

Specification Number DPNSS [188] — Digital Private Network Signalling System No 1

ICS 33.040.30

National foreword

This Published Document has been prepared by Technical Committee TCT/50. It defines a signalling system (DPNSS 1) for use between switching nodes (e.g. PBXs) in digital private networks. To facilitate understanding it is written generally in terms of a conventional voice network, but in practice it is not restricted to this application. Most Supplementary Services, for example, are applicable to both voice and data. Other fields of application include Centrex and Virtual Private Networks (VPNs).

This Published Document has been produced with place markers for some sections, not yet available, which will be issued as amendments to this Published Document when they become available.

This Published Document is not to be regarded as a British Standard

Summary of pages

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SPECIFICATION NUMBER DPNSS[188]

DIGITAL PRIVATE NETWORK SIGNALLING SYSTEM No 1

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DIGITAL PRIVATE NETWORK SIGNALLING SYSTEM NO 1 (DPNSS 1)

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HISTORY

Issue 1 - May 1983
Issue 2 - February 1984
Issue 3 - September 1984
Issue 4 - March 1986
Issue 5 - December 1989
Issue 6 - January 1995

Issue 7 - March 2001 - Responsibility for the DPNSS 1
Specification transferred from
British Telecommunications to NICC
- Specification renamed as DPNSS[188]
- References changed
- Revised FOREWORD
- Revised TABLE OF CONTENTS
- Revised OVERALL COMPLIANCE Subsection

1 FOREWORD

This specification defines a signalling system (DPNSS 1) for use between switching nodes (eg PBXs) in digital private networks. To facilitate understanding it is written generally in terms of a conventional voice network, but in practice it is not restricted to this application. Most Supplementary Services, for example, are applicable to both voice and data. Other fields of application include Centrex and Virtual Private Networks (VPNs).

THIS SPECIFICATION DOES NOT CONCERN ITSELF WITH HOW A PBX INTERFACES WITH A TELEPHONE EXTENSION OR DATA TERMINAL OR THE USE TO WHICH A TRAFFIC CHANNEL IS PUT ONCE A CONNECTION HAS BEEN ESTABLISHED AND ANSWERED.

For a PBX to be accepted as supporting the Digital Private Network Signalling System No 1 (Issue 7) it shall, as a minimum, conform to the requirements of SECTIONS 0 to 5 and at least one of the two SECTIONS 6 and 7 of this issue of the specification.

In the same way that a customer may specify a subset of the total Supplementary Service capability of an individual PBX he may specify a subset of the capabilities of DPNSS 1 for the whole private network.

The specification of the requirements for DPNSS 1 is more complex than for an individual PBX because it embraces the choice both of the range of Supplementary Services and of the roles to be played by each PBX in the network. It may also involve more than one PBX supplier.

As an aid to understanding the services, SECTIONS 6 and above of DPNSS[188] each describe a service in terms of a complete network with each PBX in that network performing one or more specific functions, ie Transit, End or Branching.

In a given network it may not be necessary for every PBX to provide all of the functions in order for the network as a whole to support the required Supplementary Services, eg PBXs that perform only Transit functions need not provide the End function requirements specified in the service.

When a PBX supports a Supplementary Service the extent to which extensions on that PBX can access the service is a matter for negotiation between the purchaser and PBX supplier. However, in order to preserve the capabilities of PBXs to interwork in a DPNSS 1 private network, each PBX which claims to provide a given DPNSS 1 Supplementary Service in the network must meet a minimum requirement. This minimum requirement is that the PBX must be able to co-operate successfully with other PBXs in the network which invoke that service in accordance with the procedures of the appropriate SECTION of this specification.

Where optional Supplementary Services are offered, these must conform, either with the appropriate SECTIONS from this issue of the specification, or with the appropriate SECTIONS from other issues of the specification. In each case, it should be ensured that the Supplementary Service offered is compatible with the mandatory SECTIONS with which the PBX complies.

The purchaser must take care that PBX requirements are specified in such a way as to achieve an acceptable compromise between imposing constraints on the Supplementary Service potential of the network and purchasing redundant capability. In order to assist in this process and provide a consistent method of specification, each SECTION of the specification contains a Subsection on Compliance. These Subsections provide forms of compliance-statement which identify the choices available within a service. These compliance-statements can be used by a customer when specifying PBX requirements or by a manufacturer when stating PBX capability.

Whilst the compliance-statements can be used by a manufacturer to provide a generalised list of all possible capabilities on a particular type of PBX, a customer must ensure that a separate statement is prepared of the requirements for each PBX in the private network.

Where a PBX is required to provide more than one function, eg Transit and End, the compliance-statements should be completed for each function.

As a further aid to specification of requirements, Subsection 5 of this Section contains an overall compliance sheet for a PBX "total offering". An entry in TABLE 1 of Subsection 5 for a particular PBX function indicates that the PBX complies with at least one of the entries in TABLE 1 of the corresponding SECTION Compliance Statement for that function.

2 TERMINOLOGY

Throughout this specification, the term "PBX" is used to indicate a "switching node" on the network. Generally, this term is used to mean a Private Branch Exchange, but can mean Centrex, VPN or other types of equipment including those which have no telephone terminations (eg a Transit exchange, a data switch or a multiplexer).

Similarly, throughout this specification the term "Extension" is used to indicate an originating or terminating process for a call through the network. Generally, this term is used to mean a telephone instrument and its associated PBX hardware and software, but can mean other types of termination, eg a data terminal and associated PBX hardware and software or, in the case of services such as Remote Alarm Reporting (SECTION 28) and Time Synchronisation (SECTION 30), some form of internal PBX process.

Terms which have a special meaning in this specification are identified by the use of initial capitals (eg "Virtual Call") and

are normally defined in the Glossary of Terms SECTION 1, Subsection 5.

The signalling messages and their component parts are often referred to by mnemonics; these also appear in the glossary but are more fully defined, together with their coding, in SECTION 4.

3 NETWORK MANAGEMENT

Supplementary Services associated with network management facilities described in this document involve the exchange of small amounts of data between PBXs, eg Remote Alarm Reporting (SECTION 28), and in such cases the data is carried in the Signalling Channel and its format is specified in this specification.

Network management facilities involving potentially large amounts of data, eg remote maintenance and remote monitoring are not currently specified in this specification. However, this does not preclude the provision of such features in a DPNSS 1 network since the Circuit-Switched Data Call (see SECTION 7) permits a data connection to be established over circuit-switched Traffic Channels which could be used to interconnect network management entities. The specification of the format of data carried in this way is outside the scope of this specification.

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5 OVERALL COMPLIANCE SHEET FOR A PBX OFFERING SUPPLEMENTARY SERVICES

Compliance with SECTIONS 0 to 7 shall be to the same "GLOBAL" Issue of this specification. Piecemeal compliance with these Sections where one or more Sections are from different "GLOBAL" issues of this specification is not allowed.

In the case of Supplementary Services, however, these can be selected from different Global Issues of this specification subject to any restrictions listed in the individual Section Compliance Statements.

NOTE 1: A PBX shall comply with SECTIONS 0-5.

