



Reference Specification

for

Access Network (AN) systems

with

V5.1 Interface (based on 2048 kbit/s)

for connection to the

Digital Local Exchange (LE)

IDA RS PSTN5
Issue 1 Rev 2, 1 December 1999

Copyright Reserved

Info-Communications Development Authority of Singapore
Equipment and Cabling Regulation Department
8 Temasek Boulevard
#14-00 Suntec Tower Three
Singapore 038988

<http://www.ida.gov.sg>

CONTENTS

		Page
PART A	INTRODUCTION	
1	SCOPE	3
2	GENERAL REQUIREMENTS	5
3	SAFETY OF TERMINAL EQUIPMENT FOR CONNECTION TO TELECOMMUNICATION NETWORKS	6
PART B	V-INTERFACES AT THE DIGITAL LOCAL EXCHANGE (LE) - V5.1 INTERFACE (BASED ON 2048 kbit/s) FOR THE SUPPORT OF ACCESS NETWORK (AN) (ITU-T Recommendation G.964, Jun 1994)	
Table		
1	INTERFACE REQUIREMENTS	8
2	SERVICES AND ARCHITECTURE ASPECTS AND REQUIREMENTS	8
3	CONTROL AND PROVISIONING	9
4	PROTOCOL ARCHITECTURE AND STRUCTURE	10
5	ENVELOPE FUNCTION SUBLAYER OF LAPV5 (LAPV5-EF)	11
6	DATA LINK SUBLAYER OF LAPV5 (LAPV5-DL)	12
7	AN FRAME RELAY SUBLAYER	15
8	SUBLAYER-TO-SUBLAYER COMMUNICATION AND MAPPING FUNCTION	15
9	PSTN SIGNALLING PROTOCOL SPECIFICATION AND LAYER 3 MULTIPLEXING	16
10	CONTROL REQUIREMENTS AND PROTOCOL	18
Annex		21
A	Service scenarios, architecture and functional definition of access arrangements with an AN at the LE	
B	Use of the protocol information elements for national PSTN protocols	
C	Basic requirements of the system management functions in the AN and the LE	
D	Protocol architecture for PSTN and ISDN user port control	
E	Structures used in the V5.1-interface	
F	The concept and requirements for the upgrade of an interface V5.1 into an interface V5.2	
G	Abbreviations	
H	AN requirement for pulse dialing	
I	Layer 3 error detection procedure	
Appendix		21
I	Bibliography	
	REFERENCES	22

NOTICE

This Specification is subject to review and revision.

PART A INTRODUCTION

1 SCOPE

1.1 This Specification defines a V-interface (V5.1) for the connection of an Access Network (AN) to a Local Exchange (LE) for the support of the following access types:

- analogue telephone access, based on IDA TS PSTN 1;
- ISDN basic access with a NT1 separated from the AN, with a line transmission system conforming to ITU-T Recommendation G.960;
- ISDN basic access with a NT1 integrated in the AN, based on IDA TS ISDN 1;
- other analogue or digital accesses for semi-permanent connections without associated outband signalling information.

with flexible (provisioned) information channel (bearer channel) allocation but without concentration capability within the AN.

NOTE

Terminal equipment connected to the user ports must be IDA type-approved models.

1.2 The V5.1-interface consists of a single 2048 kbit/s interface. The electrical and functional interface specification uses the 2048 kbit/s parts of ITU-T Rec G.703, G.704 and G.706.

1.3 The signalling from the PSTN user port is converted into a stimulus protocol with a functional part for the signalling path using layer 3 multiplexing for the information from the different user ports.

1.4 The information from the ISDN D-channels is frame relayed in the Access Network using the mechanisms defined in ITU-T Rec Q.922.

1.5 A control protocol defined in this Specification is used for the exchange of the individual port status and control functions required for the coordination with the call control procedures in the Local Exchange.

1.6 In order to coordinate the traffic demands in the various protocols, 1, 2 or 3 communication channels can be provisioned to transport the various protocols and frame relayed information. The data link layer for the protocols is defined on the basis of ITU-T Rec Q.920 and Q.921.

