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# TETRAPOL Specifications;
# Part 1: General Network Design;
# Part 1: Reference Model

## TETRAPOL FORUM

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# Contents

## Foreword

This document is the Publicly Available Specification (PAS) of the TETRAPOL land mobile radio system, which shall provide digital narrow band voice, messaging, and data services. Its main objective is to provide specifications dedicated to the more demanding PMR segment: the public safety. These specifications are also applicable to most PMR networks.

This PAS is a multipart document which consists of:

| | |
|---|---|
| **Part 1** | **General Network Design** |
| Part 2 | Radio Air interface |
| Part 3 | Air Interface Protocol |
| Part 4 | Gateway to X.400 MTA |
| Part 5 | Dispatch Centre Interface |
| Part 6 | Line Connected Terminal interface |
| Part 7 | Codec |
| Part 8 | Radio conformance tests |
| Part 9 | Air interface Protocol conformance tests |
| Part 10 | Inter System Interface |
| Part 11 | Gateway to PABX, ISDN, PDN |
| Part 12 | Network Management Centre interface |
| Part 13 | User Data Terminal to System Terminal interface |
| Part 14 | System Simulator |
| Part 15 | Gateway to External Data Terminal |
| Part 16 | Security |
| TTR1 | Guide to TETRAPOL features |
| Part 18 | Base station to Radioswitch interface |
| Part 19 | Stand Alone Dispatch Position interface |

## Introduction

This introduction positions Part 1: "general network design" in the document organisation and presents the system model.

It describes the content of the global TETRAPOL PAS as planned and which is delivered in successive phases described in document TTR 1-1 [38].

The content of the phase is a coherent set of documents describing the specified interfaces of the PAS, the first phase delivered in TETRAPOL is called phase 1 complemented by additionnal functions giving phase1+ [38].

PAS organisation

This is a multipart document which contains the specifications of the protocols and services at the different reference points and contains the relevant conformance tests. Some parts have been split into several subparts .

TETRAPOL Technical Reports (TTR) documents have been added for information, to give guidance.

The organisation is the following:

Part 1 General network design

This part contains the reference model, the functional specifications, and the principles of the main mechanisms.

Part 2 Radio Air Interface

This part describes the radio channel coding, multiplexing, and modulation.

Part 3 Air Interface protocol

This part contains the air interface protocol description including the protocol data units (PDUs).

Part 4 Gateway to X.400 MTA

This part contains the gateway protocol to the X.400 Message Transfer Agent.

Part 5 Interface to Dispatch Centre

This part contains the protocol description of the interface of the Dispatch Centre to the network.

Part 6 Line Connected Terminal interface

This part describes the interface protocol between the Network and the Line Connected Terminal.

Part 7 Codec

This part contains the exact binary description of the speech Codec. It is available only under controlled disclosure procedure.

Part 8 Radio conformance tests

This part contains the mobile and base station radio conformance tests according to ETS 300-113 [21].

Part 9 Air Interface protocol conformance tests

This part describes the Air interface Protocol conformance tests which allows type approval of a TETRAPOL mobile. It also contains the Protocol Implementation Conformance Statements.

Part 10 Inter System interface

This part describes the Inter System interface (ISI) protocol between two TETRAPOL systems and between TETRAPOL and other analog or digital PMR systems (TETRA, GSM...)

Part 11 Gateways to external networks

This part describes the gateways to fixed networks which are X.25, ISDN, PSTN, TCP-IP and PABX.

Part 12 Network Management Centre interface

This part contains the protocol description of the Network Management Centre (NMC) interface. The interface between the Operation and Maintenance Centre (OMC) and the radioswitch (RSW) is outside the scope of the present specification.

Part 13 User Data Terminal to System Terminal interface

This part contains the protocol description of the interface between the User Data Terminal (the UDT, sometimes referred to as Terminal Equipment or TE) and the Radio Terminal (the RT, also referred to as Mobile Termination Unit or MTU) or Line Connected Terminal (the LCT).

Part 14 System simulators

This part describes the simulators of the Mobile Station (MS) and of the Base Station (BS). These simulators include in the MS the RT Simulator for the UDT and the UDT Simulator for the RT. The EDT simulator is also included, with the RSW simulator for data.

Part 15 Gateway to External Data Terminal (EDT)

This part describes the gateway to EDT.

Part 16 Security

This part describes the TETRAPOL security mechanisms on the air interface including authentication, end to end encryption, key management. It shall also include the Subscriber Identity Module (SIM) content and interface, the Key Management Center interface, the ISI security. It is available only under controlled disclosure procedure.

TTR 1 This technical report describes the System as a designer's guide and gives a complete list of the references, terminology and abbreviations

Part 18 Base station (BS) to Radioswitch (RSW) interface

This part describes the protocol between the Base Station (BS) and the Radioswitch (RSW).

Part 19 Stand Alone Dispatch Position (SADP) interface

This part describes the interface of the SwMI to a Stand Alone Dispatch Position (SADP) and the System Terminal Control Protocol (STCP).

**System model**

The present PAS provides three different operational modes:

- Network mode where the mobile shall be under the coverage and the control of the large area infrastructure;
- Direct mode where the mobile shall communicate directly with the other terminal;
- Repeater mode where the mobile shall communicate with the other terminal through a repeater.

Fall back mode is a degraded operational mode used in case of technical incident.
A gateway mode may be built between direct mode and network mode.

Figure 1, 2 and 3 represent the TETRAPOL model, the different network subsystems and the parts of the specification which describe the interfaces in the different operational modes. The subsystems of the TETRAPOL model which are concerned by the external specified interfaces are listed thereafter.

