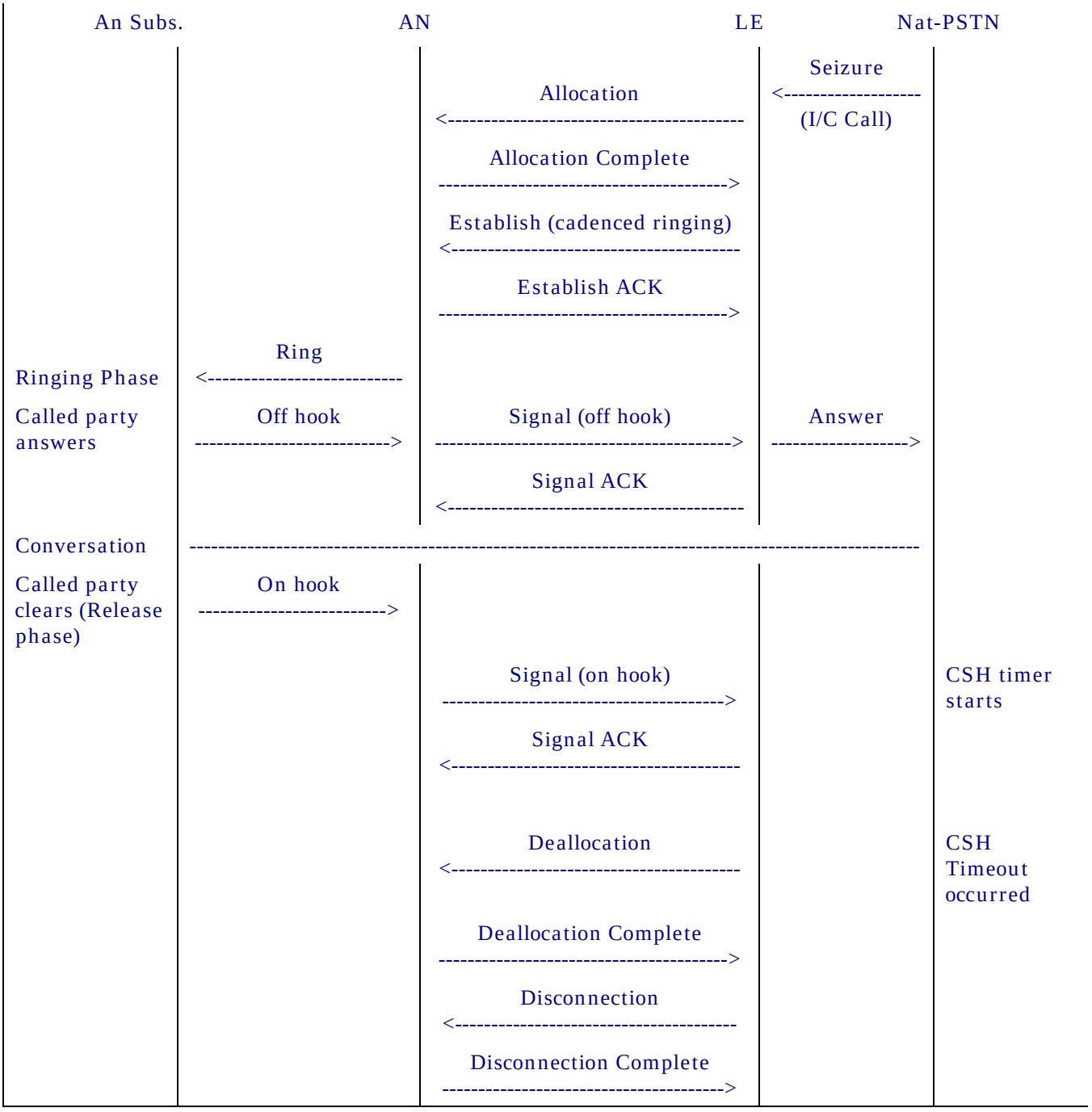
PSTN ORIGINATED CALL

(Calling Party Clears in Ringing)



