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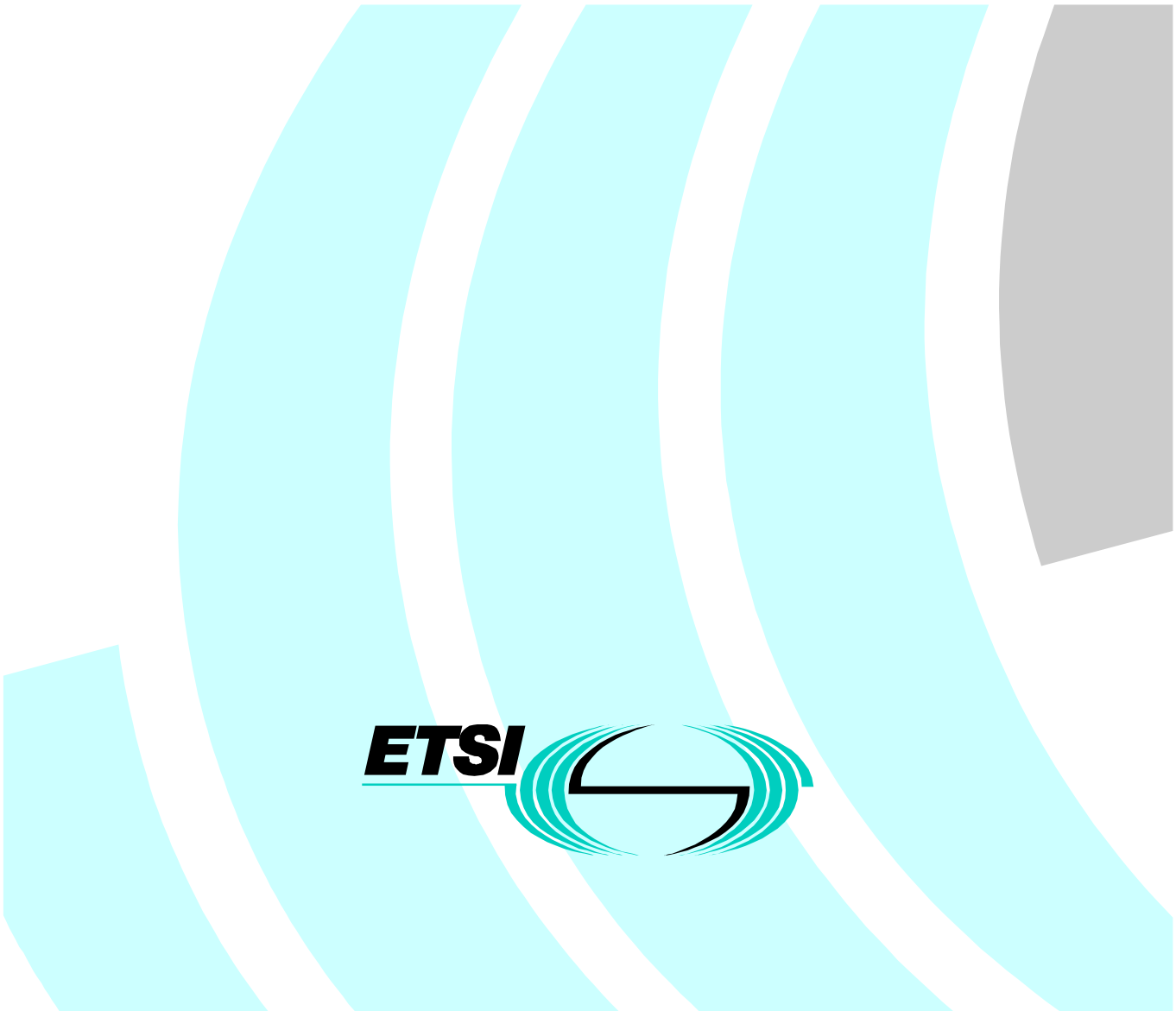
European Standard (Telecommunications series)

Integrated Services Digital Network (ISDN); Narrowband Multi-service Delivery System (NMDS); Part 1: NMDS interface specification



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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Signalling Protocols and Switching (SPS), and is now submitted for the Voting phase of the ETSI standards Two-step Approval Procedure.

The present document is part 1 of a multi-part EN covering Narrowband Multi-service Delivery System (NMDS), as identified below:

Part 1: "NMDS specification";

Part 2: "Protocol Implementation Conformance Statement (PICS) proforma specification".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

Introduction

The present document specifies the provision of Public Switched Telephone Network (PSTN) services over an existing Integrated Services Digital Network - Basic Access (ISDN-BA) digital subscriber line (DSL). Today PSTN terminals - normal telephones - can be connected to the S/T-interface via a Terminal Adapter (TA) with the support of services that can be mapped at a feasible cost from ISDN (principally the basic call services).

1 Scope

The present standard defines requirements to support the Narrowband Multi-service Delivery System (NMDS) which provides interfaces connected via a Network Termination Node (NTN) to a Local Exchange (LE), in order to support existing PSTN and ISDN services over an existing ISDN-Basic Access digital subscriber line (DSL).

The Narrowband Multi-Service Delivery System (NMDS) may also be connected via a V5 interface Access Network (AN) to a Local Exchange (LE) in order to provide existing PSTN and ISDN services. This optional arrangement is described in annex D which identifies two alternative methods to provide the same overall functionality.

The present document also contains requirements which relate to the functionality of a (new) Network Termination Node (NTN) for supporting both Public Switched Telephone Network (PSTN) access and Integrated Services Digital Network - Basic Access (ISDN-BA) S/T reference point interfaces over a single (digital section) transmission system as used for existing ISDN-BA. The NTN encompasses NT2-like (noted NT2*) functionality, physical PSTN user port(s) and PSTN protocol functionality.

An NMDS implementation may contain one ISDN-BA port and/or a limited number of PSTN ports. Typically one or two PSTN ports would be supported.

In order to maintain an evolutionary path for PSTN services, the national V5 PSTN protocol mapping is assumed to exist and forms an integral part of this specification.

NOTE: It is an underlying principle of the present document that, wherever practicable, steps may be taken to minimize the cost of the NTN, subject to maintaining the required functionality.

2 References

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

2.1 Normative references

[1] ETR 080 (1996): "Transmission and Multiplexing (TM); Integrated Services Digital Network (ISDN) basic rate access; Digital transmission system on metallic local lines".

[2] ETS 300 012-1 (1996): "Integrated Services Digital Network (ISDN); Basic User Network Interface (UNI); Part 1: Layer 1 specification".

[3] ETS 300 324-1 (1994): "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification".

[4] ETS 300 347-1 (1994): "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN); Part 1: V5.2 interface specification".

[5] ETS 300 402-2: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer; Part 2: General protocol specification [ITU-T Recommendation Q.921 (1993), modified]".

[6] ITU-T Recommendation I.412 (1988): "ISDN user-network interfaces - Interface structures and access capabilities".

2.2 Informative references

[7] EN 301 141-2 (V1.2): "Narrowband Multi-service Delivery System (NMDS); Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definitions apply:

Narrowband Multi-service Delivery System: A system that provides an interface to the network directly to the LE or via an AN to support existing PSTN and ISDN services over an ISDN-BA DSL.

Network Termination Node: The functional group on the user side of the digital section (NMDS interface noted T* reference point) that includes functionality to support an ISDN-BA port and/or one or more PSTN ports.

Network Termination Type 2 *: The functional group within the NTN which, at the user side of the T* reference point, performs the PSTN layer 2 and the ISDN layer 2 multiplexing and demultiplexing over the D channel, and only interprets (and then relays) the layer 3 messages to switch the B channels to the ISDN access and the PSTN Gateways as instructed by the signalling messages.

PSTN-Gateway: The functional group within the NTN which terminates the PSTN interface at the NTN.

T* reference point: The reference point which provides access to the NMDS, between the network termination of the digital section (NT1) and the Network Termination Node functional group.

V1* reference point: The V1 reference point with the addition of PSTN functionality required to support the NMDS.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AN	Access Network
BCC	Bearer Channel Control
CPE	Customer Premises Equipment
DLCI	Data Link Connection Identifier
DSL	Digital Subscriber Line
DTMF	Dual Tone Multi-Frequency
ISDN	Integrated Services Digital Network
ISDN-BA	Integrated Services Digital Network - Basic Access
LE	Local Exchange
NMDS	Narrowband Multi-service Delivery System
NT	Network Termination
NT1	NT type 1 (see ETR 080 [1])
NT2*	Network Termination **Type** 2* (see the definition in subclause 3.1 above)
NTN	Network Termination Node
NWK	Network Layer
PSTN	Public Switched Telephone Network
PSTN-GW	PSTN Gateway
SAPI	Service Access Point Identifier
TA	Terminal Adapter
TE	Terminal Equipment
TEI	Terminal Endpoint Identifier

UNI User Network Interface

4 General description

The purpose of the NMDS is to support both ISDN-BA and one or more PSTN user ports in the same manner such that they appear to the user as if they were directly connected to the LE. The support of ISDN-BA user ports utilizes the same type of functions as used by an NT1 defined in ETR 080 [1], whilst PSTN user ports are supported using the same PSTN protocol as defined in the V5.1 interface standard ETS 300 324-1 [3] with some modifications.

