

**Access and Terminals (AT);
Public Switched Telephone Network;
Support of legacy terminals by BroadBand IP equipment;
Listing of the most relevant features and functionalities;
Part 3: ISDN terminals**



Reference

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Access and Terminals (AT).

The present document is part 3 of a multi-part deliverable. Full details of the entire series can be found in part 1 [7].

Introduction

The Telecommunications industry in Europe and surrounding regions has started to deploy broadband IP access networks using both wired and wireless access technologies (sometimes referred to as Next Generation Networks (NGN)). The initial rollout of these Broadband networks has been focussed on supporting both data and interactive content, however, there is now an urgent need to support IP Voice (Telephony over IP) and other time critical multimedia services over these broadband networks. In particular there is a need to support legacy ISDN Terminal Equipment, this fact is highlighted in TR 101 963 [6], clause 5 relating to MTA Requirements.

Consequently in order to support the development of broadband networks and equipment with support for legacy ISDN terminals, the key functions and features of these terminals need to be sufficiently defined.

All new systems, independent of their access technology, may enjoy the results of the present document.

1 Scope

The present document describes the functional technical characteristics supported by PSTNs across the wider European market, in order to provide guidance to developers of broadband networks and equipment (e.g. IPCablecom embedded MTA, FWA subscriber units) that support an ISDN terminal.

The present document does not include any Safety or EMC aspects or requirements.

2 References

For the purposes of this Technical Report (TR) the following references apply:

- [1] ETSI TBR 003/A1 (Edition 1): "Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN basic access".
- [2] ETSI TBR 004/A1 (Edition 1): "Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN primary rate access".
- [3] ETSI TBR 008/C2 (Edition 1): "Integrated Services Digital Network (ISDN); Telephony 3,1 kHz teleservice; Attachment requirements for handset terminals".
- [4] ETSI TBR 033 (Edition 1): "Integrated Services Digital Network (ISDN); Attachment requirements for packet mode terminal equipment to connect to an ISDN using ISDN basic access".
- [5] ETSI TBR 034 (Edition 1): "Integrated Services Digital Network (ISDN); Attachment requirements for packet mode terminal equipment to connect to an ISDN using ISDN primary rate access".
- [6] ETSI TR 101 963: "Access and Terminals (AT); Report on the Requirements of European Cable Industry for Implementation of IPCablecom Technologies; Identification of high level requirements and establishment of priorities".
- [7] ETSI TR 101 973-1: "Access and Terminals (AT); Public Switched Telephone Network; Support of legacy terminals by BroadBand IP equipment; Listing of the most relevant features and functionalities; Part 1: General".
- [8] ETSI TR 103 050 (V1.2.1): "Access and Terminals (AT); Digital Access to Public Telephone Networks; Applicability of ITAAB Advisory Notes to TBRs".
- [9] ETSI ES 201 912: "Access and Terminals (AT); Short Message Service (SMS) for PSTN/ISDN; Short Message Communication between a fixed network Short Message Terminal Equipment and a Short Message Service Centre".
- [10] ETSI ES 202 122 (V1.1.1): "Access and Terminals (AT); Integrated Services Digital Network (ISDN); ISDN NT port on Terminal Equipment".
- [11] ETSI ETS 300 048 (Edition 2): "Integrated Services Digital Network (ISDN); ISDN Packet Mode Bearer Services (PMBS); ISDN Virtual Call (VC) and Permanent Virtual Circuit (PVC) bearer services provided by the B-channel of the user access - basic and primary rate".
- [12] ETSI ETS 300 050 (Edition 1): "Integrated Services Digital Network (ISDN); Multiple Subscriber Number (MSN) supplementary service; Service Description".
- [13] ETSI ETS 300 053 (Edition 1): "Integrated Services Digital Network (ISDN); Terminal Portability (TP) supplementary service; Service Description".
- [14] ETSI ETS 300 056 (Edition 1): "Integrated Services Digital Network (ISDN); Call Waiting (CW) supplementary service; Service Description".

- [15] ETSI ETS 300 059 (Edition 1): "Integrated Services Digital Network (ISDN); Subaddressing (SUB) supplementary service; Service Description".
- [16] ETSI ETS 300 062 (Edition 1): "Integrated Services Digital Network (ISDN); Direct Dialling In (DDI) supplementary service; Service Description".
- [17] ETSI EN 300 089 (V3.1.1): "Integrated Services Digital Network (ISDN); Calling Line Identification Presentation (CLIP) supplementary service; Service description".
- [18] ETSI EN 300 090 (V1.2.1): "Integrated Services Digital Network (ISDN); Calling Line Identification Restriction (CLIR) supplementary service; Service description".
- [19] ETSI EN 300 094 (V2.1.1): "Integrated Services Digital Network (ISDN); Connected Line Identification Presentation (COLP) supplementary service; Service description".
- [20] ETSI ETS 300 095 (Edition 1): "Integrated Services Digital Network (ISDN); Connected Line Identification Restriction (COLR) supplementary service; Service description".
- [21] ETSI EN 300 012-1 (V1.2.2): "Integrated Services Digital Network (ISDN); Basic User-Network Interface (UNI); Part 1: Layer 1 specification".
- [22] ETSI ETS 300 128 (Edition 1): "Integrated Services Digital Network (ISDN); Malicious Call Identification (MCID) supplementary service; Service description".
- [23] ETSI ETS 300 136 (Edition 1): "Integrated Services Digital Network (ISDN); Closed User Group (CUG) supplementary service; Service description".
- [24] ETSI ETS 300 139 (Edition 1): "Integrated Services Digital Network (ISDN); Call Hold (HOLD) supplementary service; Service description".
- [25] ETSI ETS 300 178 (Edition 1): "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at call set-up time (AOC-S) supplementary service; Service description".
- [26] ETSI ETS 300 179 (Edition 1): "Integrated Services Digital Network (ISDN); Advice of Charge: charging information during the call (AOC-D) supplementary service; Service description".
- [27] ETSI ETS 300 180 (Edition 1): "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at the end of the call (AOC-E) supplementary service; Service description".
- [28] ETSI ETS 300 182 (all parts) (Edition 1): "Integrated Services Digital Network (ISDN); Advice of Charge (AOC) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol".
- [29] ETSI ETS 300 183 (Edition 1): "Integrated Services Digital Network (ISDN); Conference call, add-on (CONF) supplementary service; Service description".
- [30] ETSI ETS 300 186 (Edition 1): "Integrated Services Digital Network (ISDN); Three-Party (3PTY) supplementary service; Service description".
- [31] ETSI EN 300 199 (V1.2.1): "Integrated Services Digital Network (ISDN); Call Forwarding Busy (CFB) supplementary service; Service description".
- [32] ETSI ETS 300 200 (Edition 1): "Integrated Services Digital Network (ISDN); Call Forwarding Unconditional (CFU) supplementary service; Service description".
- [33] ETSI EN 300 201 (V1.2.1): "Integrated Services Digital Network (ISDN); Call Forwarding No Reply (CFNR) supplementary service; Service description".
- [34] ETSI ETS 300 202 (Edition 1): "Integrated Services Digital Network (ISDN); Call Deflection (CD) supplementary service; Service description".
- [35] ETSI ETS 300 208 (Edition 1): "Integrated Services Digital Network (ISDN); Freephone (FPH) supplementary service; Service description".
- [36] ETSI ETS 300 284 (Edition 1): "Integrated Services Digital Network (ISDN); User-to-User Signalling (UUS) supplementary service; Service description".