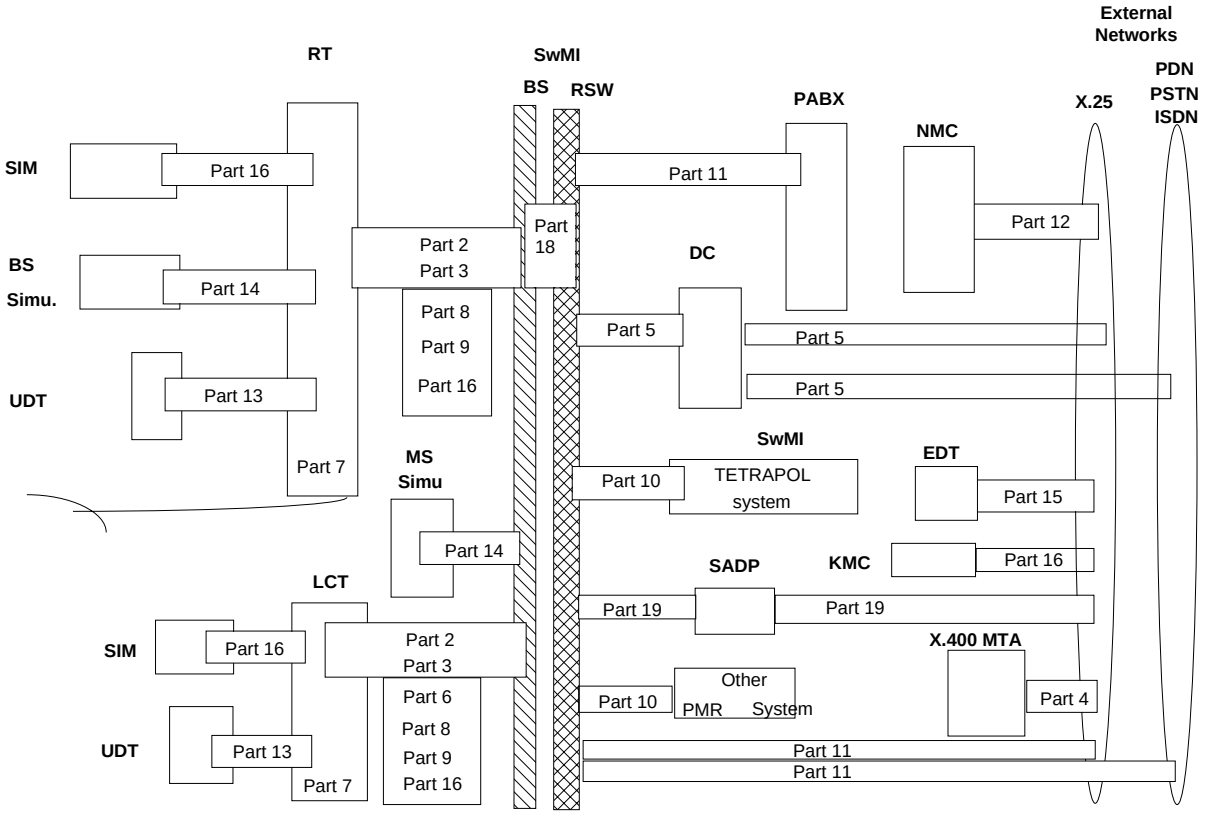


**Figure 1: Interfaces and corresponding documents (Network Mode)**

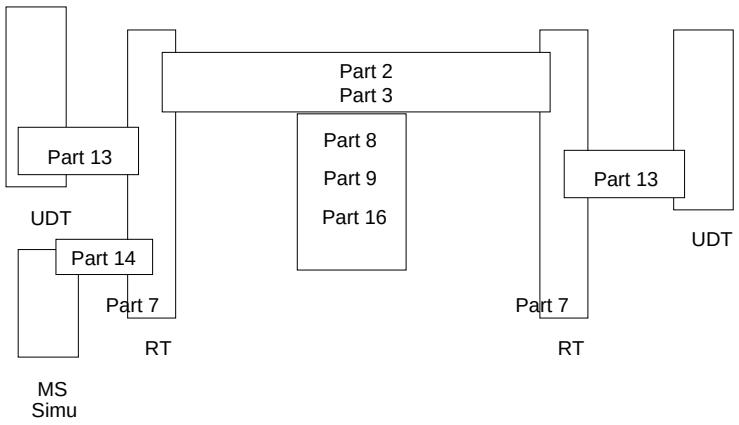


**Figure 2: Interfaces and corresponding documents (Direct Mode)**

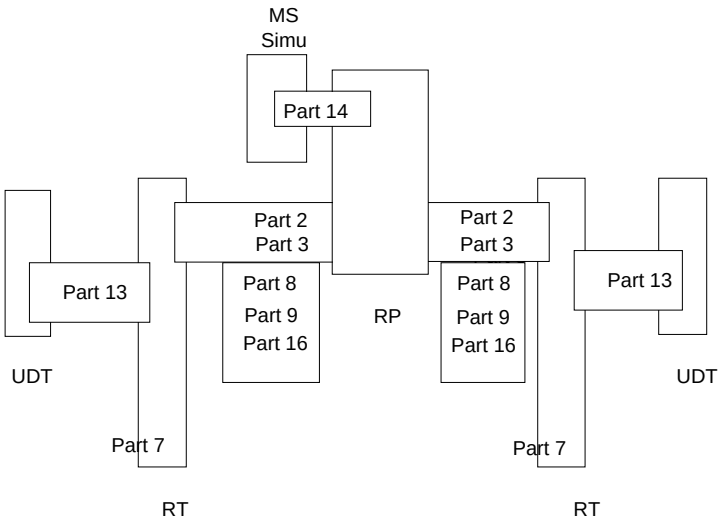


**Figure 3: Interfaces and corresponding documents (Repeater Mode)**

Part 1: "General Network Design" is divided into three subparts:

- subpart 1-1: Reference model;
- subpart 1-2: Voice and data services in network and direct mode;
- subpart 1-3: General mechanisms

This Part 1 of the Specification may, by its nature as a General Design Statement, require updating as later specific parts are completed (in order to avoid any non-alignment). If a discrepancy occurs between Part 1 and any other Part of the specification, then the other part will take precedence. Part 1 will be updated at a frequency consistent with maintaining the integrity of the specification as a whole.

It is recommended to read part 1 and TTR1 first to find the corresponding documents to the respective interfaces of the TETRAPOL system.

## 1. Scope

The present document corresponds to subpart 1-1: Reference Model.

This subpart establishes the bases for TETRAPOL General Network Design:

- Clause 4 describes the Reference Model and the Network reference points with corresponding protocol stacks;
- Clause 5 describes the Services and the Network Procedures;
- Clause 6 describes the CODEC general design;
- Clause 7 describes the ISI services;
- Clause 8 describes the DC services;
- Clause 9 describes the NMC services;
- Clause 10 describes the Radio main characteristics.
- Clause 11 describes the EMC conformity

This subpart shall apply to the three modes of operation (Network, Direct and Repeater mode).

## 2. Normative References

This PAS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this PAS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ISO 8208: "X.25 packet level protocol for data terminal equipment".

[2] ISO 8505: ITU-T X.484: "Open systems interconnection - X.400 Message HandlingSystem - Protocol instance conformity statement (PICS) proforma".

[3] ISO 9595: "Common management information service".

[4] ISO 9596: "Common management information protocol".

[5] ITU-T X.217: "Open systems interconnection - Association control service element (ACSE) - Service definition".

[6] ITU-T X.227: "Open systems interconnection - Association control service element (ACSE) - Protocol specification".

[7] ISO 9072 ITU-T X.219: "Open systems interconnection - Remote operations - Model, Notation and service definition".

[8] ITU-T X.229: "Open systems interconnection - Remote operations - Protocol specification".

[9] ISO 8822 ITU-T X.216: "Open systems interconnection - Presentation - Definition of service".

[10] ISO 8823 ITU-T X.226: "Open systems interconnection - Presentation - Protocol specification".

[11] ISO 8326 ITU-T X.215: "Open systems interconnection - Session - Definition of service".

[12] ISO 8327 ITU-T X.225: "Open systems interconnection - Session - Protocol specification".

[13] ISO 8072 ITU-T X.214: "Open systems interconnection - Transport - Definition of service".

[14] ISO 8073 ITU-T X.224: "Open systems interconnection - Transport - Protocol specification".

[15] ITU-T I.440: "Integrated Services Digital Network - User-network interface - Data Link Layer general".

[16] ITU-T I.441: "Integrated Services Digital Network - User-network interface - Data Link Layer specification".

[17] ITU-T I.450: "Integrated Services Digital Network - User-network interface - Layer 3 general".

[18] ITU-T I.451: "Integrated Services Digital Network - User-network interface - Layer 3 specification for basic call control".

[19] ETS 300-075: "Terminal equipment (TE); Processable data File transfer".

[20] ITU-T I.411: "Integrated Services Digital Network - User-network interface - Reference configuration".

[21] ETS 300-113: "Radio Equipment and Systems (RES); Land mobile service; Technical characteristics and test conditions for radio equipment intended for the transmission of data (and speech) and having an antenna connector".

[22] PAS 0001-1-2: "TETRAPOL Specifications; General Network Design; Voice and Data Services in Network and Direct Mode".

[23] PAS 0001-2: "TETRAPOL Specifications; Radio Air Interface".

[24] PAS 0001-3: " TETRAPOL Specifications; Air Interface Protocol."

[25] PAS 0001-4: "TETRAPOL Specifications; Gateway to X.400 MTA".

[26] PAS 0001-5: "TETRAPOL Specifications; Interface to Dispatch Centre."

[27] PAS 0001-6: "TETRAPOL Specifications; Line Connected Terminal interface".

[28] PAS 0001-7: "TETRAPOL Specifications; Codec."

[29] PAS 0001-8: "TETRAPOL Specifications; Radio Conformance tests".

[30] PAS 0001-9-1: "TETRAPOL Specifications; Conformance tests; Air interface Protocol Conformance tests".

[31] PAS 0001-10-1: "TETRAPOL Specifications; Inter System Interface; ISI Technical Requirements".

[32] PAS 0001-11: " TETRAPOL Specifications; Gateway to PABX, X25, ISDN, PDN."

[33] PAS 0001-12: "TETRAPOL Specifications; Network Management Centre; NMC Interface protocol".

[34] PAS 0001-13: " TETRAPOL Specifications; User Data Terminal to System Terminal interface."

[35] PAS 0001-14: "TETRAPOL Specifications; System Simulators".

[36] PAS 0001-15: " TETRAPOL Specifications; Data - Gateway to External Data Terminal."

[37] PAS 0001-16: " TETRAPOL Specifications; Security."

[38] TTR 1-1: "Guide to TETRAPOL features; System technical report".

[39] PAS 0001-18: "TETRAPOL Specifications; Base Station to Radio Switch interface".

[40] PAS 0001-19: "TETRAPOL Specifications; Stand Alone Dispatch Position interface; SADP interface".

[41] ITU-T Q931: "ISDN user-network interface layer 3 specification for basic call control."

[42] ITU-T Q921: "ISDN user-network interface layer 2 specification for basic call control."

[43] ETS 300-279: "Radio Equipment and Systems; Electromagnetic Compatibility (EMC) standard for Private land Mobile Radio (PMR) and ancillary equipment (speech and/or non speech)

[44] TTR 1-2: " Guide to TETRAPOL features; References and terminology"

[45] EN 60950: "Safety of information technology equipment, including electrical business equipment"

[46] EN 50080-1 "Electromagnetic Compatibility - Generic emission standard.Part1: residential, commercial and light industry"

[47] EN50082-1 "Electromagnetic Compatibility - Generic immunity standard. Part1: residential, commercial and light industry"

# 3. Definitions and abbreviations

## 3.1. Definitions

For the purposes of this PAS the following definitions apply [44]:

**Area**: term used to designate a surface of sea/land

**Base Network (BN)**: elementary network which is the smallest entity able to operate in normal network connected mode and to provide all nominal services and features available in normal network connected mode. It includes one RSWN and one or more BSs and corresponds to a geographical subdivision of a Network coverage.

**Base Station (BS):** the Base Station is the Radio and Control part of the SwMI connected to the RSW.

**Base Station Simulator (BSS):** the Base Station Simulator shall be the Mobile Station type approval simulator. It includes the simulators for the User Data Terminal (UDT), the Radio Terminal (RT) and the Subscriber Identity Module (SIM).

**Central Network Management (CNM):** the Central Network Management centralizes the operation and maintenance of several SwMI (NMC).

**Cell coverage**: area within which a certain quality of reception is provided; Planned radio coverage of a cell.

**Direct mode:** operational mode in which radio transmissions take place directly from terminal to terminal. Direct mode also allows listening to the TETRAPOL Network while the mobile is under its coverage (Direct mode/network monitoring or dual watch).