The LE is service responsible for and controls the tones (voice messages etc.) sent and received over the NMDS. See figure 1 for the functional architecture of NMDS.

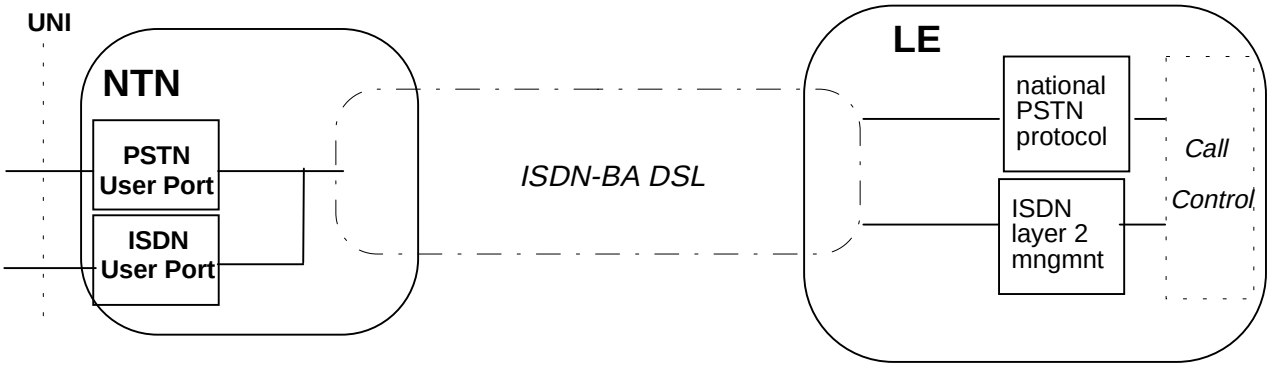


Figure 1: General NMDS functional diagram

The Narrowband Multi-service Delivery System (NMDS) is defined at the T* reference point and the complementary V1* reference point as shown in figure 2.

On any NMDS, the LE may support up to 10 PSTN (analogue) lines and the NTN may provide up to 10 PSTN (analogue) access ports. The provision of PSTN and ISDN access ports in the LE requires a bilateral agreement between the user and the service provider at subscription time.

5 Layer 1 functions

In order to permit transparent operation via an AN, there shall be no changes to the ISDN-BA digital section layer 1 protocols.

Layer 1 at the ISDN-BA UNI shall be in accordance with ETS 300 012-1 [2].

The NTN shall permit layer 1 activation from the ISDN UNI and layer 1 activation/deactivation from the network. In order to keep the NTN simple, the PSTN gateway shall not require "user side" activation procedures and the network shall maintain the digital section in a permanently activated state whenever the PSTN protocols are to be supported.

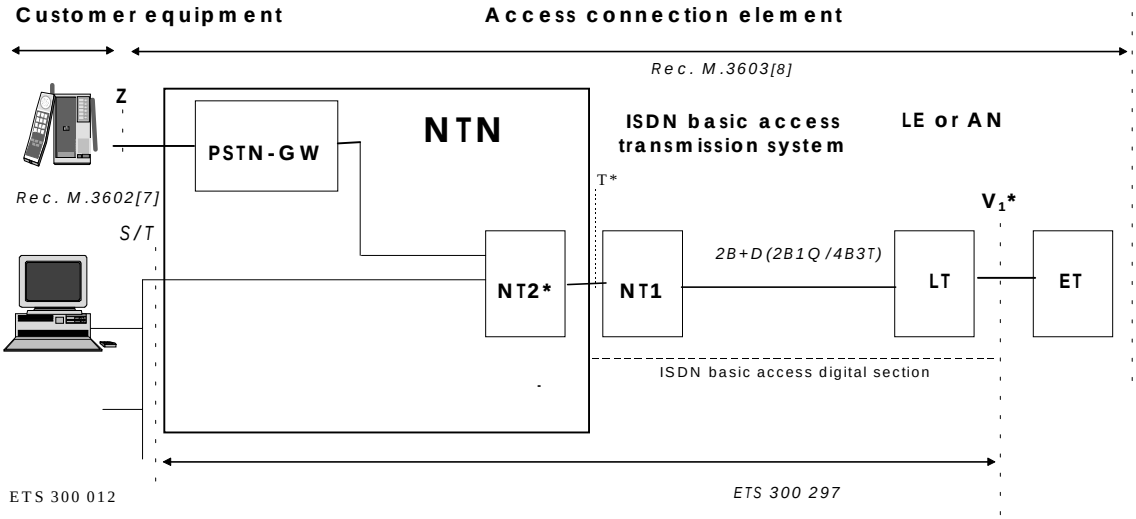
The NTN shall also allow the digital section to be activated regardless of the electrical conditions prevailing at the ISDN UNI and PSTN port.

To prevent the possibility of the exchange/multiplexer deactivating the digital section as part of the recovery actions resulting from an ISDN UNI error, the NTN shall always present a UNI "no error" indication to the network.

The permanent activation of the digital section may interfere with certain maintenance operations normally provided over the embedded operations channel. To overcome any difficulties, the exchange shall be able to detect the activation state of the ISDN UNI which would have prevailed if the PSTN ports had not been present, using a message-based maintenance mechanism at layer 3. The ISDN UNI status information element is used for this purpose and is described elsewhere in the present document.

The NTN shall support full ISDN layer 1 diagnostic loop capability.

The general access structure is described in ITU-T Recommendation I.412 [6]. The access structure for ISDN-BA in ITU-T Recommendation I.412 [6] is valid also for the PSTN application. The layer 1 transporting the full NMDS functionality from the NTN to the LE shall be an ISDN-BA layer 1.



NOTE: The functionality and layout shown in figure 2 can only be one particular example and is not representative of all architectures where NMDS can be applied.
In actual implementations the NT1 functional group is likely to be physically integrated in an equipment realizing the NTN functionality.

Figure 2: An example of an NMDS scenario for NMDS

5.1 Powering Aspects

5.1.1 Power available from the transmission system

The power available for NMDS support is the actual power budget provided by the existing ISDN-BA digital section. Additional power is expected to be provided locally to the NTN. What may happen under local power fail conditions with respect to NTN user ports is described below. Hence there are no deviations from the requirements specified in the ISDN-BA standards in order to support NMDS.

5.1.2 NMDS behaviour under power fail conditions

The ISDN-BA standards mandate that a designated instrument may be made available on an S/T Interface. If this designated instrument is available, then it shall be capable of (at least) making emergency telephone calls.

For the PSTN, the situation is not mandated on a European wide basis and depends upon nationally agreed regulations which are outside the scope of the present document.

The NMDS may be comprised of one or more PSTN ports, potentially as well as an ISDN-BA port. Hence it is not possible to define in a standard mandatory behaviour under power-fail conditions. What is more relevant is that manufacturers are able to adequately define their system's behaviour under power failure conditions. For this reason, a clause has been inserted into the Protocol Implementation Conformance Statement (PICS) document, EN 301 141-2 [7], where such behaviour may be explained.

6 Layer 2 functions

6.1 Overview

The layer 2 used within the NMDS system, used for both PSTN and ISDN-BA services, shall be in accordance with ETS 300 402-2 [5] but with the following restrictions.

The LE layer 2 state machine shall be as per ETS 300 402-2 [5].

The PSTN gateway layer 2 state machine shall be as defined in subclause 6.2 of the present document, providing a restricted functionality version of the state machine in ETS 300 402-2 [5].

The PSTN gateway shall use a single permanently activated data link with a fixed Data Link Connection Identifier (DLCI) for all communication with the network. The DLCI shall consist of a PSTN Terminal Endpoint Identifier (TEI) allocated from the automatic TEI values (i.e. 64-126) and Service Access Point Identifier (SAPI) set equal to 0. TEI values 117 to 126 shall be reserved for PSTN use when NMDS is implemented on an access.

The first PSTN gateway to be fitted shall use TEI 126 and be identified as Line 1. TEI values 117 to 125 are reserved for further PSTN gateways, lines 2 to 10, as shown in the table 1.

Table 1: Allocation of TEI to PSTN ports

TEI value	Line number
126	1
125	2
124	3
123	4
122	5
121	6
120	7
119	8
118	9
117	10

The PSTN gateway shall not support the broadcast data link, or TEI management procedures, and shall not initiate layer 2 establishment, i.e. the DL_ESTABLISH_REQUEST primitive in the TEI assigned state shall not be supported.

On the ISDN port, point-to-point (i.e. TEI 0) or point-to-multipoint procedures may be supported using the full ISDN TEI assignment procedures as currently defined. These includes TEI assignment and removal procedures. However, some previously available values are now reserved (see table 1).

It is expected that some implementations may provide additional PSTN-GWs either as separate equipment connected to the S/T Interface or as further integrated entities. In each case the TEI allocations shall comply with those shown in table 1. The TEI associated with each external PSTN-GW shall be preprovisioned.