- [37] ETSI EN 300 357 (V1.2.1): "Integrated Services Digital Network (ISDN); Completion of Calls to Busy Subscriber (CCBS) supplementary service; Service description".
- [38] ETSI EN 300 367 (V1.2.1): "Integrated Services Digital Network (ISDN); Explicit Call Transfer (ECT) supplementary service; Service description".
- [39] ETSI ETS 300 402-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Data link layer; Part 1: General aspects [ITU-T Recommendation Q.920 (1993), modified]".
- [40] ETSI EN 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".
- [41] ETSI ETS 300 710 (Edition 1): "Integrated Services Digital Network (ISDN); Public Switched Telephone Network (PSTN); Universal Access Number (UAN) service; Service description".
- [42] ETSI ETS 300 711 (Edition 1): "Integrated Services Digital Network (ISDN); Public Switched Telephone Network (PSTN); Virtual Card Calling (VCC); Service description".
- [43] ETSI ETS 300 713 (Edition 1): "Integrated Services Digital Network (ISDN); Public Switched Telephone Network (PSTN); Televoting (VOT) service; Service description".
- [44] ETSI EN 300 650 (V1.2.1): "Integrated Services Digital Network (ISDN); Message Waiting Indication (MWI) supplementary service; Service description".
- [45] ETSI EN 301 001-1 (V1.2.2): "Integrated Services Digital Network (ISDN); Outgoing Call Barring (OCB) supplementary services; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".
- [46] ETSI EN 301 065-1 (V1.2.2): "Integrated Services Digital Network (ISDN); Completion of Calls on No Reply (CCNR) supplementary service; Digital Subscriber Signalling System No. one (DSS1) protocol; Part 1: Protocol specification".
- [47] ETSI EN 301 133 (V1.1.1): "Integrated Services Digital Network (ISDN); Selective Call Forwarding (SCF) supplementary services (unconditional, busy and no reply); Service description".
- [48] ECMA-143: "Private Integrated Services Network (PISN) - Circuit Mode Bearer Services - Inter-Exchange Signalling Procedures and Protocol (International Standard ISO/IEC 11572)".
- [49] IETF RFC 3261: "SIP - Session Initiation Protocol".
- [50] IETF RFC 1889: "RTP: A Transport Protocol for Real-Time Applications".
- [51] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".
- [52] ITU-T Recommendation H.323 (2000): "Packet-based multimedia communications systems".
- [53] ITU-T Recommendation H.248 (2000): "Gateway control protocol".
- [54] ITU-T Recommendation I.112 (1993): "Vocabulary of terms for ISDNs".
- [55] ITU-T Recommendation I.210 (1993): "Principles of telecommunication services supported by an ISDN and the means to describe them".
- [56] ITU-T Recommendation I.430 (1995): "Basic user-network interface - Layer 1 specification".
- [57] ITU-T Recommendation J.162 (2001): "Network call signalling protocol for the delivery of time critical services over cable television networks using cable modems".
- [58] ITU-T Recommendation Q.931 (1995): "ISDN user-network interface layer 3 specification for basic call control".

- [59] ITU-T Recommendation X.25 (1996): "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [60] ITU-T Recommendation X.31 (1995): "Support of packet mode terminal equipment by an ISDN".
- [61] ITU-T Recommendation X.200 (1994): "Information technology - Open Systems Interconnection - Basic Reference Model: The basic model".
- [62] ITU-T Recommendation Z.100: "Specification and description language (SDL)".
- [63] ITU-T Recommendation I.431: "Primary rate user-network interface - Layer 1 specification".

3 Definitions and abbreviations

3.1 Definitions

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

basic access: user-network access arrangement that corresponds to the interface structure composed of two B-channels and one D-channel

NOTE: The bit rate of the D-channel for this type of access is 16 kbit/s (ITU-T Recommendation I.430 [56]).

basic telecommunications service: telecommunications service which is either a teleservice or a bearer service

B-channel: this function provides for the bidirectional transmission of independent B-channel signals each having a bit rate of 64 kbit/s

bearer service: type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces

NOTE 1: The ISDN connection type used to support a bearer service may be identical to that used to support other types of telecommunication service.

NOTE 2: See ITU-T Recommendation I.112 [54].

bit timing: function that provides bit (signal element) timing to enable the TE or NT to recover information from the aggregate bit stream

Call Agent (CA): entity that maintains the communication state, and controls the line side of the communication

Call Management Server (CMS): device that performs the ITU-T Recommendation E.164 number to IP address translation and call control management functions within the network

NOTE: A CMS may comprise of the following functional components: a Media Gateway Controller (MGC), an Announcement Controller (ANC), a Gate Controller (GC) and a Call Agent (CA). A CMS is sometimes referred to as a "Soft Switch" (see softswitch).

connection management entity: entity for the purpose of management of resources that have an impact on an individual data link connection

Cyclic Redundancy Check (CRC) procedure: function that provides for the protection against false framing and may provide for error performance monitoring of the interface

D-channel: this function provides for bidirectional transmission of one D-channel signal at a bit rate of 16 kbit/s for basic rate and 64 kbit/s for primary rate

designated terminal: terminal which is permitted to draw power from power source 1 under both normal and restricted power conditions

frame alignment: this function provides information to enable the TE or Network Termination (NT) to recover the time-division multiplexed channels

gatekeeper: entity on an IP network that provides address translation and controls access to the network for IP Terminals, Gateways and Multipoint Control Units (MCU)

NOTE: The Gatekeeper may also provide other services to the IP Terminals, Gateways and MCUs such as bandwidth management and locating Gateways.

High-Density Bipolar 3 (HDB3): modified Alternate Mark Inversion (AMI) code, where binary ONEs are represented by alternate positive and negative pulses, and binary ZEROs by spaces

NOTE: An exception occurs for blocks of 4 successive binary ZEROs. Each block of 4 successive ZEROs is replaced by 000V or B00V, where B represents an inserted pulse conforming to the AMI rule, and V represents an AMI violation. The choice of 000V or B00V 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 dc component is introduced.

Integrated Services Digital Network (ISDN): network that provides or supports a range of different telecommunications services and provides digital connections between user-network interfaces

Interface I_a: user side of the ISDN user-network interface for the basic and primary accesses

Interface I_b: network side of the ISDN user-network interface for the basic and primary accesses

layer management entity: entity for the purpose of management of resources that have layer-wide impact

Network Termination (NT): equipment providing Interface I_b

Network Termination type 1 (NT1): this functional group includes functions broadly equivalent to Layer 1 (physical) of the Open Systems Interconnection (OSI) reference model

NOTE: 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;
- power transfer;
- layer 1 multiplexing;
- interface termination, including multidrop termination;
- for basic rate access employing Layer 1 contention resolution.

Network Termination type 2 (NT2): this functional group includes functions broadly equivalent to Layer 1 and higher layers of the ITU-T Recommendation X.200 [61] reference model

NOTE: Private Automatic Branch Exchanges (PABXs), Local Area Networks (LANs), and terminal controllers are examples of equipment or combinations of equipment that provide NT2 functions. NT2 functions include:

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

non-designated terminal: basic rate access terminal which is only permitted to draw power from Power Source 1 (PS1) under normal power conditions

normal power condition: for the basic rate access the condition indicated by the normal polarity of the phantom voltage at the access leads, i.e. where the voltage of the transmit leads c and d on the TE is positive with respect to the voltage on the receive leads e and f

octet timing: function that provides 8 kHz timing towards TE or NT for the purpose of supporting an octet structure for voice coders and for other timing purposes as required

overlap sending: this state exists for an outgoing call when the user sends call establishment request which does not contain all the necessary routing information and which it intends to send additional call information to the network

primary rate access: user-network access arrangement that corresponds to the primary rate of 2 048 kbit/s. The bit rate of the D-channel for this type of access is 64 kbit/s

Power Source 1 (PS1): basic rate access Power Source for the provision of remote power feeding of TE via a phantom circuit of the interface wires

restricted power condition: basic rate access condition indicated by the reversed polarity of the phantom voltage at the access leads, i.e. where the voltage of the receive leads e and f on the TE is positive with respect to the voltage on the transmit leads c and d

service; telecommunications service: that which is offered by an Administration to its customers in order to satisfy a specific telecommunication requirement

NOTE 1: Bearer service and teleservice are types of telecommunications services other types of telecommunication services may be identified in the future.

NOTE 2: See ITU-T Recommendation I.112 [54], clause 2.2, definition 2a.

softswitch (software switch): generic term for any open application program interface (API) software used to bridge a public switched telephone network (PSTN) and Voice over Internet Protocol (VoIP) network by separating the call control functions of a phone call from the media gateway (transport layer)

supplementary service: See ITU-T Recommendation I.210 [55], clause 2.4.

Terminal Adapter (TA): equipment with Interface I_a and one or more auxiliary interfaces that allow non-ISDN terminals to be served by an ISDN user-network interface

Terminal Equipment (TE): equipment with Interface I_a and consisting of one or more functional blocks

NOTE: This term is used in this TBR to indicate terminal-terminating aspects of TE1, TA and NT2 functional groups, where these have an I_a Interface.