**Dispatch Centre (DC):** the Dispatch Centre shall connect a number of Dispatch Positions (DPs) to the TETRAPOL network and shall provide service access to the TETRAPOL services through server and switch functions within the DC.

**Dispatch Position (DP**): the Dispatch Position is a stand alone work position connected to the network or to the Dispatch Center

**External Data Terminal (EDT):** the External Data Terminal shall be connected through a private or public X.25 network. It acts as a data communication server, a database gateway and a private subscriber message storage.

**Fallback mode:** degraded operational mode used in case of technical incident.

**Group:** a group of terminals giving certain operational rights to users with common interests. The group is identified by a number.

**Independent Repeater (RP):** the Independent Repeater shall be the equipment used in Direct mode in order to extend the coverage between two mobiles.

**Key Management Center (KMC):** this is the sub system which manages the system security keys.

**Line Access Base Station (LABS)**: network interface to Line Connected Terminals and to SADPs, also known as Line Connection Interface Unit (LCIU).

**Line Connected Interface Unit (LCIU):** see LABS.

**Line Connected Terminal (LCT)**: System Terminal (ST) locally or remotely connected to the System through a physical connection line The System interface to LCTs is a Line Access Base Station.

**Location area**: an area within radio coverage of a Base Station or a group of Base Stations in which a Mobile Station may move freely without updating the location register.

**Message Trunking:** a method of traffic channel organisation where each traffic channel is permanently allocated for the complete duration of the call.

**Mobile Station (MS):** the Mobile Station is the combination of the Radio Terminal and the User Data Terminal.

**Mobile Station Simulator (MSS):** the Mobile Station Simulator shall be the Base Station type approval simulator.

**Multisite Open Channel:** traffic resource permanently allocated to those users authorised to access it for the duration of availability of the service (static allocation).

**Network**: the Switching and Management infrastructure and the base stations within a system.

**Network Management Centre (NMC):** the Network Management Centre centralizes the operation and maintenance for different Base Networks of a SwMI (OMC).

**Network mode**: mode where the MS is under coverage and listening to the Network (the MS has a serving cell).

**Operator**: responsible person or entity for the operation of a network.

**Open channel**: traffic resource permanently allocated to those users authorised to access it for the duration of availability of the service (static allocation).

**Participant**: the person involved in a call.

**Quasi transmission trunking:** a method of traffic channel organisation where each traffic channel is allocated for each call transaction (while the PTT is activated) and in addition the channel deallocation is

delayed for a short period at the end of the transaction. During this channel hold time the channel allocation may be re used for a new call transaction that is part of the same call.

**Radio Base Station (RBS):** Radio subset of the TETRAPOL SwMI interfacing the Radio Terminal.

**Radio SWitch (RSW):** this is the switching part of the Base Network. It may be comprised of one or several hierarchical levels, this is a manufacturer option.

**Radio SWitch Network (RSWN):** This is the switching part of the SwMI, it may be comprised of one or several RSW. The interface between RSW (IRI) is not standardised.

**Radio Terminal:** system terminal connected to the infrastructure by a radio link, also known as Mobile Termination Unit or MTU.

**Reference Point:** a conceptual point at the conjunction of two non overlapping functional group.

**Registration**: act of becoming an active and recognised Network user by exchange with the SwMI of user identity.

**Repeater Mode:** operational mode in which radio transmissions take place from terminal to terminal through repeater without control of the network.

**Stand Alone Dispatch Position (SADP):** the Stand Alone Dispatch Position shall be an isolated operator position providing dispatching and management functions.

**Subscriber**: the person who has taken a subscription to the service.

**Subscriber Identity Module (SIM):** the Subscriber Identity Module (SIM) shall be the removable module carrying subscriber information and security algorithms.

**Supplementary Service:** service which modifies or supplements a bearer service or a teleservice. A supplementary service cannot be offered as a stand alone service. It should be offered in combination with a bearer service or a teleservice.

**Switching and Management Infrastructure (SwMI):** the SwMI shall be a part of the TETRAPOL Network. It includes two subsystems: the Base Station (BS) and the RSWN. The SwMI includes the Operation and Maintenance Centre (OMC), the OMC is outside the scope of the present specification. The SwMI may be refered as the Network.

**System Terminal:** service access reference point provided to the user by the system. System terminals (STs) are Radio Terminals (RTs), Line Connected Terminals (LCTs).

**System:** the system is composed of the large area fixed infrastructure (SwMI) called network and of the System Terminals allowing user access to the available services.

**Terminal:** a generic term used to designate the equipment allowing to access to the service.

**Trunking**: a method to share the radio resources in an optimised way, between calls and/or during a call.

**Transmission trunking:** method of traffic channel organisation where each traffic channel is individually allocated for each call transaction. The channel is immediately deallocated at the end of the call transaction.

**User**: the person who uses the service offered, it can be different from the subscriber.

**User Data Terminal (UDT):** the User Data Terminal shall be a data terminal (Terminal Equipment TE) connected to the ST and used to provide data services.

**X.400 Message Transfer Agent (MTA):** the Message Transfer Agent shall be the X.400 message handling switch. It shall be connected to a private or public X.25 network and acts as a messaging server.

### 3.2. Abbreviations

For the purposes of this PAS the following abbreviations apply [44]:

| | |
|---|---|
| A/I | Air Interface |
| ACSE | Association Control Service Element |
| AVL | Automatic Vehicle Location |
| BN | Base Network |
| BS | Base Station |
| CC | Call Control |
| CCH | Control CHannel |
| CMIP | Common Management Information Protocol |
| CNM | Central Network Management |
| CODEC | Speech enCOder DECoder |
| CRC | Cyclic Redundancy Check |
| CRP | Connection Reference Point |
| CUG | Closed User Group |
| DAC | Dispatch Access Controller |
| DB | DataBase |
| DC | Dispatch Centre |
| DCN | Delivery Confirmation Notification |
| DCS | Dispatch Centre Server |
| DFN | Delivery Failure Notification |
| DL | Digital Link |
| DM | Direct Mode |
| DM/NM | Direct Mode / Network Monitoring |
| DP | Dispatch Position |
| EDT | External Data Terminal |
| FBM | FallBack Mode |
| HRSW | Home RadioSWitch |
| IRI | Inter RSW interface |
| ISI | Inter System interface |
| KMC | Key Management Centre |
| LABS | Line Access Base Station |
| LCIU | Line Connection Interface Unit |
| LCT | Line Connected Terminal |
| LLC | Logical Link Control |
| MAC | Medium Access Control |
| MM | Mobility Management |
| MOCH | Multisite Open CHannel |
| MS | Mobile Station |
| MSG APPLI | Messaging APPLIcation |
| MTU | Mobile Termination Unit |
| NDIS | Network Device Interface Specification |
| NMC | Network Management Centre |
| OG | Operational Group |
| OMC | Operation and Maintenance Centre |
| PABX | Private Automatic Branch eXchange |
| PAS | Publicly Available Specification |
| (P)DN | (Public) Data Network |
| PDU | Protocol Data Unit |
| PMR | Private Mobile Radiocommunications |
| PSTN | Public Switched Telecommunications Network |
| PTT | Push-To-Talk |
| RBS | Radio Base Station |
| Ri | Reference point index i |
| ROSE | Remote Operating SErvice |
| RP | RePeater |
| RSW | RadioSWitch |
| RSWN | Radio Switch Network |
| RT | Radio Terminal |
| SADP | Stand Alone Dispatch Position |

| | |
|---|---|
| SDL | Specification and Description Language |
| SFN | Submit Failure Notification |
| SIM | Subscriber Identity Module |
| ST | System Terminal |
| SwMI | Switching and Management Infrastructure |
| TCH | Traffic CHannel |
| TE | Terminal Equipment |
| TMSG-Id | Temporary MeSsaGe Identifier |
| TP | TransPort layer |
| TTI | Temporary Terminal Identifier |
| UA | User Agent |
| UDP | User Datagram Protocol |
| UDT | User Data Terminal |
| VRSW | Visited RadioSWitch |
| X.400 MTA | X.400 Message Transfer Agent |

# 4. Reference model

## 4.1. Reference points

This clause relies on the principle of reference configurations presented in ITU-T Recommendation I.411 [20]. The notions of teleservices, bearer services and supplementary services shall apply to TETRAPOL.

### 4.1.1. Network mode

Figure 4 shows the network mode Connection Reference Points (CRPs), which are located on the system and network boundaries. Only the protocols and services at these points are described in the present PAS.

**R1** shall be the reference point between the User Data Terminal (UDT) and the Radio Terminal (RT).

**R2** shall be the reference point between the Line Connected Terminal (LCT) and the User Data Terminal (UDT).

**R3** shall be the reference point corresponding to the Radio Air interface between the Radio Terminal (RT) and the Base Station (BS). This reference point applies to the simulator BSS which simulates the Base Station for RT and the MSS which simulates the Mobile Station for the Base Station.