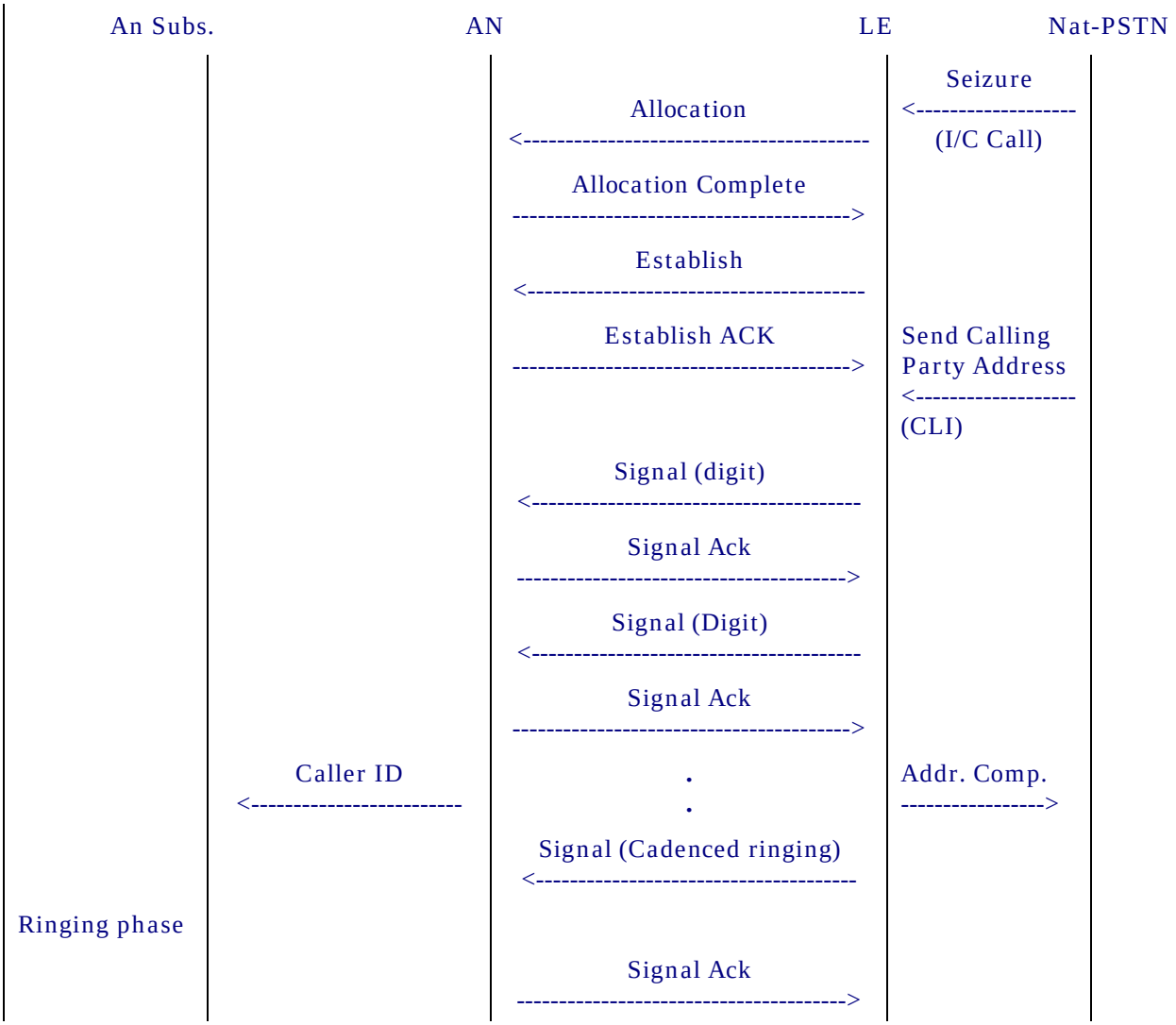
PSTN ORIGINATED CALL

(Called Party Clears)



PSTN ORIGINATED CALL

(Caller ID Feature)



Rest of the steps are same as of .... (PSTN originated call).

Chapter 7.

Operation and Maintenance

INTRODUCTION

For proper operation and maintenance of AN interface/AN subscribers, various MMI commands are available. All subscriber line administration commands available for PSTN subscribers are valid for AN subscribers also. Each AN subscriber is uniquely identified by its Directory Number and L3 address (same as PSTN subscriber is identified by directory number and TEN). TEN has no significance in case of AN subscribers as there is no physical termination of subscriber line in the exchange, instead, there exists an unique layer 3 address in the exchange (L3 address) corresponding to each subscriber. Thus, all the subscriber line administration command can be executed by the directory number of the subscriber (unlike to the case of PSTN subscribers where each subscriber line administration command can be executed with either directory number or TEN).

Section 7.1 describes the parameters used in different Operation and Maintenance command. Section 7.2 describes the MMI commands available for the administration of AN interface. Section 7.3 describes the subscriber line administration commands. Section 7.4 describes additional modified commands for maintenance and performance measurement. 7.5 describes procedure for creation and maintenance of AN interface and subscribers in MAX.

7.1. DESCRIPTION OF NEW PARAMETERS

This section gives details of new and existing (only changed ones) parameters used in different commands required for administration, maintenance and performance of AN interface on C-DOT Digital Switching System. For each parameter, definition and the values it can take have been given.

7.1.1. ADD-AI

PARAMETER NAME	:	Add AN Interface
MNEMONIC	:	ADD-AI
DEFINITION	:	It denotes the AN interface(s) that shall be put under traffic observation
TYPE	:	Numeric
POSSIBLE VALUES	:	1 to 100
DEFAULT	:	None
REMARK	:	The AI-NUM of the AN interface(s) is given under this parameter, which is to be put under traffic observation.

7.1.2. AI-CTG

PARAMETER NAME	:	AN Interface Category
MNEMONIC	:	AI-CTG
DEFINITION	:	Identifies the category of the AN subscribers.
TYPE	:	Numeric
POSSIBLE VALUES	:	1 to 64
DEFAULT	:	1
REMARK	:	None

7.1.3. AI-LLNK

PARAMETER NAME	:	AN Interface Logical Link
MNEMONIC	:	AI-LLNK
DEFINITION	:	Identifies an AN interface link uniquely for the AN interface. It is same as the logical link id in the AI-LNK parameter. It ha fixed value 0 for V5.1 interface.
TYPE	:	Numeric
POSSIBLE VALUES	:	0 to 13 (for V5.2 interface only)
DEFAULT	:	Essential Parameter
REMARK	:	

