Telecommunications Standards Advisory Committee (TSAC)

Draft Technical Specification

Terminal Equipment connecting to the Integrated Services Digital Network

Draft IDA TS ISDN
Issue 2, Jun 2013

Infocomm Development Authority of Singapore
Resource Management & Standards
10 Pasir Panjang Road
#10-01 Mapletree Business City
Singapore 117438

Acknowledgement

The Info-communications Development Authority of Singapore (IDA) and the Telecommunications Standards Advisory Committee (TSAC) would like to acknowledge the following members of the TSAC Special Working Group (TSAC SWG) for their invaluable contributions to the preparation of this Technical Specification:

IDA TS ISDN Issue 2, XXX 2013 [Revision: 0]	Technical Specification for Terminal Equipment connecting to the Integrated Services Digital Network
TSAC SWG/TF Chairpersons	Tay Wee Chin, Senior Manager (Voice Engineering, Nest Gen IP Networks), Singapore Telecommunications Ltd.
	Pyai Phyo Aung, Senior Engineer (Business Solutions & Fixed Services, StarHub Information Services and Network Engineering), StarHub Ltd
TSAC SWG/TF Editors	Tay Wee Chin, Senior Manager (Voice Engineering, Nest Gen IP Networks), Singapore Telecommunications Ltd
	Woo Yim Leng, Senior Manager (Resource Management & Standards), Infocomm Development Authority of Singapore

List of TSAC SWG Members

SN	Organisation	Name
1	Singapore Telecommunications Ltd	Mr Tay Wee Chin Senior Manager
2	StarHub Ltd	Mr Pyai Phyo Aung Senior Engineer
3		Mr Chow Yew Weng Manager
4		Mr Jason Ng Wee Peng Senior Engineer
5	Infocomm Development Authority of Singapore	Ms Woo Yim Leng Senior Manager
6		Mr Ian Teo Manager

Telecommunications Standards Advisory Committee (TSAC)

The TSAC advises IDA on the setting of ICT standards as well as on the development and recommendation of specifications, standards, information notes, guidelines and other forms of documentation for adoption and advancement of the standardisation effort of the Singapore ICT industry (hereafter termed "IDA Standards").

Telecommunications standards-setting in Singapore is achieved with the assistance of TSAC, where professional, trade and consumer interest in telecommunications standards is represented on the TSAC with representatives from network and service operators, equipment suppliers and manufacturers, academia and researchers, professional bodies and other government agencies.

List of TSAC Members

TSAC Chairman:

Mr Raymond Lee	Director (Resource Management & Standards) Infocomm Development Authority of Singapore

TSAC Members:

Mr Lim Yuk Min (TSAC Vice-Chairman)	Senior Executive Consultant (Resource Management and Standards) Infocomm Development Authority of Singapore
Dr Tan Geok Leng	Acting Executive Director Institute for Infocomm Research (I2R) Agency for Science, Technology and Research
Mr Darwin Ho Kang Ming	Vice President, Association of Telecommunications Industry of Singapore
Mr Yip Yew Seng	Honorary Secretary Association of Telecommunications Industry of Singapore
Mr Goh Kim Soon	SVP Technology Support / Technology Support (IMD) Mediacorp Pte Ltd
Mr Lim Chin Siang	Director (Interactive Digital Media Programme Office) Media Development Authority
Ms Tan Sze Siang	Deputy Director (Digital Broadcasting Deployment Office) Media Development Authority
Mr Patrick Scodeller	Chief Technical Officer, M1 Limited
Mr Lee Wing Kai	General Manager Engineering Radio Planning M1 Limited
Assoc Prof Li Kwok Hung	Nanyang Technological University School of Electrical & Electronic Engineering
Assoc Prof Xiao Gaoxi	Nanyang Technological University School of Electrical & Electronic Engineering
Assoc Prof Hari Krishna Garg	National University of Singapore Department of Electrical & Computer Engineering
Prof Ko Chi Chung	National University of Singapore Department of Electrical & Computer Engineering
Assoc Prof Tham Chen Khong	National University of Singapore Department of Electrical & Computer Engineering
Mr Chong Siew Loong	Vice President (Network and Systems) Nucleus Connect Pte Ltd
Mr Tiong Onn Seng	Director – Project Opennet Pte Ltd

Mr Daniel Teo	Director – Technical Services Opennet Pte Ltd
Mr Aw Peng Soon	Chairman of SiTF Wireless Chapter VP, ANTLabs Singapore Infocomm Technology Federation
Mr Huang Ee Choon	Deputy Director Communications & Information Technology Singapore Institute of Technology
Mr Lee Siak Kwee	Director (Radio Network Access & Quality) Singapore Telecommunications Ltd
Mr Lim Yong Nam	Director (Voice Engineering, Next Gen IP Networks) Singapore Telecommunications Ltd
Mr Lee Yeu Ching	Director (Outside Plant Engineering) Singapore Telecommunications Ltd
Mr Soh Keng Hock	Director (Private IP Engineering) Singapore Telecommunications Ltd
Dr Wong Woon Kwong	Director of the Office of Research and Industry Collaborations Singapore University of Technology and Design
Mrs Leong Suet Mui	Principal Technical Executive Standards Division Spring Singapore
Mr Tay Wei Kiang	Assistant Vice President Business Solutions & Fixed Services StarHub Integrated Network Engineering StarHub Ltd
Mr Liong Hang Chew	Assistant Vice President Personal Solutions & Integrated Applications StarHub Integrated Network Engineering StarHub Ltd
Ms Woo Yim Leng	Senior Manager Infocomm Development Authority of Singapore

Content

Section	Title	Page
1.	Introduction	2
2.	General	3
3.	Basic User-Network Interface – Layer 1 Specification (ITU-T Rec. I.430)	4
4.	Digital Transmission System on Metallic Local Lines for ISDN Basic Rate Access (ITU-T Rec. G.961)	8
5.	Primary Rate User-Network Interface – Layer 1 Specification (ITU-T Rec. I.431)	9
6.	ISDN User-Network Interface – Data Link Layer 2 Specification (ITU-T Rec. Q.921)	10
7.	ISDN User-Network Interface – Layer 3 Specification for Basic Call Control (ITU-T Rec. Q.931)	11
8.	References	12
Annex A.1	ISDN Implementation Options	13
Annex A.2	Guide to the recognised Information Elements	18
Annex B	Corrigendum / Addendum ▪ Changes to IDA TS ISDN BA Issue 1, Rev 1 and IDA TS ISDN PRA Issue 1, Rev1 (May 2011) ▪ Changes to IDA TS ISDN BA Issue 1 and IDA TS ISDN PRA Issue 1 (Jul 2005) ▪ Changes to IDA TS ISDN 1 Issue 1 Rev 3 & ISDN 3 Issue 1 Rev 3 (Oct 2000) ▪ Changes to IDA TS ISDN 2 Issue 1 Rev 4 (Jun 2005)	29

Technical Specification for Terminal Equipment connecting to the Integrated Services Digital Network

1 Introduction

1.1 This Specification outlines the principles for presentation of the Integrated Services Digital Network (ISDN) to the Terminal Equipment (TE). Sections (§) 3 to 5 define the support of the Layer 1 activation and deactivation procedures for Basic Access (BA) and Primary Rate Access (PRA), the electrical characteristics, and the power arrangements. Sections 6 and 7 define the Layer 2 and 3 signalling protocols, and where applicable, enable the mapping of the Layer 2 and 3 signalling protocols with the Access Network protocols of the Next Generation Networks (NGN).

1.2 If the TE is intended for connecting to the ISDN at the S/T interface, as shown in Figure 1, using BA, the TE shall comply with the applicable requirements set out in § 2, 3, 6 and 7 of this Specification. If the ISDN BA equipment has the NT1 function built-in, it shall comply with the applicable requirements set out in § 2, 3, 4, 6 and 7 of this Specification. If the Network Termination 1 (NT1) function is standalone, the NT1 equipment shall comply with the applicable requirements set out in § 2 and 5.

1.3 If the TE has the Network Termination 2 (NT2) function, e.g. a Private Automatic Branch Exchange (PABX), and is intended for connecting to the ISDN at the T interface, as shown in Figure 2, using PRA, the TE shall comply with the applicable requirements set out in § 2, 5, 6 and 7 of this Specification.