**R4** shall be the reference point between the Line Connected Terminal (LCT) and the Network.

**R5** shall be the reference point between the Network Management Centre (NMC) and the network.

**R6** shall be the reference point between the Dispatch Center and the network.

**R7** shall be the reference point corresponding to the PABX gateway.

**R8** shall be the reference point between the X.400 MTA and the network.

**R9** shall be the reference point corresponding to the Inter System interface (ISI) between two TETRAPOL networks.

**R10** shall be the reference point between the External Data Terminal (EDT) and the network.

**R11** shall be the reference point to other PMR system

**R12** shall be the reference point corresponding to the BS - RSW interface.

**R13** shall be the reference point corresponding to the PSTN gateway.

**R14** shall be the reference point corresponding to the ISDN gateway.

**R15** shall be the reference point corresponding to the TCP/IP interface.

**R16** shall be the reference point corresponding to the X.25 (P)DN gateway.

**R17** shall be the reference point corresponding to the SADP interface.

**R18** shall be the reference point corresponding to the interface between the SIM and RT.

**R19** shall be the reference point corresponding to the interface between the KMC and Network

**R20** Reserved

**R21** Reserved

**R22** Reserved

**R23** Reserved

**R24** shall be the reference point to the DMO

…

**R30** shall be the reference point to the Repeater

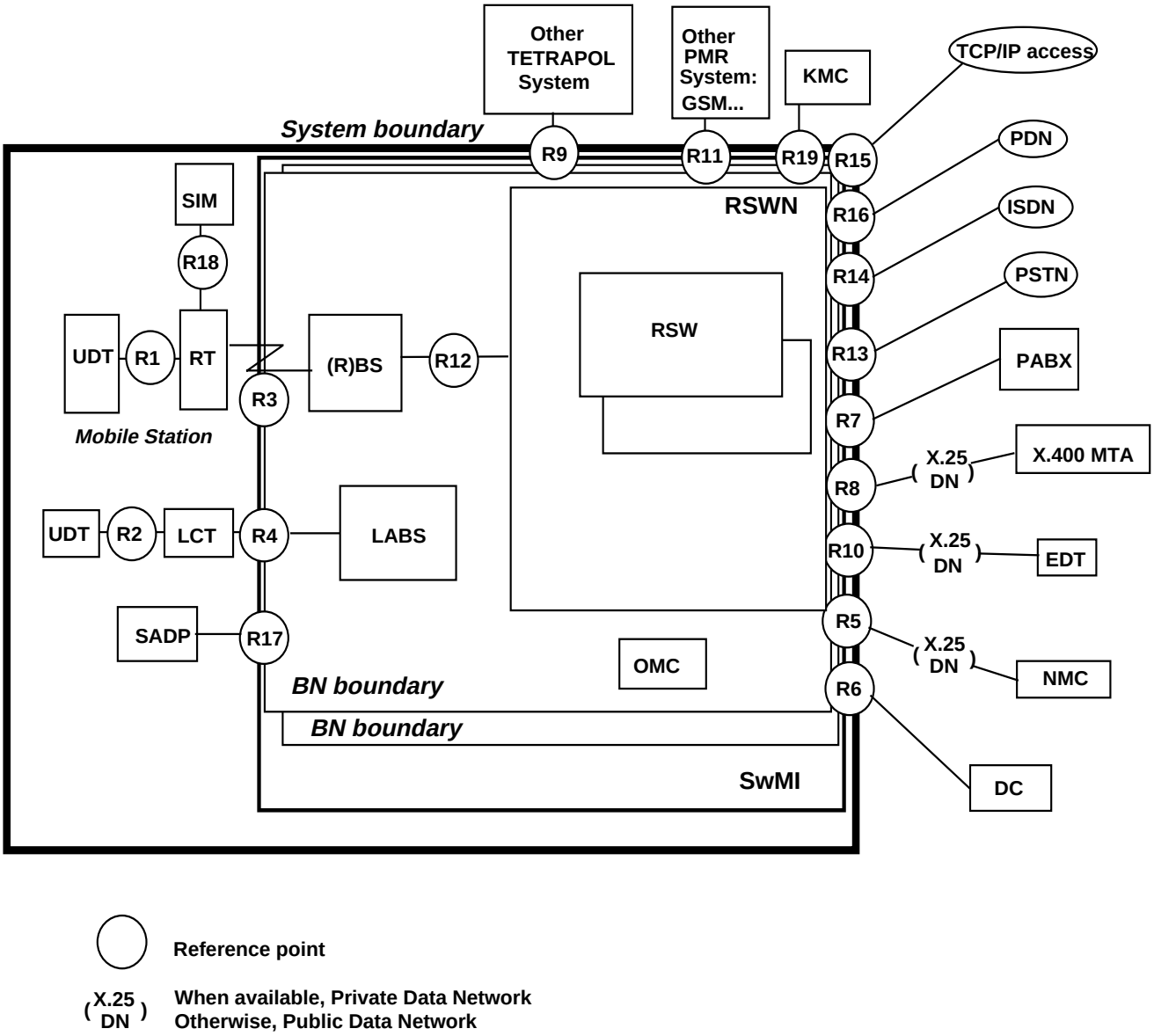


**Figure 4: Network mode reference model with CRPs**

The following figure shows the different planes of the model in a multinetwork environment.

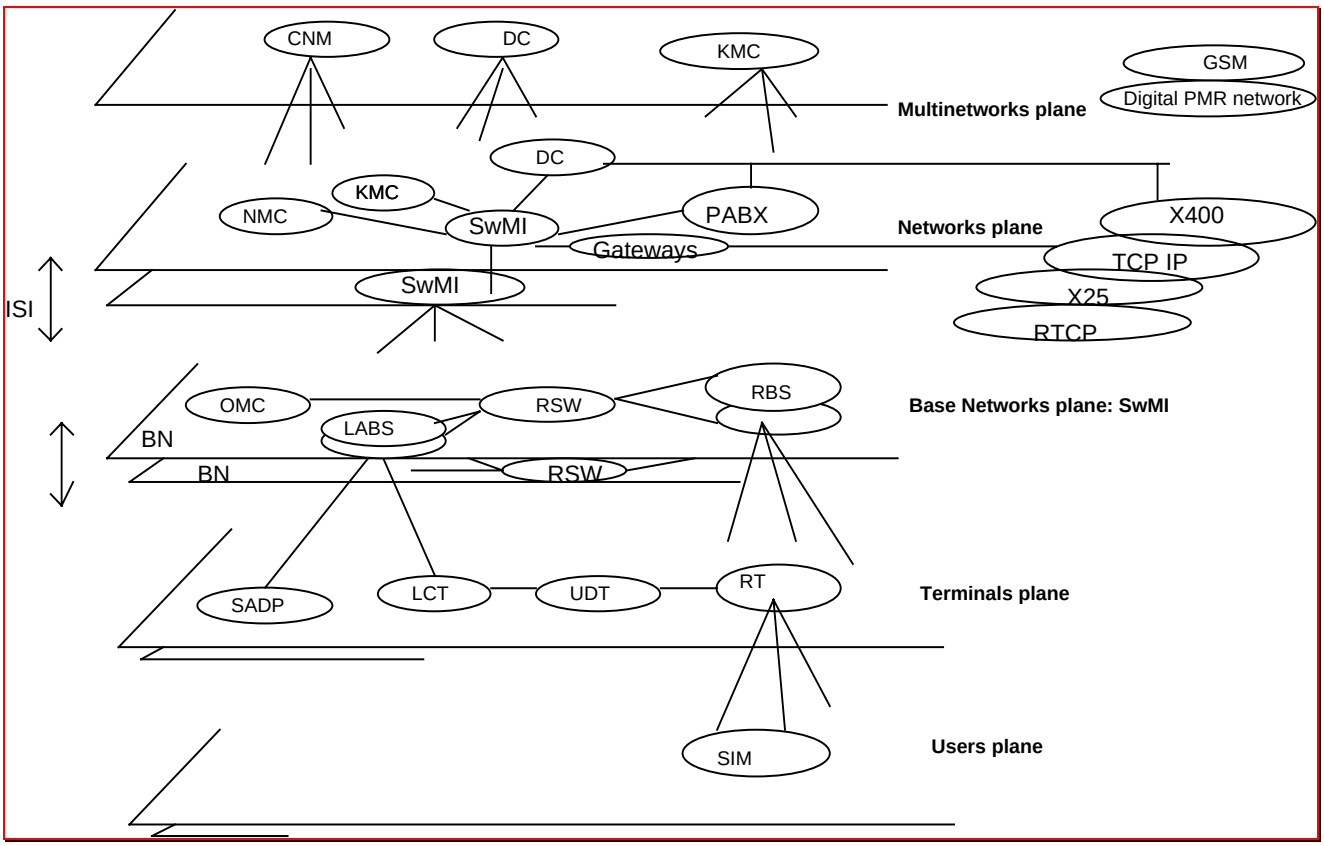


**Figure 5: TETRAPOL multiplane reference model**

Each subsystem of the model is described in the definition list of clause 3 in particular the RSW and BS sub-systems.

### 4.1.2. Fallback modes

Fallback modes shall be considered in the protocol for the following cases:

- BS - RSW disconnected mode;
- X.25 (P)DN disconnected mode;
- MS disconnected mode, with change to direct mode.

New routing and new modes are installed, either automatically or at user's choice.