Terminal Equipment type 1 (TE1): functional group which includes functions belonging to the functional group TE, and with an interface that complies with the ISDN user-network interface standard

Triple Play: refers to the three basic categories of services supported by CATV; TV Broadcasting, Internet and IP Multimedia time critical services (such as IP Telephony)

3.2 Abbreviations

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

3PTY	Three Party Service
ACC	Account Card Calling
ACCS	Automatic Credit Card Service
ACR	Anonymous Call Rejection
AOC	Advice of Charge
AOC-D	Advice of Charge, Charging Information During the Call
AOC-E	Advice of Charge, Charging Information at the End of the Call
AOC-S	Advice of Charge, Charging Information at Call Setup Time
B-ISDN	Broadband ISDN
CATV	Cable Television
CB	Call Back

CCBS	Completion of Calls to Busy Subscriber
CCC	Charge Card Calling
CCNR	Completion of Calls on No Reply
CDIST	Call DISTribution
CDO	Call Diversion Override
CF	Call Forwarding
CFB	Call Forwarding Busy
CFB-S	Call Forwarding Busy to a Service Centre
CFNR	Call Forwarding No Reply
CFNR-S	Call Forwarding No Reply to a Service Centre
CFU	Call Forwarding Unconditional
CFU-S	Call Forwarding Unconditional to a Service Centre5
CIDCW	Calling Identity Delivery on Call Waiting
CL	Call Logging
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
CNAM	Calling Name Delivery
CND	Calling Number Delivery
CNIP	Calling Name Identification Presentation
CNIR	Calling Name Identification Restriction
COLP	Connected Line Identification Presentation
COLR	Connected Line Identification Restriction
CONF	Conference Call, Add On
CRED	Credit Card Calling
CT	Call Transfer
CUG	Closed User Group
CVD	Call Volume Distribution
CW	Call Waiting
DC	Delivery Confirmation
DDI	Direct Dialling In
DR	Distinctive Ringing
DRCN	Distinctive Ringing Called Number Dependent
DRCW	Distinctive Ringing/Call Waiting
DTMF	Dual Tone Multi-Frequency
ECT	Explicit Call Transfer
FWA	Fixed Wireless Access
GD	General Deactivation
HOLD	Call Hold
HTA	Home Terminal Adaptor
ICB	Incoming Call Barring
IFS	International Freephone Service
IM	Identity Module
IP	Internet Protocol
ISDN	Integrated Services Digital Network
LH	Line Hunting
MBG	Multi-location Business Group
MCID	Malicious Call Identification
MF	Multi-Frequency (see DTMF)
MLPP	MultiLevel Precedence and Pre-emption
MMC	Meet-me Conference
MR	Message Relay
MTA	Multimedia Terminal Adapter
MWI	Message Waiting Indication
NCT	Normal Call Transfer
NGN	Next Generation Network
NTE	Network Terminating Equipment
NTP	Network Termination Point
OCB	Outgoing Call Barring
OCB-F	Outgoing Call Barring: Fixed
OCB-UC	Outgoing Call Barring: User Controlled
PAD	Packet Assembler/Disassembler
PC	Permanent Circuit

PCC	Preset Conference Calling Service
PDC	Packet Delivery Confirmation
PRI	PRiority
PS	Priority Selection
PSN	Permanent Subscriber Number
PSTN	Public Switched Telephone Network
PVC	Permanent Virtual Circuit
QSIG	Q interface SIGnalling protocol
RCSS	Remote Control of Supplementary Services
RLC	Repeat Last Call
RTP	Real-Time Protocol (see IETF RFC 1889 [50])
SA	Selective Accounting
SAPI	Service Access Point Identifier
SCF	Selective Call Forwarding
SCT	Single Step Call Transfer
SDL	(Functional) Specification and Description Language

NOTE: As defined in ITU-T Recommendation Z.100 (1993) [62] in combination with ITU-T Recommendation Z.100 Addendum 1.

SLE	Screening List Edit
SPNP	Support of Private Numbering Plan
STC	Single Step Call Transfer
TE	Terminal Equipment
TEI	Terminal Equipment Identifier
TH	Trunk Hunting
TP	Terminal Portability
TV	Television
UAN	Universal Access Number
UDR	User Defined Routing
UNI	User Network Interface
UUS	User-User Signalling
VB	Voice Box
VCC	Virtual Card Calling
VoIP	Voice over IP (also referred to as Telephony over IP)
VOT	teleVOTing

4 Overview

The Telecommunications industry in Europe and surrounding regions has started to deploy broadband IP access networks using both wired and wireless access technologies (sometimes referred to as Next Generation Networks (NGN)). The initial rollout of these Broadband networks has been focussed on supporting both data and interactive content, however, there is now an urgent need to support IP Voice (Telephony over IP) and other time critical multimedia services over these broadband networks. In particular there is a need to support legacy ISDN Terminal Equipment, this fact is highlighted in TR 101 963 [6], clause 5 relating to MTA Requirements.

Consequently in order to support the development of broadband networks and equipment with support for legacy ISDN terminals, the key functions and features of these terminals need to be sufficiently defined.

All new systems, independent of their access technology, may enjoy the results of the present document.

4.1 Principles for the ISDN presentation of the PSTN

Although the presentation of national public switched telephone networks has evolved over an extended period, much effort within ETSI TC Access and Terminals and its predecessors (EP DTA and STC TE4 and STC TE5) has brought about a massive reduction in the presentation of technical differences between the networks.

These characteristics were largely harmonized by TBR 003/A1 [1] for basic rate access and TBR 004/A1 [2] for primary rate access, but some enhancements and additional network particularities are listed in ETS 300 402-1 [39] and EN 300 403-1 [40] and corresponding subparts.

TBR 003/A1 [1] and TBR 004/A1 [2] cover the harmonization of basic electrical, mechanical, Data link and Network layer characteristics for Terminals

TBR 008/C2 [3] cover the harmonization of ISDN Terminal Adaptors that are used to support interconnectivity between a legacy analogue telephone and fax terminals to ISDN.

TBR 033 [4] and TBR 034 [5] cover the ISDN TE support of ITU-T Recommendation X.31 [60] mode A and B devices in SAPI=16, X.25 [59] Packet mode.

ISDN devices that support the ITU-T Recommendation Q.931 [58] protocol stack are terminated as TE or NT (see TR 103 050 [8] and ES 202 122 [10]) interfaces.

ITU-T Recommendation Q.931 [58] ISDN is not a symmetrical signalling protocol. Typically device interface is TE interface however where the terminal device supports an NT interface, there are additional layer 3 network side messages that will need to be catered for by an NGN call control element.

ISDN devices that support ITU-T Recommendation Q.931 [58] protocol stack may support either the ECMA-143 [48] (QSIG) protocol interface or the ISDN interface. Typically public interfaces support ISDN Q.931 signalling stacks, however there are some operators in Europe that also support the ECMA-143 [48] (QSIG) interface.

QSIG protocol stacks support a greater number of supplementary services than are supported by the ISDN stack. Support of legacy terminals supporting the QSIG stack is outside the scope of the present document.

A broadband NTE is a component that would typically be terminated at the customer premises but may be owned either by the Operator or the subscriber. In either case role of the broadband NTE is to map the ITU-T Recommendation Q.931 [58] layer 2 and 3 signalling protocols with the NGN Access network protocols. It also has to support the layer 1 activation procedures described in [56] for a Basis Rate Access and ITU-T Recommendation I.431 [63] for a Primary Rate Access.

When the Basis Rate device is powered the link must be activated and the device will attempt to move to MF state. Normally where there are no calls the network deactivates the device by bringing the link to a deactivation state. The broadband NTE will need to support the electrical characteristics and phantom power requirements given in EN 300 012-1 [21].

When there are no calls active the link is brought to deactivation state by the network. However a device terminated to a broadband NTE need not be brought to a deactivated state when there are no active calls. Deactivation occurs to limit crosstalk between devices connected to the S-bus.

The broadband NTE should therefore remain in an active state when the device is powered.

The broadband NTE must be able to support up to 8 Basic Rate terminals (TE) connected to its S-bus as described in ITU-T Recommendation I.430 [56].

The device terminated to the broadband NTE that is in the MF state should remain at the MF state. It may be assigned an automatic or static TEI. Where a permanent TEI is assigned this may simplify the management layer procedures in the assignment of identifier values to the device.

The study of a broadband NTE are outside the scope of the current document.

The basic call control features and functions that are used as the basis for the present document.

The following features/functions are identified, but not completely studied in the present document:

- Message sequence charts that describes generically typical call flows between a call controller in a broadband network and the Home Terminal Adaptor (HTA) to enable the support of Services as supported by legacy ISDN terminals (see annex A).
- The interactions between the different supplementary services (see annex B).

An overview of call flow illustrations for basic calls and interactions between supplementary services is given in Annex A and B respectively. However, detailed studies are outside the scope of the present document. These two areas of study are currently under development within ETSI TC AT NGN@Home working group as given in TR 102 162 (see bibliography).