NOTE 2: A PBX shall, in addition, comply with i) or ii) or iii) below:

- i) SECTION 6
- ii) SECTION 7
- iii) SECTION 6 and SECTION 7

TABLE 1

SECTIONS	FUNCTION NOTE: see Individual SECTION Compliance for additional details.		DPNSS[188] GLOBAL ISSUE NUMBER WITH WHICH THE PBX COMPLIES
	END	TRANSIT ONLY	
0 FOREWORD & CONTENTS			NOTE 1
1 GENERAL			
2 PHYSICAL CHARACTERISTICS			
3 DATA-LINK LAYER (LEVEL 2)			
4 MESSAGE TYPES AND FORMATS			
5 LEVEL 3 SIGNALLING PROCEDURES			
6 SIMPLE TELEPHONY CALL			NOTE 2
7 CIRCUIT-SWITCHED DATA CALL			NOTE 2

SECTIONS	FUNCTION NOTE: see Individual SECTION Compliance for additional details.		DPNSS[188] GLOBAL ISSUE NUMBER WITH WHICH THE PBX COMPLIES
	END	TRANSIT ONLY	
8 SWAP			
9 CALL BACK WHEN FREE			
10 EXECUTIVE INTRUSION			
11.1 DIVERSION - IMMEDIATE			
11.2 DIVERSION - ON BUSY			
11.3 DIVERSION - ON NO REPLY			
12 HOLD			
13 THREE PARTY			
14 CALL OFFER			
15 NON-SPECIFIED INFORMATION			
16 SERVICE-INDEPENDENT STRINGS			
17 CALL WAITING			
18.1 BEARER-SERVICE SELECTION - MANDATORY			
18.2 BEARER-SERVICE SELECTION - PREFERRED			

SECTIONS	FUNCTION NOTE: see Individual SECTION Compliance for additional details.		DPNSS[188] GLOBAL ISSUE NUMBER WITH WHICH THE PBX COMPLIES
	END	TRANSIT ONLY	
18.3 BEARER-SERVICE SELECTION - NOTIFICATION			
19 ROUTE OPTIMISATION			
20 EXTENSION STATUS			
21 CONTROLLED DIVERSION			
22 REDIRECTION			
23 SERIES CALL			
24 THREE-PARTY TAKEOVER			
25 NIGHT SERVICE			
26 CENTRALISED OPERATOR			
27 TRAFFIC-CHANNEL MAINTENANCE		NA	
28 REMOTE-ALARM REPORTING			
29 ADD-ON CONFERENCE			
30 TIME SYNCHRONISATION			
31 CALL BACK WHEN NEXT USED			
32 DO NOT DISTURB			

SECTIONS	FUNCTION NOTE: see Individual SECTION Compliance for additional details.		DPNSS[188] GLOBAL ISSUE NUMBER WITH WHICH THE PBX COMPLIES
	END	TRANSIT ONLY	
33 REMOTE REGISTRATION OF DIVERSION			
34 REMOTE REGISTRATION DO NOT DISTURB			
35 PRIORITY BREAKDOWN			
36 CALL-BACK MESSAGING			
37 LOOP AVOIDANCE			
38 FORCED RELEASE			
39 TEXT MESSAGE			
40 CHARGE REPORTING			
41 NETWORK-ADDRESS EXTENSION			
42 CALL PARK			
43 CALL DISTRIBUTION			
44 ROUTE CAPACITY CONTROL			
45 WAIT ON BUSY			
46 CALL PICK-UP			
47 TRAVELLING CLASS OF SERVICE			



SECTIONS	FUNCTION NOTE: see Individual SECTION Compliance for additional details.		DPNSS[188] GLOBAL ISSUE NUMBER WITH WHICH THE PBX COMPLIES
	END	TRANSIT ONLY	
48 NUMBER PRESENTATION RESTRICTION			
49 NON SPECIFIED INFORMATION MESSAGE			

6 HISTORY OF DPNSS[188]

NOTE: From Issue 1 to Issue 6 this specification was known as BTNR 188.

Issue 1 - May 1983

Issue 2 - February 1984 - SECTIONS 0-11 made Issue 2,
 - SECTIONS 12-18 Issued.

Issue 3 - September 1984 - SECTIONS 0-11 made Issue 3,
 - SECTION 16 deleted,
 - SECTIONS 12-18 made Issue 2,
 - SECTIONS 19-26 Issued,
 - The document issued in 2 Volumes.

Issue 3.1 - August 1985 - Corrigenda to Volume 1 added,
 - Corrigenda to Volume 2 added.

Issue 4 - March 1986 - SECTIONS 0-11 made Issue 4,
 - SECTIONS 12-18 (except 16) made
 Issue 3,
 - SECTION 16 reissued as new service,
 - SECTIONS 19-26 made Issue 2,
 - SECTIONS 27-39 Issued,
 - The document issued in 3 Volumes.

Issue 5 - December 1989 - SECTIONS 0-11 made Issue 5,
 - SECTIONS 12-18 (except 16) made
 Issue 4,
 - SECTION 16 made Issue 3,
 - SECTIONS 19-26 made Issue 3,
 - SECTIONS 27-39 made Issue 2,
 - SECTIONS 40-43 Issued,
 - The document issued in 5 Volumes.

- Issue 5.1 - December 1993
- Corrigenda added to Issue 5,
 - SECTIONS 6 and 31 reissued,
 - Minor amendments to the text of:
SECTIONS 1-6; 8-11; 13, 16, 21, 22,
27, 31, 33, 37, and the SDL of:
SECTIONS 6 and 7.
- Issue 6 - January 1995
- Addenda added to Issue 5.1,
 - SECTIONS 0, 1, 4, and 5 updated,
 - SECTIONS 6, 22, and 33 optional
functionality added,
 - SECTION 16 new Strings added,
 - SECTION 18 revised Compliance
Tables,
 - New SECTIONS 44 - 48 added.
- Issue 7 - March 2001
- Specification renamed as DPNSS[188],
 - References updated,
 - Volume 5 discontinued,
 - New SECTION 4, ANNEX 7 added,
 - New SECTION 49 added,
 - Specific changes made to the
following SECTIONS:
 - SECTION 4
 - SECTION 4, ANNEX 2
 - SECTION 4, ANNEX 5
 - SECTION 5
 - SECTION 5, ANNEX 2
 - SECTION 5, ANNEX 3
 - SECTION 5, ANNEX 4
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 - SECTION 32
 - SECTION 36
 - SECTION 46.

7 REFERENCES

DPNSS[189], DPNSS[189-I], BTNR 190;

CCITT Recommendations (Individual Sections contain references to specific Recommendations);

CEPT Services and Facilities Handbook 1981, Section III PABX;

ISO Standard 2110 - 1980;

Standard ECMA 102;

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British Standard BS 5249/1 )
                             ) Presentation of Time and Date.
ISO Standard ISO3307/1975  )

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DIGITAL PRIVATE NETWORK SIGNALLING SYSTEM NO 1 (DPNSS 1)

SECTION 1 - GENERAL

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HISTORY

Issue 1 - May 1983
Issue 2 - February 1984
Issue 3 - September 1984
Issue 4 - March 1986
Issue 5 - December 1989
Issue 6 - January 1995

Issue 7 - March 2001 - Specification renamed as DPNSS[188]
- New items added to the Glossary

REFERENCES

DPNSS[189], DPNSS[189-I]
CEPT Services and Facilities Handbook SF2

1 GENERAL

1.1 The signalling requirements of the Digital Private Network Signalling System No 1 (DPNSS 1) are detailed in this specification.

This Section gives general information on the scope, the principles and fields of application and outlines the operation of DPNSS 1. Detailed requirements are given in subsequent Sections of this specification.

1.2 DPNSS 1 extends facilities normally only available between extensions on a single PBX to all extensions on PBXs that are connected together in a private network.

1.3 Signalling for a sophisticated range of facilities for Telephony and Circuit-Switched Data Communications is specified in a manner compatible with Public ISDNs.

1.4 DPNSS 1 is a common-channel signalling system and is primarily intended for use between PBXs in private networks via time-slot 16 of a 2048 kbit/s digital transmission system. Similarly it may be used in time-slot 24 of a 1.544 kbit/s digital transmission system.