7.1.4. AI-LNK

PARAMETER NAME	:	AN Interface Link
MNEMONIC	:	AI-LNK
DEFINITION	:	Identifies the links for a particular AN interface. It consists of following five parts : BM-RACK-FRAME-SLOT-LOG_LINK_ID First four fields identify the physical location of the link and the fifth field identifies the link uniquely within the AN interface
TYPE	:	Numeric (All fields)
POSSIBLE VALUES	:	BM : 1 to 32 RACK : 1 to 3 FRAME : 1 to 6 SLOT : 1 to 26 LOG_LINK_ID : Same as the values possible for the parameter AI-LLNK (sec 7.1.3).
DEFAULT	:	Essential Parameter
REMARK	:	

7.1.5. AI-NAME

PARAMETER NAME	:	AN Interface Name
MNEMONIC	:	AI-NAME
DEFINITION	:	It uniquely identifies an AN interface in MAX.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	At most 10 characters long name. It can have alphanumerals including hyphens but cannot start or end with hyphen.
DEFAULT	:	None
REMARK	:	

7.1.6. AI-NUM

PARAMETER NAME	:	AN Interface Number
MNEMONIC	:	AI-NUM
DEFINITION	:	It uniquely identifies an AN interface in MAX.
TYPE	:	Numeric
POSSIBLE VALUES	:	1 to 100..
DEFAULT	:	None
REMARK	:	

7.1.7. AISUB-ID

PARAMETER NAME	:	AN Subscriber Identification
MNEMONIC	:	AISUB-ID
DEFINITION	:	Identifies an AN subscriber uniquely. It consists of two parts - AI_NUM-L3_addr
TYPE	:	Numeric
POSSIBLE VALUES	:	AI_NUM : Same as the values possible for the parameter AI-NUM i.e., 1 to 100 L3_addr : Same as the values possible for the parameter ST-L3ADR (sec 2.21). L3-addr should be in the range of ST-L3ADR to ST-L3ADR plus 3072. For ST-LIADDR refer 7.1.21.
DEFAULT	:	None
REMARK	:	

7.1.8. AI-TYP

PARAMETER NAME	:	AN Interface Type
MNEMONIC	:	AI-TYP
DEFINITION	:	Identifies the type of AN interface to be created
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	V5.1 or V5.2
DEFAULT	:	None
REMARK	:	None

7.1.9. CARD-SLT

PARAMETER NAME	:	Card Slot
MNEMONIC	:	CARD-SLT
DEFINITION	:	It is an existing parameter. It identifies the physical slot of terminal card.
TYPE	:	Numeric
POSSIBLE VALUES	:	Existing.
DEFAULT	:	None
REMARK	:	

7.1.10. CHNL-NO

PARAMETER NAME	:	Channel Number
MNEMONIC	:	CHNL-NO
DEFINITION	:	This parameter is used for the creation of V5.1 subscribers
TYPE	:	Numeric
POSSIBLE VALUES	:	2 to 32 (Except 16)
DEFAULT	:	
REMARK	:	

7.1.11. DEL-AI

PARAMETER NAME	:	Delete AN Interface
MNEMONIC	:	DEL-AI
DEFINITION	:	It denotes the AN interface(s) that shall be removed from traffic observation.
TYPE	:	Numeric
POSSIBLE VALUES	:	Same as the values possible for the parameter AI-NUM (sec 2.5).
DEFAULT	:	None.
REMARK	:	

7.1.12. FRM-TYP

PARAMETER NAME	:	Frame Type
MNEMONIC	:	FRM-TYP
DEFINITION	:	It is an existing parameter.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	A new value VU shall be added.
DEFAULT	:	
REMARK	:	

7.1.13. L3-STS

PARAMETER NAME	:	L3 Address Status
MNEMONIC	:	L3-STS
DEFINITION	:	Identifies the status of L3 address for an AN interface.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	FREE, ASGN
DEFAULT	:	None
REMARK	:	

7.1.14. OBS-TYP

PARAMETER NAME	:	Observation Type
MNEMONIC	:	OBS-TYP
DEFINITION	:	It denotes the entity which is under traffic observation. This is an existing input parameter
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	A new value AI shall be added for denoting an AN interface
DEFAULT	:	
REMARK	:	

7.1.15. PRI-LNK

PARAMETER NAME	:	Primary Link
MNEMONIC	:	PRI-LNK
DEFINITION	:	Identifies the Primary link out of the links of AN interface. The logical link number is used to identify the AN interface link.
TYPE	:	Numeric
POSSIBLE VALUES	:	Same as for the parameter AI-LLNK (sec. 7.1.2).
DEFAULT	:	Essential Parameter
REMARK	:	

7.1.16. PROT-INF

PARAMETER NAME	:	Protocol Information
MNEMONIC	:	PROT-INF
DEFINITION	:	Holds information regarding peculiarities of the Access Network such as - i) Caller-id type : To be given as a DTMF tone or as a signal message ii) Backward signalling : Access dependent or Access independent iii) Port-Alignment : Accelerated or not iv) Link-Control Protocol : Enabled or disabled v) Initialisation of Protocols : Parallel or Serial vi) Switchover to Secondary : Sequential or not
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	NONE, BACK_SIG_ACC_DEP, CALL_ID_MSG, ACCL_PORT_ALIGN, LINK_CTRL_DISABLED, PARALLEL_INIT, SEQ_SWITCHOVER
DEFAULT	:	None
REMARK	:	