1.7 Interface V5.1 is upgradable to V5.2 through re-provisioning and by implementation of the additional functionality.

NOTE

- Functions that are not applicable will be shown by the addition of texts (in italic) or the deletion of texts (through strikeouts).
- The following notations are used in the Specification:

CR	Conformance requirement defines features and functions which must be supported at minimum.
M	Mandatory requirements
O	Optional requirements
NA	Not Applicable
GID	General Information and Definitions

1.8 Abbreviations

AI	Activate Indication
AIS	Alarm Indication Signal
AN	Access Network
AN-FR	AN Frame Relay function
BA	ISDN Basic Access
BECN	Backward Explicit Congestion Notification
C-channel	Communication channel
C-path	Communication path
CRC	Cyclic Redundancy Check
C/R	Command/Response
CTRL	Control protocol message
Cx	Communication channel with index
C64	Communication channel 64 kbit/s
DDI	Direct-Dialling-In
DE	Discard Eligibility indicator
DI	Deactivate Indication
DL	Primitive between layer 2 and layer 3
DLCI	Data Link Connection Identifier
DTMF	Dual Tone Multiple Frequency
DS	access Digital Section
Ds	D-channel signalling type data
D16	D-channel 16 kbit/s
EA	Address Extension bit
EFaddr	Envelope Function address
EI	Error Indication
ET	Exchange Termination
FCS	Frame Check Sequence
FE	Function Element
FECN	Forward Explicit Congestion Notification
FRI	Frame Relaying Information
FSM	Finite State Machine
ID	Interface identifier
ISDN	Integrated Services Digital Network
ISDN-BA	ISDN-Basic Access
LAPB	Link Access Protocol Balanced for X.25
LAPD	Link Access Protocol for ISDN D-channel
LAP-F	Link Access Protocol for frame mode
LAPV5	Link Access Protocol for V5-interface
LAPV5-DL	LAPV5 Data Link sublayer
LAPV5-EF	LAPV5 Envelope Function sublayer
LC	Line Circuit
LE	Local Exchange
LOF	Loss of Frame alignment
LOS	Loss of Signal
LT	Line Termination
L1	Layer 1 function
L2	Layer 2 function

L3	Layer 3 function
L3addr	Layer 3 address
MCI	Malicious Call Identification
MDU	Management Data Unit
MDL	Primitive between layer 2 and layer 3 management
MF	Mapping Function
MPH	Primitive between physical layer and layer 2 management
NT1	Network Termination 1
NT2	Network Termination 2
PCM	Pulse Code Modulation
P/F	P-type and/or f-type data
PH	Primitive between physical layer and layer 2
PICS	Protocol Implementation Conformance Statements
PL	Permanent Line capability (service)
PSTN	Public Switched Telephone Network
PABX	Private Automatic Branch eXchange
Q _{AN}	Q-interface at the AN
Q _{LE}	Q-interface at the LE
RAI	Remote Alarm Indication
SAPI	Service Access Point Identifier
TE	Terminal Equipment (ISDN or PSTN)
TEI	Terminal Endpoint Identifier
TMN	Telecommunication Management Network
V5DLaddr	V5-Data Link address

2	GENERAL REQUIREMENTS	CR
2.1	POWER SUPPLY	-
	Operated from A.C. mains supply of 230 V ± 10%, 50 Hz ± 2%	O
	Employs external A.C. adapter	O
2.2	IDENTIFICATION OF EQUIPMENT	-
	Equipment shall be marked with:	
	(a) supplier's or manufacturer's name or identification mark;	M
	(b) supplier's or manufacturer's model or type reference.	M
	The markings shall be legible, indelible and readily visible.	M

3	SAFETY OF TERMINAL EQUIPMENT FOR CONNECTION TO TELECOMMUNICATION NETWORKS	CR
3.1	General	–
3.1.1	<p>Equipment (mains or battery powered) shall be designed to comply with the principles of Singapore Standards (SS), International Electrotechnical Commission (IEC) or other safety standards e.g. IEC 60950, EN60950, BS EN41003, SS 337.</p> <p>Requirements applicable to the equipment (e.g. class of equipment, type of TNV circuit and types of components) covered in the following sections of IEC 60950¹ shall be identified and complied with:</p> <p>Scope (1.1 of IEC 60950)</p> <p>Definitions (1.2 of IEC 60950)</p> <p>General requirements (1.3 of IEC 60950)</p> <p>General conditions for test (1.4 of IEC 60950)</p> <p>Components (1.5 of IEC 60950)</p> <p>Power interface (1.6 of IEC 60950)</p> <p>Marking and instructions (1.7 of IEC 60950)</p> <p>Protection from hazards (2 of IEC 60950)</p> <p>Wiring, connections and supply (3 of IEC 60950)</p> <p>Physical requirements (4 of IEC 60950)</p> <p>Thermal and electrical requirements (5 of IEC 60950)</p> <p>Connection to telecommunication networks (6 of IEC 60950)</p>	M
3.2	TNV² circuit characteristics and requirements	–
3.2.1	In a single TNV circuit or interconnected TNV circuits, the voltage between any two conductors of the TNV circuit or circuits and between any one such conductor and earth shall comply with the limits set for TNV-1 ³ circuit (refer to 6.2.1.1 (a) of IEC 60950).	M
3.2.2	Requirements for separation from other circuits and from accessible parts are in accordance with Table 19 of 6.2.1.2, IEC 60950.	M
3.2.3	The equipment shall be able to withstand the operating voltages generated externally as described in 6.2.1.3 of IEC 60950.	M
3.2.4	TNV circuits shall be separated from circuits at hazardous voltages by one or both of the methods given in 6.2.1.4 of IEC 60950.	M
3.2.5	If the TNV circuit is connected to other circuits, the requirements as given in 6.2.1.5 of IEC 60950 shall be complied with.	Note 1