It may also be used, however, in conjunction with a suitable modem or terminating equipment, via any analogue or digital transmission path which is dedicated to signalling. Note that such a signalling path may be either, physically separate from the traffic channels, or within the same tdm or fdm assembly that carries the traffic channels.

1.5 The successful operation of PBXs in a private network requires compatibility not only of signalling but also of other aspects, such as:

- Transmission
- Numbering plans
- Modems

This specification does not specify all other aspects; a customer planning to set up a private network using DPNSS 1 must satisfy himself that the components of the network are compatible in all aspects.

NOTE: Care should be taken when configuring a network to ensure that the regulations applicable in the country concerned are observed, eg regarding connection of inter-PBX circuits to the PSTN or ISDN.

1.6 The specification of DPNSS 1 is in terms of the International Organisation for Standardisation (ISO) Reference Model for Open Systems Interconnection (OSI), see FIGURE 1.

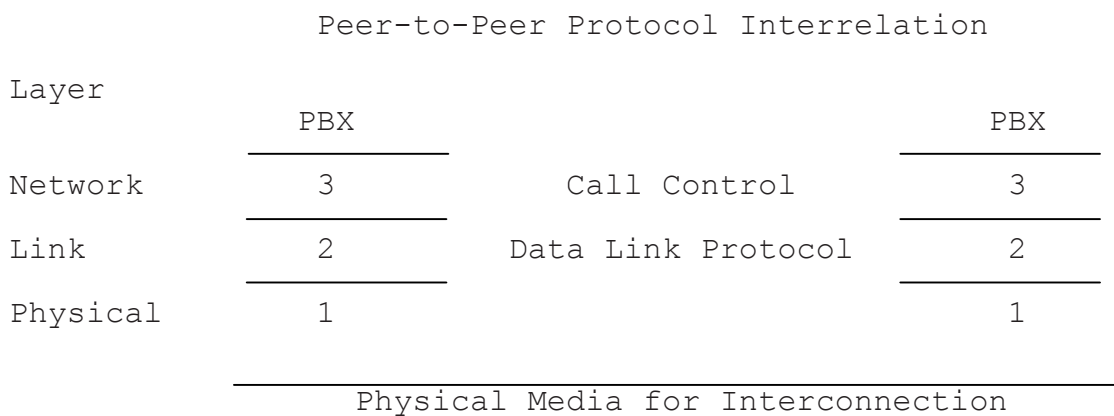


FIGURE 1: ISO REFERENCE MODEL

Using this model, signalling is effected between the inter-connected PBXs by a combination of peer layer protocols and interactions between adjacent layers.

1.7 For the purpose of this specification, Layers 1, 2 and 3 of the ISO reference model are referred to as Levels 1, 2 and 3, respectively.

1.8 Within this specification a DPNSS 1 PBX is considered to comprise a number of interacting processes. A block schematic diagram of a PBX showing the relationship between these processes is shown in FIGURE 2. Each process is specified in detail in subsequent Sections of this specification as referenced on the diagram.

FIGURE 2 is for explanation and overall functional specification only and is not intended to show the required method of realising a DPNSS 1 PBX. However, overall functional equivalence to FIGURE 2 must be achieved.

1.9 Within this specification the description is given in the form of text and Message Sequence Diagrams (MSDs). Some aspects of the specification are also described using SDL diagrams.

NOTE: The textual description and MSDs represent the definitive specification; the SDL diagrams, where provided, are only for the purpose of assisting in the understanding of the text.

MSDs are not produced for all aspects of DPNSS 1 (eg interactions between Supplementary Services are covered only by text).

1.10 This specification is structured such that SECTIONS 2 to 5 specify the essential core of the system and the procedures that are common to all of the services it supports.

SECTIONS above 5 specify individual services.

SECTION 6 details the Simple Telephony Call.

SECTION 7 details the Circuit-Switched Data Call.

To claim compliance with DPNSS 1, a PBX must support SECTIONS 0 to 5 plus at least one of SECTIONS 6 and 7.

SECTIONS 8 and above specify the signalling for the Supplementary Services that make up the network facilities of DPNSS 1. The provision of these Supplementary Services is optional and depends upon agreement between the purchaser and the PBX supplier.

SECTION 16 specifies a number of Service-Independent Strings which may optionally be used with simple calls (SECTION 6 and SECTION 7) or Supplementary Services (SECTIONS 8 and above).

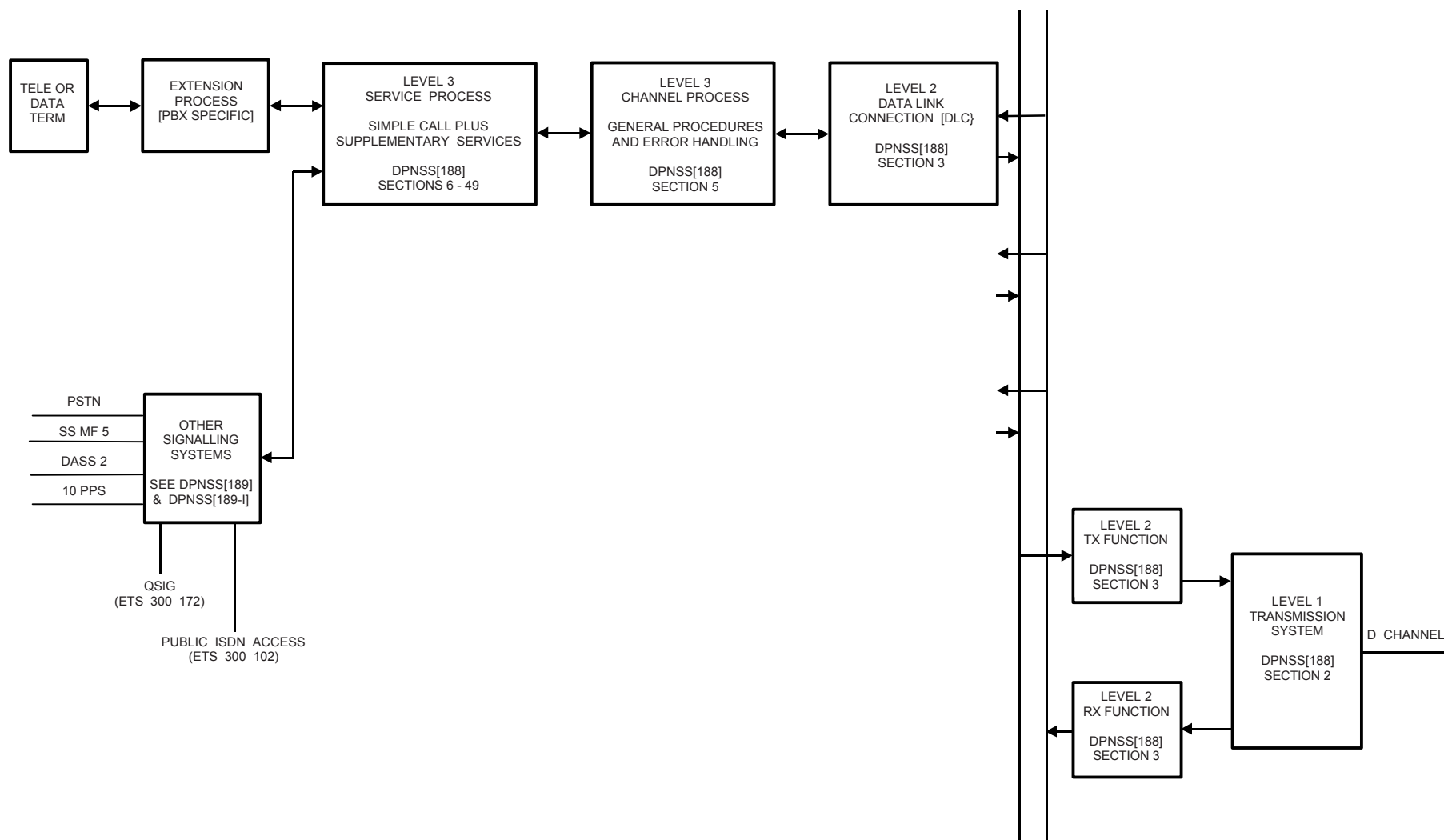


FIGURE 2: BLOCK SCHEMATIC OF MAIN PROCESSES IN A DPNSS 1 PBX

2 PRINCIPLES AND FIELDS OF APPLICATION

2.1 DPNSS 1 was originally derived from British Telecom's Digital Access Signalling System No 1 (DASS 1) enhanced where necessary to meet the Private Network Requirements. Some of these enhancements have been incorporated in DASS 2.