6.2 PSTN-GW layer 2 state machine modifications

The modifications required to the BA layer 2 state machine for the PSTN-GW are specified below as a list of differences to the state machine contained in annex D of ETS 300 402-2 [5].

Delete states 1, 2, 3, 5.0, 5.2 and 6.

Delete the following input events:

- DL-ESTABLISH-REQUEST;
- DL-RELEASE-REQUEST;
- DL-UNIT DATA-REQUEST;
- UI FRAME IN QUEUE;

- MDL-ASSIGN-REQUEST;
- MDL-REMOVE-REQUEST;
- MDL-ERROR-RESPONSE;
- T203 TIME-OUT.

Renumber state 4, and all references to it, to state 9; rename the state to "LINK NOT ESTABLISHED".

Delete all instances of the following output events replacing the event with "-" if it was the only action associated with the input event/state combination under consideration:

- DISC UI QUEUE;
- START T203;
- STOP T203;
- RESTART T203;
- MDL-ERR-IND(all variants);
- DL-UNIT-DATA-IND.

Replace all instances of "DISC I and UI QUEUES" with "DISC I QUEUE".

For input event "T200 TIME-OUT" in states 7.0 through to state 7.3 delete the "either" option.

For input event "T200 TIME-OUT; RC<N200; V(A)<V(S)" in states 8.0 through to state 8.3 delete the "either" option.

Replace all instances of DL-EST-IND and DL-REL-IND with MDL-EST-IND and MDL-REL-IND respectively.

Replace the action for input event "DM F=0 able to enter state 7.0" in state 9 with "-".

6.3 PSTN layer 2 activation

After installing the NTN, the PSTN-GW part of the NTN shall wait for activation from the network. As soon as layer 1 is activated, the LE shall be in a position to attempt layer 2 establishment of the PSTN-GW as and when required (as immediate service provision may not be required).

Loss of power and resumption of power on the DSL shall force a reset of the PSTN-GW functionality to the idle condition.

7 Layer 3 messages

The PSTN network layer (NWK) protocol shall be as defined in ETS 300 324-1 [3], clause 13. The national PSTN mappings are beyond the scope of the present document.

The normal path establishment procedures of ETS 300 324-1 [3] shall be used.

However, the PSTN Port blocking and the PSTN Restart procedures defined in ETS 300 324-1 [3] do not apply to the NMDS. Hence the following events described in ETS 300 324-1 [3] PSTN functional state machines (clause 13) are not applicable: MDU-CRTL (port blocked), MDU-CTRL (port unblocked), MDU-CTL (restart request) MDU-CTRL (restart complete). It results that the states AN0, AN6, LE0 and LE6 defined in ETS 300 324-1 [3] (subclauses 13.2.1.1 and 13.2.1.2) for the V5.1 interface are not used by the NMDS state machine.

The present document provides additions to the message formats and procedures to those found in ETS 300 324-1 [3].

The protocol discriminator value for the additional messages defined in the present document shall be the same as for ETS 300 324-1 [3], i.e. 48H.

7.1 General

The NTN shall support the national PSTN requirements for all applicable signals. All tones and announcements generated by the network shall be passed as inband signalling transparently over the B-channel to the customer. In the event of no B-channel being available then the proceed indication shall not be given to the customer until a channel becomes available i.e. the proceed indication shall not be generated by the PSTN-GW.

DTMF dialled digits shall be passed transparently over the B-channel to the network.

7.2 Error handling

The LE shall support the full error handling procedures defined in ETS 300 324-1 [3] clause 13, relating to the V5.1 PSTN protocol.

The NTN shall support the full error handling procedures as defined in ETS 300 324-1 [3] clause 13 for the AN, relating to the V5.1 PSTN protocol.

In addition, in case of a PSTN layer 2 failure, if a PSTN call is established, this call is released by the LE. Upon successful re-establishment of the PSTN layer 2, the LE shall send a DISCONNECT COMPLETE message to the NTN and go into the "Null state (LE1)" in order to ensure synchronization of the NTN PSTN GW and the LE state machines.

NOTE: Call release may cause a network clearing message with a cause #27, *destination out of order*, or #41, *temporary failure*, and the location field set to 'public network serving the remote user', to be sent towards the exchange serving the remote user.

7.3 Maintenance

This clause defines the mechanism for the LE to be able to determine if customer equipment is connected to the PSTN-GW and to determine the synchronization status of the S/T interface. The support of the (ISDN and PSTN) maintenance mechanisms by the LE and NTN is optional.

It shall use the Layer 3 STATUS and STATUS ENQUIRY messages as defined in ETS 300 324-1 [3] subclause 13.4, except that the State and Cause information elements already defined for the STATUS are changed to optional and only one of the new variable length information elements defined below shall be included in a STATUS message.

7.3.1 The new STATUS ENQUIRY and STATUS messages

The new STATUS ENQUIRY and STATUS messages shall follow those defined in ETS 300 324-1 [3], with the following additions:

The State and Cause information elements shall not be included in the STATUS message.

New information elements are defined for the STATUS and STATUS ENQUIRY messages.

7.3.1.1 The STATUS ENQUIRY and STATUS messages for PSTN maintenance messages

The STATUS ENQUIRY and STATUS messages for the PSTN-GW status shall be sent using the TEI which is allocated to that gateway (see table 1).

7.3.1.1.1 The STATUS ENQUIRY message for PSTN maintenance

Table 2: The PSTN gateway STATUS ENQUIRY message

Bit 8	7	6	5	4	3	2	1
Protocol Discriminator							
Layer 3 Address (note)							1
Layer 3 Address (lower) (note)							
Message Type							
1	1	0	1	0	0	0	0
Information element identifier							

NOTE: The layer 3 address shall be coded according to subclause 8.1.

7.3.1.1.2 The STATUS message for PSTN maintenance

This message shall be sent on receipt of a STATUS ENQUIRY message from the LE.

This new variable length optional information element shall be carried in the STATUS message in the direction NTN - LE.

Table 3: The PSTN gateway STATUS message

Bit 8	7	6	5	4	3	2	1
Protocol Discriminator							
Layer 3 Address							1
Layer 3 Address (Lower)							
Message Type							
0	0	0	1	1	1	1	0
Information element identifier							
0	0	0	0	0	0	0	1
Information element length							
1 ext.	STGW						

NOTE: The layer 3 Address shall be coded according to subclause 8.1.

STGW defines the status of the addressed PSTN-GW (CPE presence indicator).

The coding of the STGW field shall be according to table 4:

Table 4: Coding of the STGW field

Bits 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0	No CPE present
0 0 0 0 0 0 1	CPE connected
0 0 0 0 0 1 0	Test Unavailable
NOTE: All other values are reserved.	

NOTE: The method for detecting that CPE is connected is not specified here and will depend upon the PSTN architecture used.

7.3.1.2 The STATUS ENQUIRY and STATUS messages for ISDN maintenance messages

The STATUS ENQUIRY and STATUS messages for the ISDN UNI status shall be sent using TEI 126.

7.3.1.2.1 The STATUS ENQUIRY message for ISDN maintenance

Table 5: The ISDN UNI STATUS ENQUIRY message

Bit 8	7	6	5	4	3	2	1
Protocol Discriminator							
Layer 3 Address (note)							1
Layer 3 Address (lower) (note)							
Message Type							
1	1	0	1	0	0	0	1
Information element identifier							

NOTE: The layer 3 Address is coded according to subclause 8.1.

7.3.1.2.2 The STATUS message for ISDN maintenance

This message shall be sent in response to the receipt of a STATUS ENQUIRY message from the network containing the ISDN UNI status enquiry information element.

This new variable length information element shall be carried in the STATUS message in the direction NTN - LE.

Table 6: The ISDN UNI STATUS message

Bit 8	7	6	5	4	3	2	1
Protocol Discriminator							
Layer 3 Address (note)							1
Layer 3 Address (Lower) (note)							
Message Type							
0	0	0	1	1	1	1	1
Information element identifier							
0	0	0	0	0	0	0	1
Information element length							
1 ext.	STUNI						

NOTE: The layer 3 address is coded according to subclause 8.1.

STUNI defines whether the S/T Interface of any particular ISDN-BA is active (i.e. INFO3 has been received).

The coding of the STUNI field shall be according to table 7.

Table 7: Coding of the STUNI field

Bits 7 6 5 4 3 2 1	Meaning
0 0 0 0 0 0 0	No S/T Interface synchronization on ISDN-BA userport
0 0 0 0 0 0 1	S/T Interface synchronization on ISDN-BA userport
0 0 0 0 0 1 0	Test Unavailable
NOTE: All other values are reserved.	

8 B-channel selection procedure

8.1 Introduction

The B-channels of the access are a common resource for both the ISDN-BA and the PSTN ports. To handle the selection of B-channel for the PSTN port use, a new mechanism has been defined (see subclause 8.2).

The operation of the B-channel selection procedures is shown in examples within annex A.