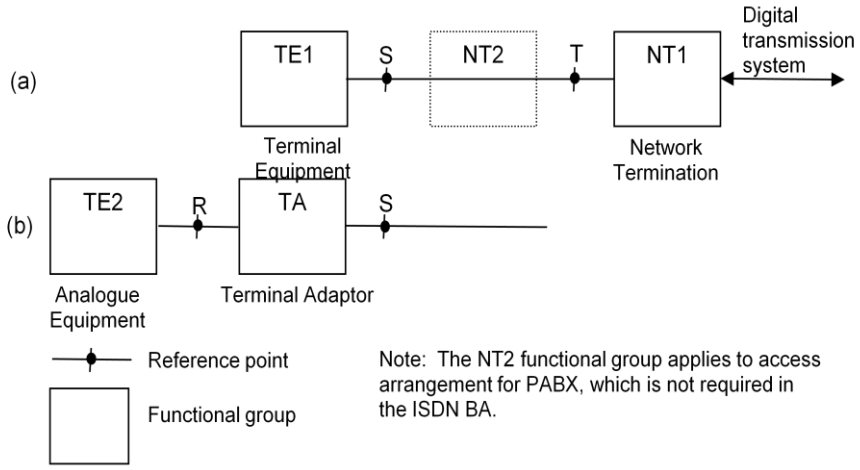


Figure 1: Reference Configurations for ISDN User-Network Interface (Figure 1/I.430)

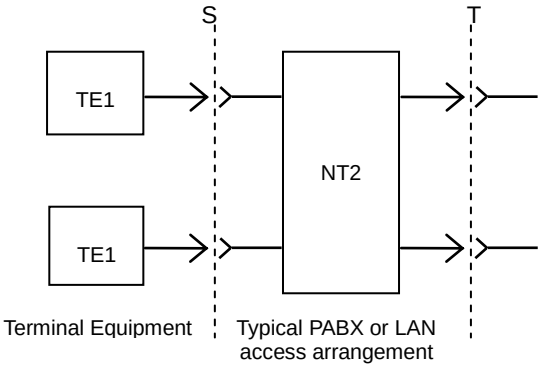


Figure 2 (Figure 1/I.412): Reference Configuration for Multiple Connections

2 General Requirements

2.1	**Design of Equipment**
Power supply	The TE may be AC powered or DC powered. For AC powered equipment, the Specification shall be complied with when operating from an AC mains supply of voltage, 230V ± 10% and frequency, 50 Hz ± 2%. Where external power supply is used, e.g. AC adaptor, it shall not affect the capability of the equipment to meet the Specification.
Identification of equipment	The TE shall be marked with the supplier or manufacturer's name or identification mark, and the supplier or manufacturer's model or type reference. The markings required shall be legible, indelible and readily visible.
Keypad Dialling	Keypads used in the TE for dialling shall be alphanumeric keypads and the relationships between the letters and the digits shall comply with ITU-T Rec. E.161 as shown below. **1** | **2 ABC** | **3 DEF** **4 GHI** | **5 JKL** | **6 MNO** **7 PQRS** | **8 TUV** | **9 WXYZ** ***** | **0** | **#** The associated letters must not impair the legibility of the digit (§ 3.1.1, ITU-T Rec. E.161). The tactile identifier on the "5" button shall be provided (§ 3.6, ITU-T Rec. E.161).

2.2	**Analogue Interface**
If the TE has the TA function for connecting analogue equipment to the R interface as shown in Figure 2, the following requirements shall be applicable.	
Connector	2 wire, 6 pin modular RJ 11 jack
Feed voltage	≤ 40 V DC
Line extension	Interworking with loop resistance up to 500 Ω
Multi-Freq Push Button (MFPB) receiver	Level range: 0 to –26 dBm
	Signal detection: min 40 ms
	Inter-digit pause : min 40 ms
	Frequency deviation: ± 1.8%
Ringing current transmit	Frequency: 24 Hz
	Periodicity for normal ringing: 0.4 s (on), 0.2 s (off), 0.4 s (on), 2.0 s (off)
	Periodicity for duplex/distinctive ringing: 1.2 s (on), 3.0 s (off)
	Voltage: ≤ 75 V
Dial tone transmit	425 Hz continuous tone
Busy tone transmit	425 Hz
	Periodicity: 0.75 s (on), 0.75 s (off)
Output level	Analogue output signal level shall not exceed –6 dBm averaged over any 10 s period
Analogue/Digital/ Analogue companding	Digital telephones and other customer equipment providing acoustic interfaces to the digital bit stream shall comply with ITU-T G.711 (A law).

2.3	**Characteristics of Telephone**
If the TE has the telephone handset function, the following requirements shall be applicable.	
Sending Loudness Rating (SLR)	In the range 5 to 11 dB
Receiving Loudness Rating (RLR)	In the range –1 to 5 dB
Sidetone Masking Rating (STMR)	In the range 10 to 15 dB

2.4	**Safety Requirements**
The equipment shall be tested for compliance with the International Electrotechnical Commission IEC 60950-1 safety standard[1]. The requirements in IEC 60950-1 that are applicable to the equipment [e.g. class of equipment, type of telecommunication network voltage (TNV) circuit and types of components] shall be identified and complied with.	

2.5	**Electromagnetic Compatibility (EMC) Requirement**
The equipment shall comply with the EMC requirements defined in IEC CISPR 22.	

[1] The safety standard includes, among others, protection of telecommunications network service personnel and users of other equipment connected to the network from hazards in the equipment.

3 Basic User-Network Interface – Layer 1 Specification (ITU-T Rec. I.430)

3.1 General

3.1.1 This section identifies the Layer 1 aspects of the Terminal Equipment (TE) for connecting to the Integrated Services Digital Network (ISDN) at the S/T interface (shown in Figure 1) using Basic Access (BA). It also identifies the requirements for the digital transmission system at the network side of the Network Termination 1 (NT1) forming part of the ISDN BA.

3.1.2 The ISDN BA equipment may have the NT1 function built-in or standalone. The digital transmission system at the network side of the NT1 shall be based on the ITU-T Rec. G.961. The digital transmission system shall use line codes and transmission methods given in Appendix II of the ITU-T Rec. G.961. The TE shall conform to the user requirements, and the TE side of the NT1 shall conform to the network requirements of the ITU-T Rec. I.430, and where applicable, shall be tested according to the ETSI TBR 3.

3.2 Service Characteristics

3.2.1 Layer 1 of this interface requires a balanced metallic transmission medium, for each direction of transmission, capable of supporting 192 kbit/s.

3.3 Service provided to Layer 2 includes:

a) Transmission capability with encoded bit streams for the B- and D-channels, their related timing, and synchronization functions;

b) Signalling capability and procedures for activation and deactivation of the TEs and/or NTs as defined in § 4.6.2 of this Specification;

c) Signalling capability and procedures for TEs to gain access to D-channel signalling resource and its performance requirements, as defined in § 4.6.1 of this Specification;

d) Signalling capability and procedures for the maintenance functions; and

e) Indication of the layer 1 status to the higher layers.

3.4 Primitives to be passed across the layer 1/2 boundary or to the management entity and parameter values associated with these primitives are outlined in Table1 of ITU-T Rec. I.430, and described in § 4.6.2 of this Specification.

3.5 Modes of Operation

3.5.1 Either point-to-point or point-to-multipoint mode of operation defined in § 3 of ITU-T Rec. I.430 shall be applied to the layer 1 procedural characteristics of the interface, but this does not imply any constraints on the modes of operation at the higher layers.

3.6 Types of wiring configuration

3.6.1 The electrical characteristics of the user-network interface are determined by the wiring configurations which may exist in the user premises as shown in the reference configuration in Figure 2 (Figure 2/I.430). Either one of the two major wiring configurations described in § 4 of ITU-T Rec. I.430 shall be applied.

3.6.2 For a point-to-point wiring configuration, the two wires of the interchange circuit pair may be reversed. However, for point-to-multipoint wiring configuration, the wiring polarity integrity of the interchange circuit (TE-to-NT direction) must be maintained between TEs (see the reference configuration in Figure 21 of ITU-T Rec. I.430).

3.6.3 The TE shall meet the requirements of this Specification connected with a cord of a minimum length of 5 metres. The cord may be detachable or provided as a part of the TE. If the connecting cord is part of the TE, the requirements specified in § 8.9 of the ITU-T Rec. I.430 for a standard ISDN basic access TE cord, shall be applicable. The use of an extension cord of up to 25 metres

is permitted for point-to-point wiring configurations. In this case, the total attenuation of the wiring and the cord should not exceed 6 dB.

3.7 Functional Characteristics

3.7.1 For each direction of transmission, two independent B-channels shall be used to carry voice encoded and data information 64 kbit/s, and one D-channel is used for signalling information at a bit rate of 16 kbit/s. Procedures relating to D-channel access shall be as defined in § 6.1 of ITU-T Rec.I.430.

3.7.2 Two interchange circuits, one for each direction of transmission, shall be used to transfer digital signals across the interface. All of the functions described in § 5.1 of ITU-T Rec.I.430, except for power feeding, shall be carried by means of a digitally multiplexed signal structured as defined in § 5.4 of ITU-T Rec.I.430.

3.7.3 The appearance/disappearance of power shall be the criterion used by a TE to determine whether it is connected or disconnected at the interface. A description of the power sources is given in § 9 of ITU-T Rec.I.430.

3.7.4 In both directions of transmission, the bits shall be grouped into frames of 48 bits each. The frame structure (given in Figure 3/I.430) is identical for both the point-to-point and point-to-multipoint configuration.

3.7.5 Also, in both directions of transmission, pseudo-ternary coding shall be used with 100% pulse width as shown in Figure 4/I.430.

3.7.6 A TE shall derive its timing from the signal received from the NT, and use this derived timing to synchronise its transmitted signal.

3.8 Interface Procedures

3.8.1 The D-channel access procedure shall be as defined in § 6.1 of ITU-T Rec.I.430, which ensures that when two or more TEs are attempting to access the D-channel simultaneously, only one TE will be successful in completing the transmission of information. The interframe time fill (when there is no layer 2 frames to transmit) shall be all ONEs in the TE-to-NT direction, and HDLC flags in the NT-to-TE direction.