2.2 The services and procedures specified in this specification are based on the definitions and requirements given in CEPT/SF2 "Handbook on Services and Facilities" Section III, where applicable.

2.3 PBX-to-PBX call control signals are sent in the form of variable-length messages (Level 3), conveyed within the Information Field of HDLC type frames (Level 2).

2.4 The signalling information flows (Level 3), defined in this specification are intended to be suitable for transport in any message transfer part (Level 2). However, it is mandatory to support at least the DPNSS 1 Data Link Layer which is detailed in SECTION 3 of this specification.

2.5 At Level 3 DPNSS 1 includes a number of error-handling procedures to enable evolution of the system and to ensure that new services can be added with minimum retrospective impact on other PBXs in the network.

These error-handling features are detailed in SECTION 5 of this specification.

3 OUTLINE OF OPERATION

3.1 DPNSS 1 provides the signalling capability to establish simple telephony and data calls plus a wide range of Supplementary Services.

3.2 The range of Supplementary Services provided by a PBX is optional and depends upon customer requirements. PBXs of differing capabilities will be encountered and the procedures specified in this specification take this into account.

3.3 DPNSS 1 is capable of interworking, via a Gateway PBX, with the following signalling systems:

Private Network

- SSAC15
 - SSDC5
 - SSDC10
- } Decadic Signalling - Simple Call only
- SSMF5 - Supplementary Services to SSMF5 capability
 - QSIG - Basic Call to ETS 300 172 (1992)

Public Network

- Loop Disconnect (PSTN)
- DASS 2 (UK ISDN)
- Public ISDN Access - Basic Call to ETS 300 102-1 (1990)

Interworking details are given in DPNSS[189] and DPNSS[189-I].

NOTE: The fact that a signalling system is not listed here does not imply that an interworking facility cannot be achieved with that signalling system. Similarly, the fact that interworking with a supplementary service in another signalling system is not described within DPNSS[189] or DPNSS[189-I] does not mean that interworking with that supplementary service is not possible.

3.4 Signals are conveyed between PBXs within addressed messages. DPNSS 1 works on a link by link basis with each message being passed to the adjacent PBX, which either acts upon it or repeats it to the next PBX dependent upon the message type and content.

3.5 The message types, formats and contents are detailed in SECTION 4 of this specification.

3.6 A connection may be established between two PBXs for:

- a simple telephony or data call
- a Supplementary Service
- passing supplementary information

The procedure for all of the above is essentially the same although with some Supplementary Services the connection may involve signalling only, ie a Virtual Call.

3.7 A principle of DPNSS 1 is to gain maximum utilisation of the inter-PBX channels by holding a connection for the shortest possible time; to this end, Simple Calls encountering busy, etc, and certain Supplementary Service Requests are immediately released by a backward-clearing message.

The clearing message may contain the state of destination and, if appropriate, an acknowledgement to a Supplementary Service signal and, if necessary, additional supplementary information.

3.8 Detailed signalling procedures are given in SECTION 5 and subsequent Sections to this specification. The following paragraphs give a brief outline of call establishment.

3.8.1 A call is initiated by the Originating PBX sending to the adjacent PBX a message containing the following:

- type of service required eg telephony or data;
- data rate and adaptation method if appropriate;
- Calling Line Category (CLC) eg ordinary extension, operator, PSTN, etc;
- the Originating Line Identity, if available, eg, extension number;
- a Supplementary Service Request or information, if appropriate, and,
- the required Destination Address.

3.8.2 On receipt of this message, the responding PBX either:

- routes the call to an extension within the PBX (see paragraph 3.8.3) or,
- routes the call to the next PBX and repeats the message, modified as necessary.

If the required outgoing route is not DPNSS 1 the Gateway PBX must provide the conversion between the different signalling systems (see DPNSS[189] and DPNSS[189-I]).

3.8.3 On receipt of the call establishment message the Terminating PBX will check the calling and called terminals for compatibility and the state of the called terminal.

If the call is unacceptable or if the called party is busy, out-of-service, etc, the connection will be released by the Terminating PBX sending a backward-clearing message.

This message will contain a signal indicating the reason for clearing.

If the incoming call can be accepted, an acknowledgement message is sent by the Terminating PBX and repeated by each Transit PBX back to the Originating PBX. The connection will be maintained awaiting further signalling.

The acknowledgement message will contain the following information:

- Called Line Category, eg ordinary extension, PSTN encountered, etc;
- the Called Line Identity, if available;
- the State of Destination eg, busy, free, if known, and,

- a Supplementary Service Request or supplementary information, if appropriate.

3.8.4 When the called terminal is answered, the Terminating PBX sends a Call Connected Message (Answer) which is repeated by each Transit PBX, back to the Originating PBX.

3.8.5 A Recall Message is provided to enable Supplementary Service Requests that require a second call via the existing channel to be made during an established call.

This message may be used in either the forward or the backward direction. In the forward direction, the recall may be used both before and after answer.

3.8.6 An End-to-End Message is provided to enable Supplementary Service signalling between the Originating and Terminating PBXs.

Intermediate Transit PBXs repeat the message without acting upon it.

A Link-by-Link Message is provided to enable supplementary signalling between adjacent PBXs.

3.8.7 At the end of the call the connection is released by an interchange of clearing messages. Clearing can be initiated from either end. The call is released on a link by link basis.

4 DPNSS 1 NETWORK STRUCTURE

A DPNSS 1 network comprises a number of "Nodes" interconnected by DPNSS 1 signalling links with some Nodes giving access to a number of different types of non-DPNSS 1 interfaces. These non-DPNSS 1 interfaces are considered to be "Users" of the DPNSS 1 network and are differentiated by category, eg, Ordinary Extension, Operator, PSTN, etc.

DPNSS 1 Nodes can be either PBXs within a Private Network or Public Exchanges that provide Business Communications Network capability in the form of Virtual Private Networks (VPN) and Centrex.

This Subsection identifies and describes the different types of Node and the different User categories.

4.1 PBX APPLICATION

Within a Private Network, PBXs perform a number of different roles. For the purpose of this specification, PBXs are considered to provide one, some or all of the following Functions:

4.1.1 Transit Function

The Transit function supports the interconnection of a call between two DPNSS 1 channels. The call may be the initial call set-up via new channels or, in the case of certain Supplementary Services, a new call over a channel that is already in use. The Transit function also supports the interconnection of two DPNSS 1 Virtual Channels.