¹ IEC 60950, 2nd Edition, 1991 + Amend. 1, 1992 + Amend. 2, 1993 + Amend. 3, 1995 + Amend. 4, 1996

² Telecommunication Network Voltage (TNV) as defined in 1.2.8.8, IEC 60950 Amend. 4, 1996

³ Only TNV-1 circuits are permitted for connection to the Singapore telecommunication network. Operating voltages of TNV-1 circuits do not exceed 42.4 V peak or 60 V d.c. under normal operating conditions (refer to 1.2.8.9 and 2.3.2 of IEC 60950 Amend. 4, 1996).

3	SAFETY OF TERMINAL EQUIPMENT FOR CONNECTION TO TELECOMMUNICATION NETWORKS (Continued)	CR
3.3	Protection of telecommunication network service personnel, and users of other equipment connected to the network, from hazards in the equipment	–
3.3.1	Circuitry intended to be directly connected to a telecommunication network shall comply with the requirements for an SELV ⁴ circuit or a TNV-1 circuit (refer to 6.3.1 of IEC 60950).	M
3.3.2	Where protection of telecommunication network relies on the protective earthing of the equipment, the equipment installations instructions and other relevant literature shall state that integrity of protective earthing must be ensured (refer to 6.3.2 of IEC 60950).	Note 2
3.3.3	There shall be insulation between circuitry intended to be connected to a telecommunication network and any parts or circuitry that will be earthed (refer to 6.3.3 of IEC 60950).	M
3.3.4	The leakage current to a telecommunication network originating from a mains powered equipment shall not exceed 0.25 mA r.m.s. (refer to 6.3.4.1 of IEC 60950). This requirement does not apply to equipment where the circuit to be connected to a telecommunication network is connected to an earthing terminal in the equipment.	Note 2
3.4	Protection of equipment users from over voltages on telecommunication networks	–
3.4.1	Equipment shall provide adequate electrical separation between TNV-1 circuit and certain parts of the equipment (refer to 6.4.1 of IEC 60950).	M
3.4.2	Compliance with 3.4.1 is checked by the electric strength test procedure of 6.4.2 of IEC 60950.	M
3.5	Protection of the telecommunication wiring system from overheating	–
3.5.1	Equipment intended to provide power over the telecommunication wiring system to remote equipment shall limit the output current to a value that does not cause damage to the telecommunication wiring system (refer to 6.5 of IEC 60950).	Note 2
Note 1	Requirements are mandatory if TNV circuits are connected to other circuits.	
Note 2	Requirements are mandatory if clause is applicable.	

⁴ Safety Extra Low Voltage (SELV) circuit is so designed and protected that under normal and single fault conditions, its voltages do not exceed a safe value of 42.4 V peak or 60 V d.c. under normal operating conditions.

