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Integrated Services Digital Network (ISDN); Primary rate User Network Interface (UNI); Part 1: Layer 1 specification

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM).

The present document aims to meet urgent requirements of network operators and equipment manufacturers who are designing equipment to operate with an Integrated Services Digital Network (ISDN) primary rate access User Network Interface (UNI).

The present document is based upon ITU-T Recommendation I.431 [14] and provides modifications and further requirements to that document. It also is affected by ITU-T Recommendations G.703 [15], G.704 [16] and G.706 [17], and modifications to these ITU-T Recommendations are provided within the present document.

The present document also takes into account requirements contained in ECMA 104 [13]: "Physical layer at the primary rate access interface between data processing equipment and private switching networks (1985)", which are given in annex A.

The present document consists of 3 parts as follows:

- Part 1: "Layer 1 specification"**
- Part 2: "Conformance test specification for interface I_A and I_B";
- Part 3: "Implementation Conformance Statement (ICS) and Implementation eXtra Information for Testing (IXIT) proforma specification for Interface I_A and I_B".

The present document includes editorial improvements of the safety related clauses.

National transposition dates	
Date of latest announcement of this EN (doa):	31 August 2000
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	29 February 2001
Date of withdrawal of any conflicting National Standard (dow):	29 February 2001

1 Scope

The present document specifies requirements and test principles for the ISDN 2 048 kbit/s primary rate UNI including the physical, electrical and functional characteristics and the information exchange with higher layers. Compliance with the present document ensures that, with regard to layer 1 interface aspects, equipment for use with ISDN primary rate access is portable within countries that adhere to the present document and, furthermore, that interworking with higher layer protocols for ISDN is supported.

The present document is applicable to equipment having interface I_A or I_B for the connection to the ISDN primary rate UNI intended to be installed on customers' premises. In accordance with ITU-T Recommendation I.411 [1], the present document is to be applied to interfaces at reference points S, T and S/T (coincident S and T) of the ISDN reference configuration.

The present document is applicable for ISDN channel arrangements as defined in ITU-T Recommendation I.412 [2], as far as the primary rate at 2 048 kbit/s is concerned.

Annex A specifies additional requirements for interfaces at reference point S.

The present document does not specify:

- safety requirements;
- interface or equipment overvoltage protection requirements;
- immunity requirements against electromagnetic interferences;
- emission limitation requirements.

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2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, 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.

- [1] ITU-T Recommendation I.411 (1993): "ISDN user-network interfaces - Reference configurations".
- [2] ITU-T Recommendation I.412 (1988): "ISDN user-network interfaces- Interface structures and access capabilities".
- [3] ITU-T Recommendation O.151 (1992): "Error performance measuring equipment operating at the primary rate and above".
- [4] EN 60603-7 (1993): "Connectors for frequencies below 3 MHz for use with printed boards - Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features".
- [5] ITU-T Recommendation O.162 (1992): "Equipment to perform in-service monitoring on 2 048, 8 448, 34 368 and 139 264 kbit/s signals".
- [6] ITU-T Recommendation M.20 (1992): "Maintenance philosophy for telecommunication networks".
- [7] ETSI ETR 001: "Integrated Services Digital Network (ISDN); Customer access maintenance".