5 Features and functionality summary

5.1 Summary of basic features of ISDN terminal and network equipment

Table 1 lists the basic features of ISDN TE or NT and how they are implemented.

Table 1: Basic features supported by ISDN terminal and network equipment

	Implementation by TE	Related standards	Comments
Basic Features	Call establishment at the originating interface	EN 300 403-1 [40]	Before these procedures are invoked, a reliable data link connection must be established between the user and the network. The data link services described in ETS 300 402-1 [39] are assumed.
	Call establishment at the destination interface	EN 300 403-1 [40]	This procedure assumes that a data link connection may not exist before the first layer 3 message (SETUP) is transferred across the interface. However, reliable data link connections must be established by user at the interface before they respond to the SETUP message.
	Call Clearing	EN 300 403-1 [40]	Under normal conditions, call clearing is usually initiated when the user or the network sends a DISCONNECT message.
	Call rearrangements.	EN 300 403-1 [40]	This provides for physical layer and/or data link layer rearrangements after a call has entered the Active state. The procedure is restricted to use on the same interface structure, and resumption on the same B-Channel. Only applicable to Basic rate Terminals.
	In-band tones and announcements	EN 300 403-1 [40]	These in-band tones/announcements may or may not be associated with a call state change and are provided by the network before reaching the Active state.
	Call collisions	EN 300 403-1 [40]	Channel selection conflicts may occur, if an incoming call and outgoing call select the same channel. This is resolved by the network through channel selection mechanisms.
	Handling of error conditions	EN 300 403-1 [40]	This provides the capabilities for facilitating the orderly treatment of error conditions.
	User notification procedure	EN 300 403-1 [40]	This procedure allows the network to notify a user of the suspension or resumption of the call at the remote user. It also allows a user to notify the remote user of such an event.
	Restart procedure	EN 300 403-1 [40]	The restart procedure is used to return channels and interfaces to an idle condition.
	User-to user signalling procedures	EN 300 403-1 [40] and ETS 300 284 [36]	Allows an ISDN user to send/receive a limited amount of information to/from another ISDN user over the signalling channel in association with a call to the other ISDN user.

5.2 Enhanced network functions

In some cases, Enhanced network functions (e.g. supplementary services and SMS) will require a variety of additional signalling arrangements beyond those necessary for a basic call.

Table 2 describes possible technical solutions for the implementation of a variety of supplementary services and other enhanced network functions over an ISDN interface.

Table 2: Enhanced Network functions supported by ISDN equipment

		Service Type and Name	Possible implementation by TE	Comments and reference standards
Enhanced Features	Address Services	AA	For further study	
		FDC	For further study	
		RLC	For further study	
	Address Information Services	APC	For further study	
		DDI	Optional within Network Layer Stack	As defined in ETS 300 062 [16]
		DR	For further study	
		DRCN	For further study	
		DRCW	For further study	
		MSN	Optional within Network Layer Stack	As defined in ETS 300 050 [12]
		SUB	Optional within Network Layer Stack	As defined in ETS 300 059 [15]
	Advice of Charge Services	AoC	Optional within Network Layer Stack	As defined in ETS 300 182 [28]
		AoC-S	Optional within Network Layer Stack	As defined in ETS 300 178 [25]
		AoC-D	Optional within Network Layer Stack	As defined in ETS 300 179 [26]
		AoC-E	Optional within Network Layer Stack	As defined in ETS 300 180 [27]
		AoC-R	Optional within Network Layer Stack	As defined in ETS 300 180 [27]
	Booking Services	Alarm Call	For further study	
		Booked Call	For further study	
		Diary Service	For further study	
	Call Barring Services	CUG	Optional within Network Layer Stack	As defined in ETS 300 136 [23]
		ICB	For further study	
		OCB-F	Optional within Network Layer Stack	As defined in EN 301 001-1 [45]
		OCB-UC	For further study	
		SS	For further study	
		IIFC	For further study	
		ACR	For further study	
		SCA	For further study	
		SCR	For further study	
	ADS	For further study		
	Call Completion Services	CW	Optional within Network Layer Stack	As defined in ETS 300 056 [14]
		CCBS	Optional within Network Layer Stack	As defined in EN 300 357 [37]
		QS	For further study	
		CCNR	Optional within Network Layer Stack	As defined in EN 301 065-1 [46]
Called Line Free Indication		For further study		
Call Return		For further study		
CB		For further study		
Call Reg. Services	Date & Time Call Record	For further study		
	CL	For further study		
	MCID	Optional within Network Layer Stack	As defined in ETS 300 128 [22]	
	BCLID	For further study		

Service Type and Name		Possible implementation by TE	Comments and reference standards
Enhanced Features	Changed Charging Services	FPH	Optional within Network Layer Stack As defined in ETS 300 208 [35]
		REV-S	For further study
		REV-U	For further study
		Transfer of Charge	For further study
		Wide Area Service	For further study
		Split Charging	For further study
		Premium Rate	For further study
		International [Premium Rate] Service	For further study
		IFS	For further study
		Home Country Direct	For further study
	Diversion Services	CFU	Optional within Network Layer Stack As defined in ETS 300 200 [32]
		CB	For further study
		CD	Optional within Network Layer Stack As defined in ETS 300 202 [34]
		SCF	Optional within Network Layer Stack As defined in EN 301 133 [47]
		CF	For further study
		CFB	Optional within Network Layer Stack As defined in EN 300 199 [31]
		CFB-S	For further study
		CFNR	Optional within Network Layer Stack As defined in EN 300 201 [33]
		CFNR-S	For further study
		CFU-S	For further study
		SCF Busy	Optional within Network Layer Stack As defined in EN 301 133 [47]
		SCF Reply	Optional within Network Layer Stack As defined in EN 301 133 [47]
		Help Services	Fault Reporting
	GD		For further study
	Operator Access to and Control of Supplementary Services		For further study
	RCSS		For further study
	Time Dependent Control of Supplementary Services		For further study
	SLE		For further study
	Information Transfer Services	DC	For further study
		PDC	For further study
		UUS	Optional within Network Layer Stack As defined in ETS 300 284 [36]
		VB	For further study
		MWI	Optional within Network Layer Stack As defined in EN 300 650 [44]
		SMS Text [S21 & S22]	For further study SMS Fax and Data communication with a MHS via the ISDN. Refer to ES 201 912 [9]
	Multitine Services	Centrex	For further study
		LH	For further study
TH		For further study	
SPNP		For further study	
MBG		For further study	
Multiparty Calls	HOLD	Optional within Network Layer Stack As defined in ETS 300 139 [24]	
	3PTY	Optional within Network Layer Stack As defined in ETS 300 186 [30]	
	CT	For further study	
	NCT	For further study	
	ECT	Optional within Network Layer Stack As defined in EN 300 367 [38]	
	SCT	For further study	
	CONF	Optional within Network Layer Stack As defined in ETS 300 183 [29]	
	MMC	For further study	
	Lecture Call	For further study	
	PCC	For further study	
Booked Add-On Conference	For further study		

		Service Type and Name	Possible implementation by TE	Comments and reference standards
Enhanced Features	Identification Services	CIDCW	For further study	
		CLIP	Optional within Network Layer Stack	As defined in EN 300 089 [17]
		CLIR	Optional within Network Layer Stack	As defined in EN 300 090 [18]
		CNAM	For further study	
		CND	For further study	
		CNIP	For further study	
		CNIR	For further study	
		COLP	Optional within Network Layer Stack	As defined in EN 300 094 [19]
	COLR	Optional within Network Layer Stack	As defined in ETS 300 095 [20]	
	Numbering Services	Out of Area Line	For further study	
		PSN	For further study	
		UAN	Optional within Network Layer Stack	As defined in ETS 300 710 [41]
		CDIST	For further study	
		CVD	For further study	
		UDR	For further study	
		Temporary Location of Outgoing Calls	For further study	
		PC	For further study	
	PVC	Optional within Network Layer Stack	As defined in ETS 300 048 [11]	
	Payment Charging Services	CRED	For further study	
		Payphone	For further study	
		ACCS	For further study	
		ACC	For further study	
		Automatic Transfer Call Charge	For further study	
		SA	For further study	
		CCC	For further study	
	VCC	Optional within Network Layer Stack	As defined in ETS 300 711 [42]	
	Priority Service	PRI	For further study	
		PS	For further study	
		MLPP	For further study	
	Opinion Collecting Services	VOT	Optional within Network Layer Stack	As defined in ETS 300 713 [43]
		Teledialogue	For further study	
		Mass Calling	For further study	
	Miscellaneous Services	Alarm (Warning)	For further study	
Changing of Service during an Established Call		For further study		
Expediting of a call in progress		For further study		
Interception of Calls		Not Implemented		
National Selection and Indication of Throughput Class		Not Implemented		
TP		Specific to ISDN basic rate.	As defined in ETS 300 053 [13]	
User selection of PAD Parameter Settings		For further study		
CDO		For further study		
IM		For further study		
Pick-up facility		For further study		
MR		For further study		

NOTE: Future revisions of the present document may enhance table 2 to show complete examples of the impact and implementation within ISDN TE of such enhanced features (supplementary services).