7.1.17. RPT-ID

PARAMETER NAME	:	Report Identification
MNEMONIC	:	RPT-ID
DEFINITION	:	It denotes the type of traffic report that is to be displayed. This is an existing input parameter.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	New values V5.1-REP and V5.2-REP shall be added for denoting V5.1 an V5.2 AN interface reports.
DEFAULT	:	
REMARK	:	

7.1.18. RPT-TYP

PARAMETER NAME	:	Report Type
MNEMONIC	:	RPT-TYP
DEFINITION	:	It denotes the type of traffic report that is to be generated. This is an existing input parameter.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	A new value of AI-REP shall be added for denoting an AN interface report
DEFAULT	:	None
REMARK	:	

7.1.19. SEC-LNK

PARAMETER NAME	:	Secondary Link
MNEMONIC	:	SEC-LNK
DEFINITION	:	Identifies the Secondary link out of the links of AN interface. The logical link number is used to identify the AN interface link.
TYPE	:	Numeric
POSSIBLE VALUES	:	Same as for the parameter AI-LLNK (sec. 7.1.2).
DEFAULT	:	INVALID
REMARK	:	

7.1.20. STAT-TRM

PARAMETER NAME	:	Status of Terminal
MNEMONIC	:	STAT-TRM
DEFINITION	:	It is an existing parameter. It identifies the status of terminal.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	New values INS-ANBLK and INSF-ANBLK will be added. INS-ANBLK will be applicable to both AN subscribers and AI channels while INSF-ANBLK will be applicable to only AI channels.
DEFAULT	:	ALL
REMARK	:	

7.1.21. STAT-SWU

PARAMETER NAME	:	Status of Switch Unit
MNEMONIC	:	STAT-SWU
DEFINITION	:	It is an existing parameter. It identifies the status of a switch unit.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	New value OOS-INI will be added to indicate VU CPU status during initialisation
DEFAULT	:	ALL
REMARK	:	

7.1.22. ST-L3ADR

PARAMETER NAME	:	Start L3 Address
MNEMONIC	:	ST-L3ADDR
DEFINITION	:	Identifies the start L3 address of the range of L3 addresses valid for an AN interface.
TYPE	:	Numeric
POSSIBLE VALUES	:	0 to 32767
DEFAULT	:	Essential Parameter
REMARK	:	

7.1.23. TML-TYP

PARAMETER NAME	:	Terminal Type
MNEMONIC	:	TML-TYP
DEFINITION	:	It is an existing parameter. It identifies the type of terminal.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	New values corresponding to AN interface are ANSUB, AICHNL.
DEFAULT	:	None
REMARK	:	These values of parameter is not value for command DISPL-LSCNT-OOS

7.1.24. UNIT-ID

PARAMETER NAME	:	Unit Identification
MNEMONIC	:	UNIT-ID
DEFINITION	:	It is an existing parameter.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	New values corresponding to VTU's units are VU-0, VU-1, VMU-0 and VMU-1.
DEFAULT	:	None
REMARK	:	

7.1.25. UNIT-TYP

PARAMETER NAME	:	Unit Type
MNEMONIC	:	UNI-TYP
DEFINITION	:	It is an existing parameter.
TYPE	:	Alphanumeric
POSSIBLE VALUES	:	New values corresponding to VTU's units are VU and VMU.
DEFAULT	:	None
REMARK	:	

7.1.26. VAR-ID

PARAMETER NAME	:	Variant Identification
MNEMONIC	:	VAR-ID
DEFINITION	:	It denotes an independent set of AN Interface related data. Different sets are given different variant id's. The variant id for a working AN Interface must have the same value at LE and AN ends
TYPE	:	Numeric
POSSIBLE VALUES	:	0 to 127
DEFAULT	:	None
REMARK	:	

7.2. AI-INTERFACE ADMINISTRATION COMMANDS

Following commands are available for the AI-interface administration in the MAX.

7.2.1. CRE-AI (Create An Interface) New-Command

Description :

This command is used for configuring an AN interface (V5.1 and V5.2) data in the exchange. The AN should have already connected to the exchange through E1 links.

Input Parameters :

AI-NUM	:	
AI-NAME	:	
AI-TYP	:	
VAR-ID	:	
[AI-CTG]	:	1
ST-L3ADR	:	
AI-LNK	:	
PRI-LNK	:	
[SEC-LNK]	:	INVALID
[PROT-INF]	:	None

Output Form :

Following is the output report displayed after successful execution of command.

CREATE ACCESS NETWORK INTERFACE REPORT

AN Interface Number :
AN Interface Name :
AN Interface Type :
Varient id :
Start L3 Address :
AN Interface Category :
AN Interface Links added :
AN Interface Links not added :
Primary Link :
Secondary Link :
Protocol information :

7.2.2. DEL-AI (Delete AN Interface) New Command

Description :

This command is used to delete a particular AN Interface from MAX.

Input Parameters :

[AI-NUM] :

[AI-NAME} :

Only one of them should be given.

Output Form :

Following is the output report displayed after successful execution of command.

DELETE ACCESS NETWORK INTERFACE REPORT

AN Interface Number :
AN Interface Name :
AN Interface Type :

7.2.3. DISPL-AI-CHAR (Display AI Characteristics) New Command

Description :

This command will be used to display the information of a particular AN interface.