- [8] ETSI ETS 300 166 (1993): "Transmission and Multiplexing (TM); Physical and electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s - based plesiochronous or synchronous digital hierarchies".
- [9] ETSI ETS 300 233 (1994): "Integrated Services Digital Network (ISDN); Access digital section for ISDN primary rate".
- [10] ETSI ETS 300 247 (1995): "Business Telecommunications (BT); Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U) Connection characteristics".
- [11] ETSI ETS 300 419 (1995): "Business Telecommunications (BTC); 2 048 kbit/s digital structured leased lines (D2048S); Connection characteristics".
- [12] CCITT Recommendation X.200 (1994): "Information technology - Open Systems Interconnection - Basic reference model: The basic model".
- [13] ECMA 104: "Physical Layer at the Primary Rate Access Interface between Data Processing Equipment and Private Switching Networks".
- [14] ITU-T Recommendation I.431 (1993): "Primary rate user-network interface - Layer 1 specification".
- [15] ITU-T Recommendation G.703 (1991): "Physical/electrical characteristics of hierarchical interfaces".
- [16] ITU-T Recommendation G.704 (1995): "Synchronous frame structures used at 1 544, 6 312, 2 048, 8 488 and 44 736 kbit/s hierarchical levels".
- [17] ITU-T Recommendation G.706 (1991): "Frame alignment and cyclic redundancy check (CRC) procedures relating to basic frame structures defined in Recommendation G.704".
- [18] CCITT Recommendation G.811 (1988): "Timing requirements at the outputs of primary reference clocks suitable for plesiochronous operation of international digital links".
<https://standards.iteh.ai/catalog/standards/sist/55881771-7230-4add-bc77-138e8441c335/sist-93300-011-1-v1-2-2003>
- [19] ITU-T Recommendation G.823 (1993): "The control of jitter and wander within digital networks which are based on the 2 048 kbit/s hierarchy".
- [20] CCITT Recommendation I.604 (1988): "Application of maintenance principles to ISDN primary rate accesses".
- [21] ITU-T Recommendation O.9 (1999): "Measuring arrangements to assess the degree of unbalance about earth".
- [22] CCITT Recommendation O.171 (1992): "Timing jitter measuring equipment for digital systems".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Alternate Mark Inversion (AMI): is a code where ONEs are represented by alternate positive and negative pulses, and ZEROs by spaces.

High-Density Bipolar 3 (HDB3): is a modified AMI code. An exception occurs for blocks of 4 successive ZEROs. Each block of 4 successive ZEROs is replaced by OOOV or BOOV where B represents an inserted pulse conforming to the AMI and V represents an AMI violation. The choice of OOOV or BOOV is made so that the number of B pulses between consecutive V pulses is odd. In other words, successive V pulses are of alternate polarity so that no direct current (dc) component is introduced.

interface I_A: user side of the ISDN UNI for the primary rate access.

interface I_B: network side of the ISDN UNI for the primary rate access.

network side: NT1, LT and ET functional groups in case of an interface at the T reference point; or relevant parts of the NT2 functional group in case of an interface at the S reference point.

network option 1: the digital link between interface at the T and V reference point does not provide a CRC-4 processing, i.e. the CRC-4 is terminated in the TE and the ET. This digital link is called to be "without CRC processing" (see subclause 7.2.2.2).

NOTE 1: This option is not provided by the public ISDN at the T reference point. However it might be used for Private Telecommunications Network Exchange (PTNX) interconnection using unstructured 2 048 kbit/s leased lines.

network option 2: the digital link between interface at the T and V reference point provides CRC-4 processing in the NT1 and the ET according ETR 001 [7]. Therefore the combinations of CRC-4 error information and Remote Alarm Indication (RAI) indicate the fault condition; FC1 or FC4 (see subclause 7.2.2.1).

NOTE 2: Option 3 of CCITT Recommendation I.604 [20] with CRC-4 processing in NT1, LT and ET is not relevant for the present document.

Network Termination (NT): an equipment providing interface I_B.

NOTE 3: This term is used in the present document to indicate network-terminating aspects of NT1 and NT2 functional groups where these have an I_B interface.

Network Termination Type 1 (NT1): this functional group includes functions broadly equivalent to layer 1 (physical) of the Open System Interconnection (OSI) reference model. These functions are associated with the proper physical and electromagnetic termination of the network. NT1 functions are:

- line transmission termination;
- layer 1 maintenance functions and performance monitoring;
- timing;
- layer 1 multiplexing;
- interface termination.

Network Termination Type 2 (NT2): this functional group includes functions broadly equivalent to layer 1 and higher layers of the CCITT Recommendation X.200 [12] reference model. Private Telecommunication Network Exchanges (PTNXs), local area networks and terminal controllers are examples of equipment or combinations of equipment that provide NT2 functions. NT2 functions include:

- layer 2 and layer 3 protocol handling;
- layer 2 and layer 3 multiplexing;
- switching;
- concentration;
- maintenance functions;
- interface termination and other layer 1 functions.