PART B V-INTERFACES AT THE DIGITAL LOCAL EXCHANGE (LE) – V5.1 INTERFACE (BASED ON 2048 kbit/s) FOR THE SUPPORT OF ACCESS NETWORK (AN)

(ITU-T Recommendation G.964, Jun 1994)

TITLE	ITU-T REC G.964	COMMENTS	CR
SCOPE	1		GID
REFERENCES	2		GID
DEFINITIONS	3		GID
ELECTRICAL AND PHYSICAL INTERFACE REQUIREMENTS	4	The V5.1-interface consists of a single 2048 kbit/s interface as defined in ITU-T Rec G.703, G.704 and G.706.	M
		- The interface is of the balance interface pair type.	O
		- The interface is of the coaxial type.	O
PROCEDURAL INTERFACE REQUIREMENTS	5	The functional and procedural requirements of the interface shall conform to ITU-T Rec G.704 and G.706, 2048 kbit/s case.	M

TITLE	ITU-T REC G.964	COMMENTS	CR
SERVICES AND ARCHITECTURE ASPECTS AND REQUIREMENTS	6		-
On-Demand Services	6.1	Heading	-
PSTN	6.1.1	PSTN user ports <ul style="list-style-type: none"> – with DTMF or line state signalling – with or without supplementary services – PABXs with or without DDI 	O
ISDN Basic Access	6.1.2	ISDN user ports <ul style="list-style-type: none"> – with NT1 as integral part of the AN – with NT1 as a separate equipment 	O
Permanent Line (PL) Capability	6.2		O

TABLE 2: SERVICES AND ARCHITECTURE ASPECTS AND REQUIREMENTS (continued)			
TITLE	ITU-T REC G.964	COMMENTS	CR
Semi-Permanent Leased Line	6.3		O
Permanent Leased Line Services	6.4		O

TABLE 3: CONTROL AND PROVISIONING			
TITLE	ITU-T REC G.964	COMMENTS	CR
CONTROL AND PROVISIONING	7	Heading	-
Control Principles	7.1		GID
Provisioning strategy and requirements	7.2	Heading	-
General	7.2.1	Provisioning shall be performed through the Q-interfaces of the AN and the LE.	GID
Provisioning requirements	7.2.2	<ul style="list-style-type: none"> - The association of bearer channels to user ports at the AN and LE shall be provisioned. - The control of the association between user ports and V5.1-interfaces shall be performed via the Q-interface. 	M

TABLE 4: PROTOCOL ARCHITECTURE AND STRUCTURE			
TITLE	ITU-T REC G.964	COMMENTS	CR
PROTOCOL ARCHITECTURE AND MULTIPLEXING STRUCTURE	8	Heading	-
Functional Description	8.1		GID
Protocol Requirements for PSTN and ISDN	8.2		GID
Time Slots	8.3		M
Time Slot Allocation for Communication Channels	8.4	- Communication channels allocated shall be timeslots 15 and 16 (C-channel 2 and 1 respectively).	Note 1
		- Communication channels allocated shall be timeslots 15, 16 and 31 (C-channel 2, 1 and 3 respectively).	Note 2
		- The control communication path shall always be allocated to C-channel 1.	M
		- The other communication paths shall be allocated to any C-channel by provisioning.	M
Layer 2 Sublayering and Multiplexing on Communication Channels	8.5		GID
Layer 3 Multiplexing	8.6		GID
Congestion Control	8.7		GID

Note 1 "M" if 6.1.1 is supported.

Note 2 "M" if 6.1.2 is supported or if 6.1.2 and 6.1.1 are supported.

Note 3 "f-type" data may not be supported.

TABLE 5: ENVELOPE FUNCTION SUBLAYER OF LAPV5 (LAPV5-EF)			
TITLE	ITU-T REC G.964	COMMENTS	CR
ENVELOPE FUNCTION SUBLAYER OF LAPV5 (LAPV5-EF)	9	Heading	-
Frame Structure for Peer-to-Peer Communication	9.1	Heading	-
General	9.1.1	All Envelope function peer-to-peer exchanges of information between the AN and the LE shall be in frames conforming to the format shown in Figure 7/G.964.	M
Flag sequence	9.1.2		M
Interframe time fill	9.1.3		M
Envelope Function Address field	9.1.4		M
Envelope Information field	9.1.5		M
Transparency	9.1.6		M
Frame check sequence (FCS)	9.1.7		M
Format convention	9.1.8		M
Invalid frames	9.1.9		M
Frame aborts	9.1.10		M
Format of Fields for Data Link Envelope Peer-to-Peer Communication	9.2	Heading	-
Envelope Function Address field format	9.2.1		M
Address field variables	9.2.2	Heading	-
Address field extension bit (EA)	9.2.2.1		M
EFaddr	9.2.2.2		M