6 Call States

6.1 General

In this report the terms "incoming" and "outgoing" are used to describe the call as viewed by the user side of the interface. In the paragraphs which follow states are defined for circuit switched calls in clauses 6.2 and 6.3 and for the interface in clause 6.4.

These clauses define the basic call control states that individual calls may have. These definitions do not apply to the state of the interface itself, any attached equipment, the D-Channel, or the logical links used for signalling on the D-Channel. Because several calls may exist simultaneously at a user-network interface and each call may be in a different state, the state of the interface itself cannot be unambiguously defined.

6.2 Call states at the user side of the interface

The states which may exist on the user side of the user-network interface are defined in this clause.

6.2.1 Null state (U0)

No call exists.

6.2.2 Call initiated (U1)

This state exists for an outgoing call, when the user requests call establishment from the network.

6.2.3 Overlap sending (U2)

This state exists for an outgoing call when the user has received acknowledgement of the call establishment request which permits the user to send additional call information to the network in overlap mode.

6.2.4 Outgoing call proceeding (U3)

This state exists for an outgoing call when the user has received acknowledgement that the network has received all call information necessary to effect call establishment.

6.2.5 Call delivered (U4)

This state exists for an outgoing call, when the calling user has received an indication that remote user alerting has been initiated.

6.2.6 Call present (U6)

This state exists for an incoming call when the user has received a call establishment request but has not yet responded.

6.2.7 Call received (U7)

This state exists for an incoming call when the user has indicated alerting but has not yet answered.

6.2.8 Connect request (U8)

This state exists for an incoming call when the user has answered the call and is waiting to be awarded the call.

6.2.9 Incoming call proceeding (U9)

This state exists for an incoming call when the user has sent acknowledgement that the user has received all call information necessary to effect call establishment.

6.2.10 Active (U10)

This state exists for an incoming call when the user has received an acknowledgement from the network that the user has been awarded the call. This state exists for an outgoing call when the user has received an indication that the remote user has answered the call.

6.2.11 Disconnect request (U11)

This state exists when the user has requested the network to clear the end-to-end connection (if any) and is waiting for a response.

6.2.12 Disconnect indication (U12)

This state exists when the user has received an invitation to disconnect because the network has disconnected the end-to-end connection (if any).

6.2.13 Suspend request (U15)

This state exists when the user has requested the network to suspend the call and is waiting for a response.

6.2.14 Resume request (U17)

This state exists when the user has requested the network to resume a previously suspended call and is waiting for a response.

6.2.15 Release request (U19)

This state exists when the user has requested the network to release and is waiting for a response.

6.2.16 Overlap receiving (U25)

This state exists for an incoming call when the user has acknowledged the call establishment request from the network and is prepared to receive additional call information (if any) in overlap mode.

6.3 Call states at the network side of the interface

The states which may exist on the network side of the user-network interface are defined in this clause.

6.3.1 Null state (N0)

No call exists.

6.3.2 Call initiated (N1)

This state exists for an outgoing call when the network has received a call establishment request but has not yet responded.

6.3.3 Overlap sending (N2)

This state exists for an outgoing call when the network has acknowledged the call establishment request and is prepared to receive additional call information (if any) in overlap mode.

6.3.4 Outgoing call proceeding (N3)

This state exists for an outgoing call when the network has sent acknowledgement that the network has received all call information necessary to effect call establishment.

6.3.5 Call delivered (N4)

This state exists for an outgoing call when the network has indicated that remote user alerting has been initiated.

6.3.6 Call present (N6)

This state exists for an incoming call when the network has sent a call establishment request but has not yet received a satisfactory response.

6.3.7 Call received (N7)

This state exists for an incoming call when the network has received an indication that the user is alerting but has not yet received an answer.

6.3.8 Connect request (N8)

This state exists for an incoming call when the network has received an answer but the network has not yet awarded the call.

6.3.9 Incoming call proceeding (N9)

This state exists for an incoming call when the network has received acknowledgement that the user has received all call information necessary to effect call establishment.

6.3.10 Active (N10)

This state exists for an incoming call when the network has awarded the call to the called user. This state exists for an outgoing call when the network has indicated that the remote user has answered the call.

6.3.11 Disconnect request (N11)

This state exists when the network has received a request from the user to clear the end-to-end connection (if any).

6.3.12 Disconnect indication (N12)

This state exists when the network has disconnected the end-to-end connection (if any) and has sent an invitation to disconnect the user-network connection.

6.3.13 Suspend request (N15)

This state exists when the network has received a request to suspend the call but has not yet responded.

6.3.14 Resume request (N17)

This state exists when the network has received a request to resume a previously suspended call but has not yet responded.

6.3.15 Release request (N19)

This state exists when the network has requested the user to release and is waiting for a response.

6.3.16 Call abort (N22)

This state exists for an incoming call for the point-to-multipoint configuration when the call is being cleared before any user has been awarded the call.

6.3.17 Overlap receiving (N25)

This state exists for an incoming call when the network has received acknowledgement of the call establishment request

6.4 Call states associated with the global call reference

This clause defines the states that the protocol may adopt using the global call reference. There is only one global call reference per interface.

6.4.1 Call states at the user side of the interface

The states which may exist on the user side of the user-network interface are defined in this clause.

6.4.1.1 Null (Rest 0)

No transaction exists.

6.4.1.2 Restart request (Rest 1)

This state exists for a restart transaction when the user has sent a restart request but has not yet received an acknowledgement response from the network.

6.4.1.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the network and responses have not yet been received from all locally active call references.

6.4.2 Call states at the network side of the interface

The states which may exist on the network side of the user-network interface are defined in this clause.

6.4.2.1 Null (Rest 0)

No transaction exists.

6.4.2.2 Restart request (Rest 1)

This state exists for a restart transaction when the network has sent a restart but has not yet received an acknowledgement response from the user.

6.4.2.3 Restart (Rest 2)

This state exists when a request for a restart has been received from the user and a response has not yet been received from all locally active call references.

7 Supplementary Services

7.1 General

A variety of signalling is required to support calling features such as:

- Advice of Charge;
- Completion of Calls to Busy Subscriber;
- Call Waiting;
- Cancel Call Waiting;
- Call Forwarding (no-answer, busy, variable);
- Three-way Calling (3PTY);
- Voice mail Message Waiting Indicator;
- Calling Line Identification Presentation;
- Calling Line Identification Restriction;
- Connected Line Identification Presentation;
- Connected Line Identification Restriction;
- Conference call, add-on;
- Closed User Group;
- Direct Dialling In;
- Hold;
- Malicious Call Identification;
- Multiple Subscriber Number;
- Subaddressing.

Annex B of TR 101 973-1 [7] lists the relevant supplementary service definitions.

7.2 Signalling mechanisms supporting supplementary services

7.2.1 General

Annex B provides a high level study into the interactions between the different supplementary services, together with the references for definition standards.

7.2.2 Short Message Service (SMS)

The ETSI SMS assumes that both the sending and receiving terminal equipment (TE) have appropriate capabilities to send, receive, store, display and delete short messages.

The SMS can be realised in two ways:

- either a **User Based Solution (UBS)** using the basic call procedures, or
- a **Network Based Solution (NBS)**.

The UBS service is provided as part of a function within the end-user equipment, which does not require any specific short message transfer function inside the public network.

Two protocols are available and are currently being developed:

- **Protocol UBS 1:** this protocol is fully compliant with the GSM SMS service,
- **Protocol UBS 2:** this protocol is specifically focuses on the residential fixed network environment.

The protocols described above are currently being developed by ETSI for ISDN TE.

8 Presentation of Network Termination Point

The recommended harmonized arrangement for the presentation of the NTP to ISDN TE is as a socket, as specified in TBR 003/A1 [1] for basic rate access and TBR 004/A1 [2] for primary rate access.