8.2 B-channel selection

This clause describes the mechanism by which the LE indicates to which bearer channel the selected PSTN-GW shall connect for any particular call. This is a departure from the V5.1 recommendation ETS 300 324-1 [3] and can only function because the NMDS allows only one PSTN layer 3 per layer two (addressed via TEIs).

The LE shall be responsible for the B-channel selection and shall not change directly between the two B-channels.

L3ADDR	**B-channel**
L3addr = 0	no B-channel selected or that the NTN shall release the B-channel
L3addr = 1	B1 selected
L3addr = 2	B2 selected
L3addr = n	Bn Selected (the general case) (note)
L3addr = 7FFFh	Layer 3 address not relevant in current message
All other values are reserved.	

NOTE: In general this applies, although for NMDS there are only two B-channels available.

The selected B-channel shall be indicated in the L3addr field of all messages sent between LE and NTN.

Upon receiving any message with a TEI identifying a PSTN port, where the L3addr in the message is valid, the NTN shall change the connection to match the L3addr in the message, e.g.:

Current Connection	**Received L3addr**	**New Connection**
Port 1, B-channel 1	0	Port 1, No channel
Port 2, B-channel 2	1	Port 2, B-channel 1
Port 1, No channel	2	Port 1, B-channel 2

The NTN shall reflect the last received value of the L3addr when sending a message to the LE.

If the NTN should receive a message with a reserved value of L3addr then it shall ignore the message and send a STATUS message to the LE with the L3addr received, the State information element indicating the current state and the Cause information element indicating cause "L3 address error".

The LE when in receipt of a reflected L3addr which is not understood shall clear the call using the normal call clearing procedures, ensuring any connected channel is released.

Annex A (normative): B-channel selection

A.1 General

This annex describes the B-channel selection procedure for the NMDS application.

The following requirements can be stated for the B-channel selection:

The LE is responsible for the B-channel allocation and, at reception of the ESTABLISH message from the NTN, the B-channel shall be selected prior to returning the ESTABLISH ACKNOWLEDGE message to the NTN.

The B-channel shall be released by the LE when receiving the DISCONNECT COMPLETE message from the NTN or when the LE sends the DISCONNECT message or the DISCONNECT COMPLETE message.

An ESTABLISH message sent by the NTN containing the Off hook signalling information element cannot contain a B-channel allocation, since no allocation has been made by the LE at this point in time. In this case, the value L3addr = 0 shall be sent to indicate this fact (this is redundant information as far as the LE is concerned as it is the default condition).

It shall not be possible for the LE to dynamically alter the B-channel (e.g. from B1 to B2 or vice versa) assignment in mid-PSTN-call (i.e. between an ESTABLISH message and a DISCONNECT COMPLETE message).

A.2 Outgoing calls (NTN to LE)

An off hook generated by the user shall cause the L3addr to be set to "no B-channel selected" in the ESTABLISH message sent to the LE. B-channel selection in the LE shall be performed and the selected B-channel returned in the L3addr field in the ESTABLISH ACK message to NTN (see figure A.1). The selected B-channel shall be shown in the L3addr of all signalling until the call is cleared.

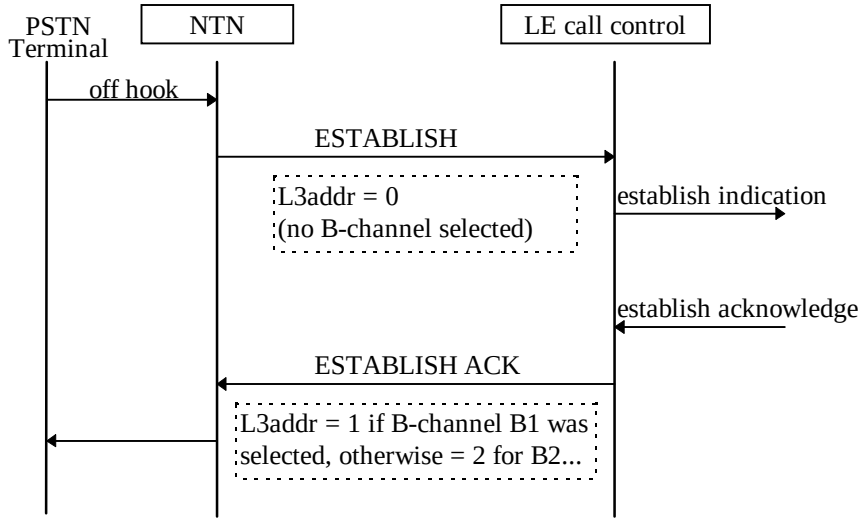
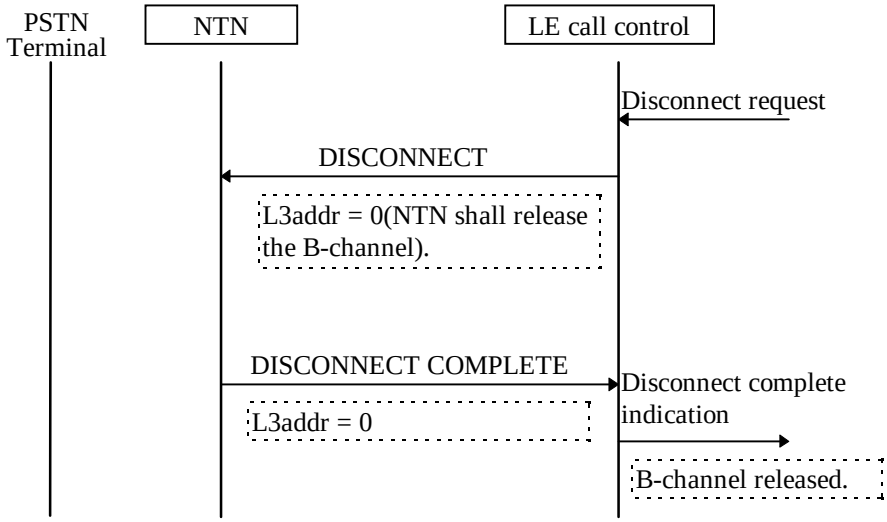


Figure A.1: Outgoing calls (NTN to LE)

All outgoing calls, successful or unsuccessful, shall follow the above procedure with the exception that if the signalling path is required but no B-channels are available the L3addr in the ESTABLISH ACK shall be set to 0.

A.3 Call clearing

The B-channel shall be released when LE receives the DISCONNECT COMPLETE message (see figure A.2).



NOTE: There is only one case of the NTN initiating the release of the signalling path and that is when the NTN has insufficient resource to process the call and sends a DISCONNECT message to the LE. In this case the LE shall release the B-channel immediately after sending the DISCONNECT COMPLETE message to the NTN.

Figure A.2: Call clearing from the network

A.4 Incoming calls (LE to NTN)

The LE shall select the B-channel and indicate it in the ESTABLISH message sent from the LE to the NTN (see figure A.3). The selected B-channel shall be shown in the L3addr of all signalling messages until the call is cleared.

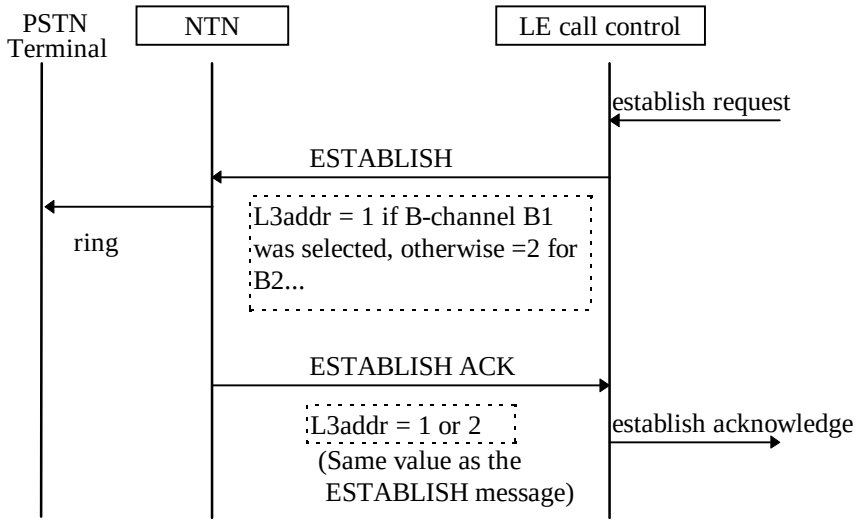


Figure A.3: Incoming calls

A.5 PSTN-GW parked state

In this case, after the expiry of a network timer, the SIGNAL message (Steady Reduced Battery) is sent to the NTN and the line is in the PARKED state (see A.4). This message shall have the L3addr = 0 indicating that, whilst the signalling path remains connected, the B-channel shall be released by the LE for use by another call. On receipt of the SIGNAL message the PSTN-GW shall detach from the B-channel and send a SIGNAL ACKnowledge message to the exchange with the L3addr = 0 indicating that it has detached from the B-channel.