4.1.2 End Function

The End function supports the interconnection of a DPNSS 1 channel to a "DPNSS USER" eg, an extension telephone, a non-voice terminal, a route to another signalling system, or a conference bridge.

The End function is provided by:

- an Originating PBX
- a Gateway PBX from another signalling system
- a Gateway PBX to another signalling system
- a Terminating PBX
- a Conference PBX

4.1.3 Branching Function

Some Supplementary Services result in a new call that is related to an existing call. In such a case, the new call may share channels on none, on some or on all of its path from its Originating PBX with an existing call. The Branching Function exists at the point where the two calls diverge and may occur at an Originating, a Terminating or a Transit PBX. As far as each call is concerned, the Branching Function is always accompanied by either an End or a Transit function.

4.2 PUBLIC EXCHANGE APPLICATION

4.2.1 Virtual Private Network (VPN)

The requirements of a VPN are detailed in appropriate public network specifications. In general, a VPN will conform to the Transit requirements of this specification, although, in many cases a greater degree of transparency to DPNSS 1 messages and their contents may be provided.

4.2.2 Centrex

When a Centrex Node forms part of a "Hybrid" DPNSS 1 private network, it shall behave as a DPNSS 1 End PBX.

5 GLOSSARY OF TERMS

5.1 INTRODUCTION

The purpose of this Subsection is to bring together, for reference, all of the mnemonics used in connection with DPNSS 1 signalling. Also included, for clarification and in order to remove any ambiguity in their interpretation, are definitions of some terms.

It should be of benefit to the newcomer in this field, and also to those who are extending the signalling system further and who wish to check on previously used mnemonics.

5.2 ALPHABETICAL LISTING OF THE GLOSSARY

10 pps	Decadic Signalling (DEC) at 10 pulses per second.
A10	SSMF5 Signal "A-10"
A12	SSMF5 Signal "A-12"
A13	SSMF5 Signal "A-13"
A14	SSMF5 Signal "A-14"
A2	SSMF5 Signal "A-2"
A5	SSMF5 Signal "A-5"
A7	SSMF5 Signal "A-7"
A8	SSMF5 Signal "A-8"
AC	Add-On Conference
-CBI	-Conference Bridge Identity
-CDC	-Clear Down Conference
-DR	-Details Request
-NAO	-No Add-On Currently Available
-PD	-Party Details
-PI	-Party Index
ACK	Acknowledgement
ACT	Activate
AD	Add-On
-O	-Added-On
-RQ	-Request
-V	-Validation
ADPCM	Adaptive Differential Pulse Code Modulation
AIS	Alarm Indication Signal
ARC	Auxiliary Route Restriction Class
AS	Alarm Status
-R	-Request
ASST-INFO	Assistance Information
AUTO-A	Autoanswer

B Channel	see Traffic Channel
BAS	Basic SSMF5
BBC	Back-Busy Control (see MA)
BEL	"Bell" IA5 character
BSS	Bearer-Service Selection
-M	-Mandatory
-N	-Notification
-P	-Preferred
BT	British Telecommunications plc trading name
BY-INFO	Busy Information (now Service Information SERV)
CA	Call Arrival Message
CAM	Call Accept Message
CAN	"Cancel" IA5 Character
CAUSE	(Clearing) Cause
CBC	Call Back Complete
CBM	Call Back Messaging
-C	-Cancel
-CSU	-Call Set-Up
-R	-Request
CBWF	Call Back When Free
-C	-Cancel Request
-CB	-Call Back Request
-CLB	-Call Back Call
-CSUD	-Call Set Up Delayed
-CSUI	-Call Set Up Immediate
-FN	-Free Notification
-R	-Request
CBWNU	Call Back When Next Used
-R	-Request
CC	Clearing Cause
-AB	-Access Barred
-ACK	-Acknowledgement
-AI	-Address Incomplete
-BY	-Busy
-CHOS	-Channel Out of Service
-CNR	-DTE Controlled Not Ready
-CON	-Congestion
-CT	-Call Termination
-FNR	-Facility Not Registered
-ICB	-Incoming Calls Barred
-INC	-Service Incompatible
-MNU	-Message Not Understood
-NAE-E	-NAE-Error
-NT	-Network Termination
-NU	-Number Unobtainable
-PFR	-Priority Force Release
-REJ	-Reject
-ROS	-Route Out of Service
-SCT	-Subscriber Call Termination
-SI	-Subscriber Incompatible



CC (Continued)	
-SNU	-Signal Not Understood
-SNV	-Signal Not Valid
-SOS	-Subscriber Out Of Service
-SSI	-Signalling System Incompatible
-STU	-Service Temporarily Unavailable
-SU	-Service Unavailable
-TRFD	-Transferred
-UNR	-DTE Uncontrolled Not Ready
CCF	Clear Confirmation Message
CCI	Call Charge Information
CCITT	The International Telegraph and Telephone Consultative Committee
CCM	Call Connected Message
CD	Call Distribution
-CSU	-Call Set Up
-DNQ	-Do Not Queue
-FN	-Free Notify
-LINK	-Linked
-Q	-Queue
-UNLINK	-Unlinked
CDIV	Controlled Diversion
CEPT	European Conference of Postal and Telecommunications Administrations
CH	Charge Reporting
-AC	-Account Code
-ACR	-Account Code Request
-ACT	-Active
-CLR	-Clear
-CR	-Cost Request
-CST	-Cost
-TR	-Time Rate
-UR	-Unit Rate
-UU	-Units Used
CHID	Channel Identity
CIM	Clear Indication Message
CLC	Calling/Called Line Category
-DASS2	-Digital Access Signalling System No 2 (now renamed CLC-ISDN)
-DEC	-Decadic
-ISDN	-Public ISDN (including DASS 2)
-MF5	-Signalling System Multifrequency No 5
-NET	-Network
-OP	-Operator
-ORD	-Ordinary extension
-PSTN	-Public Switched Telephone Network
CLI	Called Line Identity (Network Identity)
CO	Call Offer
COC	Connected Call
COS	Class of Service
CP	Call Proceeding
CRM	Clear Request Message
CS	Channel Seized

CUG	Closed User Group
CW	Call Waiting
D Channel	see Signalling Channel
D+AR	Data Rate and Adaptation method
D-SIC	DASS 2-SIC
DA	Destination Address
DASS 1	Digital Access Signalling System No 1
DASS 2	Digital Access Signalling System No 2
DC(1->4)	"Device Control" IA5 character
DCE	Data Communications Equipment
DDI	Direct Dialling In
DEACT	Deactivate
DEC	Decadic Signalling - a signalling system based on elements representing the decimal digits 0 to 9 (eg 10 pps dialling)
Decadic Signalling	see "DEC"
DEL	"Delete" IA5 character
DI	Device Identity
DIV	Diversion
-BY	-Bypass
-CA	-Cancellation All
-CB	-Cancellation on Busy
-CI	-Cancellation Immediate
-CR	-Cancellation on Ring Tone No Reply
-FM	-Follow Me
-RCA	-Remote Cancel All
-RCB	-Remote Cancel Busy
-RCC	-Remote Cancel Combined
-RCI	-Remote Cancel Immediate
-RCR	-Remote Cancel No Reply
-RSB	-Remote Set Busy
-RSC	-Remote Set Combined
-RSI	-Remote Set Immediate
-RSR	-Remote Set No Reply
-V	-Validation
DLC	Data Link Connection
DND	Do Not Disturb
-C	Clear
-O	Override
-S	Set
DPNSS 1	Digital Private Network Signalling System No 1
DPU-R	Directed Call Pick-Up - Request
DRS	Direct Route Select
DTE	Data Terminal Equipment