Private Telecommunication Network Exchange (PTNX): a nodal identity in a private telecommunication network which provides autonomous and automatic switching and call handling functions used for the provision of telecommunication services which are based on the definitions for those of the public ISDN.

Private Network Termination (PNT): a remote unit of equipment which terminates a transmission system employed between the PTNX and the interface I_B and the S reference point.

Terminal Adapter (TA): an equipment with interface I_A and one or more auxiliary interfaces that allow non-ISDN terminals to be served by an ISDN UNI.

Terminal Equipment (TE): an equipment providing an interface I_A .

NOTE 4: This term is used in the present document to indicate terminal-terminating layer 1 aspects of TE1, TA and NT2 functional groups, where these have an I_A interface.

NOTE 5: In annex A, this definition applies with the exception that the NT2 functional grouping is not covered.

Terminal Equipment Type 1 (TE1): this functional group includes functions belonging to the functional group TE, and with an interface that complies with the ISDN UNI standard.

user side: terminal terminating layer 1 aspects of TE1, TA and NT2 functional groups.

3.2 Symbols

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

ONE	binary "1"
ZERO	binary "0"

3.3 Abbreviations

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

AIS	Alarm Indication Signal
AMI	Alternate Mark Inversion
CRC	Cyclic Redundancy Check
dc	direct current
EMC	ElectroMagnetic Compatibility
ET	Exchange Termination
FC	Fault Condition
HDB3	High-Density Bipolar 3 (line code)
ISDN	Integrated Service Digital Network
LOS	Loss Of Signal
MPH	Management (entity) - PPhysical (layer) [primitive]
MPH-AI	MPH Activate Indication
MPH-EI	MPH Error Indication
MTIE	Maximum Time Interval Error
NOF	Normal Operational Frames
NT	Network Termination
PH	PHysical (layer)
PH-AI	PH - Activate Indication
PH-DI	PH - Deactivate Indication
PNT	Private Network Termination
PRBS	Pseudo-Random Binary Sequence
PTN	Private Telecommunications Network
PTNX	Private Telecommunications Network Exchange
RAI	Remote Alarm Indication
SMF	Sub-MultiFrame
TA	Terminal Adapter
TE	Terminal Equipment
UNI	User Network Interface

4 Type of configuration

The type of configuration applies only to the layer 1 characteristics of the interface and does not imply any constraints on modes of operation at higher layers.

4.1 Point-to-point

The primary rate shall support only the point-to-point configuration.

Point-to-point configuration at layer 1 implies that for each direction only one source (transmitter) and one sink (receiver) are connected to the interface. The maximum reach of the interface in the point-to-point configuration is limited by specification for the electrical characteristics of transmitted and received pulses and the type of interconnecting cable.

4.2 Location of interface

The electrical characteristics apply to the interface points I_A and I_B of figure 1.



NOTE: I_A is located at the input and output ports of the TE. I_B is located at the input and output ports of the NT.

Figure 1: Location of interfaces

4.3 Interface wiring

The magnitude of the characteristic impedance of symmetrical type interface cable shall be $120 \Omega \pm 20 \%$ in a frequency range from 200 kHz to 1 MHz and $120 \Omega \pm 10 \%$ at 1 MHz.

The use of shielded interface cables may be required to meet radiation emission and immunity requirements. Therefore the Terminal Equipment (TE) and the Network Termination (NT) shall have provided a point on the equipment where a shield of the interface cable can, and if provided shall be connected to.

This point shall be designed respecting EMC requirements providing access to the signal reference for the transmitter and receiver of the equipment interface.

Application of interface cable with individually shielded pairs or with a common shield for both pairs shall be possible.

4.4 Interface connector

The interface connector and contact assignments is specified in EN 60603-7 [4] and the contact assignments in table 1. However permanent wiring connections from TE to NT are also permitted.