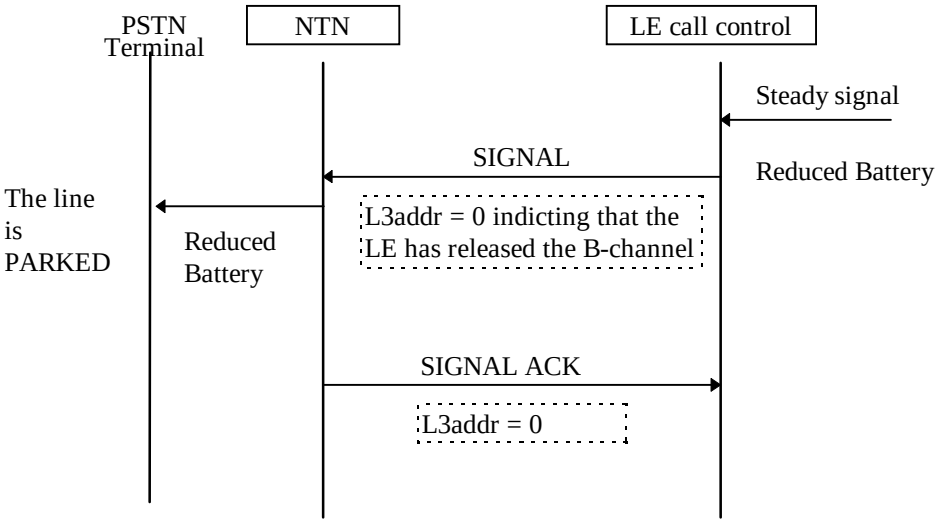


Figure A.4: Entering parked state

A.6 Clearing from parked state

When the PSTN-GW detects an "on hook" it shall send a SIGNAL message indicating steady state "On Hook" this message shall have the L3addr = 0 indicating that a B-channel is not connected. The signalling path shall be cleared following the normal clearing procedure (see A.5). The exception is that the L3addr shall be set to zero both in the DISCONNECT and DISCONNECT COMPLETE messages.

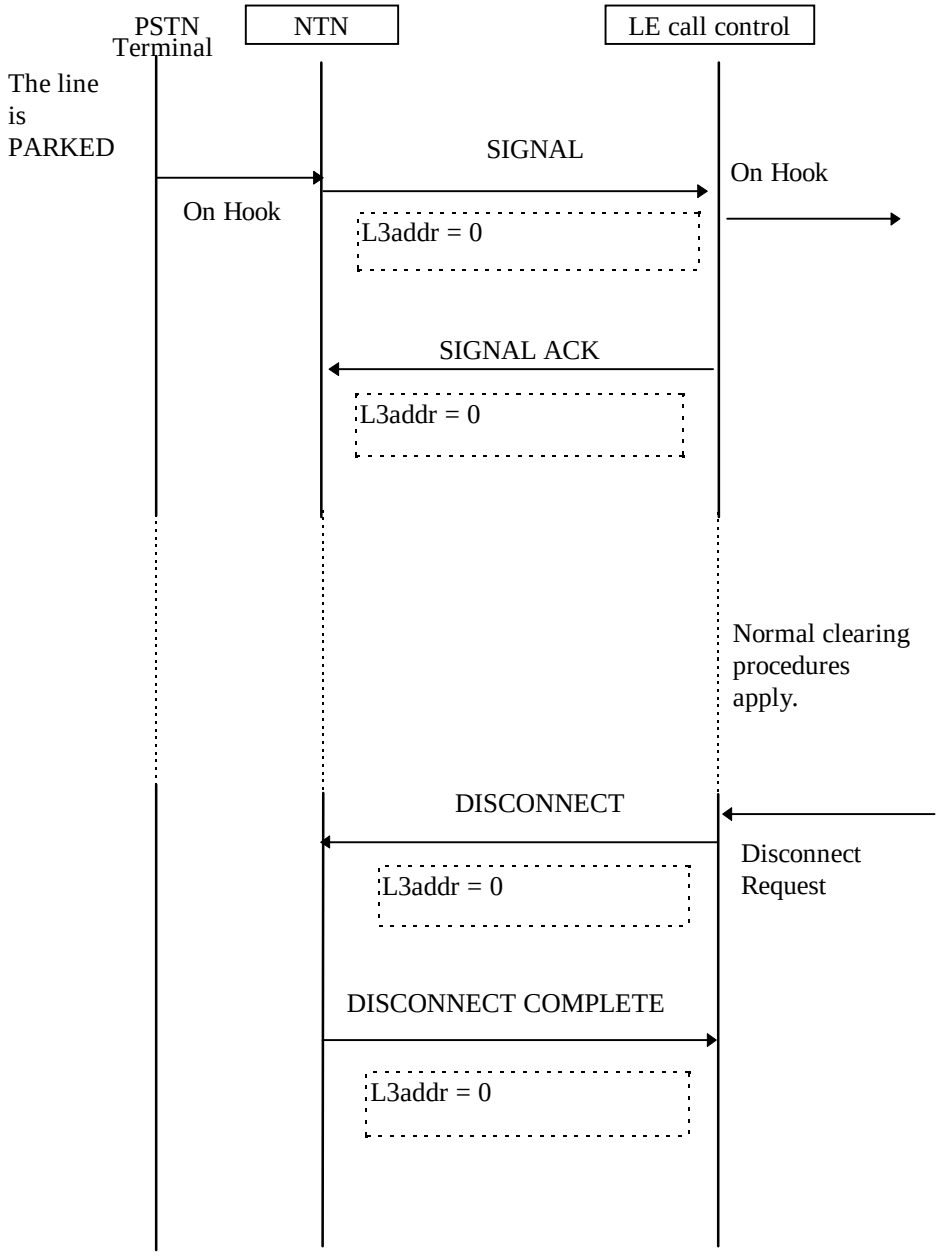


Figure A.5: Clearing from parked state

Annex B (informative): Background and motivation for NMDS

Standardized protocol and additions for the PSTN signalling over the ISDN-BA DSL will result in cheaper NTN equipment. To fully support PSTN services over the same subscriber line when ISDN-BA is installed will probably be a factor in more rapid ISDN deployment.

B.1 Transparent supplementary service operation

It is possible to provide voice type services similar, but not identical, to those provided by the PSTN using the ISDN service and associated terminal adapter. However in this case the voice services as perceived by the customer will not be identical to those received by a customer directly connected to a national PSTN. Due to both regulatory constraints and user resistance, this lack of commonality is a situation that cannot be accepted. It is this lack of commonality which has lead to the development of the NMDS.

The NMDS will allow further independent evolution of national PSTN and ISDN services.

B.2 Operational benefits

The advantages of the combination of PSTN and ISDN-BA on-demand services are that:

- a customer that wants to upgrade from PSTN to ISDN-BA can keep the existing PSTN equipment and just add an upgrade with the NTN;
- a customer can keep the same PSTN services as before the upgrade;
- a customer who wants to run data communication such as Internet could easily connect the computer/PC and get up to 128 kbit/s bandwidth. PSTN can only provide a maximum bit rate of about 30 kbit/s;
- an NTN could be used to support only the PSTN services and, at a future date, could be replaced with another NTN which will be able to support, in addition to PSTN service(s), an ISDN-BA service;
- TN services like "PSTN display services", "ADSI" and similar can easily be carried over the V5-based PSTN protocol;
- a customer gets an additional line, i.e. two B-channels, without an access network infrastructure upgrade;
- in-band signalling equipment, e.g. MF4 receivers or modems, is not introduced into the access network.

Annex C (informative): The PSTN protocol adopted for the NMDS

C.1 The V5 PSTN protocol

The V5 PSTN protocol has been specifically designed for the V5 series of interface standards. It is used within a signalling path from the user port where the line card function is located, to the LE, from which the service is controlled.

The PSTN protocol actually splits into two parts.

The first is a common part which is used in order to define the operation of PSTN lines under such conditions as incoming/outgoing call clash or an overloaded LE which is temporarily unable to provide service to that remote user port. This is a standard part of the PSTN protocol and has to be supported.

The second part of the PSTN protocol is, in reality, just a set of messages which may be mixed and matched in order to synthesize any analogue service required. The mapping of these messages to the analogue services required within any particular country is outside the scope of the present document. It is assumed that this task will have been completed prior to any NMDS implementation being specified within any country. Should this prerequisite not be met, the NMDS system cannot be expected to function correctly.

It is the fact that the PSTN protocol has already been extensively tested and mapped onto the various PSTN services as supported by many countries that makes it such a powerful tool and hence so useful for this application.

Annex D (informative): The relationship between a directly connected NMDS and one supported via an access network

Although the support of NMDS via V5 interfaces is outside the scope of the present standard, this annex identifies two possible methods which may be envisaged to support the NMDS via V5 interface Access Networks. The purpose of this annex is only to highlight the major functional requirements and impacts on the AN and the LE, depending on the method applied, when the NMDS support via a V5 Access Network is considered.