3.8.2 The activation and deactivation procedures shall be as defined in § 6.2 of ITU-T Rec.I.430, using primitives between layers 1 and 2, and management primitives between layer 1 and the management entity shall be as defined in § 6.2 of ITU-T Rec.I.430.

3.8.3 The frame alignment procedures shall be as defined in § 6.3 of ITU-T Rec.I.430.

3.8.4 A TE shall send binary ONEs in any B-channel that is not assigned to it.

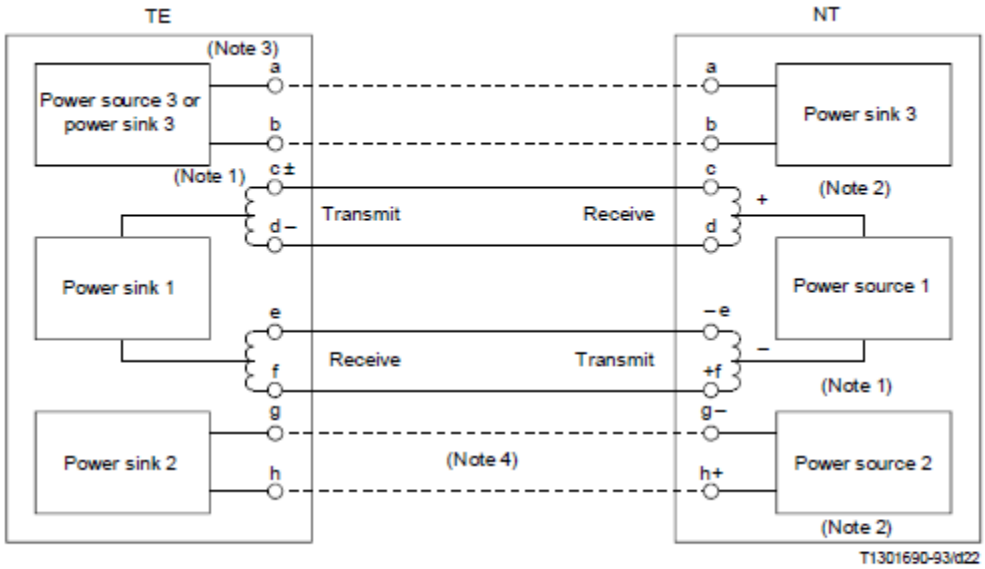
3.8.5 Provision of maintenance and optional functionalities in the S- and Q-channels between TE and NT1, according to § 7 of ITU-T Rec.I.430, are optional.

3.9 Electrical Characteristics

3.9.1 The electrical characteristics of the TE shall be as defined in § 8 of ITU-T Rec.I.430.

3.10 Power Feeding

3.10.1 The reference configuration for power feeding shall be based on an eight pin interface connector as described in § 9.1 of ITU-T Rec.I.430, and Figure 21/I.430. This reference configuration allows for interface at reference point S/T, which is independent of the choice of internal or external power source arrangements. The possible power source arrangements are defined in § 9 of ITU-T Rec.I.430 for Power Source 1 (power from NT or locally, from mains and/or batteries), Power Source 2 (power from mains and/or batteries), and Power Source 3 (not used).



NOTES

1 This symbol refers to the polarity of framing pulses.

2 This symbol refers to the polarity of power during normal power conditions (reversed for restricted conditions).

3 The access lead assignments indicated in this figure are intended to provide for direct interface cable wiring, i.e. each interface pair is connected to a pair of access leads having the same two letters at TEs and NTs.

4 If access pair g-h is used for PS2 power feeding, the polarity of wires within this pair must be maintained, i.e. the wires must not be interchanged.

Figure 3 (Figure 21/I.430): Reference configuration for signal transmission and power feeding in normal operating mode

3.10.2 Power may be available at the NT in Power Source 1 normal and restricted mode.

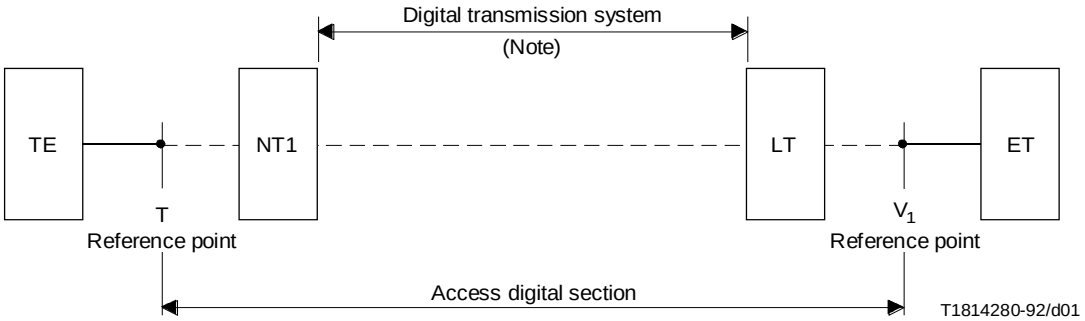
3.10.3 Power may also be available at the TE in Power Source 1 phantom mode. Power Source 2 (optional third pair) mode is not available.

3.10.4 Interface Connector and Contact Assignments

The interface connector and the contact assignments shall be with reference to the pole assignments for 8-pole connections (plugs and jacks) given in Table 17/ITU-T Rec. I.430.

4 Digital Transmission System on Metallic Local Lines for ISDN Basic Rate Access (ITU-T Rec. G.961)

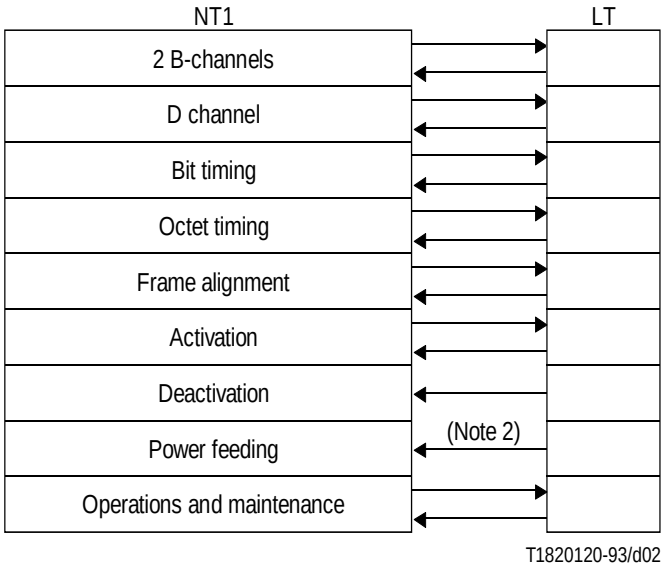
4.1 This section defines the characteristics and parameters of a digital transmission system at the network side of the NT1 that forms part of the access digital section for ISDN basic access, based on the ITU-T Rec. G.961. The concept of a digital transmission system is used to describe the characteristics of an implementation of a specific medium in support of the access digital section as shown in Figure 4 (Figure 1/G.961). The transmission system using 2B1Q (2 binary, 1 quaternary) line code and transmission method shall be supported (Appendix II of ITU-T Rec. G.961).



Note 1: Digital transmission system refers to a line system using metallic lines.
The use of one intermediate regenerator may be required.

Figure 4 (Figure 1/G.961): Access digital section and transmission system boundaries

4.2 The functions of the digital transmission system, using metallic local lines, shall be as defined in § 2 – 8 of ITU-T Rec. G.961, and outlined in Figure 5 (Figure 2/G.961).



Note 2: Remote power feeding is supported.

Figure 5 (Figure 2/G.961): Functions of the Digital Transmission System

5 Primary Rate User-Network Interface – Layer 1 Specification (ITU-T Rec. I.431)

5.1 This section identifies the Layer 1 aspects of the Terminal Equipment (TE) for connecting to the Integrated Services Digital Network (ISDN) at the T interface (shown in Figure 2) using Primary Rate Access (PRA). The ISDN channel arrangements, applicable to the user-network interface (UNI) at 2048 kbit/s, shall be supported as defined in the ITU-T Rec. I.412.

5.2 The primary rate access at the T reference point shall support the point-to-point configuration only. The electrical characteristics for the UNI at 2048 kbit/s shall apply to the T interface as shown in Figure 5 (Figure 1/I.412), according to § 5 of the ITU-T Rec. I.431, and where applicable, shall be tested according to § 9 of the ETSI TBR 4.

5.3 The functions which provide bidirectional transmission of independent B-channel (or optional H_0- or H_1-channel) signals as outlined in Figure 6 (Figure 2/I.431), where applicable, shall be as defined in § 3 of the ITU-T Rec. I.431 and tested according to § 9 of the ETSI TBR 4. Two interchange circuits, one for each direction, are used for transmission of digital signals. The primary rate UNI shall be active at all times.