DVD	Diverted
-B	-On Busy
-E	-Externally
-I	-Immediate
-R	-On Ring Tone No Reply
DVG	Diverting
-B	-On Busy
-I	-Immediate
-R	-On Ring Tone No Reply
DVL	Diversion - Last Controlling Extension Identity
DVT	Divert
-B	-On Busy
-CF	-On Call Failure
-I	-Immediate
-I/B	-Immediate or On Busy
-R	-On Ring Tone No Reply
-RD	-Redirection
ECMA	European Computer Manufacturers Association
EEM(C)	End to End Message (Complete)
EEM(I)	End to End Message (Incomplete)
EI	Executive Intrusion
-C	-Convert
-I	-Intruded
-PVR	-Prior Validation Request
-R	-Request
-W	-Withdraw
EM	"End of Medium" IA5 Character
End of Selection	All information for routing the call has been provided.
ENH	Enhanced SSMF5
ENQ	Enquiry Call
EOC	End of Call
ERD	External Routing Disabled
ERM	End to End Recall Message
ESC	"Escape" IA5 character
ESRA	ECMA Standard for Rate Adaptation
EST	Extension Status Call
ET	Exchange Termination
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
EX	Extraordinary Extension

FCS	Frame Check Sequence
fdm	Frequency Division Multiplex
FE(0->5)	"Format Effectors" IA5 characters
FNR	Facility Not Registered (see CC)
FR-R	Forced Release - Request
GPU-R	Group Pick-Up - Request
H PSTN	Holding PSTN
HDG	Holding
HDL	High Level Data Link Control
HF	Hands-Free
-A	-Activated
-D	-Deactivated
HGF	Hunt-Group Forwarded
HOLD-REQ	Hold Request
I	ISDN
-BC	-Bearer Capability
-CC	-Clearing Cause
-CPN	-Calling Party/Connected Number
-CSA	-Calling Party/Connected Subaddress
-DSA	-Destination Subaddress
-HLC	-High Layer Compatibility
-LLC	-Low Layer Compatibility
-PROG	-Progress
IA5	International Alphabet No 5
ICB	Incoming Calls Barred
ICC	Intercom Call
ICI	Incoming Call Indication
ICL	Intrusion Capability Level
IG	Ignored
-SNU	-Signal Not Understood
-SU	-Service Unavailable
Indication Block	One or more Indication Fields used to transport the Indication Block (see SECTION 4, paragraph 4.2 for a description of the contents of an Indication Block).
Indication Field	SECTION 4, Subsection 2 defines the Indication Field for each message type that contains one. The contents of the Indication Field are defined in terms of the contents of the Indication Block (see Indication Block).
INT-A	Interim Answer
IPL	Intrusion Protection Level
-R	-Request
IPN	Interworking via a Private ISDN

IRD	Internal Routing Disabled
IS(1->4)	"Information Separator" IA5 character
ISDN	Integrated Services Digital Network
ISO	International Organisation for Standardisation
ISPBX	Integrated Services PBX
ISRM(C)	Initial Service Request Message (Complete)
ISRM(I)	Initial Service Request Message (Incomplete)
LA	Loop Avoidance
LBA	Loop-Back Abort (see MA)
LBC	Loop-Back Control (see MA)
Link	A Transmission facility directly connecting two PBXs.
LLM(C)	Link-by-Link Message (Complete)
LLM(I)	Link-by-Link Message (Incomplete)
LLRM	Link-by-Link Reject Message
LMM	Link-Maintenance Message
LMRM	Link-Maintenance Reject Message
LSB	Least-Significant Bit
M-INDEX	Message Index
MA	Maintenance Action
-ACK	-Acknowledge
-BBC	-Back-Busy Control
-LBA	-Loop-Back Abort
-LBC	-Loop-Back Control
-TCS-R	-Traffic-Channel Status-Request
MCI	Malicious Call Indication
MF5	Signalling System Multifrequency No 5
MSB	Most-Significant Bit
MSD	Message Sequence Diagram
NAE	Network-Address Extension
-CC	-Calling/Called Identity Complete
-CI	-Calling/Called Identity Incomplete
-DC	-Destination Complete
-DI	-Destination Incomplete
NAM	Number Acknowledge Message
NICC	Network Interoperability Consultative Committee
NIM	Network Indication Message
NLT	Non-Looped-Back Test
-PT	-Perform Test
-RES	-Result
-RQ	-Test Request
-SC	-Sequence Complete

NPR	Number Presentation Restriction
-A	-A Party
-B	-B Party
-O	-Other Party
NS	Night Service
-DA	-Deactivated
-DVD	-Diverted
-DVG	-Diverting
-DVT	-Divert
-N	-Notification
-RDVD	-Rediverted
-RDVG	-Rediverting
-RDVT	-Redivert
NSI	Non-Specified Information
NSIM	Non-Specified Information Message
NSL	Network Signalling Limit
NT	Network Termination
NUL	"Null" IA5 character
OCP	Originally Called Party
OLI	Originating Line Identity
OPD	Output Digits
-R	-Request
ORD	Ordinary
OSI	Open Systems Interconnection
PARK	Park Request
PASSW	Password
Path	A series of channels used by a call
PB	Priority Breakdown
-P	-Protection
-R	-Request
PBX	Private Branch Exchange
PCLG	Public Calling Party Number
-D	-Default
-P	-Provided
PCM	Pulse Code Modulation
PCON	Public Connected Number
-D	-Default
-P	-Provided
PDR	Power Down Request
PKD	Parked
PNO-IG	Public Network Operators - Interest Group
/ISC	/Interconnect Standards Committee
POTS	Plain Ordinary Telephone Service
ppm	parts per million
PSTN	Public Switched Telephone Network

PU	Call Pick-Up
-DVD	-Diverted
-DVG	-Diverting
-DVT	-Divert
Q	Queue
-INFO	-Information
-PRIO	-Priority
QSIG	An inter-PBX Signalling Protocol
RA	Rate Adaptation
RC	Rejection Cause (For Rejection Cause Qualifier see CC)
RCC	Route Capacity Control
-CA	-Capacity Available
-OI	-Override Invoked
RCF	Redirecting on Call Failure
RDG	Redirecting
Real Call	A DPNSS 1 call with associated traffic (B) channels, cf Virtual Call.
RECON	Reconnected
RED-BY	Redirection Bypass
REJ	Reject
RM(C)	Recall Message (Complete)
RM(I)	Recall Message (Incomplete)
RO	Ring Out
ROP	Route Optimisation
-CON	-Connected
-CSU	-Call Set Up
-INV	-Invite
-INVA	-Invite With Acknowledgement
-R	-Request
Routing Phase	The phase of the call from the point where the ISRM is sent until receipt of the NAM. For Supplementary Services using Single-Channel Working this is the phase from the point where the RM is sent until receipt of the NAM.
RR-SNU	Recall Rejected - Signal Not Understood
RRM	Recall Rejection Message
RTI	Routing Information
SABMR	Set Asynchronous Balanced Mode Restricted
SATB	Satellite Barred
SAVE	Save
SCE	Single Channel Enquiry
SCI	Subsequent Call Indication
SCIM	Single-Channel Clear Indication Message
SCN	Subscriber Changed Number