Input Parameters :

[AI-NUM] :

[AI-NAME] :

Output Form :

Following output report will be displayed after successful execution of the command

DISPLAY ACCESS NETWORK INTERFACE CHARACTERISTICS REPORT.

AN Interface Number :
AN Interface Name :
AN Interface Type :
Varient id :
AN Interface Category :
Start L3 Address :
Number of Subscribers :
An Interface Links :
Primary Link :
Secondary Link :
Protocol Information :

7.2.4. ADD-AI-LNK (Add AI Links) New Command

Description :

This command is used to add one or more E1 links to an existing AN interface. (This command doesn't hold for V5.1 interface)

Input Parameters :

[AI-NUM] : NONE

[AI-NAME] : NONE

AI-LNK

Output Form :

Following is the output report displayed after successful execution of command.

ADD ACCESS NETWORK INTERFACE LINKS REPORT

AN Interface Number :

AN Interface Name :

AN Interface Links Added :

AN Interface Links not Added :

7.2.5. DEL-AI-LNK (Delete AI Links) New Command

Description :

This command is used to delete links from a particular AN interface. Primary or Secondary links cannot be deleted using this command. This command doesn't held for V5.1 interface.

Input Parameters :

[AI-NUM] : None

[AI-NAME] : none

AI-LLNK :

Only one of AI-NUM and AI-NAME is to be given.

Output Form :

Following is the output report displayed after successful execution of command.

DELETE ACCESS NETWORK INTERFACE LINK REPORT

AN Interface Number :

AN Interface Name :

AN Interface Logical Links :

7.2.6. MOD-AI-CHAR (Modify AI Characteristics) New Command

Description :

This command shall be used to modify the characteristics of an AN Interface. AI must be put OOS for execution of this command.

Input Parameters :

AI-NUM :

[VAR-ID] : Displays existing value

[PRI-LNK] : Display the existing value

[SEC-LNK] : Display existing value

[PROT-INF] : Display existing value

Output Form :

Following is the output report displayed after successful execution of command.

MODIFY ACCESS NETWORK INTERFACE REPORT

AN Interface Number :

AN Interface Name :

AN Interface Type :

Varient id :

Primary Link :

Secondary Link :

Protocol information :

7.2.7. DISPL-L3-ADDR (Display L3 Addresses) New Command

Description :

This command is used to display the list of L3 addresses with given status for an AN interface.

Input Parameters :

[AI-NUM] : ALL-ENTITIES

[AI-NAME] : ALL-ENTITIES

[AI-TYP] : ALL

[L3-STS] : FREE

Only one of AI-NUM and AI-NAME is to be given.

Output Form :

Following is the output report displayed after successful execution of command.

DISPLAY FREE L3 ADDRESS REPORT FOR V5.2 AI

AN Interface Number :

AN Interface Name :

BM Number :

Start L3 Address :

L3 Addresses :

DISPLAY L3 ADDRESS REPORT FOR V5.1 AI

AN Interface Number :

AN Interface Name :
BM Number :
Status L3 Address :
L3 Addresses :
AI channel Number :

Similarly reports for V5.1 & V5.2 AI assigned L3 address will be displayed.

7.3. SUBSCRIBER LINE ADMINISTRATION COMMANDS

For exchange there is no difference between AN subscribers and PSTN subscribers. Hence, all the subscriber line administration commands are valid for AN subscriber also. All such available commands are described in detail in [11].

All AN subscribers are uniquely identified by its DIRNO and AISUB-ID. Most of the subscriber line administration commands for AN subscriber are executed by DIRNO of the subscriber.

7.3.1. CRE-SUB (Creation of AN/PSTN Subscribers) Modified Command

Description :

This command is used to configure on AN/PSTN subscriber.

Input Parameters :

DIR-NO	:	
[TEN]	:	NONE
[AISUB-ID]	:	NONE
[CHNL-NO]	:	NONE
[LIN-TYP]	:	ORD-LIN
[INS-TYP]	:	DECAD
[SUB-PRI]	:	1
[CAL-MOD]	:	NO-INT
[FAC-ORG]	:	NO-ORG
[FAC-TRM]	:	NO-TRM
[MTR-CLS]	:	NRM-MTR
[DET-BLG]	:	ORD-BLG
[ACC-BAR]	:	OG-UPTO-LCL
[LIN-CAT]	:	1
[CAB-ID]	:	1-1-1
[OPR-ACC]	:	YES
[SUB-CTG]	:	1

Output Form :

Output report displayed after successful execution of command.

CREATE SUBSCRIBER REPORT

Directory Number	:	
Terminal Equipment Number	:	*
AN Subscriber Id	:	
AI Channel Number	:	
Line Type	:	
Instrument Type	:	
Priority	:	
Call Mode	:	
Facility Origination	:	
Facility Terminating	:	
Metering Class	:	
Detailed Billing	:	
Cable Id	:	
Line Category	:	
Operator Accessibility	:	
Access Barring	:	
Local Counter	:	
STD Counter	:	
STD Calls	:	
ISD COUNTER	:	
ISD CALLS	:	

7.4. ADDITIONAL COMMAND FOR MAINTENANCE AND PERFORMANCE MEASUREMENTS

All the commands used for the maintenance of terminals in MAX e.g., PUT-TRM-OOS, DISPL-TRM-ALL etc.) can be used for AN subscribers AI channels and PHC terminals. So three more values are used in TML-TYP, namely, ANSUB, AICHNL and PHC. The AI-links can be maintained by the commands used for DTKs in the MAX. So, all the commands used for DTKs are valid for AI-links also. However few new commands are added for maintenance purpose which are as follows.