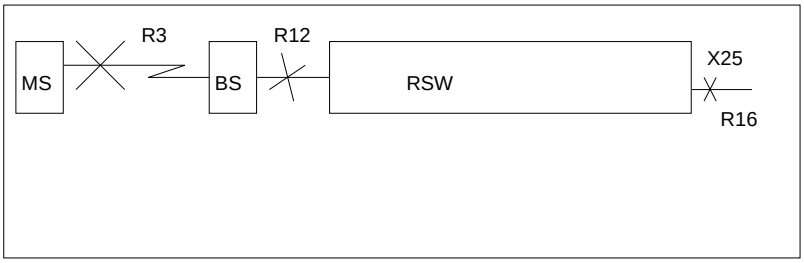


**Figure 6: Fallback modes**

Security mechanisms shall take into account these reconfigurations. These mechanisms are dealt with other parts of this specification.

### 4.1.3. Direct Mode (DM)

DM operation the reference points shall be as follows:

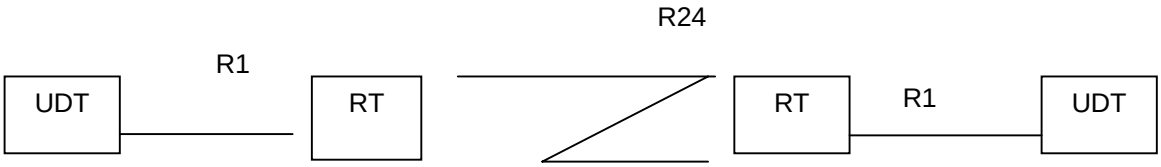


**Figure 7: Direct Mode reference points**

**R1** shall be the reference point between UDT and RT.

**R24** shall be the reference point corresponding to the Air interface RT-RT.

Direct Mode also allows listening to the TETRAPOL network when the Radio Terminal is under its coverage (Direct Mode/Network monitoring or dual watch service).

### 4.1.4. Repeater Mode

In Repeater Mode (RP mode) the reference points shall be the following ones:

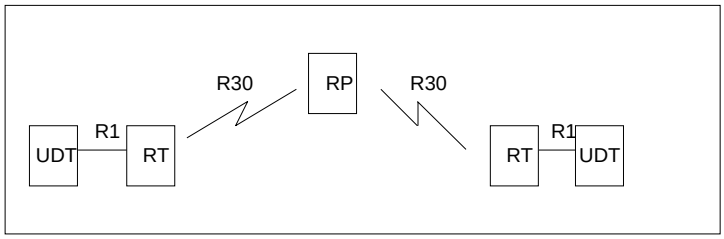


**Figure 8: Repeater Mode reference points**

**R30** shall be the reference point between the Radio Terminal (RT) and the Repeater (RP)

A Gateway can be built between the network Air Interface and the Direct Mode Air Interface (Gateway mode). Gateway and Repeater modes may be combined.

### 4.2. Protocol stacks at reference points

Protocol stacks are described at reference points defined above.

#### 4.2.1. Protocol stack at reference points R1 and R2

Figure 9 shows the protocol stack corresponding to the reference point R1 between the User Data Terminal (UDT) and the Radio Terminal (RT) and to the reference point R2 between the User Data Terminal (UDT) and the Line Connected Terminal (LCT).

It shall be applicable to Network mode, Direct Mode and Repeater Mode.

It relies on the Videotex implementation of the standard as defined in ETS 300 075 [19].

It can be expanded to offer TCP-IP interface through a convergence layer recommended to be based on the NDIS service. Broadcast, datagram and connected mode shall then be offered to the applications.

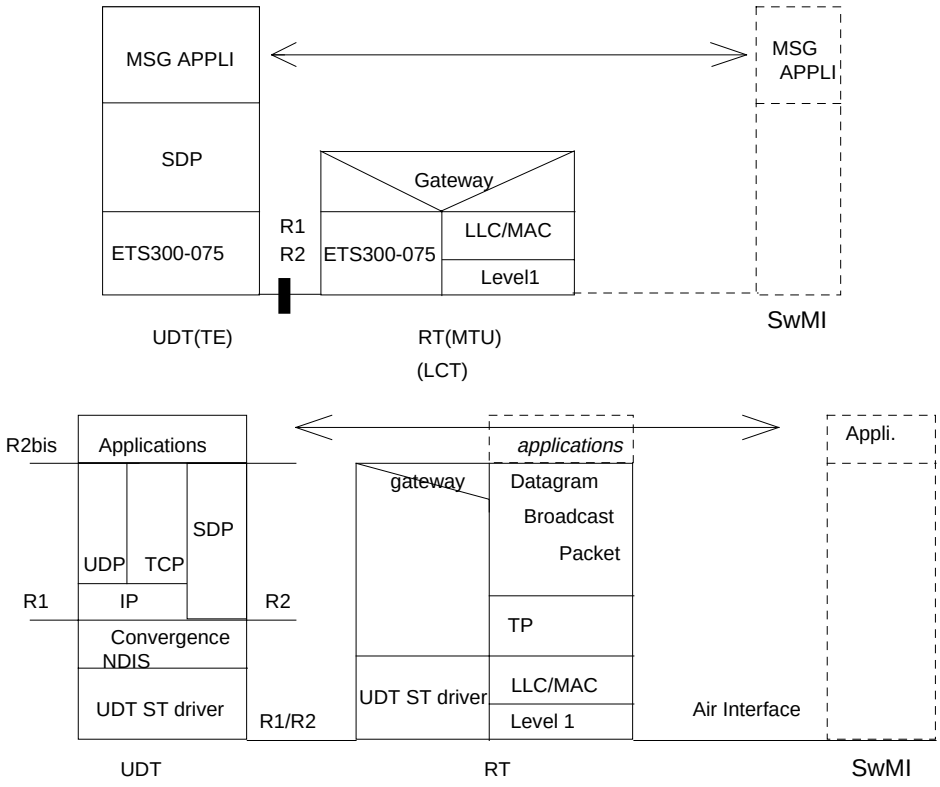


**Figure 9: Protocol stack at reference points R1 and R2**

Different combinations are offered to allow:

- X.400 messaging with applications in the UDT and the RSW;
- TCP/IP applications in the UDT;
- Datagram, broadcast and packet connected mode may be offered if required on the RT as well as a gateway function.

The protocol and services at reference points R1 and R2 are described in PAS 001.13 [34]

### 4.2.2. Protocol stack at reference points R3 and R4

Figure 10 shows the protocol stack corresponding to the reference point R3 between the Radio Terminal (RT) and the Base Station (BS) and to the reference point R4 between the Line Connected Terminal (LCT) and the Line Access Base Station (LABS) also called Line Connected Interface Unit, (LCIU).

This protocol stack shall apply to the network mode. This shall be also applicable to the Base Station and Mobile Station Simulator interface.

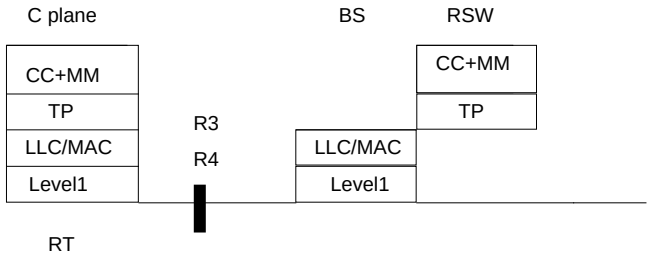


**Figure 10: Protocol stack at reference points R3 and R4**

The Air interface Protocol is described in PAS 001-3 [24] while the radio air interface is described in PAS 001-2 [23] and the line interface in PAS 001-6 [27].

### 4.2.3. Protocol stack at reference points R8 and R10

Figure 11 and 12 show the protocol stacks corresponding to the System gateways to the Message Transfer Agent (MTA) and to the External Data Terminal (EDT). The services offered correspond to interpersonal messaging allowing message exchanges between the UDT and the X.400 external network subscribers described in ISO 8505 [2], in ISO 8326 [11], in ISO 8327 [12], in ISO 8072[13], in ISO 8073 [14].

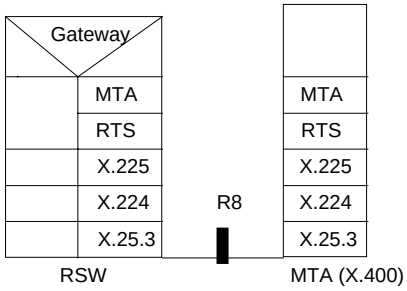


**Figure 11: Protocol stack at reference point R8**

The interface protocol and services are described in PAS0001-4 [25].

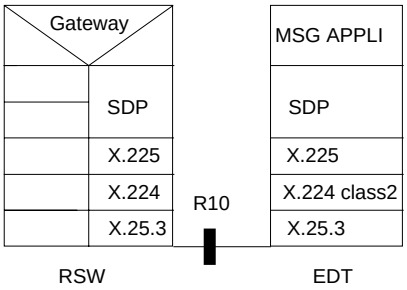


**Figure 12: Protocol stack at reference point R10**

The interface protocol and services are described in PAS0001-15 [36].

### 4.2.4. Protocol stack at reference point R5

Figure 13 shows the protocol stack corresponding to the reference point between the Network and the Network Management Centre (NMC) described in ISO 9595[3], in ISO 9596 [4], in ISO 8822 [9], in ISO 8823 [10], in ITU-T X.217 [5] and in ITU-T X.227 [6]. An SNMP protocol stack shall be available for smaller configurations at the same reference point.