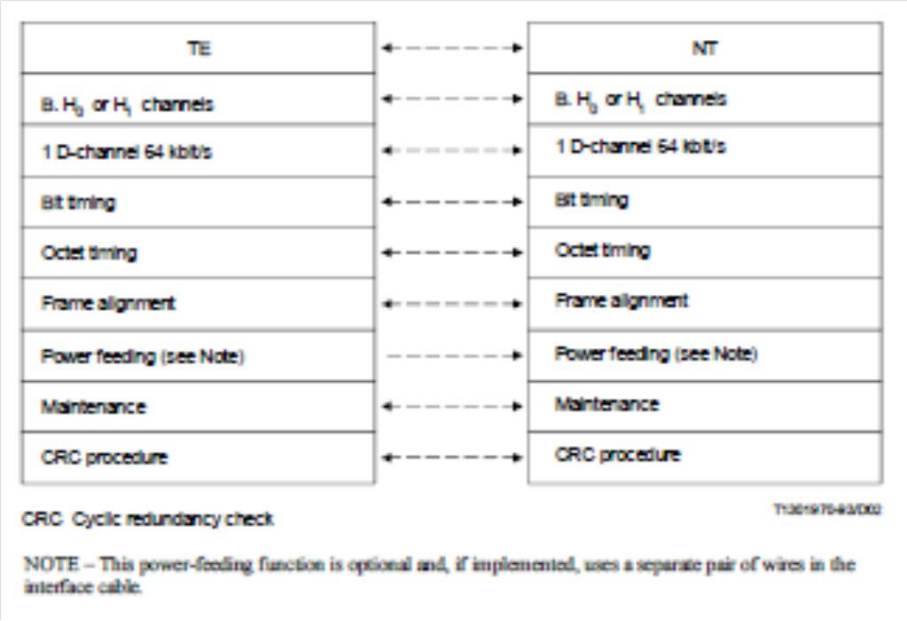


Figure 6 (Figure 2/I.431): Location of Interfaces

5.4 The interface connectors may be provided as described § 6 of ITU-T Rec. I.431, and with method of connection based on examples given in § 9.1 of the ETSI TBR 4. For interface wiring, 2 symmetrical pairs of characteristics of 120 Ω ± 20% in a frequency range of 200 kHz to 1 MHz, and 120 Ω ± 10% at 1 MHz, shall be provided (§ 7 of ITU-T Rec. I.431).

5.5 The provision of power shall be as described in § 8 of ITU-T Rec. I.431. The provision of power via the UNI, using a separate pair of wires from those used for signal transmission, is optional.

6 ISDN User-Network Interface – Data Link Layer 2 Specification (ITU-T Rec. Q.921)

6.1 This section specifies the frame structure, elements of procedure, format of fields and procedures for proper operation of the Link Access Procedure on the D-channel (LAPD) according to the ITU-T Rec. Q.921.

6.2 Definition of the peer-to-peer procedures of the data link layer

6.2.1 If TE supports configuration using only a single point-to-point data link, the procedures for unacknowledged information transfer described in § 5.2 of ITU-T Rec. Q.921, and the Terminal Endpoint Identifier (TEI) management procedures described in § 5.3 of ITU-T Rec. Q.921, are not applicable. § 5.2 and § 5.3 of ITU-T Rec. Q.921 are also not applicable for primary rate access. For single point-to-point signalling connection at layer 3, TEI value 0 shall be used in combination with Service Access Point Identifier value 0 (SAPI 0) (Annex A, ITU-T Rec. Q.921).

6.2.2 Initialization of data link layer parameters necessary for the correct peer-to-peer information transfer, shall be based on the method of initialization to the default values listed in § 5.9 of ITU-T Rec. Q.921, and shown in Table 1 below.

ITU-T Rec. Q.921	ETSI TBR3/4	System Parameters	Default Value
5.9.1	10.10.1	Timer T200	1s
5.9.2	10.10.2	Max number of retransmissions (N200)	3
5.9.3	10.10.3	Max number of octets in an information field (N201)	260
5.9.4	10.10.4	Max number of transmission of the TEI identity request message (N202)	3
5.9.5	10.10.5	Max number of outstanding I frames (k)	1 (Note 1) 7 (Note 2)
5.9.6	–	Timer T201	Network requirement
5.9.7	10.10.6	Timer T202	2s
5.9.8	–	Timer T203 (optional)	10s
–	10.10.7	Layer 2 response time	(Note 3)
Note 1: For a SAP supporting basic access signalling, the value is 1. Note 2: For a SAP supporting primary rate signalling, the value is 7. Note 3: The maximum time between receipt of an incoming frame and generation of a response, shall not exceed 500 ms, if operating in a point-to-point signalling connection, and 200 ms for TEs in point-to-multipoint configuration.			

Table 1: List of System Parameters (§ 5.7 of ITU-T Rec. Q.921)

6.2.3 Procedures for establishment and release of multiple frame operation, for information transfer in multiple frame operation, for re-establishment of multiple frame operation, shall be as defined in § 5.5 and § 5.7 of ITU-T Rec. Q.921.

6.2.4 The error recovery procedures available to effect recovery following the reception of an exception condition at the data link layer, shall be as defined in § 5.8 of ITU-T Rec. Q.921.

6.2.5 The use of the data link monitor function, as described in § 5.10 of ITU-T Rec. Q.921, is optional.

7 ISDN User-Network Interface – Layer 3 Specification for Basic Call Control (ITU-T Rec. Q.931)

7.1 This section specifies the procedures for the establishing, maintaining, and clearing of network connections at the ISDN user-network interface that are defined in terms of messages exchanged over the D-channel of basic and primary rate interface structures.

7.2 § 2.1 of ITU-T Rec. Q.931, which defines the basic call control states for circuit-switched calls, shall be supported. The procedures for circuit-switched call control shall be as defined in § 5 of ITU-T Rec. Q.931. Suspend and resume request states (U17 and U19) are not applicable to primary rate access. The support for packet-mode access connection control states (§ 2.2 of ITU-T Rec. Q.931), and for basic call control states for user-to-user signalling not associated with circuit-switched calls (§ 2.3 of ITU-T Rec. Q.931), is optional. If TE supports the point-to-multipoint configuration only, states associated with the global call reference (§ 2.4 of ITU-T Rec. Q.931) are not applicable.

7.3 The messages, and their functional definition and information content, where applicable, shall be as described in § 3 of ITU-T Rec. Q.931. A TE may not transmit some messages and their corresponding information elements, but all TEs must be able to receive the messages and the corresponding information elements, and handle them correctly according to the procedures given in § 5 of ITU-T Rec. Q.931 and all its subsections. Use of messages for call re-arrangement is optional for basic access, but is not applicable for primary rate access. For specific local network implementations (optional messages and information supported by the local networks), refer to the Annexes A.1 and A.2 of this Specification. If TE supports point-to-multipoint configuration only, the messages used with the global call reference (§ 3.4 of ITU-T Rec. Q.931) are not applicable.

7.4 The general message format and information elements coding, where relevant, shall be according to § 4 of ITU-T Rec. Q.931. All layer 3 messages shall be sent to the data link layer using a DL-DATA request primitive (ITU-T Rec. Q.921).

7.5 Circuit-switched call control procedures

7.5.1 The procedures for call establishment at the originating interface, where applicable, shall as defined in § 5.1 of ITU-T Rec. Q.931. Before these procedures can be invoked, a data link connection must be established between the user (TE/NT2) and the network.

7.5.2 The procedures for call establishment at the destination interface, where applicable, shall be as defined in § 5.2 of ITU-T Rec. Q.931.

7.5.3 The procedures for call clearing shall be as defined in § 5.3 of ITU-T Rec. Q.931.

7.5.4 If TE supports point-to-multipoint configuration only, the restart procedure is not applicable (§ 5.5 of ITU-T Rec. Q.931).

7.5.5 The use of call re-arrangement procedure (§ 5.6 of ITU-T Rec. Q.931) is restricted to basic access, i.e. it will not be available for primary rate access, and is also network implementation dependent.

7.5.6 The handling of error conditions shall be as defined in § 5.8 of ITU-T Rec. Q.931.

7.6 List of System Parameters

7.6.1 The description of timers and their implementation in circuit-switched call control procedures (§ 5 of ITU-T Rec. Q.931), where applicable, shall be as defined in § 9 of ITU-T Rec. Q.931.