SCRM	Single-Channel Clear Request Message
SDL	Functional Specification and Description Language
Selection Block	One or more Selection Fields used to transport the Selection Block (see SECTION 4, paragraph 4.1 for a description of the contents of the Selection Block).
Selection Field	SECTION 4, Subsection 2 defines the Selection Field for each message type that contains one. The contents of the Selection Field is defined in terms of the contents of the Selection Block (see Selection Block).
SER	Series Call
-C	-Cancellation
-E	-Established
-R	-Request
SERV	Service Information
SF2	CEPT Services and Facilities Handbook Section III PABX
SFI	Supplementary Facilities Inhibited
SHTL	Shuttle
SI	Subscriber Incompatible (see CC)
SI	Supplementary Information
SI	"Shift In" IA5 Character
SIC	Service Indicator Code
Signalling Channel	A channel reserved for signalling used to support Real and Virtual calls. It may be carried on a discrete analogue or digital bearer or within a tdm or fdm assembly.
SIM-A	Simulated Answer
Simple Call	A telephony call within the DPNSS Network Boundary with no invocation of Supplementary Services (as per the protocol of DPNSS[188] SECTION 6).
SM	Swap Message
SN	Send Next
-REQ	-Request
SNU	Signal Not Understood
SO	"Shift Out" IA5 character
SOD	State of Destination
-B	-Busy
-F	-Free
-I	-Indeterminate
-REQ	-Request
SP	"Space" IA5 character
SPL	Split

SPM	Subscribers Private Meter
SSMF5	Signalling System Multifrequency No 5
SSRM(C)	Subsequent Service Request Message (Complete)
SSRM(I)	Subsequent Service Request Message (Incomplete)
SU	Service Unavailable
SUB	"Substitute Character" IA5 character
Supplementary Information (SI)	Information in a DPNSS 1 message in addition to a Destination Address or fixed information octets - usually in the form of SI Strings (and associated Parameters) - to be communicated from one PBX to another on a call.
Supplementary Service	Used to provide facilities and/or information not provided by a Simple Call.
SW	Swap
-R	-Rejected
-V	-Validation
TA	Terminal Adaptor
TAD	Time and Date
-R	-Request
TC(1->10)	"Transmission Control" IA5 character
TCOS	Travelling Class of Service
-R	-Request
TCS	Traffic Channel Status
-R	-Request (see MA)
tdm	time division multiplex
TEXT	Textual Display
TEXTM	Text Message
TID	Trunk Identity
TOS	Temporarily Out of Service
TOV	Three-Party Takeover
-R	-Request
-V	-Validation
Traffic Channel	A circuit switched channel which may be carried on a discrete analogue or digital bearer or within a tdm or fdm assembly.
TRFD	Transferred
TRFR	Transfer Request
TWP	Two Party

UA	Unnumbered Acknowledgement
UDC	User Data Control
UI(C)	Unnumbered Information (Command)
UI(R)	Unnumbered Information (Response)
UNR	DTE Uncontrolled Not Ready
V-NID	VPN Nodal Identity
VIC	VPN Initiated Clear
Virtual Call	A DPNSS 1 call with no associated Traffic (B) Channels.
VPN	Virtual Private Network
WOB	Wait On Busy

DIGITAL PRIVATE NETWORK SIGNALLING SYSTEM NO 1 (DPNSS 1)

SECTION 2 - PHYSICAL CHARACTERISTICS (LEVEL 1)

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ANNEX 4: PHYSICAL CHARACTERISTICS OF THE 1544 kbit/s DIGITAL
TRANSMISSION SYSTEM INTERFACE

HISTORY

Issue 1 - May 1983
Issue 2 - February 1984
Issue 3 - September 1984
Issue 4 - March 1986
Issue 5 - December 1989

Issue 6 - March 2001 - Specification renamed as DPNSS[188]

REFERENCES:

CCITT Recommendations (From the Red Book - 1984)	G.701, G.703, G.704, G.705, G.711, G.732, G.733, G.823, G.824, O.151, O.171, V.11, V.22, V.22 bis, V.24, V.26, V.27 bis, V.28, V.29, V.32 X.1, X.21, X.21 bis, X.24
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ISO Standards: 2110-1980, 4903-1980

1 GENERAL

Standardisation of the physical characteristics of the signalling channels is essential for the interconnection of PBXs.

DPNSS 1 can operate over a signalling channel of any bit rate, but care must be taken to provide a bit rate which can support the expected signalling traffic, and which will not lead to unacceptable delays in message transmission.

ANNEX 1 of this Section reproduces the requirements specified for structuring a 2048 kbit/s digital transmission system to connect PBXs to Phase 2 of the ISDN in the UK. It is recommended that this structure be adopted for use on 2048 kbit/s digital leased lines used to interconnect PBXs and thereby carry DPNSS 1 on time slot 16.

ANNEX 4 of this Section describes a multiplex structure for use with North American 1544 kbit/s transmission systems.

Where the traffic between two PBXs in a DPNSS 1 network is too low to justify the use of a Primary Rate interface, an alternative means of carrying DPNSS 1 signalling is required:

ANNEX 2 of this Section describes a method suitable for transmission of signalling on a dedicated signalling circuit at a rate between 1200 bit/s and 9600 bit/s via either a rate adapted 64kbit/s digital circuit or an analogue circuit with modems.

ANNEX 3 of this Section describes a method suitable for transmission of signalling on a dedicated 64 kbit/s digital signalling circuit at rates up to 64 kbit/s.

2 COMPLIANCE

This Section defines four possible methods of transporting DPNSS 1. The choice of method depends upon the Private Network concerned and is a matter of negotiation between a customer and his supplier.

TABLE 1 lists the options available and may be used as an aid to these negotiations.

A customer must ensure that the PBXs at each end of a signalling link provide a compatible solution.

TABLE 1

PHYSICAL CHARACTERISTICS		COMMENT
2048 kbit/s Digital Transmission System Interface, with CRC (as defined in ANNEX 1).		
2048 kbit/s Digital Transmission System Interface, without CRC (as defined in ANNEX 1).		
V-Series Digital Interface (as defined in ANNEX 2). The customer must specify speed and modem type.		
X-Series Digital Interface (as defined in ANNEX 3). The customer must specify speed and DCE type.		
1544 kbit/s Digital Transmission System Interface (As defined in ANNEX 4).		

DIGITAL PRIVATE NETWORK SIGNALLING SYSTEM NO 1 (DPNSS 1)

SECTION 2

ANNEX 1: PHYSICAL CHARACTERISTICS OF THE 2048 kbit/s DIGITAL TRANSMISSION SYSTEM INTERFACE

1 INTRODUCTION

The interface shall be in accordance with the appropriate parts of CCITT Recommendations G.701, G.703, G.704, G.705, G.732 and G.823 of the Red Book 1984. For the purposes of this document these will be called G.701, G.703, G.704, G.705, G.732 and G.823. The appropriate parts of these recommendations and additional requirements are given below. If any incompatibility exists between these recommendations and this specification then the requirements of this specification shall apply.

2 PORTS

The interface will consist of two ports. For the purposes of this specification they will be designated the "Network Output Port" and the "Network Input Port". The Network Output Port will supply signals from the distant PBX and the Network Input Port will accept signals for the distant PBX.

3 CHARACTERISTICS OF THE DIGITAL SIGNAL AT THE NETWORK OUTPUT PORT

The digital signal at the Network Output Port will meet the requirements for G.703, paragraph 6 except where otherwise stated. The following options will apply:

- 3.1** One coaxial pair in each direction will be used.
- 3.2** The test load impedance will be 75 ohms resistive.
- 3.3** The nominal peak voltage of a mark (pulse) will be 2.37 V.
- 3.4** The peak voltage of a space (no pulse) will be 0 ± 0.237 V.

The maximum peak-to-peak jitter will be in accordance with Recommendation G.823, paragraph 2.

The maximum value of wander at the Network Output Port will not exceed 18 microseconds peak-to-peak.