D.1 Introduction

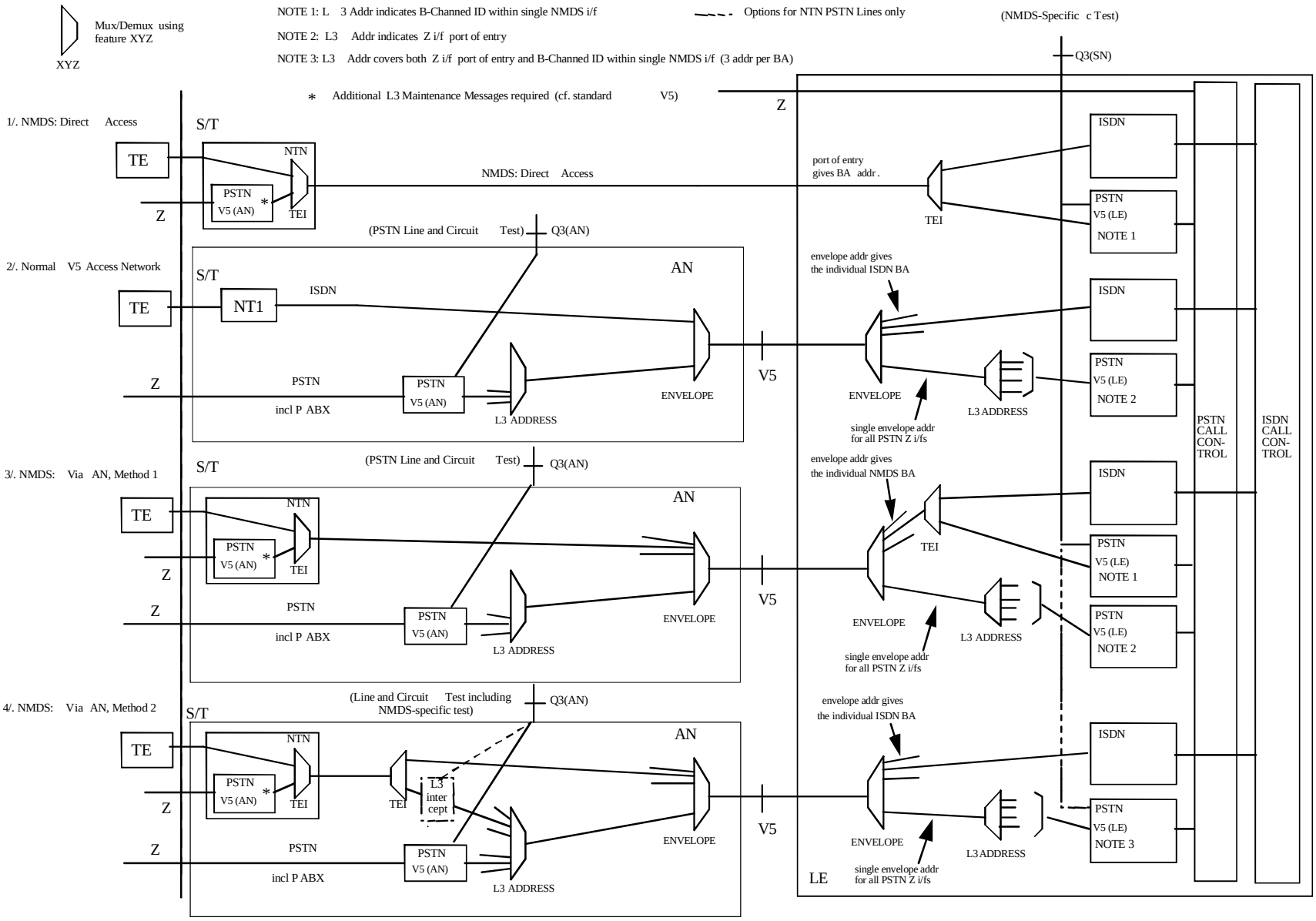
Figure D.1 compares the functions required to support NMDS access via an Access Network with those for NMDS direct access and those for a normal V5 access network. Two alternative methods have been identified: both provide the same overall functionality. They differ only in the basis of multiplexing and demultiplexing methods used in LE and AN. The first results in complexity in the LE, the latter, equivalent complexity in the AN. Either method is permissible.

It has been identified that scenario 4 in figure D.1 showing the second method of connecting an NMDS via an AN will require changes to both the V5 specification ETS 300 324-1 [3] and to the associated Q(V5AN) specifications. Whilst these changes are not thought to be overly complex, there would be a need for an in-depth analysis in order that all the ramifications of this architecture are identified.

Tables D.1 and D.2 support the diagram, describing the functions involved in both AN and LE for both the AN options in a manner permitting easy comparison.

Method 1 has major impacts on LE functional requirements relating to the termination of NMDS on the V5 interface, while Method 2 has major impacts on AN functionalities to terminate the NMDS and to support the NMDS management.

The viability of either methods requires careful consideration and would imply appropriate enhancements to the V5 management standards.



NMDS: Direct Access case and the two possible cases of access via an Access Network (AN) compared with Normal V5 Acces

Figure D.1

Table D.1: Functionality in scenario 3 from figure D.1

Figure D.1 at AN	Figure D.1 at SN (LE)	Comment
Layer 2 frames from NTNs are envelope multiplexed on to V5 link to LE (Layer "1.5" function).	Envelope de-multiplexing is used to separate out individual NTN streams and the AN's V5 stream.	SN is more complex than in Configuration 4; AN is less complex.
PSTN (V5) inputs to the AN are multiplexed on the basis of Layer 3 address and the resulting Layer 2 frames multiplexed along with NTN Layer 2s by enveloping.	NTN streams are de-multiplexed into ISDN and PSTN by reference to TEI (layer 2).	
AN functionality is very like basic V5.	Individual AN PSTN lines are de-multiplexed by Layer 3 address which indicates the Z i/f port of entry.	
	NTN PSTN lines: the Layer 3 address defines the B-channel i/d within a single NMDS access.	
Q3(AN) is used to implement Line and Circuit testing on the AN connected PSTN (incl. PABX) lines.		Simple AN structure but at cost of inconsistent handling of Line and circuit test: AN connected PSTN lines handled via Q3(AN), NTN connected PSTN lines handled via Q3(SN).
Q3(AN) is not used to implement Line and Circuit testing on the NTN connected PSTN lines since the NMDS layer 3s are not terminated at the AN and there is therefore no access to NMDS Layer 3 messages in the AN.	Q3(SN) used to send modified V5 layer 3 messages to implement (e.g.) line testing at the NMDS Z i/f, i.e. on the NTN connected PSTN lines.	

Table D.2: Functionality in scenario 4 from figure D.1

Figure D.1 at AN	Figure D.1 at SN (LE)	Comment
NTN streams are de-multiplexed at layer 2 (TEI) into ISDN and PSTN streams.	Envelope de-multiplexing is used to separate individual ISDN BA streams from the aggregate PSTN stream.	Simple arrangement at LE almost identical to functionality required for support of V5 AN. TEIs for the AN-hosted NMDS systems are assigned by provisioning via Q3(AN). AN is more complex than in configuration 3.
PSTN(V5) inputs to the AN and PSTN streams from the NTNs are multiplexed on the basis of layer 3 Address. Note that for the NTN PSTN Streams there are 3 possible L3 addresses per basic access. So, in this multiplexing function the L3 address covers both the BA port of entry to the AN and the B Channel identity of the individual NTN PSTN stream.	PSTN Stream is de-multiplexed using the Layer 3 address . L3 Address will identify either: Z interface port of entry, or 1 of 3 possible B channel IDs plus the address of the basic access containing the B channel.	
Envelope multiplexing (Layer 1.5) is used to multiplex NTN ISDN streams and the aggregated V5 PSTN stream.	Arrangement at LE is very similar to normal V5 functionality (configuration 2).	
Q3(AN) is used to implement Line and Circuit testing on the AN connected PSTN (incl. PABX) lines.		This option requires more complexity in the AN but gives consistent handling of the management of PSTN line/circuit test in that both AN connected. and NTN connected PSTN lines are tested from the AN Manager.
Q3(AN) could be used to send modified V5 layer 3 messages implement Line and Circuit testing on the NTN connected PSTN lines since the NMDS PSTN layer 3s are opened at the AN to enable L3 address based multiplexing. This means --->	if <--- applies, Q3(SN) does not need to send modified V5 layer 3 messages to implement (e.g.) line testing at the NMDS Z i/f, i.e. on the NTN connected PSTN lines.	
If Q3(AN) is not used to implement Line and Circuit testing on the NTN connected PSTN lines, then this function would be as in Configuration 3 and ---> applies.	if <--- applies, Q3(SN) would be used to send modified V5 layer 3 messages to implement (e.g.) line testing at the NMDS Z i/f, i.e. on the NTN connected PSTN lines.	This option is less complex in the AN in that no sourcing/interpretation of the NMDS Layer 3 messages is involved in the AN but as with configuration 3 results in inconsistent handling of Line and circuit test: AN connected PSTN lines handled via Q3(AN), NTN connected PSTN lines handled via Q3(SN.

Annex E (informative): The reasons for the new information element values chosen

E.1 General

The information element values were chosen for specific reasons. These are historic and are given below in order to aid understanding.