7.4.1. DISPL-AICNT-OOS New Command

Description

This command is used to display the count of faulty AN subscribers or AI channels in a particular AN interface.

Input Parameters :

[AI-NUM] : None

[AI-NAME] : None

TML-TYP :

[STAT-TRM] : All

Output Form :

(i) (When [STAT-TEN] = ALL given)

TML-TYP = ANSUB

ALL STATUS ACCESS NETWORK SUBSCRIBER COUNT REPORT

AI-NUM :

AI-NAME :

AI-TYP :

OOS_OPR INS INS_ANBLK INS_LLO

(ii) When STAT-TRM = ALL & TML-TYP = AICHNL given

ALL STATUS ACCESS NETWORK INTERFACE CHANNEL COUNT REPORT

AI-NUM :

AI-NAME :

AI-TYP :

OOS_SE OOS_OPR OOS_EXT OOS_SO OOS_TRANS
INS INS_ANBLK

(iii) When STAT-TRM value is not 'ALL'

TERMINAL COUNT REPORT : ACCESS NETWORK INTERFACE

AI-NUM :

AI-NAME :

AI-TYP :

STATUS TML-TYP COUNT

7.4.2. DISPL-LSCNT-OOS Modified Command

Description

This command is used to display the count of PHC terminals (given as TML-TYP = PHC) of a particular type. This is an existing command in which new parameter FRM-TYP is added which will take value VU or SU in case of PHC terminals.

Input Parameters

TML-TYP :

[FRM-TYP] : None

[STAT-TRM] : All

[MOD-NO] : All

Output Form

(i) When TML-TYP = PHC & STAT-TRM = ALL

EQ_TYP FRM-TYP OOS_SYS OOS_OPR OOS_EXT OOS_SE INS

(ii) When TML-TYP = PHC & STAT-TRM other than ALL

STATUS FRM_TYP EQ_TYP COUNT

7.4.3. DISPL-AI-STATUS New Command

Description

This command is used to display the status of an AN interface.

Input Parameters

[AI-NUM] : None

[AI-NAME} : None

Command is to be invoked by giving input value to only one parameter field (not both).

Output Form

ACCESS NETORK INTERFACE STATUS INTERROGATION REPORT

AN Interface Number :

AN Interface Name :

AN Interface Type :

AI-STATUS :

AN Interface Type :

ACTIVE-LINK :

ACTIVE PHC-id :

STANDBY-LINK :
Std by PHC-id :

7.4.4. MOD-AI-OBS — New Command

Description :

This command is used to put AN interface(s) under traffic observation or for deleting AN interface(s) from traffic observation.

Input parameters :

[ADD-AI] : None
[DEL-AI] : None
[DEL-ALL] : No
[OBS-PRD] : 0 : 0 : 0 : 0
[STP-DTE] : None
[STP-TME] : 0 : 0

Output Form :

MODIFY ACCESS NETWORK INTERFACE OBSERVATION REPORT

AN Interface Added to the List :
AN Interface Deleted from the List :
Old Stop Date :
Old Stop Time :
New Stop Date :
New Stop Time :

7.4.5. DISPL-TRF-RPT — Modified Command

Description

This is an existing command in MAX and can also be used for displaying the traffic report (s) of AN interface(s) under traffic observation.

Input Parameters

Input form remains unchanged (Refer 11.). In RPT-ID parameter. V5.1 REP or V5.2 REP shall be used.

Output Form

The output form of traffic-report for different case is given in [13].

7.4.6. START-TRF-RPT Modified Command

Description

This is an existing MAX command and can also be used to start traffic reports for AN interface(s).

Input Parameters

RPT-TYP : In addition to existing values it has new value `AI-REP' to start traffic reports for AN Interfaces.

Output Form

Following output report shall be displayed after successful execution of the command.

START A SPECIFIED TYPE OF TRAFFIC REPORT

	REPORT TYPE	UNIT	PERIODICITY	
[	AN-Interface	MIN	60	]

Input Parameters

Input form remains unchanged (Refer 11.). In RPT-ID parameter. V5.1 REP or V5.2 REP shall be used.

7.4.7. MOD-RPT-PERDTY Modified Command

Description

This is an existing MAX command and can also be used to modify the periodicity of AI traffic report.

Input Parameters

RPT-TYP : AI-REP

TIM-UNIT : Existing MAX parameter

RPT-PRD : Existing parameter

Output Parameters

Following report shall be displayed after successful execution of the command.

MODIFY PERIODICITY OF A TRAFFIC REPORT

REPORT TYPE	UNIT	OLD	NEW
AN-Interface			

7.4.8. DISPL-NUM-NAME Modified Command

Description

This is an existing MAX command which can also be used to see all the existing AN interfaces in the system.

Input Parameters

ENT-TYPE : AI (To be given to see Existing Ais).

[ENT-NUM] : ALL ENTITIES (or known AI num can be given)

[ENT-NAME] : ALL ENTITIES (or known AI name can be given)

Both ENT-NUM & ENT cannot have non-default value

Output Report

Following report shall be displayed after successful execution of the command.