4 CHARACTERISTICS OF THE DIGITAL SIGNAL PRESENTED TO THE NETWORK INPUT PORT

The digital signal presented to the Network Input Port shall be as defined in paragraph 3 but modified by the characteristics of the interconnecting coaxial pair (see paragraph 7).

The maximum value of wander applied to the Network Input Port shall not exceed 18 microseconds peak-to-peak.

5 CHARACTERISTICS OF THE NETWORK INPUT PORT

The input impedance of the Network Input Port will be nominally 75 ohms. The return loss when referred to 75 ohms will be better than the limits given in TABLE 1 for the two frequency ranges indicated.

TABLE 1

MINIMUM VALUES OF RETURN LOSS AT THE NETWORK INPUT PORT

Frequency Range	Limits
100 kHz to 3 MHz	20 dB
50 kHz to 100 kHz	15 dB

The tolerance to jitter at the network input port will be in accordance with the requirements of Recommendation G.823, paragraph 3. The optional values for f2 and f3 in Note 2 of TABLE 2/G.823 will not be used.

The Network Input Port will also have an immunity to interference in accordance with the following test condition:

A pseudo random test signal of sequence length $2^{15} - 1$ as described in CCITT Recommendation O.151, coded into the standard interface conditions, should have added to it a non-synchronous interfering signal with the same pulse shape as the wanted signal. The interfering signal should be combined with the wanted signal in an active combining network which has an overall zero loss in the signal path and an output impedance of 75 ohms, to give a signal-to-interference ratio of 18 dB.

During a time period of 3 minutes, no errors shall result when the combined signal, attenuated by up to the maximum specified interconnecting cable loss, is applied to the Network Input Port.

NOTE: It is not implied that the PBX is required to generate or detect the test pattern. However, the PBX Output Port must conform with the requirement.

6 CHARACTERISTICS OF THE DIGITAL INPUT PORT OF THE PBX CONNECTED TO THE NETWORK OUTPUT PORT

The Digital Input Port of the PBX connected to the Network Output Port shall meet the same requirements as described in paragraph 5 for the Network Input Port and shall be connected to the Network Output Port by a coaxial pair having characteristics in accordance with paragraph 7.

7 COAXIAL PAIRS

The coaxial pairs between the PBX and the interface shall be provided by the customer. Each pair shall have a nominal characteristic impedance of 75 ohms and an attenuation-frequency characteristic approximating to a $\sqrt{f}$ law. The insertion loss of each pair shall not exceed 6 dB when measured at a frequency of 1024 kHz.

7.1 Earthing

7.1.1 Pair connecting the Network Output Port to the Input Port of the PBX

The outer conductor of this pair shall be connected to earth at the Network Output Port.

An optional facility shall be provided for the outer conductor of this pair to be either connected to earth or isolated from earth at the input port of the PBX. In normal operation, the outer conductor will be isolated from earth at the input port of the PBX.

7.1.2 Pair connecting the PBX Output Port to the Network Input Port

The outer conductor of this pair shall be connected to earth at the PBX.

An optional facility shall be provided for the outer conductor of this pair to be either connected to earth or isolated from earth at the Network Input Port. In normal operation, the outer conductor will be isolated from earth at the Network Input Port.

8 CHARACTERISTICS OF THE FRAME STRUCTURE

The characteristics of the frame structure shall be in accordance with G.704 paragraph 3.3 with the following exceptions or qualifications (see also paragraph 10 of this Annex):

8.1 All time slots except 0 and 16 shall be switchable.

8.2 Speech shall be encoded in accordance with G.732 paragraph 1.1.

8.3 Timing in a synchronised network (G.705, para 3.1.2.2) shall apply.

8.4 The requirements of Section 3 of G.732 shall apply for frame-alignment procedures.

NOTE: CCITT Recommendation G.704 leaves some of the bit allocations for the time-slot 0 unassigned and reserved for National Use. The use of these bits is for future definition and in the interim any combination received shall be accepted as valid.

8.5 Time slots 1 to 15 and 17 to 31 may be used for telephony or other services, as designated by the Service Indicator Code (SIC) at Level 3 (see SECTION 4 of this specification). The Time-Slot number is coded in the Data-Link Protocol Address Field (see SECTION 3 of this specification).

8.6 Common-channel signalling shall be used and this shall always be allocated to time-slot 16. No other time-slots shall be used for this purpose.

8.7 The requirements of G.704, para 3.3.3.1 shall apply for common-channel signalling (Bit 1 shall be transmitted first).

8.8 When a traffic channel is idle or held, ie not connected to an active party, the pattern shown in TABLE 2 shall be transmitted. This pattern shall not be used as an indication of an idle or barred condition of a channel since this information should be derived from the control or signalling functions.

TABLE 2

BITS	8	7	6	5	4	3	2	1
	0	0	1	0	1	0	1	0

8.9 Bits shall be transmitted in ascending numerical order, starting from bit 1 for each time-slot.

9 ALARMS

Alarms are given when there is a loss of signal, a loss of frame alignment or a high error rate.

9.1 Network Output Port

9.1.1 AIS at the Network Output Port

An Alarm Indication Signal (AIS) is an all "1"s condition at 2048 kbit/s $\pm$ 50 ppm on the digital signal. The strategy for detecting the presence of AIS should be such that the AIS is detectable even in the presence of an error ratio of 1×10^{-3} . However, a signal with all bits except the frame-alignment signal in the "1"s state should not be mistaken for an AIS.

NOTE: AIS is locally generated at faulty equipment usually by a free running crystal oscillator and will therefore not be synchronised to any network reference timing.

If an Alarm Indication Signal (AIS) is present at the Network Output Port, this indicates an upstream loss of signal and that a maintenance alarm indication within the network has been activated.

9.1.2 Bit 3 in Time-Slot 0

If bit 3 of time-slot 0 goes to a 1 condition in those frames not containing the frame-alignment signal, this shall indicate that one or more of the following conditions has been detected in the direction from the PBX to the Network Input Port:

- 9.1.2.1 An error ratio worse than 1×10^{-3} ;
- 9.1.2.2 AIS;
- 9.1.2.3 Loss of signal;
- 9.1.2.4 Loss of frame-alignment.

9.2 Network Input Port

9.2.1 Bit 3 in Time-Slot 0

Bit 3 of time-slot 0 shall be set to a 1 condition in those frames not containing the frame-alignment signal when one or more of the following conditions are detected by the PBX in the direction from the Network Output Port to the PBX:

- 9.2.1.1** An error ratio worse than 1×10^{-3} ;
- 9.2.1.2** AIS;
- 9.2.1.3** Loss of signal;
- 9.2.1.4** Loss of frame-alignment.

10 CYCLIC REDUNDANCY CHECK PROCEDURE

As an option a PBX may incorporate the Cyclic-Redundancy-Check (CRC) Procedure described in G.704, paragraph 2.3.3.

This CRC procedure, which utilises some of the otherwise spare capacity of bit 1 of time-slot 0, provides an enhanced error monitoring capability on links between cooperating PBXs.

PBXs, when interworking with other PBXs which are unable or unwilling to cooperate with this procedure, shall comply with the note following paragraph 2.3.3 (a) of G.704.

A receiving PBX on a link which incorporates the CRC procedure may also utilise the check to obtain an enhanced frame-alignment performance. The details of the method are contained in G.706 {Recommendation G.706 was adopted by the CCITT in 1987 using the accelerated approvals procedure and is currently available in CCITT Report COM XVIII-R 25(C)}. Provided both PBXs incorporate and cooperate with the CRC check of G.704 paragraph 2.3.3, no extra cooperation is required for a PBX to incorporate the G.706 enhancement unilaterally.