E.2 Specific coding rules for information elements in the V5 specifications

The information elements allocated for V5 are specified in table M.2 of ETS 300 347-1 [4]. This shows some additional features:

- Single Octet information elements have a 1 in bit position 8.
- Variable length information elements have a 0 in bit position 8. For these information elements further rules are added:
  - Bit 7 set to 1 is used to indicate BCC functions.
  - Bit 6 set to 1 is used to indicate Control functions.

E.3 Specific codes used for the STATUS ENQUIRY information elements for NMDS

The STATUS ENQUIRY information elements octets are single octet information elements.

For the reasons specified elsewhere in the present document, and taking into account the information elements already defined in table M.2 of ETS 300 347-1 [4], it was decided to define the following single octet information elements:

1 1 0 1 0 0 0 0 for PSTN STATUS ENQUIRY messages.

1 1 0 1 0 0 0 1 for ISDN STATUS ENQUIRY messages.

E.4 Specific codes used for the STATUS information elements for NMDS

The STATUS message information elements octets are multiple octet information elements.

For the reasons specified elsewhere in the present document, and taking into account the information elements already defined in table M2 of ETS 300 347-1 [4], it was decided to define the following multiple octet information elements:

0 0 0 1 1 1 1 0 for PSTN STATUS messages.

0 0 0 1 1 1 1 1 for ISDN STATUS messages.

Annex F (informative): Permanent activation of basic access digital section

The use of permanent activation of the basic access digital section for NMDS may improve the service perceived by the user, based on the following:

1) Many networks have delay to dial tone requirements and especially on today's modern electronic exchanges the user expectation is that dial tone is present by the time the handset has reached the ear. It is this performance that will be expected of the PSTN service from NMDS. It has been recognized in the V5 forum that the protocol stack of V5.1 (effectively permanently activated layer 1 (primary rate) and point-to-point layer 2 carrying PSTN protocol with national mapping at layer 3) may make it difficult to achieve such performance for PSTN ports connected via a V5.1 AN. As the same protocol stack is used for NMDS it will inherit the same issues. Choosing to use a permanently activated digital section ensures that the structure of NMDS does not make the situation worse. Using a layer 1 protocol which involved the need to activate the digital section on detecting a seize would add an additional delay.

2) The decision as to when to apply power feed to the PSTN port may in some networks be linked to the provision of PSTN service to the line by the LE. An effective method of achieving this is to supply power only in the presence of an established layer 2 with respect to the PSTN-GW concerned. If, however, layer 1 activation and layer 2 establishment were to be triggered from the NTN PSTN-GW, then the power feed to the PSTN port would have to be supplied independently from these. This may result in a PSTN user erroneously believing service is available (because the line is powered) when it is not. Alternatively whether to apply power feed to the PSTN port may be determined by some stored data in the NTN based on an earlier layer 3 communication with the exchange. This NTN stored data would have to follow the exchange data in relation to supporting the PSTN port/service. The use of permanent activation and point-to-point layer 2 establishment to determine when to apply power feed to the PSTN port thus simplifies the NTN and the exchange.

3) Permanent activation of the basic access digital section further simplifies the NTN as it removes the need for it to support user activation procedures triggered from detecting a seize at the PSTN port or user initiation of activation of the S/T interface.

Annex G (informative): Remote equipment - functional requirements

The basic remote equipment functional requirements for an NTN are shown in figure G.1a. The NTN has a full capability S/T interface able to support the maximum number of ISDN terminals. In addition, it can support a PSTN terminal via a Z interface. The NT1* function has additional functionality over the normal ISDN NT1 in order to enable it to handle the additional PSTN interface.

In effect, ISDN TEs and a PSTN TE via its PSTN Gateway (effectively a PSTN TA) are in contention for the S/T Interface, even though the latter is a different type of terminal. (More details of the internal functions of the NT1* and PSTN-GW are indicated in figure G.1b). The reason for this is that it must be possible to prevent the ISDN-BA terminals from sending D-channel information whilst signalling information is being transmitted to the LE from the PSTN-GW. An alternative approach, although potentially more expensive, is to buffer ISDN-BA D-channel frames within the NTN and to control the time of their transmission towards the LE.

In different markets, the NTN implementation may be varied to meet the local requirements. Some examples of NMDS compliant NTN variants which may be implemented follow:

1) (Ref. figure G.2a) Regulatory reasons may require complete separation of the customer interfaces for ISDN and PSTN, i.e. that PSTN information is prevented from getting onto the S/T Interface and, in these circumstances, some additional functionality is required in the configuration to achieve the separation (indicated in figure G.2b):

   - upstream - functionally, a buffer is required on the network side of the S/T interface and PSTN information inserted on the network side of this. An "all 1s" pattern is inserted on the echo bit to hold the bus.

   - downstream, (if required) the L2 frames are inspected to prevent PSTN information from passing onto the S/T Interface.

   - the upstream functions may be implemented based on the use of buffer memory associated with the user ports: this still requires feedback to the S/T Interface so that ISDN users are aware of "hold-ups".

2) (Ref. figure G.3) Where permitted by the regulatory environment, the PSTN-GW functions may be supported by the S/T Interface, appearing at layer 1 as another ISDN-like terminal. This configuration reduces by one the number of ISDN terminals that can be handled on the S/T Interface, but uses an ISDN NT1. The logical development of this is:

3) (Ref. figure G.4) (Where permitted by the regulatory environment,) combination of the PSTN-GW and PSTN TE to form a "PSTN Digital telephone". In this case there is no interface at the Z reference point.

In general, the NMDS standard is concerned with the functionality of the NTN and therefore refers to this grouping throughout, however this does not preclude implementations based on different physical groupings where regulatory contexts permit.

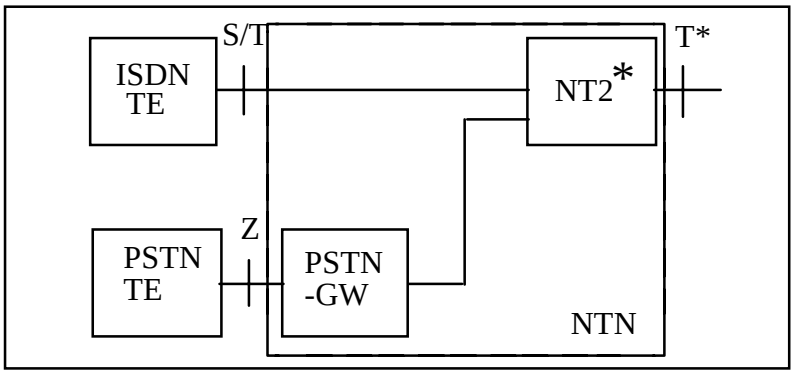


Figure G.1a: The basic remote equipment functional requirements for an NTN

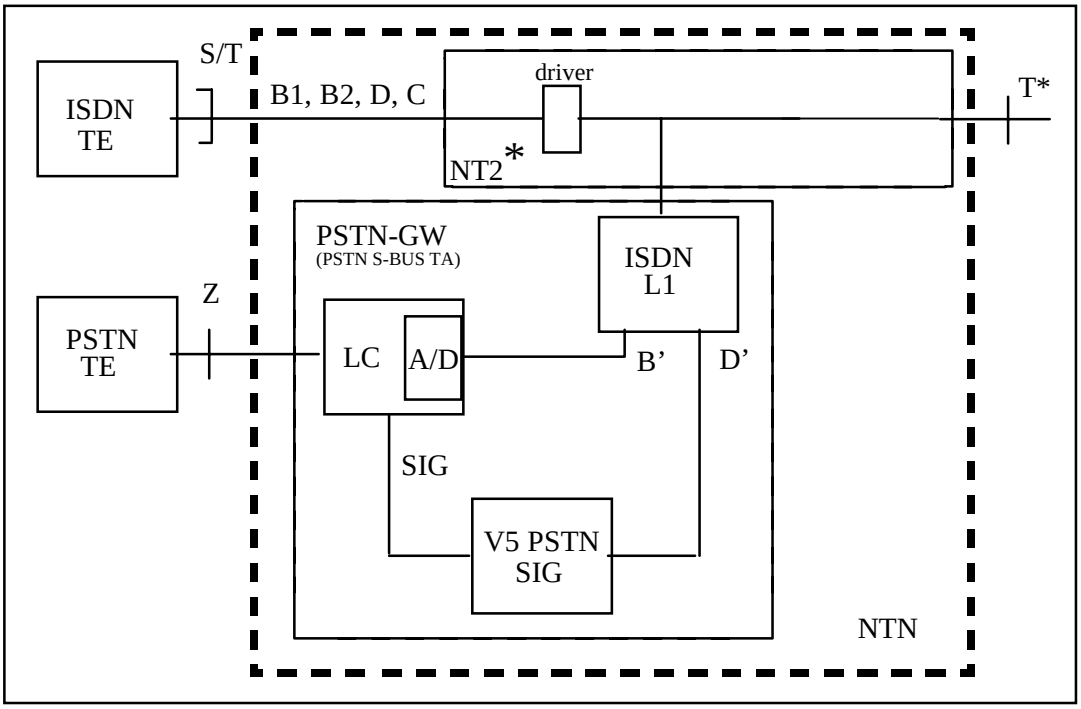


Fig G.1b: D-channel potential internal functionality of the NT2* and PSTN-GW, given no D-channel buffering