REPORT FOR DISPL-NUM-NAME

[

ENTITY TYPE ACCESS-NETWORK-INTERFACE

ENTITY NUMBER ENTITY NAME

]

7.4.9. DISPL-TRM-STATUS Modified Command

Description

This is an existing MAX command which can also be used to see status of AN subscribers and AI channels. It is used to see the status of PHC terminals also.

Input Parameters

[STAT-TRM] : ALL

TML-TYP :

[TEN] :

[DIRNO] :

TEN value is to be given when TML-TYP = AICHNL/PHC and DIRNO is to be given for TML-TYP = ANSUB.

Output Report

Following output report shall be generated when command is executed successfully.

i) when TML-TYP = PHC STAT-TRM = ALL

TML-TYPE TEN STAT TRM

ii) when TML-T YP = ANSUB/AICHNL STAT-TRM = ALL

TML TYPE AI-NUM AI-STATUS DIR TEN STAT TRM

7.4.10. DISPL-TRM-ALL Modified Command

Description

This is an existing MAX command which shows AICHNL/ANSUB and PHC terminals in output, if they are in the status given as input.

Input Parameters

MOD-NO :

STAT-TRM :

Output Parameters

The output report format is same as that of command DISPL-TRM-STATUS

7.5. PROCEDURE FOR OPERATING AN ACCESS NETWORK INTERFACE IN MAX

7.5.1. Procedure to Equip Access Network in MAX

Step 1 Equip a frame as VU using command EQUIP-FRAME with [FRM-TYP] = VU

Note that SU cannot be equipped in concentration with VU and vice-versa.

Step 2 Equip PHC Card(s) in slot 7,8,9 or 10 of the VU frame using command `EQUIP-TRML-CARD' with
HW-TYP = PHC

Step 3 Equip the DTK card (where the E1 links of AI are terminated) as
HW-TYP = DTK-CCS

Step 4 Equip the ACCESS NETWORK in the switch using command CRE-AI (See 7.2.1 for details of the command).

7.5.2. Procedure to Create AN Access Network Subscriber

Assuming that AN interface has already been configured, the following command should be executed to create a subscriber

1. CRE-SUB

7.5.2.1. Remarks

(i) For creating AN subscriber, no TEN value should be given. Instead, AISUB-ID should be given.

(ii) L3 addr should belong to AN interface. If interface type is V5.1 the L3 addr should be lie with start L3 address and start L3 address +23 and if interface type is V5.2 the L3 addr should lie between start L3 address and start L3 address + 3071.

(iii) L3 address should not be in use already for another AN subscriber.

(iv) LIN-TYP should not be PBX/PBX-RVRS2

(v) CHNL-NO should have non-default value only when interface type is V5.1 and it should not be in use by another subscriber, when given.

7.5.3. Procedure for Maintenance of AN Interface

7.5.3.1. To Make AN Interface OOS

There are several ways, described in 7.5.3.1.1 to 7.5.3.1.2 to make the AI OOS. AI will be down also when VU is down.

7.5.3.1.1. By making Primary/Secondary link OOS

If AI has only one link, then give command FRC-DTK-OOS for the link and if it has secondary link also than give FRC-DTK-OOS for both primary and secondary.

Status can be reversed by FRC-DTK-INS command.

7.5.3.2. By making VU OOS

VU can be brought OOS by making both the TUCs of VU out of service. In this state all the AI links connected to the exchange will be down. TUCs can be made OOS by FRC-SWU-OOS and brought inservice by command PUT/FRC-SWU-INS.

7.5.3.3. To make links of AN Interface OOS

Individual links (except primary and secondary), can be made OOS through command PUT-DTK-OOS or FRC-DTK-OOS. They can be brought inservice through command PUT-DTK-INS or FRC-DTK-INS.

7.5.3.4. To make AN Subscriber OOS

The subscribers of the AN interface can be made OOS using the command PUT-TRM-OOS/FRC-TRM-OOS. For AN subscribers, the command will work with DIRNO of the subscriber.

Status can be restored by command PUT-TRM-INS.

7.5.3.5. To make PHC terminals OOS

PHC terminals of VU can be made OOS using PUT-TRM-OOS/FRC-TRM-OOS with

TML-TYP = PHC

They can be brought inservice using

PUT-TRM-INS/FRC-TRM-INS

Appendix-A

A.1 STUB SETTINGS FOR CONFIGURATION OF TU AS V5 TERMINAL UNIT (VU)

The processor id for VP-0 and VP-1 are `CC' and `CD' (in Hexadecimal) respectively. These ids are assigned by bit settings done on stubs meant for it in backplane of motherboard of TU.

The bit stream for CC and CD are 1100 1100 and 1100 1101 respectively. These are represented by making stubs open or short. An `open' stub indicates `1' whereas a `short' stub indicates `0'. On the backplane of motherboard stubs marked W1 to W8 (for HPC0) and W13 to W20 (for HPC1) are present.