Annex A: Basic Call Information Flows

This Annex describes basic call flows in the format of message sequence charts to illustrate typical call flows between a Call Controller in a Broadband network and the Home Terminal Adaptor to enable the support of Services as supported by legacy ISDN terminals. The present document only provides an overview with a few basic call illustrations. For a detailed analysis of more complex call scenarios, reference should be made to the draft ETSI deliverable TR 102 162 (see bibliography).

A.1 Purpose

The purpose of providing a series of basic call information flow scenarios is to assist developers of broadband equipment and associated technologies in understanding the various timing constraints already applied to legacy ISDN terminals. The call flow uses an elementary "technology independent" naming convention to illustrate the types of event messages that may be passed within a broadband network, these are in no way definitive and are provided as an example.

A.2 Explanation of Basic Call Information Flows

A successful end to end call establishment is illustrated as given in figure 1.

An unsuccessful call resulting from the terminating device not answering is illustrated as given in figure 2.

An unsuccessful call resulting from the terminating device being in a busy call state is illustrated as given in figure 3.

A successful call resulting from the terminating device being first in a busy call state with the originating side supporting the supplementary service "Call Waiting" is illustrated as given in figure 4.

The figures 1 to 4 cover basic call scenarios and illustrate the typical message flows between the broadband NTE and a call control element in an NGN network.

A call control element would typically be a Softswitch, Gatekeeper, Call Agent or Call Management Server.

The call control element in an NGN network typically would support ITU-T Recommendation H.323 [52], SIP [49], ITU-T Recommendation H.248 [53] or NCS [57] signalling protocols. This illustration assumes an architecture where the broadband NTE maps ITU-T Recommendation Q.931 [58] messages to the signalling messages supported by the NGN i.e. ITU-T Recommendation H.323 [52], SIP [49], ITU-T Recommendation H.248 [53] or NCS [57] protocols.

The illustrations assume that the call control intelligence is centralized rather than at the edge of the network.

A.3 Explanation of the timing constraints associated with Call Flows

Basic call flows scenarios are illustrated with the associated timing constraints, Tx. The timing constraints between the ISDN TE and Broadband TE are given. The timers have a number of states, timer start, timer expire, timer stopped, timer reset are all timer events that are fixed in accordance with the compliance of a TE to the ETSI base standards ETS 300 402-1 [39] and EN 300 403-1 [40]. The protocol interactions between the Broadband TE and call control function to support call establishment and release would need to take care of these timing constraints.

Tables 3 and 4 give an explanation of each timer Tx, its value and base standard reference. The basic call flow illustrations do not cover all possible layer 2 and 3 timer events that may result from more complex behaviour. Reference should be made to TR 102 162 (see bibliography) for further call scenarios to illustrate other timer constraints resulting from abnormal call signalling behaviours.

Timer T1 is described in ETS 300 402-1 [39] as T202. This is a Layer 2 timer started when the TE sends an Identity Request message and stops on receipt of Identify Check Request message. However, T202 may be stopped and restarted for N intervals if no response is received or following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Timer T2 is described in ETS 300 402-1 [39] as T200. This is a layer 2 timer between the TE initiating a request for the multiple frame operation and the acknowledgment and acceptance of the mode-setting command. The timer may expire or be reset under other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Timer T3 is described in EN 300 403-1 [40] as T303. This is a Layer 3 timer started after sending the SETUP message, the TE at the originating end starts timer T303 and enters Call Initiate State. The timer is stopped when the TE receives a SETUP ACK message. However, T303 may also stop following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Timer T4 is described in EN 300 403-1 [40] as T310. This is a Layer 3 timer started after receiving the CALL PROCESSING message, the TE at the originating end starts timer T310 and enters Outgoing call proceeding State. The timer is stopped when the TE receives an ALERTING message. However, T310 may also stop following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Timer T5 is described in EN 300 403-1 [40] as T301. This is a Layer 3 timer started after receiving the ALERTING message, the TE at the originating end starts timer T301 and enters Call delivered State. The timer is stopped when the TE receives a CONNECT message. However, T301 may also stop following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Timer T6 is described in EN 300 403-1 [40] as T305. This is a Layer 3 timer started after sending the DISCONNECT message, the TE at the originating end starts timer T305 and enters Disconnect request State. The timer is stopped when the TE receives a RELEASE message. However, T305 may also stop following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Timer T7 is described in EN 300 403-1 [40] as T308. This is a Layer 3 timer started after sending the RELEASE message, the TE at the originating end starts timer T308 and enters Release request State. The timer is stopped when the TE receives a RELEASE COMPLETE message. However, T308 may also stop following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Timer T8 is described in EN 300 403-1 [40] as T301. This is a Layer 3 timer started after receiving the ALERTING message, the TE at the originating end starts timer T301 and enters Call delivered State. Upon the expire of this timer the TE sends a DISCONNECT message. However, T301 maybe stopped following the condition for T5 above or by other conditions that are not illustrated in the Basic call establishment illustration, see figure 2.

Timer T9 is described in EN 300 403-1 [40] as T302. This is a Layer 3 timer started after receiving the SETUP ACK message, the TE at the destination end starts timer T302 and enters Overlap receiving State. The timer is stopped when the TE sends a CALL PROCEEDING message. However, T302 may also stop following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

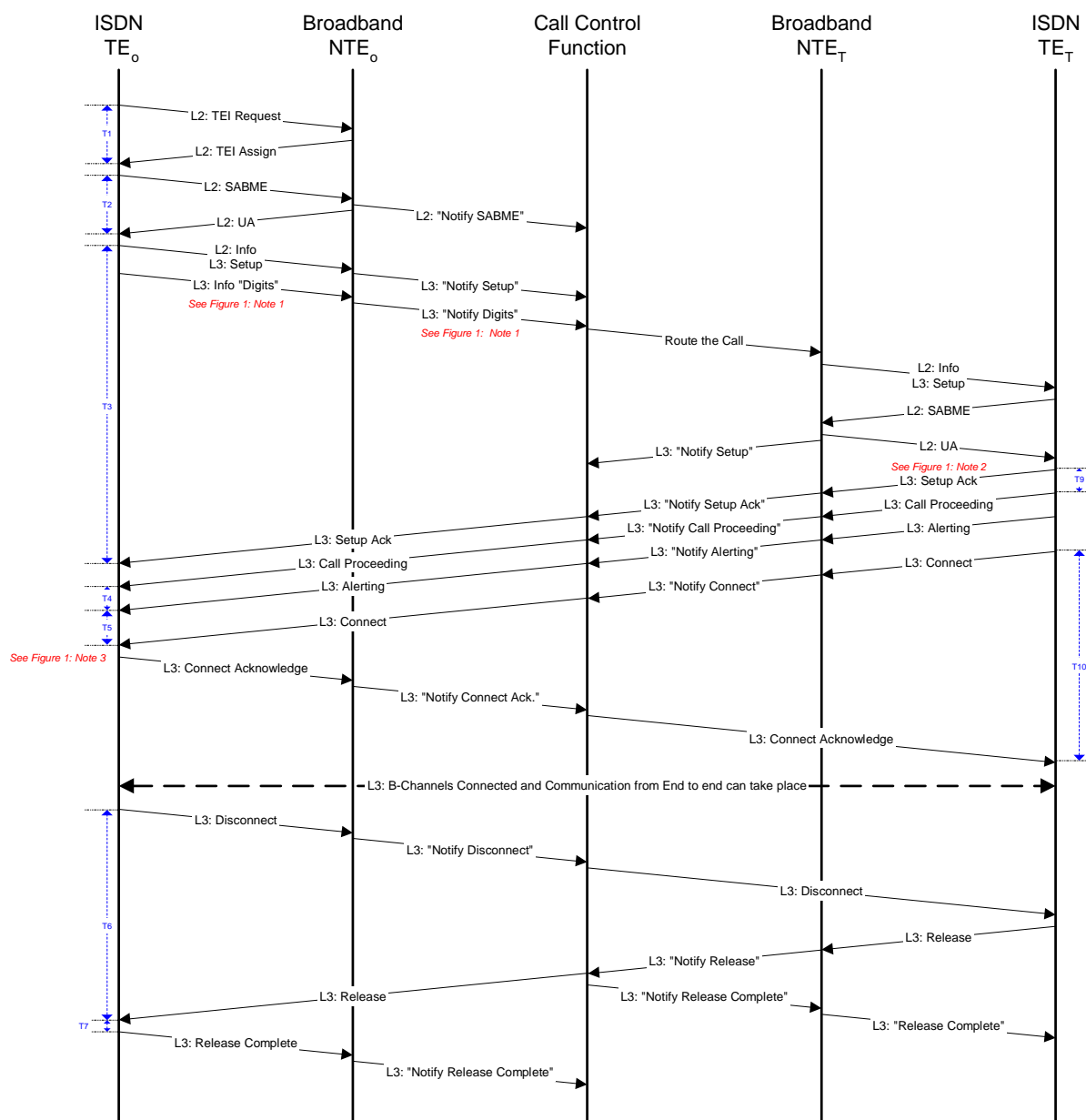
Timer T10 is described in EN 300 403-1 [40] as T313. This is a Layer 3 timer started after receiving the CONNECT message, the TE at the destination end starts timer T313 and enters Connect request State. The timer is stopped when the TE sends a CONNECT ACK message. However, T302 may also stop following other conditions that are not illustrated in the Basic call establishment illustration, see figure 1.