8 References

8.1 For the technical requirements captured in this Specification, reference has been made to the following documents:

ITU-T Rec. I.430 (11/95)	Basic User-Network Interface – Layer 1 Specification
ITU-T Rec. I.412 (1988)	ISDN User-Network Interface – Interface Structures and Access Capabilities
ITU-T Rec. E.161 (06/2001)	Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network
IEC 60950-1 (2005)	Information Technology Equipment – Safety
IEC CISPR 22 (2008)	Information Technology Equipment – Radio disturbance characteristics – Limits and methods of measurement
ITU-T Rec. G.961 (03/93) & Erratum No. 1 (08/2000)	Digital Transmission System on Metallic Local Lines for ISDN Basic Rate Access
ETSI TBR 3 Nov 95	Attachment requirements for terminal equipment to connect to an ISDN using ISDN basic access
ETSI TBR 3 A1 Dec 97	This amendment A1 modifies the TBR 3 (1995)
ITU-T Rec. I.431 (03/93)	Primary Rate User-Network Interface – Layer 1 Specification
ITU-T Rec. I.431 Amendment 1 (06/97)	Primary Rate User-Network Interface – Layer 1 Specification Amendment 1
ETSI TBR 4 Nov 95	Attachment requirements for terminal equipment to connect to an ISDN using ISDN primary rate access
ETSI TBR 4 A1 Dec 97	This amendment A1 modifies the TBR 4 (1995)
ITU-T Rec. Q.921 (09/97)	ISDN User-Network Interface – Data Link Layer Specification
ITU-T Rec. Q.921 Amendment 1 (06/2000)	ISDN User-Network Interface – Data Link Layer Specification Amendment 1
ITU-T Rec. Q.931 (05/98)	ISDN User-Network Interface Layer 3 Specification for Basic Call Control
ITU-T Rec. Q.931 Amendment 1 (12/02)	ISDN User-Network Interface Layer 3 Specification for Basic Call Control Amendment 1 Extensions for the support of digital multiplexing equipment
Erratum1 (02/2003) to ITU-T Rec. Q.931	ISDN User-Network Interface Layer 3 Specification for Basic Call Control

ETSI European Telecommunications Standards Institute
ETR ETSI Technical Report
IEC International Electro-technical Commission
ITU-T International Telecommunication Union – Telecommunication Sector
TBR Technical Basis for Regulation

Annex A.1

ISDN Implementation Options

Basic UNI – Optional Layer 1 Requirements	ITU-T Rec. I.430 (11/95)	SingTel's Option	StarHub's Option
Point-to-point operation	3.1	Supported	Supported
Point-to-multipoint operation	3.2	Supported	Supported
Point-to-point configuration	4.1	Supported	Supported
Point-to-multipoint configuration	4.2	Supported	Supported
Multiframing	6.3.3	Not supported, M bit set to binary 0	Not supported, M bit set to binary 0
S-channel structuring algorithm	6.3.4	Not supported, S-subchannels set to all binary 0s	Not supported, S-subchannels set to all binary 0s
Layer 1 maintenance	7	The optional functionality of S- and Q-channels is not implemented.	The optional functionality of S- and Q-channels is not implemented.

Primary Rate UNI – Optional Layer 1 Requirements	ITU-T Rec. I.431 (03/93)	SingTel's Option	StarHub's Option
Summary of functions (Layer 1)	3.1	H-channels are not supported. Power feeding is not supported.	Supported partially, AUXP and M-channels are not supported.
B-channel and H-channels	5.2.4.3	H-channels are not supported.	H-channels are not supported.
Power feeding to the NT	8	Not supported	Not supported
Timeslot assignment for interfaces having only H0 channels	Annex A	Not supported	Not supported
Timeslot assignment for 2048 kbit/s interface having H11 channel	Annex B	Not supported	Not supported

Optional Layer 2 Requirements	ITU-T Rec. Q.921 (09/97)	SingTel's Option	StarHub's Option
Frame Reject (FRMR) response	3.6.11	Supported	Supported
Exchange Identification (XID) command/response	3.6.12	Not supported	Not supported
Data link monitor function	5.10	Supported	Supported
Provision for point-to-point data link connection	Annex A (Note 1)	Supported	Supported
Retransmission of REJ response frame	App. I	Not supported	Not supported
Automatic negotiation of data link layer parameters	App. IV	Not supported	Not supported
Note 1: For single point-to-point signalling connection at layer 3, TEI value 0 shall be used in combination with SAPI 0. TEI management procedures are not applicable.			

Optional Layer 3 Requirements	ITU-T Rec. Q.931 (05/98)	SingTel's Option	StarHub's Option
Overlap sending (U2)	2.1.1.3	Supported	Supported
Call received (U7)	2.1.1.7	Supported	Supported
Incoming call proceeding (U9)	2.1.1.9	Supported	Supported
Suspend request (U15)	2.1.1.13 (Note 1)	Supported	Supported
Resume request (U17)	2.1.1.14 (Note 1)	Supported	Supported
Overlap receiving (U25)	2.1.1.16	U25 and N25 states are not supported.	U25 and N25 states are not supported.
Packet mode access connections	2.2	Not supported	Not supported
Temporary signalling connections	2.3	Not supported	Not supported
States associated with the global call reference	2.4 (Note 2)	Supported	Supported
Restart request (Rest 1)	2.4.1.2	Supported	Supported
INFORMATION	3.1.6	Supported	Supported
NOTIFY	3.1.7	Supported	Supported
PROGRESS	3.1.8	Supported	Supported
RESUME	3.1.11 (Note 3)	Supported	Supported
RESUME ACKNOWLEDGE	3.1.12 (Note 3)	Supported	Supported
RESUME REJECT	3.1.13 (Note 3)	Supported	Supported
SUSPEND	3.1.18 (Note 3)	Supported	Supported
SUSPEND ACKNOWLEDGE	3.1.19 (Note 3)	Supported	Supported
SUSPEND REJECT	3.1.20 (Note 3)	Supported	Supported
Messages for packet mode connection control	3.2	Not supported	Not supported
Messages for user to user signalling not associated with circuit switched calls	3.3	Not supported	Not supported
RESTART	3.4.1	Supported	Supported
STATUS (with global call reference)	3.4.3	Supported	Supported

Note 1: Suspend request (U15) and Resume request (U17) call states are not applicable in PRA.

Note 2: If TE supports point-to-multipoint configuration only, call states associated with global call reference are not applicable. However, these call states shall be supported in PRA.

Note 3: These messages are not applicable in PRA.

Optional Layer 3 Requirements	ITU-T Rec. Q.931 (05/98)	SingTel's Option	StarHub's Option
Extension of codesets	4.5.2	Not supported	Not supported [2]
Locking shift procedure	4.5.3	Not supported	Not supported [4]
Non-locking shift procedure	4.5.4	Not supported	Not supported [4]
Call identity	4.5.6 (Note 1)	Supported	Supported
Called party subaddress	4.5.9	Supported	Supported
Calling party number	4.5.10	Supported	Supported
Calling party subaddress	4.5.11	Supported	Supported
Congestion level	4.5.14	Not supported	Not supported
Date/time	4.5.15	Supported	Supported
Display	4.5.16	Supported	Supported
High layer compatibility	4.5.17	Supported	Supported
Keypad facility	4.5.18	Supported	Supported (Note 2)
Low layer compatibility	4.5.19	Supported	Supported
More data	4.5.20	Not supported	Not supported
Network-specific facilities	4.5.21	Not supported	Not supported
Notification indicator	4.5.22	Supported (Note 3)	Supported (Note 3)
Progress indicator	4.5.23	Supported	Supported
Repeat indicator	4.5.24	Not supported	Not supported
Restart indicator	4.5.25 (Note 4)	Supported	Supported
Segmented message	4.5.26	Not supported	Not supported
Sending complete	4.5.27	Supported	Supported
Signal	4.5.28	Supported	Supported
Transit network selection	4.5.29	Not supported	Not supported
User to user	4.5.30	Supported	Supported
Information elements for packet communications	4.6	Not supported	Not supported

Note 1: Call identity information element is not applicable in PRA.
Note 2: For StarHub, keypad facility information element is not supported in PRA.
Note 3: Notification indicator information element is not supported in PRA.
Note 4: It is mandatory to support the restart indicator information element in PRA.

[2] Locking and non-locking shift information element is recognised by StarHub's ISDN. Information elements that are in Codeset other than 0 will be discarded. Only Codeset 0 is supported.

Optional Layer 3 Requirements	ITU-T Rec. Q.931 (05/98)	SingTel's Option	StarHub's Option
Overlap sending	5.1.3	Supported	Supported
Call proceeding, enbloc sending	5.1.5.1	Supported	Supported
Call proceeding, overlap sending	5.1.5.2	Supported	Supported
Transit network selection	5.1.10	Not supported	Not supported
SETUP message delivered by point-to-point data link	5.2.3.1	Supported	Supported
SETUP message delivered by broadcast data link	5.2.3.2 (Note 1)	Supported	Supported
Overlap receiving	5.2.4	Not supported	Not supported
Clearing when tones/ announcements provided	5.3.4.1	Supported	Supported
Clearing when tones/ announcement not provided	5.3.4.2	Supported	Supported
Restart procedure	5.5	Supported (Note 2)	Supported (Note 2)
Call re-arrangements	5.6 (Note 3)	Supported	Supported
User notification procedure	5.9 (Note 3)	Supported	Supported
Basic telecommunication service identification and selection	5.10	Not supported	Not supported
Signalling procedures for bearer capability selection	5.11	Not supported	Not supported
Signalling procedures for high layer compatibility selection	5.12	Not supported	Not supported
Timers in the user side	9.2	T301, T302, T314 and T321 are not supported. T303, T304, T309, T310, T316, T317, T318, T319 and T322 are supported.	T301, T302, T314 and T321 are not supported. T303, T304, T309, T310, T316, T317, T318, T319 and T322 are supported.

Note 1: SETUP message delivered by broadcast data link, is not applicable in PRA.
Note 2: If TE supports point-to-multipoint configuration only, restart procedure is not applicable. However, restart procedure shall be supported in PRA.
Note 3: Call re-arrangements and user notification procedures are not applicable in PRA.