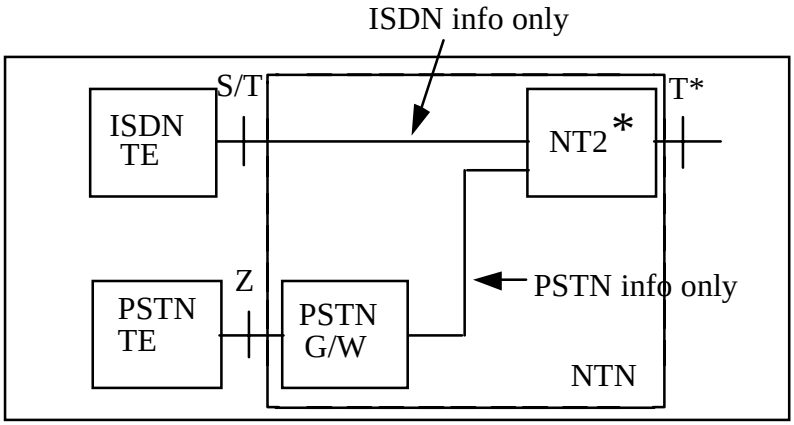


Figure G.2a: Regulatory reasons may require complete separation of the customer interfaces for ISDN and PSTN

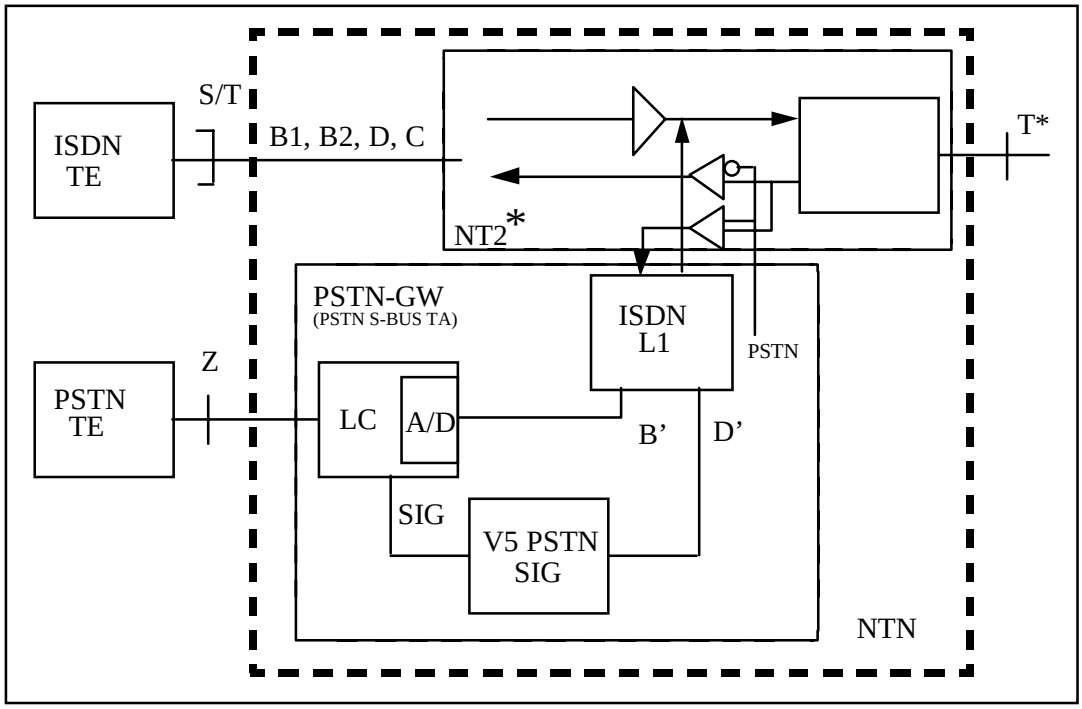


Figure G.2b: Additional functionality required should it be necessary to prevent PSTN information from getting onto the S/T Interface

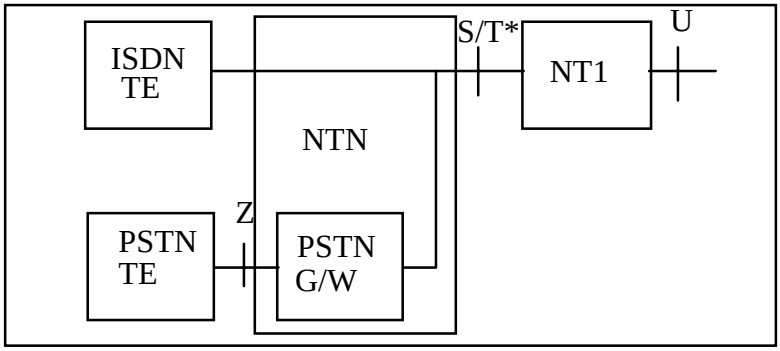


Figure G.3: The PSTN gateway functions may be supported by the S Bus, appearing at layer 1 as another ISDN-like terminal

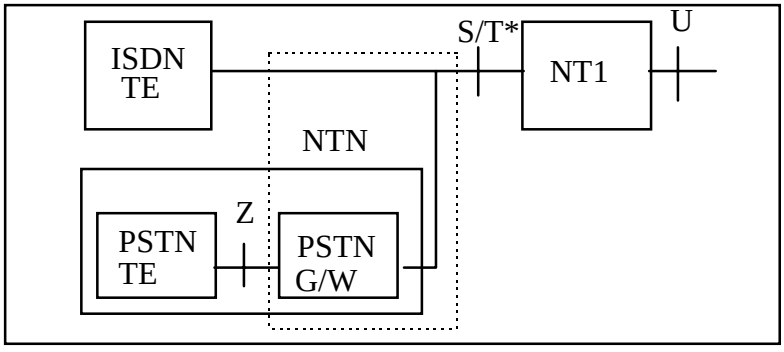


Figure G.4: The combination of the PSTN gateway and PSTN TE to form a PSTN digital telephone

Annex H (informative): Supplementary services useable at the NMDS

Supplementary services provided by the network to direct PSTN access and ISDN basic access may be provided and made available to the NMDS. The provision of the supplementary services to each provisioned PSTN line and to the ISDN access requires appropriate subscription arrangements with the network service provider.

NOTE: It is expected that PSTN supplementary services available to direct PSTN lines in a network are also made available, at similar conditions, to PSTN lines at the NMDS. Similarly, ISDN supplementary services available to direct ISDN basic accesses in a network are also made available, at similar conditions, to the ISDN access at the NMDS.

H.1 Applicability of PSTN supplementary services

PSTN supplementary services applicable to the direct PSTN lines are applicable to (incoming and outgoing) calls handled through a PSTN port via the NMDS, without any impact except those stated below.

Due to the concentrating nature of the NMDS, the following specific interactions with supplementary services apply to an incoming call destined to a PSTN line which is known to be not already engaged in a call:

- Call Forwarding busy supplementary service : if provisioned and activated for the called PSTN line, may be invoked by the LE if there is no B channel available (to establish the path to the PSTN gateway), regardless of which of the PSTN lines or ISDN access port are currently using the B channels at the NMDS;

- Call completion on busy subscriber : if provisioned and possible for the call instance, may be invoked by the LE if there is no B channel (available to establish the path to the PSTN gateway), regardless of which of the PSTN lines or ISDN access port are currently using the B channels at the NMDS.

NOTE: If both are provisioned and activated, their interaction may be handled in the same way as their interaction is handled on direct LE PSTN lines (e.g. precedence may be given to the invocation of the Call forwarding busy supplementary service).

If none of these two supplementary services are applicable (not provided or not activated), and if no B channel is available to proceed with an incoming call destined to one of the PSTN lines which is known to be not already engaged in a call , then the call may be cleared and a network clearing message with a cause #34, *no circuit/channel available*, and the location field set to 'public network serving the remote user', be sent towards the exchange serving the remote user.

H.2 Applicability of ISDN supplementary services

ISDN supplementary services applicable to the S/T reference point are applicable, without any impact and restriction, to the NMDS. They apply to (incoming and outgoing) calls handled through the ISDN-BA Port.

Bibliography

- ETS 300 297 (1995): "Integrated Services Digital Network (ISDN); Access digital section for ISDN basic access".
- ITU-T Recommendation M.3602 (10/92): "Application of maintenance principles to ISDN subscriber installations".
- ITU-T Recommendation M.3603 (10/92): "Application of maintenance principles to ISDN basic rate access".
- ITU-T Recommendation I.112: "Vocabulary of terms for ISDNs".

History

Document history				
V1.1.1	January 1998	Public Enquiry	PE 9822:	1998-01-30 to 1998-05-29
V1.2.1	July 1998	Vote	V 9837:	1998-07-14 to 1998-09-11