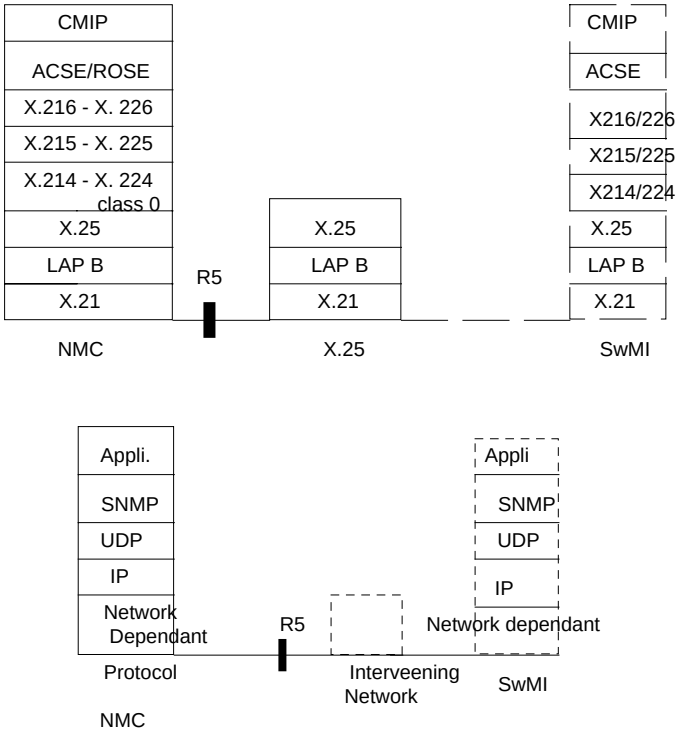


**Figure 13: CMIP/SNMP Protocol stacks at reference point R5**

The interface protocol and services are described in PAS0001-12 [33].

### 4.2.5. Protocol stack at reference point R6

Figure 14 shows the protocol stacks corresponding to the dispatch interface between the Dispatch Center and the Network.

This interface corresponds to Voice (T0 protocol) defined in ITU-T I.440 [15], in ITU-T I.441 [16], in ITU-T I.450 [17], in ITU-T I.451 [18] and Data protocol stacks as defined in ISO 8208 [1].

The interface protocol and services are described in PAS0001-5 [26].

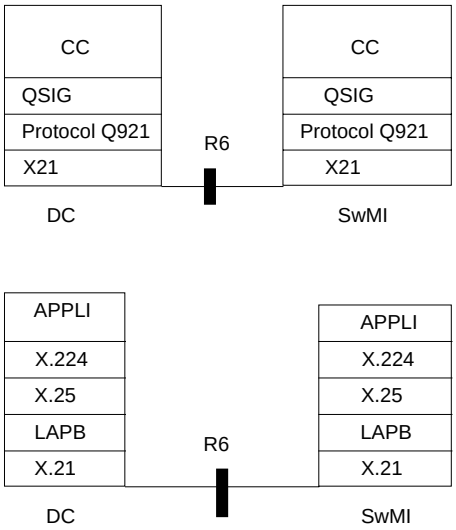


**Figure 14: Protocol stacks at reference point R6**

### 4.2.6. Protocol stack at reference point R7

Figure 15 shows the protocol stack corresponding to the reference point between the PABX and the Network (S0 protocol) [41], [42]. A QSIG based interface will be offered.

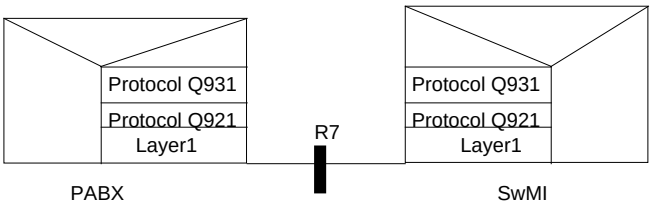


**Figure 15: Protocol stack at reference point R7**

The interface protocol and services are described in PAS0001-11 [32].

### 4.2.7. Protocol stack at reference point R9 and R11

R9 shall be the Inter-System Interface (ISI) between TETRAPOL systems. The protocol stack at R9 is QSIG based.

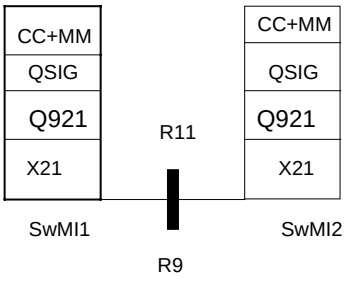


**Figure 16: Protocol stack at reference point R11 or R9**

The protocol stack will also be the protocol stack corresponding to the reference point R11 which is the gateway to other PMR systems for example GSM (phase 2 +), TETRA, analog PMR system.

The interface protocol and services are described in PAS0001-10 [31].

### 4.2.8. Protocol stack at reference point R12

R12 shall be the Base Station - Radioswitch interface (BS-RSW).

The protocol stack shall be X.25 based for data and signalling, and for voice it shall be circuit mode based (HDLC) at 64 kbit/s on a 2 Mbit/s link. For mobility information an external X.25 network is used.

The interface protocol and services are described in PAS0001-18 [39].

#### 4.2.9. Protocol stacks at reference points R13, R14, R15 and R16

The protocol stacks at R13, R14, R15 and R16 correspond respectively to PSTN, ISDN, TCP/IP and X.25 standard interfaces at the gateway.

The interface protocol and services are described in PAS 0001-11 [32].

#### 4.2.10. Protocol stack at reference point R17

R17 shall be the reference point of the Stand Alone Dispatch Position (SADP) interface to the Network boundary. The protocol stack at R17 shall be X.25 based for data and similar to the LCT (RT) protocol stack for voice. The link can be fixed lines or over the air.

The interface protocol and services are described in PAS0001-19 [40].

## 5. Services and Network procedures

### 5.1. Introduction

This Clause describes the Services and the Network Procedures which will be included in the TETRAPOL specification. A more detailed description of the TETRAPOL Services is given in subpart 1-2: "Voice and Data Services in network and Direct Mode".

The main objective is to provide the services and the network procedures necessary for the most demanding PMR segmenti.e. Public Safety.

The services and network procedures are described hereafter for the 3 modes of operation of the TETRAPOL systems i.e. network mode, direct mode and repeater mode.

### 5.2. Network mode

#### 5.2.1. Services

Services are telecommunications services which users access from the terminals. They correspond to Bearer Services, Teleservices and Supplementary Services.

##### 5.2.1.1. Voice Teleservices

The following voice teleservices are defined in the present specification:

- Broadcast open channel call;
- Emergency call and emergency open channel;
- Group call;
- Individual call;
- Multiparty call;
- Multisite open channel and multisite trunked open channel;
- Talk group.

###### 5.2.1.1.1. Description of the voice Teleservices

**Broadcast call:** one-way point to multipoint voice and data communication from a calling party to several called parties within a selectable predefined area. The selected area and all of the called parties shall be previously defined. There shall be no acknowledgement of called parties presence in the communication.

**Emergency call:** on a user action, a status shall be sent by the terminal. Two options shall then be possible (as an operator option):

- automatic call set-up of a pre-emptive open channel;
- using a pre-emptive priority, a predefined user (dispatcher,...) shall establish a call chosen on an operational basis. For example: open channel, ambience listening, individual call,...

**Group call:** group number addressed voice communication between a calling party and one or several called parties. All of the called parties shall belong to the same group (same group number) which may be different from the call initiator. The group call can be acknowledged or there may be no control of called parties presence in the communication (non acknowledged group call). The normal end of the call corresponds to the on hook of the call owner and resources are made free. Group composition can be modified dynamically, the call may be in clear or encrypted and may be trunked.

**Individual call:** bi-directional voice communication between a calling party and a called party (line or radio connected) for dispatching or inter-connection purposes.

**Multiparty call:** voice service enabling a user to set up a call to several enumerated users (line or radio connected) either by dialling their numbers or by retrieving them from a predefined list. This service shall allow point to multipoint communication between previously defined parties as well as acknowledgement of the called parties presence in the call. The call shall be active as soon as one called party answers.

**Multisite open channel:** communication identified by a number, between several terminals located within a predefined area (mono, multisite, multi base network). The open channel is established and released by authorised terminals. Resources may be allocated permanently during the call or trunked between users.

**Talk group:** point-to-multipoint group addressed communication established within a selectable predefined area. The coverage is associated to the group number and may be different of the total coverage. Resources are allocated all the time. Any concerned user may enter or leave the talk group at any time.

#### 5.2.1.2. Data services

The following Data Services are defined in the present specification:

- Support Services:
  - Circuit data services;
  - Connected packet data service;
  - Connectionless packet data service.
- Teleservices
  - Broadcast without acknowledgment;
  - Short data messaging;
  - Status transmission;
  - TCP/IP access.
- Applications:
  - External application messaging;
  - Fast local messaging;
  - Interpersonal messaging (X.400);
  - Paging.

##### 5.2.1.2.1. Description of the Data services

This subclause describes the teleservices offered by TETRAPOL.

**Broadcast without acknowledgement:** this service shall provide one-way point-to-multipoint data communication without acknowledgement.

**Circuit data service:** this service shall offer a permanent or switched circuit between 2 terminals or between a terminal and a gateway at a standardised data rate.

**Connectionless packet data service:** this service shall transfer a single packet of data from one Base Station to one or more Radio Terminals in a single phase (i.e. without establishing a logical connection or a virtual circuit).