Table 3: ISDN TE Layer 2 Timers associated with a Basic Call

Timer Tx	Description	Value (seconds)	Base Standard Reference table 5.9 [39]
T1	Layer 2 Time between the TE Identity request and verifying of the identity.	$\geq 1,9 \text{ s} \leq 5 \text{ s}$	T202
T2	Layer 2 Time between the TE initiating a request for the multiple frame operation and the acknowledgment and acceptance of the mode-setting command.	$\geq 0,95 \text{ s} \leq 3 \text{ s}$	T200

Table 4: ISDN TE Layer 3 Timers associated with a Basic Call

Timer Tx	Description	Value (seconds)	Base Standard Reference tables 9.1 and 9.2 [40]
T3	Layer 3 Time between the TE sending a Setup message and receiving a Setup Acknowledge.	$\geq 3,8$ s	T303
T4	Layer 3 Time between the TE receiving Call Proceeding and Alerting.	> 40 s	T310
T5	Layer 3 Time between the TE receiving Alerting and Connect.	> 180 s	T301
T6	Layer 3 Time between the TE sending a Disconnect and receiving a Release.	> 30 s	T305 (see note)
T7	Layer 3 Time between the TE sending a Release and receiving a Release Complete.	> 4 s	T308 (see note)
T8	Layer 3 Time between the TE receiving Alerting and sending a Disconnect due to the Called Party not sending a Connect i.e. Answering the incoming call.	> 180 s	T301
T9	Layer 3 Time between the TE receiving a Setup Ack message and sending a Call Proceeding.	> 15 s	T302
T10	Layer 3 Time between the TE receiving a Connect message and sending a Connect Acknowledge.	> 4 s	T313
NOTE: ISDN TE equipment compliant to the ETSI Base standard EN 300 403-1 [40] would require to implement these timers as mandatory requirement applicable to all user side implementations.			



NOTE 1: The sending of Layer 3 Info Messages containing digits is only required when Overlap Sending is being performed. If this is not the case then the call will go direct from "L3: Notify Setup" to "Route the Call".

NOTE 2: TE may accept an incoming call by responding to the incoming Setup message with any of the messages Setup Acknowledge, Call Proceeding, Alerting or Connect. All TEs must be able to send the Connect message but the use of the other messages is optional.

NOTE 3: A Connect Acknowledge response from the terminal is optional.

Figure 1: Basic Call Flow - successful connection of ISDN TE

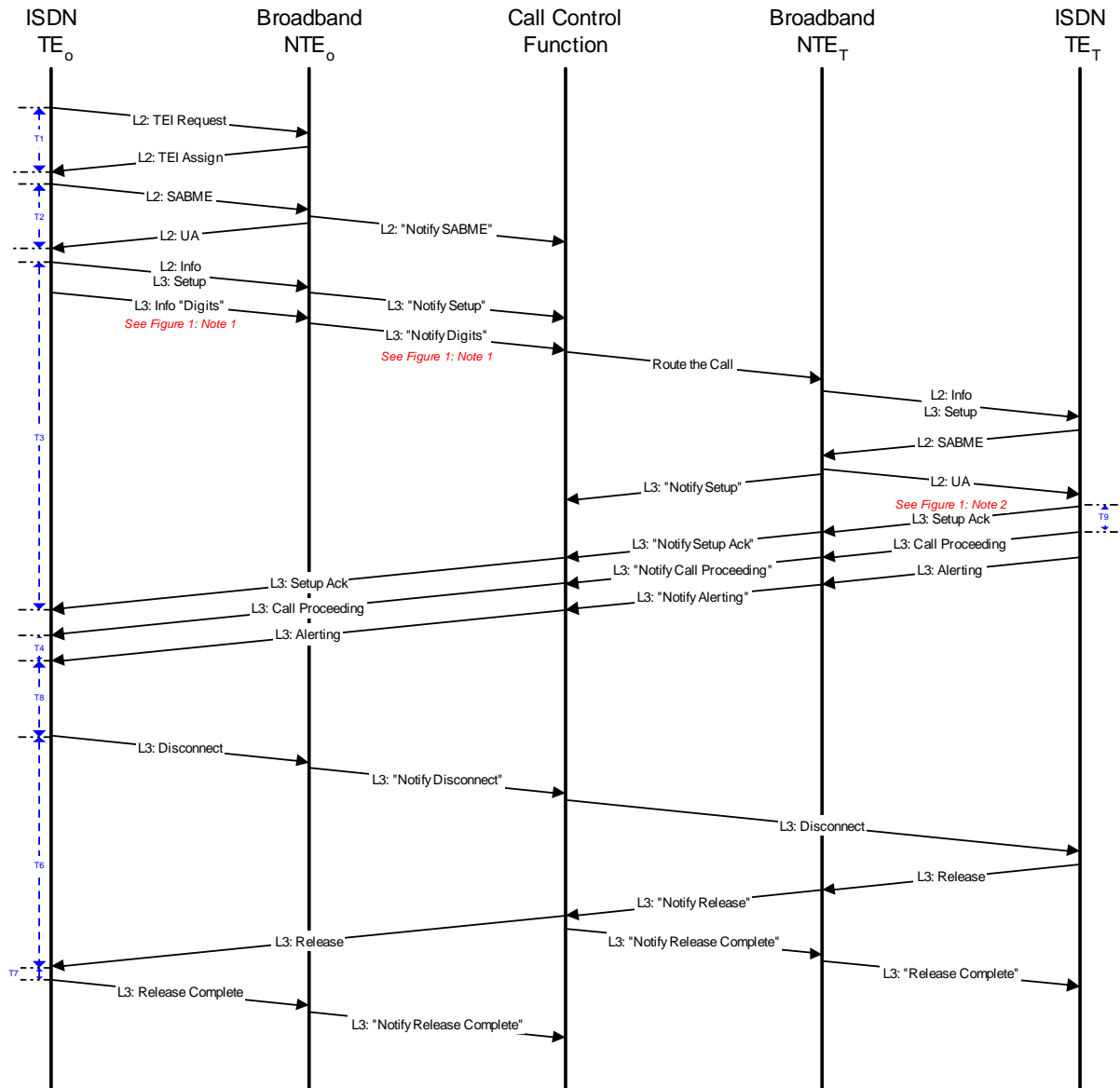
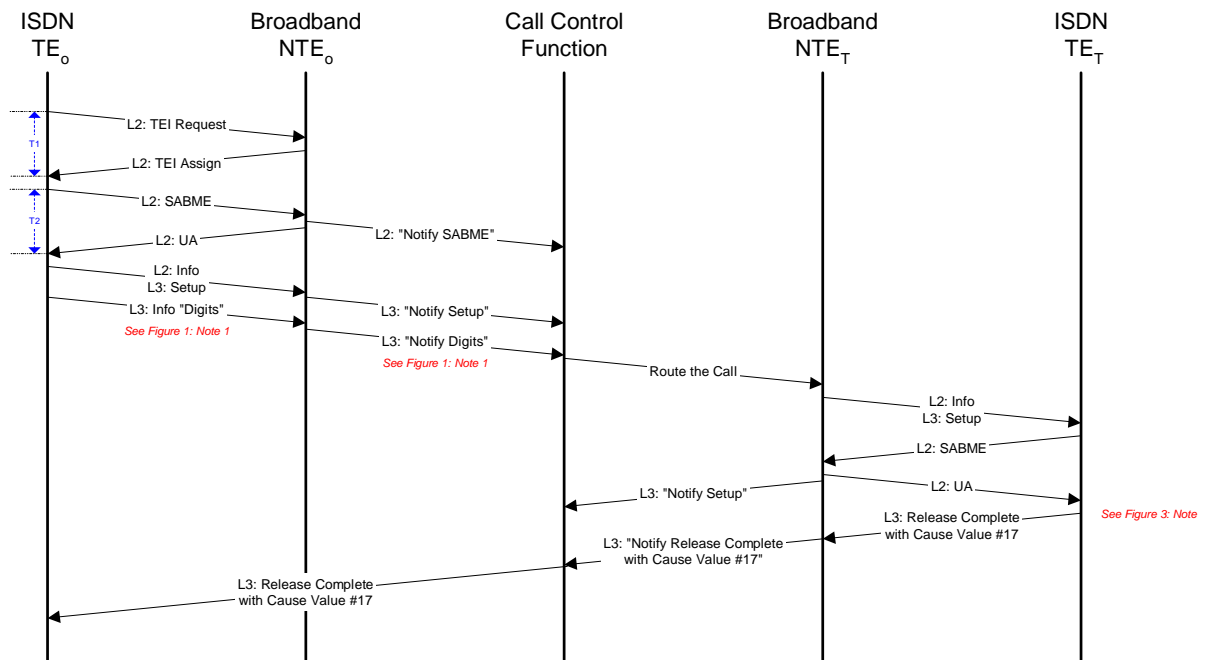
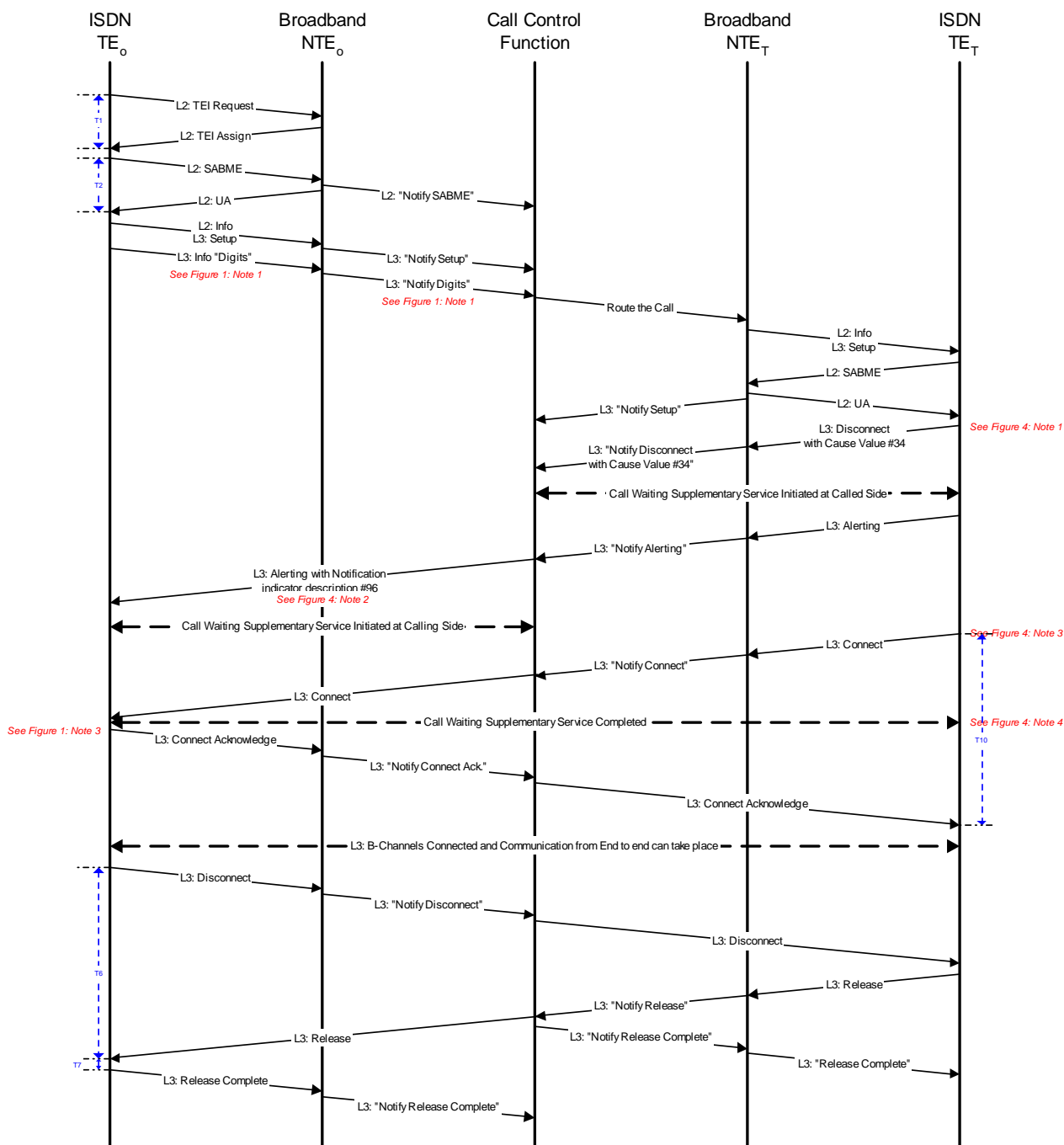