Optional Layer 3 Requirements	ITU-T Rec. Q.931 (05/98)	SingTel's Option	StarHub's Option
Packet communication procedures	6	Not supported	Not supported
User signalling bearer service call control procedures	7	Not supported (as Q.931 clause 2.3 is not supported)	Not supported (as Q.931 clause 2.3 is not supported)
Circuit-mode multirate (64 kbit/s base rate bearer capability)	8	Not supported	Not supported
Transit network selection	Annex C	Not supported	Not supported
Network specific facility selection	Annex E	Not supported	Not supported
Message segmentation procedures	Annex H	Not supported	Not supported
Low layer compatibility negotiation	Annex J	Not supported	Not supported
Procedures for establishment of bearer connection prior to call acceptance	Annex K	Not supported	Not supported
Optional procedures for bearer service change	Annex L	Not supported	Not supported
Additional basic call signalling requirements for the support of private network inter-connection for Virtual Private Network applications	Annex M	Not supported	Not supported
Flexible channel selection	Annex N	Not supported	Not supported

Annex A.2

Guide to the recognised Information Elements

Bearer capability (Q.931 clause 4.5.5)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	Supported
	Coding standard	ITU-T standardised coding	Supported	Supported
		ISO/IEC standard	–	–
		National standard	–	–
		Standard defined for the network (either public or private) present on the network side of the interface	–	–
	Information transfer capability	Speech	Supported	Supported
		Unrestricted digital information	Supported	Supported
		Restricted digital information	–	–
		3.1 kHz audio	Supported	Supported
		Unrestricted digital information with tones/announcements	–	–
		Video	–	–
4	Extension bit	Last octet	Supported	Supported
	Transfer mode	Circuit mode	Supported	Supported
		Packet mode	–	–
	Information transfer rate	This code shall be used for packet mode calls.	–	–
		64 kbit/s	Supported	Supported
		2 x 64 kbit/s	–	–
		384 kbit/s	–	–
		1536 kbit/s	–	–
		1920 kbit/s	–	–
		Multirate (64 kbit/s base rate)	–	–
5*	Extension bit	Last octet	Supported	Supported
		Octet continues through the next octet	Supported	Supported
	User information layer 1 protocol	ITU-T standardised rate adaptation V.110/X.30 (Octet 5a is required. Octets 5b, 5c and 5d are optional.)	Supported	Supported
		Rec. G.711 μ-law	–	–
		Rec. G.711 A-law	Supported	Supported
		Rec. G.721 32 kbit/s ADPCM and Rec. I.460	–	–
		Rec. H.221 and H.242	–	–
		Rec. H.223 and H.245	–	–
		Non-CCITT standardized rate adaption.	–	–
		ITU-T standardised rate adaption V.120 (Octets 5a and 5b are required, and octets 5c and 5d are optional.)	Supported	Supported (Not supported in PRA)
		ITU-T standardised rate adaption X.31 HDLC flag stuffing.	–	– (Supported in PRA)
		Recommendation G.728 [98] LD-CELP	–	–
		Recommendation G.729 [99] CS-ACELP	–	–
5a* (Note 1) (Note 2)	Extension bit	Last octet	Supported	Supported
		Octet continues through the next octet	Supported	Supported
	Synchronous / Asynchronous	Synchronous	Supported	Supported
		Asynchronous	Supported	Supported
	Negotiation	In-band negotiation not possible	Supported	Supported
		In-band negotiation possible	Supported	Supported
	User rate	(as specified in Table 4-6/Q.931 on user rate octet 5a)	Supported	Supported

Bearer capability (Q.931 clause 4.5.5 continued)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
5b* (for V.110 / X.30 rate adaption) (Note 2)	Extension bit	Last octet	Supported	Supported
		Octet continues through the next octet	Supported	Supported
	Intermediate rate	Not used	Supported	Supported
		8 kbit/s	Supported	Supported
		16 kbit/s	Supported	Supported
		32 kbit/s	Supported	Supported
	Network Independent Clock (NIC) on transmission (Tx)	Not required to send data with network independent clock	Supported	Supported
		Required to send data with network independent clock	Supported	Supported
	Network Independent Clock (NIC) on reception (Rx)	Cannot accept data with network independent clock	Supported	Supported
		Can accept data with network independent clock	Supported	Supported
	Flow control on transmission (Tx)	Not required to send data with flow control mechanism	Supported	Supported
		Required to send data with flow control mechanism	Supported	Supported
	Flow control on reception (Rx)	Cannot accept data with flow control mechanism	Supported	Supported
		Can accept data with flow control mechanism	Supported	Supported
5b* (V.120 rate adaption) (Note 2)	Rate adaption header / no header	Rate adaption header not included	Supported	Supported
		Rate adaption header included	Supported	Supported
	Multiple frame establishment support in data link	Multiple frame establishment is not supported. Only UI frames are allowed.	Supported	Supported
		Multiple frame establishment supported	Supported	Supported
	Mode of operation	Bit transparent mode of operation	Supported	Supported
		Protocol sensitive mode of operation	Supported	Supported
	Logical Link Identifier (LLI) negotiation	Default, LLI=256 only	Supported	Supported
		Full protocol negotiation (A connection over which protocol negotiation will be executed is indicated in bit 2 of octet 5b.)	Supported	Supported
	Assignor/assignee	Message originator is "Default assignee"	Supported	Supported
		Message originator is "Assignor only"	Supported	Supported
	In-band/out-band negotiation	Negotiation is done with USER INFORMATION messages on a temporary signalling connection	Supported	Supported
		Negotiation is done in-band using logical link zero	Supported	Supported
5c* (Note 1) (Note 2)	Extension bit	Last octet	Supported	Supported
		Octet continues through the next octet	Supported	Supported
	Number of stop bits	Not used	Supported	Supported
		1 bit	Supported	Supported
		1.5 bits	Supported	Supported
		2 bits	Supported	Supported
	Number of data bits excluding parity bit if present	Not used	Supported	Supported
		5 bits	Supported	Supported
		7 bits	Supported	Supported
		8 bits	Supported	Supported
	Parity information	Odd	Supported	Supported
		Even	Supported	Supported
		None	Supported	Supported
		Forced to 0	Supported	Supported
		Forced to 1	Supported	Supported
5d* (Note 1) (Note 2)	Extension bit	Last octet	Supported	Supported
	Duplex mode	Half duplex	Supported	Supported
		Full duplex	Supported	Supported
	Modem type	Coded according to network specific rules (as specified in Table 4-6/Q.931 on modem type octet 5d)	Supported	Supported

Bearer capability (Q.931 clause 4.5.5 continued)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
6* (Note 2)	Extension bit	Last octet	Supported	Supported
	Layer 2 identification	Layer 2 identification code	Supported	Supported
	User information layer 2 protocol	Rec. Q.921	Supported	Supported
		Rec. X.25, link level	Supported	Supported
		LAN logical link control (ISO/IEC 8802-2)	–	– (Supported in PRA)
7* (Note 2)	Extension bit	Last octet	Supported	Supported
	Layer 3 identification	Layer 3 identification code	Supported	Supported
	User information layer 3 protocol	Rec. Q.931	Supported	Supported
		Rec. X.25, packet layer	Supported	Supported
		ISO/IEC TR 9577 (Protocol identification in the network layer)	–	– (Supported in PRA)

Note 1: This octet may be present if octet 3 indicates *unrestricted digital information* and octet 5 indicates either of the ITU-T standardised rate adaption V.110/X.30 or V.120. It may also be present if octet 3 indicates 3.1 kHz audio and octet 5 indicates G.711.
Note 2: Octet 5a and further octets are transported transparently and are not interpreted by the network.

Call identity (Q.931 clause 4.5.6)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Call identity information	The information element is coded in IA5 characters and the default maximum length is 10 octets.	Supported (Note 1)	Supported (Note 1)

Note 1: Call identity information element is not applicable in ISDN PRA (for identifying the suspended call in call re-arrangement, which is restricted to ISDN BA).

Call State (Q.931 clause 4.5.7)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Coding standard	ITU-T standardised coding	Supported	Supported
		ISO/IEC standard	–	–
		National standard	–	–
		Standard defined for the network (either public or private) present on the network side of the interface	–	–
	Call state value	Null	Supported	Supported
		Call initiated	Supported	Supported
		Overlap sending	Supported	Supported
		Outgoing call proceeding	Supported	Supported
		Call delivered	Supported	Supported
		Call present	Supported	Supported
		Call received	Supported	Supported
		Connect request	Supported	Supported
		Incoming call proceeding	Supported	Supported
		Active	Supported	Supported
		Disconnect request	Supported	Supported
		Disconnect indication	Supported	Supported
		Suspend request	Supported	Supported
		Resume request	Supported	Supported
		Release request	Supported	Supported
	Global interface state value	Null	Supported	Supported
		Restart request	Supported	Supported
		Restart	Supported	Supported

Called party number (Q.931 clause 4.5.8)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	Supported
	Type of number (Note 1)	Unknown (Note 2)	Supported	Supported
		International number (Note 3)	Supported	Supported
		National number	Supported	Supported
		Network specific number	–	–
		Subscriber number (Note 3)	Supported	Supported
		Abbreviated number	–	–
		Reserved for extension	–	–
	Numbering plan identification	Unknown (Note 2)	Supported	Supported
		ISDN/telephony numbering plan (Rec. E.164)	Supported	Supported
		Data numbering plan (Rec. X.121)	–	–
		Telex numbering plan (Rec. F.69)	–	–
		National standard numbering plan	–	–
		Private numbering plan	–	–
		Reserved for extension	–	–
4, etc.	Number digits (IA5 characters)	Decimal digits 0 - 9 (The number digits appear in multiple octet 4's in the same order in which they would be entered, that is, the number digit which would be entered first is located in the first octet 4.)	Supported	Supported

Note 1: For the definition of "number", see ITU-T Rec. I.330.
Note 2: The type of number "unknown" is used when the user or the network has no knowledge of the type of number, e.g. international number, national number, etc. In this case the number of digits field is organized according to the network dialling plan; e.g. prefix or escape digits might be present.
Note 3: Prefix or escape digits shall not be included.