**Connected packet data service:** this service shall offer a X.25 connection between 2 terminals. It shall also offer an X.25 access to an external PDN or to a computer directly linked with the TETRAPOL network.

**External application messaging:** this service shall offer a communication tool for customer-tailored interactive applications between the network terminals and one or several external computers (e.g. database query).

**Fast local messaging:** this service shall provide a fast non-acknowledged message transmission.

**Interpersonal messaging (X.400):** this service shall make it possible for a user to send messages to one or several other users. The message transmission shall be secured in terms of acknowledgement, non delivery and storage. The service shall also allow sending messages to subscribers of non-TETRAPOL networks. In this case the interface with the TETRAPOL networks may offer a X.400 compatible interface with other networks.

**Paging:** this service shall complement local messaging and shall allow sending the same type of messages from Dispatch Positions to classical pagers. From a dispatcher's point of view, paging and internal messaging form a single service.

**Short data messaging:** this message service shall be optimised to be a quick service enabling the user to exchange a short user message.

**Status transmission:** this service shall allow to send or broadcast upward or downward a very short predefined message.

**TCP/IP access:** this service shall permit access to fixed networks (such as Internet) and to the corresponding computers conforming to the TCP/IP protocols.

#### 5.2.1.3. Supplementary Services (SS)

The following Supplementary Services are defined in the present specification:

- Access priority;
- Adaptive area selection;
- Ambience listening;
- Area selection;
- Automatic call-back;
- Call completion to busy subscriber;
- Call barring;
- Call authorised by dispatcher;
- Call forwarding;
- Calling (called) party identification;
- Call-me-back;
- Call transfer;
- Call waiting;
- Direct call watch;
- Discreet listening;
- Digital Tone MultiFrequency (DTMF);
- Dynamic group number assignment;
- Include call;
- Interconnect access;
- Intrusion;
- Late entry;
- Listening restriction;

- List Search Call;
- Pre-emptive priority call;
- Priority call;
- Priority scanning;
- Short number addressing;
- ShortenednNumbering;
- Stroke signal;
- Talking party identification;
- Talk group merging.

#### 5.2.1.3.1. Description of the Supplementary Services

**Access priority:** this supplementary service shall give specified users preferential access to the system in the event of radio link congestion. Preferential treatment shall apply to the uplink access only.

**Adaptive area selection:** this service shall allow the selection area to be a function of the Radio Terminal movement.

**Ambience listening:** this service shall enable a Dispatch Position to place a user equipment into a special type of individual call so that the called terminal is transmitting without any action from or indication to the called user. Ambience listening is set-up only if the called terminal is not already engaged in a call.

**Area selection:** this service shall allow a user to select on a call by call basis a predefined area to be used by the network for call set-up. For a group call or a talk group this means that called users shall not be alerted if they are outside of the selected Area.

**Automatic call-Back:** this service shall allow a calling party (radio or line connected), encountering a busy network, to have the call automatically redialed when the network resource(s) becomes free.

**Call completion to busy subscriber:** this service shall allow a calling party (radio or line connected), encountering a busy called party, to have the call automatically redialed when the called party becomes free (the difference between this service and the call-me-back Service is that call-me-back is not automatic and the called party may or may not return the call).

**Call barring:** this service shall prevent all or certain types of calls or calling identities to be issued or received by a user or a terminal. Barring could also inhibit the use of supplementary services.

**Call authorised by dispatcher:** this service shall provide call set-up mode where calls between third parties have to be authorised by dispatcher. This is a call authorisation service as intercepted by a dispatcher. Concerning telephony access the dispatcher or the operator can intercept either incoming or outgoing calls and grant authority for the call to be completed. The same service can offer interception between terminals.

**Call forwarding:** this service shall enable a call intended for one terminal to be diverted to another terminal (radio or line connected): e.g. call forwarding on busy subscriber, on no reply, unconditional.

**Calling (/Called) party identification:** this service shall make it possible to store and/or to display at terminal level Calling Parties Identities at call set-up.

**Call-me-back:** this service shall enable a calling party to leave his identity to a called party for a subsequent call-back. This voice facility shall operate as a prompt for the party to call back.

**Call transfer:** this service shall enable a user to transfer the ongoing call to another user in the System.

**Call waiting:** this service shall enable a user to be notified of an incoming Voice Call while the terminal is already engaged in another call.

**Dual watch:** this service shall prompt a terminal in the network mode when it is called in Direct Mode.

**Discreet listening:** this supplementary service shall make possible for a Dispatcher to listen to a voice call.

**Digital Tone Multi Frequency (DTMF):** this service shall make possible to transmit DTMF signalling to an external network (PABX, PSTN, ISDN...) from the keypad of a terminal.

**Dynamic Group Number Assignment:** this service shall allow a served user or an authorised user to create, modify and delete a Group (Dynamic regrouping/Group merging).

**Intrusion:** this service shall allows an authorised user to intervene in an ongoing call.

**Include call:** this service shall allow addition of one or more users to an existing communication.

**Interconnect access:** this service shall allow connection to other networks like ISDN, PSTN and PABX.

**Late entry:** this service shall enable the Network to send, during a group communication, late entry indications related to this call, and shall allow latecomer users to join the ongoing call.

**Listening restriction:** this service shall prevent mobiles communicating in a point-to-multipoint call from hearing each other. Only the dispatcher can communicate with them.

**List search call:** this service shall allow a user to define a search list. When providing this service the Network starts sending the message or the call request to the first address in the list. If the call succeeds no further action is taken, otherwise it is sent to the next address in the list. This continues until an acknowledgement is received or until the end of the list is reached.

**Priority call:** this service shall allow a call to proceed before any other call with lower priority. The priority level can be assigned according to various criteria.

**Priority scanning:** a user can belong to several groups. In case of concurrent calls, the terminal can switch automatically to the call.

**Pre-emptive priority call:** this service shall make it possible to release the necessary resources if needed to set up the communication.

**Short number addressing:** this service shall allow a user (radio or line connected) or an operator to define and use short numbers. These may be stored in the network and the necessary address conversion may be done by the network.

**Shortened numbering:** this service shall allow entering only the last digits at call set-up. The lacking digits are implicitly equal to the calling party ones.

**Stroke signal:** this service shall make it possible for the user, simply by depressing a function key on the terminal, to transmit simultaneously a tone received by all users in the same group.

**Talking party identification:** this service shall enable all connected parties of a call/or a dispatcher to be aware of the Talking Party Identity.

### 5.2.2. Applications

The following applications are defined in the present specification:

- Database access;
- Fax;
- File transfer;
- GPS support;
- Still video image.

Applications shall be end-to-end functions, i.e. located in terminals (or gateways), built on the services. The system does not manage the applications.

#### 5.2.2.1. Description

**Database access:** this application gives the possibility to a terminal to consult an external database in a message mode.

**Fax:** this application allows the exchange of faxes between a fax machine connected to a TETRAPOL terminal and:

- a fax device connected to another TETRAPOL terminal;
- a fax device connected to another network (in this case a gateway is provided between the TETRAPOL network and the other network).

**File transfer:** this application allows to transfer files.

**GPS support:** this application makes it possible to collect at a Dispatch Position the data on terminals locations. The terminals are linked with GPS receivers.

**Still video image:** this application allows the exchange of still video images between two devices connected to TETRAPOL terminals.

### 5.2.3. Network procedures

Network procedures are features offered by the network that the user cannot command from the terminals. They are processed automatically or controlled by network managers or dispatchers.

The following network procedures are available:

- Attach-detach;
- Call duration limitation;
- Call re-establishment;
- Call recording;
- Call retention;
- Dynamic regrouping;
- Group merging;
- Migration;
- Presence check;
- Power saving mode;
- Push-to-talk priority;
- Roaming;
- Terminal location registration;
- Transmitter power control;
- User profile management.

#### 5.2.3.1. Description

**Attach-detach:** this procedure shall inform the network when a RT is powered on/off and removes the user identity.

**Call duration limitation:** this procedure shall allow to limit the duration of a call or of a transmission of the talking parties. The limitation may be applicable on a call by call basis or as a general parameter of the network.

**Call re-establishment:** this procedure shall switch a call in progress from one cell (or location area or simulcast area) to another or between radio channels in the same cell.

**Call recording:** this procedure shall record an ongoing call.

**Call retention:** this procedure shall define a relative level of protection of the call (once established) against the probability of having the network resources pre-empted.

**Dynamic regrouping:** this procedure shall enable a Dispatch Position to modify at any time the group composition. Newcomers can join a call as soon as they have received their new group membership (Group downloading).

**Group merging:** this procedure shall give the possibility to a dispatcher to add one or more groups to an established call.

**Migration:** this procedure realises a change of network.

**Presence check:** this procedure shall provide a mechanism to check the presence of the user.

**Power saving mode:** this procedure shall provide a mode whereby the terminal RT is either dormant or active to save battery.

**Push-to-talk priority:** this procedure shall provide some Dispatch Positions with a priority to intervene during a call.

**Roaming:** this procedure shall realise a change of location area within the same network.

**Terminal location registration:** this procedure shall allow Dispatch Positions to collect the location of terminals in terms of cells where they are registered.