TABLE 6: DATA LINK SUBLAYER OF LAPV5 (LAPV5-DL)			
TITLE	ITU-T REC G.964	COMMENTS	CR
DATA LINK SUBLAYER OF LAPV5 (LAPV5-DL)	10	Heading	-
Frame Structure for Peer-to-Peer Communication	10.1	Heading	-
General	10.1.1	All data link sublayer peer-to-peer exchanges of information between the AN and the LE shall be in frames conforming to the formats defined in Figure 9/G.964.	M
Link Address field	10.1.2		M
Control field	10.1.3		M
Information field	10.1.4		M
Format convention	10.1.5		M
Invalid Frames	10.2		M
Elements of Procedures and Formats of Fields for Data Link Sublayer Peer-to-Peer Communication	10.3	Heading	-
Link Address field format	10.3.1		M
Link address field variables	10.3.2	Heading	-
Address field extension bit (EA)	10.3.2.1		M
Command/response field bit	10.3.2.2		M
V5DLaddr	10.3.2.3	The V5DLaddr shall be a 13-bit number. Defined values of the V5DLaddr are given in Table 1/G.964.	M
Control field formats	10.3.3		M
Control field parameters and associated state variables	10.3.4		M
Frame types	10.3.5		M

TABLE 6: DATA LINK SUBLAYER OF LAPV5 (LAPV5-DL) (continued)			
TITLE	ITU-T REC G.964	COMMENTS	CR
Definition of the Peer-to-Peer Procedures of the Data Link Sublayer	10.4	Heading	-
General	10.4.1	The Link Access Procedures for the Control-channel or PSTN-signalling-channel are based on the point-to-point Link Access Procedures on the D-channel (LAPD) specified in ITU-T Rec Q.920 and Q.921. For the LAPV5-DL peer-to-peer communication procedures only the multiframe acknowledged information transfer shall be used. The elements of procedure (frame types) shall apply except for DISC-command and FRMR response which are neither generated nor expected to be received.	M
Procedure for the use of the P/F-bit	10.4.2		M
Terminal Endpoint Identifier (TEI) management procedures	10.4.3		NA
Automatic negotiation of data link layer parameters	10.4.4		NA
Procedures for establishment and release of multiple frame operation	10.4.5	Heading	-
Establishment of multiple frame operation	10.4.5.1		M
Information transfer	10.4.5.2		M
Termination of multiple frame operation	10.4.5.3		M
Link-not-established state	10.4.5.4		M
Collision of unnumbered commands and responses	10.4.5.5		M
Unsolicited DM response and SABME command	10.4.5.6		M
Procedures for information transfer in multiple frame operation	10.4.6		M

TABLE 6: DATA LINK SUBLAYER OF LAPV5 (LAPV5-DL) (continued)			
TITLE	ITU-T REC G.964	COMMENTS	CR
Re-establishment of multiple frame operation	10.4.7		M
Exception condition reporting and recovery	10.4.8	The TEI-assigned state in ITU-T Rec Q.920 and Q.921 is replaced by the link-not-established state.	M
List of system parameters	10.4.9	<ul style="list-style-type: none"> – timer T200 (1s); – maximum number of retransmissions N200 (3); – maximum number of octets in an information field N201 (260); – timer T203 (10s). 	M
Data link monitor function	10.4.10	Heading	-
General	10.4.10.1		GID
Data link layer supervision in the multiple-frame-established state	10.4.10.2		M
Connection verification procedures	10.4.10.3		M
PSTN and control data link FSM and requirements	10.4.11		M
General	10.4.11.1	State 5 Awaiting-establishment State 7 Multiple-frame-established State 8 Timer-recovery State 9 Link-not-established	M
Data link FSM	10.4.11.2		GID

TABLE 7: AN FRAME RELAY SUBLAYER			
TITLE	ITU-T REC G.964	COMMENTS	CR
AN FRAME RELAY SUBLAYER	11	Heading	-
General	11.1		Note 1
Invalid Frames	11.2		Note 1
Detailed Description of the AN Frame Relay Function	11.3		Note 1
Frame received from LE	11.3.1		Note 1
Frame received from ISDN user port	11.3.2		Note 1

Note 1 "M" if 6.1.2 is supported.

TABLE 8: SUBLAYER-TO-SUBLAYER COMMUNICATION AND MAPPING FUNCTION			
TITLE	ITU-T REC G.964	COMMENTS	CR
SUBLAYER-TO-SUBLAYER COMMUNICATION AND MAPPING FUNCTION	12	Heading	-
LAPV5-EF to LAPV5-DL Communication	12.1		M
LAPV5-DL to LAPV5-EF Communication	12.2		M
AN-FR to LAPV5-EF Communication	12.3		Note 1
LAPV5-EF to AN-FR Communication	12.4		Note 1

Note 1 "M" if 6.1.2 is supported.