Stub settings for VU :

	HPC1 ID		Setting	Bit	HPC0 ID	Setting	Bit
(LSB)	W13	:	Open	1	W1	Short	0
	W14	:	Short	0	W2	Short	0
	W15	:	Open	1	W3	Open	1
	W16	:	Open	1	W4	Open	1
	W17	:	Short	0	W5	Short	0
	W18	:	Short	0	W6	Short	0
	W19	:	Open	1	W7	Open	1
(MSB)	W20	:	Open	1	W8	Open	1

LSB : Least Significant Bit

MSB : Most Significant Bit

A.2 ECN IN BPC CARD FOR ACTING AS VPC

Following capacitors in BPC (Base Processor Controller) card has to be removed to make it work as VPC (V5 Processor Controller) card :

C_{24}, C_{111} and C_{182}

A.3 For packaging and interconnection of VU refer to chapter 8 of **C-DOT CCS7 User's Manual.**

Appendix-B

Glossary

AN	:	Access Network
BCC	:	Bearer Channel Connection
BRA	:	Basic Rate Access
BS	:	Base Station
BSC	:	Base Station Controller
C-CHANNELS	:	Communication Channels (16^{th} time slot of E1 link)
CER	:	Call Event Record
CMR	:	Call Manager
DLE	:	Data Link Entity
DSS	:	Digital Switching System
DTU	:	Digital Terminal Unit
E1	:	2.048 Mbps PCM Link
EQN	:	Equipment Number
ETSI	:	Euopian Telecommunications Standards Institute
FITL	:	Fiber In The Loop
GPC	:	Global Path Control
GRRA	:	Global Routing and Resource Allocation
HDT	:	Host Digital Terminal
ISDN	:	Integrated Services Digital Network
LE	:	Local Exchange
MAX	:	Main Automatic Exchange :- A Generic Term Used for C-DOT Family of Digital Switching Systems
MAX-L	:	Main Automatic Exchange - Large
MAX-XL	:	Main Automatic Exchange - Extra Large
MMI	:	Man Machine Interface
ONU	:	Optical Network Unit

OTP	:	Originating Terminal Process
PHC	:	Protocol Handler Card
POTS	:	Plain Old Telephone System
PRA	:	Primary Rate Access
PSTN	:	Public Switched Telephone Network
SBM	:	Single Base Module
SCP	:	Status Control Process
SMH	:	Signalling Message Handler
SU	:	#7 Signalling Unit
TTP	:	Terminating Terminal Process
V5.X	:	Standard Interface Specified by ETSI between LE and AN
VU	:	V5 Unit
WLL	:	Wireless in Local Loop

References

[1] V5.2 Interface Specifications, ETSI, ETS300347-1, Sep 1994

[2] V5.2 Interface Specifications, ITU, G.965

[3] V5.2 Interface National Standards, TEC G/VAN-02/01, Sep 1996

[4] V5.1 Interface Specifications, ETSI, ETS300324-1, Mar 1993

[5] V5.1 Interface Specifications, ITU, G964

[6] V5.1 Interface National Standards, TEC G/VAN-01/01, Sep 1996

[7] Q.920 and Q.921 CCITT Recommendations

[8] G.703, G.704 and G.706 CCITT Recommendations

[9] C-DOT DSS MAX General Description

[10] C-DOT DSS MAX-XL General Description

[11] C-DOT DSS MAX Exchange Operations

[12] C-DOT #7 General Description

[13] OAM Specification for AN Interface in MAX.

Technical Specifications

1)	Capacity per Base Module	:	2048 Terminations (512 TS, 1:4 concentration)
2)	Engineered Capacity (BHCA)	:	12.5 k / BM 100k - MAX-L 300k - MAX-XL
3)	Ports Connectivity	:	8k - MAX-L (16 BM) without concentration 16k - MAX-XL (32 BM) without concentration.
4)	Numbering Plan	:	20 digits
	- Directory Number	:	4 to 7 digit
	- Exchange code	:	1 to 4 digit
5)	No. of Exchange codes (max.)	:	60 of 1000 nos. each or 4 of 10000 Nos. each
	- Directory Numbers	:	60k
6)	Type of register signalling	:	2 (Decadic, MFR2)
7)	Type of Hardware supported	:	2W analog trunks, 4 E-M trunks Digital Trunks on Type I, Type II, Type III and CCS #7 trunks
8)	Maximum Trunk Groups	:	512
9)	Types of Trunk Groups	:	3 (Incoming, Outgoing & bothway)
10)	No. of Categories	:	64
11)	No. of routes in an exchange	:	2048
12)	Depth of Analysis	:	12 digits (max.)
13)	Total no. of Charge Rate Number	:	0 to 127
14)	No. of Priorities	:	1 to 14

15)	No. of maximum trunk groups for alternate routing on a route	:	7
16)	Possible types of days	:	8
17)	No. of periods on type of day	:	8
18)	Subscriber Services	:	a) Basic Services b) Rapid Call set-up Services c) Call Booking Services d) Call Restriction Services e) Absent Subscriber Services f) Call Completion Services g) Call Charge Services h) Multiparty Services i) Administrative Service j) Miscellaneous Services
19)	V5.x interface	:	a) V5.1 interface b) V5.2 interface
20)	No. of AN subscriber per BM	:	3072
21)	No. of V5 interface	:	Max. five. V5.2 interface/Max. ten V5.1 interface (SBM)
		:	Max. seven V5.2 interface/Max. fourteen V5.1 interface (MBM)
22)	No. of E1 link	:	10 (SBM) & 14 (MBM)

System Practices

COMMENTS

The following comments pertain to:

Document Name

CSP Section □□□ - □□□ - □□□□

Issue/Draft □□ , □□□ - □□□□

No. (Month) (Year)

COMMENTS :

(Use a separate sheet if required)

Please mail your comments to:

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