Called party subaddress (Q.931 clause 4.5.9)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	(Note 2)
	Type of subaddress	NSAP(X.213/ISO 8348 AD2)	Supported	
		User specified	Supported	
	Odd/even indicator	Even number of address signals	Supported	
		Odd number of address signals	Supported	
4, etc.	Subaddress information (Note 1)	The NSAP X.213/ISO 8348 AD2 address shall be formatted as specified by octet 4 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in NSAP X.213/ISO 8348 AD2. For the definition of this type of subaddress, see Rec. I.334.For user specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with X.25 networks BCD coding should be applied.	Supported	

Note 1: It is recommended that users apply the NSAP subaddress type since this subaddress type allows the use of decimal, binary and IA5 characters in a standardised manner.
Note 2: The network does not interpret this information. Octets are passed through without checking.

Calling party number (Q.931 clause 4.5.10)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	Supported
		octet continues through the next octet	Supported	Supported
	Type of number (Note 1)	Unknown (Note 2)	Supported	Supported
		International number (Note 3)	Supported	Supported
		National number (Note 3)	Supported	Supported
		Network specific number (Note 4)	–	–
		Subscriber number (Note 3)	Supported	Supported
		Abbreviated number (Note 5)	–	–
		Reserved for extension	–	–
	Numbering plan identification	Unknown (Note 2)	Supported	Supported
		ISDN/telephony numbering plan (Rec. E.164)	Supported	Supported
		Data numbering plan (Rec. X.121)	–	–
		Telex numbering plan (Rec. F.69)	–	–
		National standard numbering plan	–	–
		Private numbering plan	–	–
		Reserved for extension	–	–
3a*	Extension bit	Last octet	Supported	Supported
	Presentation indicator (If octet 3a is omitted "Presentation allowed" is assumed.)	Presentation allowed	Supported	Supported
		Presentation restricted	Supported	Supported
		Number not available due to interworking	Supported	Supported
		Reserved	Supported	Supported
	Screening indicator (If octet 3a is omitted "User-provided, verified and passed" is assumed.)	User-provided, not screened	Supported	Supported
		User-provided, verified and passed	Supported	Supported
		User-provided, verified and failed	Supported	Supported
		Network provided	Supported	Supported
4, etc.	Number digits	Decimal digits 0 - 9 (This field is coded with IA5 characters, according to the formats specified in the appropriate numbering / dialling plan.)	Supported	Supported

Note 1: For the definition of "number", see ITU-T Rec. I.330.

Note 2: The type of number "unknown" is used when the user or the network has no knowledge of the type of number, e.g. international number, national number, etc. In this case the number of digits field is organized according to the network dialling plan; e.g. prefix or escape digits might be present.

Note 3: Prefix or escape digits shall not be included.

Note 4: The type of number "network specific number" is used to indicate administration/service number specific to the serving network, e.g. used to access an operator.

Note 5: The support of this code is network dependent. The number provided in this information element presents a shorthand representation of the complete number in the specified numbering plan as supported by the network.

Calling party subaddress (Q.931 clause 4.5.11)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	(Note3)
	Type of subaddress	NSAP (X.213/ISO 8348 AD2)	Supported	
		User specified	Supported	
	Odd/even indicator (Note 1)	Even number of address signals	Supported	
		Odd number of address signals	Supported	
4, etc.	Subaddress information	The NSAP X.213/ISO 8348 AD2 address shall be formatted as specified by octet 4 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in NSAP X.213/ISO 8348 AD2. For the definition of this type of subaddress, see Rec. I.334. For user specified subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with X.25 networks BCD coding should be applied.	Supported	

Note 1: The odd/even indicator is used when the type of subaddress is "user specified" and the coding is BCD.
Note 2: It is recommended that users apply the NSAP subaddress type since this subaddress type allows the use of decimal, binary and IA5 characters in a standardised manner.
Note 3: The purpose of this information element is to identify the subaddress associated with the origin of the call. Octets are passed through without checking.

Cause (Q.931 clause 4.5.12)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	Supported
		octet continues through the next octet	Supported	Supported
	Coding standard	ITU-T standardised coding	Supported	Supported
	Location Note: Depending on location of users, the local public network and the remote public network may be the same network.	User	Supported	Supported
		Private network serving the local user	Supported	Supported
		Public network serving the local user	Supported	Supported
		Transit network	Supported	Supported
		Public network serving the remote user	Supported	Supported
		Private network serving the remote user	Supported	Supported
		International network	Supported	Supported
		Network beyond interworking point	Supported	Supported
3a*	Extension bit	Last octet	Supported	Supported
	Recommendation	Q.931	Supported	Supported
4	Extension bit	Last octet	Supported	Supported
	Cause value	The cause value is divided in two fields, a class (bits 5 through 7) and a value within the class (bits 1 through 4). The class indicates the general nature of the event. The cause values are defined in Appendix I of Q.931.	Supported	Supported
5*	Diagnostics	Diagnostic information is not available for every cause. The inclusion of diagnostics is optional. When available the coding of diagnostic(s) is the same as for the corresponding information element identifier or message type code.	Supported	Supported

Channel identification (Q.931 § 4.5.13)

Octet	Field	Value(s) recognised		SingTel's Option	StarHub's Option
3	Extension bit	Last octet		Supported	Supported
	Interface identifier present (Note 1)	Interface implicitly identified (including the D-channel carrying this information element)		Supported	Supported
		Interface explicitly identified in one or more octets, beginning with octet 3.1		Supported	Supported
	Interface type	Basic interface		Supported	Supported
		Other interface e.g. primary rate interface		Supported	Supported
	Preferred / Exclusive (has significance only for B-channel selection)	Indicated channel is preferred		–	–
		Exclusive, only the indicated channel is acceptable		Supported	Supported
	D-channel indicator (has significance in D-channel used)	The channel identified is not the D-channel		Supported	Supported
		The channel identified is the D-channel		Supported	Supported
	Information channel selection	Basic interface No channel	Primary rate interface No channel	Supported	Not supported in PRA
		B1 channel	As indicated in the following octets	Supported	Supported
		B2 channel	Reserved	Supported	Not Supported in PRA
		Any channel	Any channel	Supported	Supported
3.1*	Extension bit	Octet continues through the next octet		Supported	Supported
	Interface identifier	Binary code assigned to interface at the time of subscription		Supported	Supported
3.2* (Note 2)	Extension bit	Last octet		Supported	Supported
	Coding standard	ITU-T standardised coding		Supported	Supported
		ISO/IEC standard		–	–
		National standard		–	–
		Standard defined for the network (either public or private) present on the network side of the interface		–	–
	Number/Map	Channel is indicated by the number in the following octet		Supported	Supported
		Channel is indicated by the slot map in the following octet(s)		Supported	Not supported in PRA
	Channel type / Map element type	B-channel units		Supported	Supported
		H0-channel units		–	–
		H11-channel units		–	–
		H12-channel units		–	–
3.3* (Note 2)	Channel number / Slot map	Channel number - Binary number assigned to the channel. For B-channels, the number equals the time slot number.		Supported	Supported
		Slot map		Supports Figure 4-19/Q.931 a) only in PRA	Not supported in PRA

Note 1: When the "interface identifier present" field in octet 3 indicates "interface implicitly identified" octet 3.1 is omitted. When octet 3.1 is present, it may be extended by using the extension bit (bit 8).

Note 2: When the "interface type" field in octet 3 indicates "basic interface", octets 3.2 and 3.3 are functionally replaced by the "information channel selection" field in octet 3, and thus omitted.

Congestion level (Q.931 clause 4.5.14)

The purpose of the Congestion level information element is to describe the congestion status of the call. It is a single octet information element coded as shown in Figure 4-20/Q.931 and Table 4-14/Q.931.

Congestion level information element is not supported in both SingTel's and StarHub's ISDN.

Date/time (Q.931 clause 4.5.15)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
4	Month	This field is binary coded.	Supported	Supported
5	Day	This field is binary coded.	Supported	Supported
3	Year	This field is binary coded.	Supported	Supported
6	Hour	This field is binary coded.	Supported	Supported
7	Minute	This field is binary coded.	Supported	Supported
8	Second	This field is binary coded.	–	–

Display (Q.931 clause 4.5.16)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Display information	The display information element is coded in IA5 characters and has a network dependent default maximum length of 34 or 82 octets.	Supported	Supported

High layer compatibility (Q.931 clause 4.5.17)

The purpose of the High layer compatibility information element is to provide a means, which should be used by the remote user for compatibility checking. See Annex B/Q.931.