**Transmitter power control:** this procedure shall provide a mechanism to control transmitter power of the MS and .

**User profile management:** this procedure shall manage the user access rights and the service parameters.

### 5.2.4. Security procedures

Security procedures have been designed for each mode to counter threats like:

- Control channel tampering;

- Interception of control signals;
- Jamming;
- Masquerading of another TETRAPOL infrastructure;
- Masquerading of another user;
- Replay;
- Reuse of user identity;
- Terminal theft;
- Traffic analysis;
- Unauthorised interception of voice and data signals anywhere in the system.
- Firewall

The following Security procedures are defined in the present specification:

- Detection of Intrusion;
- End-to-end encryption;
- Login/Logout;
- Mutual authentication (network-terminal);
- Secured key management;
- Security fallback Modes;
- Temporary terminal identity generation;
- Terminal disabling;
- Terminals identity control;
- Total inhibition of terminal.

#### 5.2.4.1. Description

**Detection of Intrusion:** access control and reporting of incidents to an operator.

**End-to-end encryption:** encrypted transmission from sender to receiver without intermediate decryption.

**Login/Logout:** pin code procedure executed by the user on the Radio Terminal.

**Mutual authentication (network-terminal):** mutual proof of identity between a System Terminal and the Network, based on confidential elements known only to the other party.

**Secured key management:** encrypted way to record and to transmit keys automatically on the Air Interface (over the air).

**Security fallback modes:** addition of particular procedures in case of technical incident to ensure security function.

**Temporary terminal identity generation:** alias subscriber identity given by the system after registration.

**Terminal disabling:** inhibition of Radio Terminal operation.

**Terminal identity control:** verification of existence and consistency of Radio Terminal parameters.

**Total inhibition of radio terminal:** inhibition and erasure of sensible information in the Radio Terminal.

### 5.3. Repeater Mode

The Repeater Mode shall be based on a single channel/single site repeater (RP).

Definitions of services are similar to those of network mode. If it is not the case a definition is given.

### 5.3.1. Services

#### 5.3.1.1. Voice services

The voice services offered are:

- Emergency call;
- Group call;
- Individual call;
- Talk group.

##### 5.3.1.1.1. Description

Same as subclause 5.2.1.1.1.

#### 5.3.1.2. Data services

The data services offered are:

- Circuit mode;
- Status.

##### 5.3.1.2.1. Description

Same as subclause 5.2.1.2.1.

#### 5.3.1.3. Supplementary services

The supplementary services offered are:

- Ambience listening;
- Call waiting;
- Calling party identification;
- Discreet listening;
- Dual watch;
- Late entry;
- Shortened numbering;
- Stroke signal;
- Talking party identification.

##### 5.3.1.3.1. Description

Definitions given in subclause 5.2.1.3.1. apply as well as the following one:

**Dual Watch**: this service shall make it possible for the user to listen to the TETRAPOL Network when it under network coverage. There are 2 parts in the dual watch service, indication that the terminal is under the coverage of the network, indication that the terminal is called on the network.

### 5.3.2. Applications

The applications offered are:

- Fax;
- GPS support;
- Still video image.

### 5.3.3. Security procedures

The available security procedures are:

- End-to-end encryption;
- Login/Logout;
- Secured key management;
- Manual key selection.

#### 5.3.3.1. Description

Definitions given in subclause 5.2.4.1 apply as well as the following ones:

**Secured key management**: downloading of keys from the Network before Direct Mode call.

**Manual key selection**: manual loading of keys by the user.

## 5.4. Direct mode

### 5.4.1. Services

Definitions of services are generally similar to those of network mode. If it is not the case a definition is given.

#### 5.4.1.1. Voice services

The voice services offered are:

- Emergency call;
- Individual call.

##### 5.4.1.1.1. Description

Emergency call: this service is obtained by depressing a special emergency key.

#### 5.4.1.2. Data services

The data services offered are:

- Circuit mode;
- Status.

##### 5.4.1.2.1. Description

Same as subclause 5.2.1.2.1.

#### 5.4.1.3. Supplementary services

The supplementary services offered are:

- Ambience listening;
- Dual watch;
- Late entry;
- Shortened numbering;
- Stroke signal;
- Talking party identification.

##### 5.4.1.3.1. Description

Definitions given in subclause 5.2.1.3.1 apply as well as the following ones:

**Dual watch**: this service shall make it possible for the user to listen to the TETRAPOL Network when it is under network coverage. There are 2 parts in the dual watch service, indication that the terminal is under the coverage of the network, indication that the terminal is called on the network.

### 5.4.2. Applications

The applications offered are:

- Fax;
- GPS support;
- Still video image.

### 5.4.3. Security procedures

The available security procedures are:

- End-to-end encryption;
- Login/Logout;
- Secured key management;
- Manual key selection.

#### 5.4.3.1. Description

Definitions given in subclause 5.2.4.1 apply as well as the following ones:

**Secured key management**: downloading of keys from the Network before Direct Mode call;

**Manual key selection**: manual loading of keys by the user.

## 6. Speech CODEC

Coding shall be done end-to-end and as a consequence the CODEC shall be only required in the mobile and in the gateway and shall not be necessary in the infrastructure. Combined with self-synchronised end-to-end encryption this allows simpler coding, faster response time and no echo. Since no transcoding is applied for mobile to mobile communication, speech quality is optimised.

Speech shall be digitised at a 6 Kbit/s net rate and is transmitted on an 8 Kbit/s traffic channel.

The speech frame duration of 20 ms corresponds to 120 bits. The coding technique used shall be of the RPCELP type, based on analysis by synthesis code excited approach with Regular Pulse Codes. Channel coding shall be used for protection against transmission errors.

Used in half-duplex mode, the speech CODEC shall not require any specific acoustic processing, like echo cancellation.

The CODEC shall meet the requirements of quality, complexity, delay, documentation and Industrial Property Rights information.

In particular, it shall demonstrate excellent performance under specific operating conditions like:

- noisy environment;
- double talk conditions.

The low complexity of the speech coding algorithm shall allow implementation on a 2 Mips DSP performing radio signal processing at the receiver end.

## 7. ISI

The Inter System Interface (ISI) functional requirements and services are described in PAS 0001-10-1 [31]. The ISI shall allow roaming from one TETRAPOL network to another TETRAPOL network. Interworking with GSM and TETRA as well as existing analog systems like MPT1327 are part of the ISI.

## 8. DC

The Dispatch Center (DC) functional requirements and services are described in PAS 0001-5-1 [26].

## 9. NMC

The Network Management Center (NMC) functional requirements and services are described in PAS 0001-12-1 [33].

## 10. Radio main characteristics

The TETRAPOL access mode is FDMA and the modulation used is GMSK (BT = 0,25), 8 Kbits/s.

The frequency band is below 1 GHz with a duplex separation of 10 MHz in 400 MHz.

The RF carrier spacing shall consist of 12,5 or 10 kHz version with a possible 6,25 kHz extension. Frames are organised in superframes, the radio is described in detail in document referenced PAS 0001-2 [23].

TETRAPOL complies to ETS 300-113 [31]

## 11. EMC

TETRAPOL complies to applicable EMC tests, test methods, limits and minimum performance criteria for Private Land Mobile Radio equipment and the associated ancillary equipment as defined in ETS 300-279 [43].

TETRAPOL radio equipments also comply to electrical security and persons as defined in document referenced [45].

TETRAPOL non radio equipments like LCT , SADP conform to generic norms as defined in documents referenced [46] and [47].

## History

| Document history | | |
|---|---|---|
| **Date** | **Status** | **Comment** |
| 20 May 1995 | Approved version | Version 1.0.0 |
| 26 September 1995 | Clarification on SADP reference points<br>Inter RSW interface added<br>OMC add on figures | Version 1.0.1 |
| 31 October 1995 | Corrections following review | Version 1.0.2 |
| 14 November 1995 | Details on phase | Version 1.0.3 |
| 4 December 1995 | SIM reference point added<br>Figures 4 and 5 merge | Version 1.0.4 |
| 12 December 1995 | Formal modifications | Version 1.0.5 |
| 27 December 1995 | Page-setting | Version 1.0.6 |
| 7 March 1996 | ISI, SNMP, NDIS stacks added. Content of phase 1 detailed. Data protocols expanded. Reference point R9 suppressed. UDT added on LCT. Internal architecture of DP suppressed. | Version 1.0.7 |
| 25 March 1996 | Update following review | Version 1.1.0 |
| 30 April 1996 | Tetrapol forum approval | Version 2.0.0 |
| 04 June 1996 | Editorial changes<br>ISI and Dispatch services added<br>Phase 1, 2, 3 content added | Version 2.0.1 |
| 25 June 1996 | Editorial changes<br>Introduction of KMC interface<br>Review of phases content | Version 2.0.2 |
| 15 July 1996 | Update following review<br>DC interfaces clarified.<br>Phase content moved in a separate document. | Version 2.1.0 |
| 31 July 1996 | Tetrapol forum approval | Version 3.0.0 |
| 16 December 1996 | Precisions on LABS, RBS and RSW | Version 3.0.1 |
| 30 January 1997 | EMC compliance added | Version 3.0.2 |

| Document history | | |
|---|---|---|
| **Date** | **Status** | **Comment** |
| 19 May 1998 | Precisions given on definitions | Version 3.0.3 |
| 10 November 1999 | Reference points added | Version 3.0.4 |