Figure 2: Basic Call Flow - unsuccessful connection NO ANSWER



NOTE: Cause #17 "user busy" This cause is used when the called user has indicated the inability to accept another call. It is noted that the user equipment is compatible with the call.

Figure 3: Basic Call Flow - unsuccessful connection BUSY



NOTE 1: Notification indicator information element with notification description #96 "call is a waiting call". This is used to initiate the Call Waiting Supplementary service at the Calling side.

NOTE 2: Cause #34 "no circuit/channel available" This cause indicates that there is no appropriate circuit/channel presently available to handle the call. This is used to initiate the Call Waiting Supplementary service at the Called side.

NOTE 3: The Called TE User can free terminal resources to accept a waiting call by either releasing an existing call or using the call hold supplementary service on an existing call.

NOTE 4: The Connect message indicates the acceptance of the waiting call and completes the use of the Call Waiting Supplementary service for this call.

Figure 4: Basic Call Flow - successful connection of ISDN TE with the use of the supplementary service "Call Waiting"

Annex B: Supplementary Service Interactions

A broadband NGN call control element that may be a Call Agent, softswitch or Gatekeeper, would need to support the call signalling interactions with the customer premises ISDN TE.

ISDN TE may support several categories of calls as defined in TR 102 162 (see bibliography). The various supplementary services are listed in clause 7. An ISDN TE supporting one or more services would need to ensure the service can be properly provisioned and supported by the NGN access network.

A detailed study of the various interactions between supplementary services supported by a TE is outside the scope of the current document. Reference should be made to TR 102 162 (see bibliography) for further details of interactions between the ISDN services supported by a TE.

An ISDN terminal device may support more than one supplementary service. It may not be possible to support a specific service where the two services interactions conflict.

An NGN call control element that supports the set of supplementary services as listed in clause 7 will also need to manage the service interactions.

Table 5 is a template that is for illustration purposes only and may be used in subsequent studies to identify at a high level the services that can and cannot exist together as supported by an ISDN terminal device. The actual interactions and behaviours are currently under study in TR 102 162 (see bibliography). Table 5 does not identify the scenario where an ISDN terminal device supports more than one service type. Subsequent revisions of the present document should include Service interactions and behaviour SDLs to offer guidance to developers that need to code software to manage the different interactions between service types supported by an ISDN terminal device.

Legend:

- The symbol: **X** is used to indicate that the two services can not exist together, supported by an ISDN terminal device.
- The symbol: **✓** is used to indicate that the two services can exist together.

Table 5: ISDN legacy terminal supporting two service types

	Service 1	Service 2	Service 3	Service 4	Service 5	Service n
Service 1	-	X	X	✓	X	✓
Service 2	X	-				X
Service 3			-			
Service 4				-		
Service 5					-	
Service n		X				-

Annex C: Bibliography

ETSI TR 101 731: "Access and Terminals (AT); Digital access to the public telecommunications network; Publication of interface specification under Directive 1999/5/EC".

ETSI TR 102 159: "Access and Terminals (AT); Support of analogue legacy TTE in a Home Local Network, interworking and compatibility studies with NGN".

ETSI TR 102 162: "Access and Terminals (AT); Support of ISDN legacy TTE, access to NGN-BB-IP networks".

ETSI TR 101 844: "Access and Terminals (AT); Study of the global usage and acceptance of non-radio TBRs and associated documents".

ETSI ETS 300 085: "Integrated Services Digital Network (ISDN); 3,1 kHz telephony teleservice; Attachment requirements for handset terminals (Candidate NET 33)".

Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (R&TTE Directive).

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History

Document history		
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