The High layer compatibility information element is coded as shown in Figure 4-23/Q.931 and Table 4-15/Q.931.
The maximum length of this information element is five octets.

Note: The high layer compatibility information element is transported transparently by an ISDN between a call originating entity, e.g., a calling user and the addressed entity, e.g., a remote user or a high layer function network node addressed by the call originating entity.

Keypad facility (Q.931 clause 4.5.18)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Keypad facility information	IA5 characters entered by means of a terminal keypad	Supported	Not supported in PRA

Low layer compatibility (Q.931 clause 4.5.19)

The purpose of the Low layer compatibility information element is to provide a means to be used for capability checking by an addressed entity (e.g. a remote user or an interworking unit or a high layer function network node addressed by the calling user). The low layer information element is transferred transparently by an ISDN between the call originating entity (e.g., the calling user) and the addressed entity (see Annex B and Annex I).

The Low layer compatibility information element is coded as shown in Figure 4-25/Q.931 and Table 4-16/Q.931. The maximum length of this information element is 18 octets.

More data (Q.931 clause 4.5.20)

The More data information element is sent by the user to the network in a USER INFORMATION message, and delivered by the network to the destination user(s) in the corresponding USER INFORMATION message. The presence of the More data information element indicates to the destination user that another USER INFORMATION message will follow, containing information belonging to the same block.

The network does not supervise the use of the More data information element.

The More data information element is coded as shown in Figure 4-26/Q.931. The length of this information element is one octet.

More data information element is not supported in both SingTel and StarHub's ISDN BA, and not supported in SingTel's ISDN PRA.

Network-specific facilities (Q.931 clause 4.5.21)

The purpose of the Network-specific facilities information element is to indicate which network facilities are to be invoked. The Network-specific facilities information element is coded as shown in Figure 4-27/Q.931 and Table 4-18/Q.931. No more than four Network-specific facilities information elements may be included in a single message.

The maximum length of this information element is network dependent.

Network-specific facilities information element is not supported in both SingTel's and StarHub's ISDN BA, and not supported in SingTel's ISDN PRA.

Notification indicator (Q.931 clause 4.5.22)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	Supported
	Notification description	User suspended	Supported	Supported
		User resumed	Supported	Supported
		Bearer service change	–	–

Notification indicator is not applicable to PRA.

Progress indicator (Q.931 clause 4.5.23)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	Supported
	Coding standard	ITU-T standardised coding	Supported	Supported
		ISO/IEC standard	–	–
		National standard	–	–
		Standard specific to identified location	–	–
	Location	User	Supported	Supported
		Private network serving the local user	Supported	Not supported in PRA
		Public network serving the local user	Supported	Supported
		Transit network	Supported	Supported
		Public network serving the remote user	Supported	Supported
		Private network serving the remote user	Supported	Supported
		Network beyond the interworking point	Supported	Supported
4	Extension bit	Last octet	Supported	Supported
	Progress description	Call is not end-to-end ISDN; further call progress information may be available in-band	Supported	Supported
		Destination address is non ISDN	Supported	Supported
		Origination address is non ISDN	Supported	Supported
		Call has returned to the ISDN	Supported	Supported
		Interworking has occurred and has resulted in a telecommunication service change	–	Supported in PRA
		In-band information or an appropriate pattern is now available	Supported	Supported

Repeat indicator (Q.931 clause 4.5.24)

The purpose of the Repeat indicator information element is to indicate how repeated information elements shall be interpreted, when included in a message. The Repeat indicator information element is included before the first occurrence of the information element which will be repeated in a message. The Repeat indication information element is coded as shown in Figure 4-30/Q.931 and Table 4-21/Q.931.

The length of this information element is one octet.

Repeat indicator information element is not supported in both SingTel and StarHub's ISDN BA, and not supported in SingTel's ISDN PRA.

Restart indicator (Q.931 clause 4.5.25)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Extension bit	Last octet	Supported	Supported
	Class	Indicated channels (Note 1)	Supported	Supported (Note 2)
		Single interface	–	Supported
		All interfaces	–	Supported

Note 1: In the network to user direction only indicated channel is used. However, the StarHub's ISDN supports all class values from the user to network direction.

Note 2: The channel identification information element must be included and indicate which channels to be restarted, i.e. RESTART (R1="Indicated channels", CI(channel 1, 2, 3 ……..n).

Segmented message (Q.931 clause 4.5.26)

The purpose of the Segmented message information element is to indicate that the transmission in which it appears is part of a segmented message, in addition to the use of message type SEGMENT. When included in a message segment, it appears directly after the Message type information element (see Annex H/Q.931).

The Segmented message information element is coded as shown in Figure 4-32/Q.931 and Table 4-23/Q.931. The length of this information element is four octets.

Segmented message information element is not supported in both SingTel and StarHub's ISDN BA, and not supported in SingTel's ISDN PRA.

Sending complete (Q.931 clause 4.5.27)

The purpose of the Sending complete information element is to optionally indicate completion of called party number.

It is a single octet information element coded as shown in Figure 4-33/Q.931.

Signal (Q.931 clause 4.5.28)

Octet	Field	Value(s) recognised	SingTel's Option	StarHub's Option
3	Signal value	Convey information to user regarding tones and alerting signals (see clause 7)	Supported	Supported

Transit network selection (Q.931 clause 4.5.29)

The purpose of the Transit network selection information element is to identify one requested transit network. The Transit network selection information element may be repeated in a message to select a sequence of transit networks through which a call must pass (see Annex C/Q.931).

The Transit network selection information element is coded as shown in Figure 4-35/Q.931 and Table 4-25/Q.931. The maximum length of this information element is network dependent.

Transit network selection information element is not supported in both SingTel and StarHub's ISDN BA, and not supported in SingTel's ISDN PRA.

User-user (Q.931 clause 4.5.30)

The purpose of the User-user information element is to convey information between ISDN users. This information is not interpreted by the network, but rather is carried transparently and delivered to the remote user(s).

The User-user information element is coded as shown in Figure 4-36/Q.931 and Table 4-26/Q.931. There are no restrictions on content of the user information field.

Annex B: Corrigendum / Addendum

Changes to IDA TS ISDN BA Issue 1, Rev 1 and IDA TS ISDN PRA Issue 1, Rev1 (May 2011)			
Page	**TS Ref.**	**Items Changed**	**Date of Issue**
—	—	The Specification has been streamlined, based on the principles of presenting the Integrated Services Digital Network (ISDN) to the TE. It consolidates the requirements for: (a) the support of Layer 1 activation and deactivation procedures for both the Basic Access (BA) and the Primary Rate Access (PRA); (b) the electrical characteristics; (c) the power arrangements; and (d) the Layer 2 and 3 signalling protocols. It enables the mapping of the Layer 2 and 3 signalling protocols with the Access Network protocols of the next generation networks. Renamed as the "Technical Specification for Terminal Equipment connecting to the Integrated Services Digital Network (ISDN)", it has superseded the following 2 Technical Specifications: ▪ IDA TS ISDN BA Issue 1 Rev 1; and ▪ IDA TS ISDN PRA Issue 1 Rev 1 There are no changes to the requirements set out previously in the 2 Technical Specifications for the purpose of conformity assessment for connection to the ISDN using BA or PRA.	XX XXX 13

Changes to IDA TS ISDN BA Issue 1 and IDA TS ISDN PRA Issue 1 (Jul 2005)			
Page	**TS Ref.**	**Items Changed**	**Date of Issue**
—	—	Change of IDA's address at cover page to Mapletree Business City.	1 May 11

Changes to IDA TS ISDN 1 Issue 1 Rev 3 & ISDN 3 Issue 1 Rev 3 (Oct 2000)			
Page	**TS Ref.**	**Items Changed**	**Date of Issue**
—	—	Title of Specification has been renamed as “Technical Specification for connecting to the Integrated Services Digital Network (ISDN) using Basic Access (BA)” (IDA TS ISDN BA Issue 1). The Technical Specification has superseded the following two IDA Type Approval Specifications: IDA TS ISDN 1 Issue 1 Rev 3 IDA TS ISDN 3 Issue 1 Rev 3 The Technical Specification has also incorporated the EMC requirements, previously published under the IDA TS EMC Issue 1 Rev 1. Changes are mainly editorial in nature, in which the essential technical requirements for compliance formerly defined under the two Specifications (TS ISDN 1 and TS ISDN 3) are now incorporated as one.	21 Jul 05

Changes to IDA TS ISDN 2 Issue 1 Rev 4 (Jun 2003)			
Page	**TS Ref.**	**Items Changed**	**Date of Issue**
—	—	Title of Specification has been renamed as “Technical Specification for connecting to the Integrated Services Digital Network (ISDN) using Primary Rate Access” (IDA TS ISDN PRA Issue 1). The Technical Specification, IDA TS ISDN PRA Issue 1 has superseded the IDA TS ISDN 2 Issue 1 Rev 4. It has also incorporated the EMC requirements, previously published under the IDA TS EMC Issue 1 Rev 1. Changes are mainly editorial in nature, in which the essential technical requirements for compliance remain unchanged.	21 Jul 05