TABLE 9: PSTN SIGNALLING PROTOCOL SPECIFICATION AND LAYER 3 MULTIPLEXING			
TITLE	ITU-T REC G.964	COMMENTS	CR
PSTN SIGNALLING PROTOCOL SPECIFICATION AND LAYER 3 MULTIPLEXING	13	Heading	-
General	13.1	Heading	-
Introduction	13.1.1		GID
Separation of responsibilities	13.1.2	Time critical responses by AN	Note 1
National specific PSTN signal information elements	13.1.3	It will be the responsibility of the individual equipment providers to ensure that their equipment contains at least the ability to recognise and utilise the correct PSTN signal information elements for the national PSTN protocols to be supported by the local network provider.	GID
PSTN Protocol Entity Definition	13.2	Heading	-
Definition of PSTN path states and explanation	13.2.1	Heading	-
Path states in the AN [AN(PSTN)]	13.2.1.1	Out of service state (AN0) Null state (AN1) Path initiated by AN state (AN2) Path abort request state (AN3) Line information state (AN4) Path active state (AN5) Port blocked state (AN6) Disconnect request state (AN7)	Note 1
Path states in the LE [LE(PSTN)]	13.2.1.2		NA
Definition of PSTN protocol primitives, messages and timers	13.2.2		GID
PSTN protocol message definition and content	13.3		GID
ESTABLISH	13.3.1		Note 1
ESTABLISH ACK	13.3.2		Note 1
SIGNAL	13.3.3		Note 1
SIGNAL ACK	13.3.4		Note 1
STATUS	13.3.5		Note 1
STATUS ENQUIRY	13.3.6		Note 1
DISCONNECT	13.3.7		Note 1
DISCONNECT COMPLETE	13.3.8		Note 1
PROTOCOL PARAMETER	13.3.9		Note 1

Note 1 "M" if 6.1.1 is supported

Note 2 "O" if 6.1.1 is supported

TABLE 9: PSTN SIGNALLING PROTOCOL SPECIFICATION AND LAYER 3 MULTIPLEXING (continued)			
TITLE	ITU-T REC G.964	COMMENTS	CR
General Message Format and Information Element Coding	13.4		Note 1
Overview	13.4.1		Note 1
Protocol discriminator	13.4.2		Note 1
Layer 3 address	13.4.3		Note 1
Message type	13.4.4		
Coding of other information elements	13.4.5		GID
Single octet information elements	13.4.6	Heading	-
Pulse notification	13.4.6.1		Note 2
Line-information	13.4.6.2		Note 2
State	13.4.6.3		Note 2
Autonomous-signalling-sequence	13.4.6.4		Note 2
Sequence-response	13.4.6.5		Note 2
Information elements with variable length format	13.4.7	Heading	-
Sequence-number	13.4.7.1		Note 2
Cadenced-ringing	13.4.7.2		Note 2
Pulsed-signal	13.4.7.3		Note 2
Steady-signal	13.4.7.4		Note 2
Digit-signal	13.4.7.5		Note 2
Recognition-time	13.4.7.6		Note 2
Enable-autonomous-acknowledge	13.4.7.7		Note 2
Disable-autonomous-acknowledge	13.4.7.8		Note 2
Cause	13.4.7.9		Note 2
Resource-unavailable	13.4.7.10		Note 2
PSTN Call Control Procedures	13.5		GID
General	13.5.1		GID
Handling of error conditions	13.5.2		Note 1
Path related procedures	13.5.3		GID
Path initiation by AN	13.5.3.1		Note 1
Path initiation by LE	13.5.3.2		Note 1
Path collision	13.5.3.3		Note 1
Path active	13.5.3.4		Note 1

Note 1 "M" if 6.1.1 is supported

Note 2 "O" if 6.1.1 is supported

TABLE 9: PSTN SIGNALLING PROTOCOL SPECIFICATION AND LAYER 3 MULTIPLEXING (continued)			
TITLE	ITU-T REC G.964	COMMENTS	CR
Disconnecting path	13.5.3.5		Note 1
Line information procedure	13.5.3.6		Note 2
Non-path related procedures	13.5.4		GID
Protocol parameter procedures	13.5.4.1		Note 1
Port blocking procedures	13.5.4.2		Note 1
Restart procedure	13.5.4.3		Note 1
Layer 3 error detection procedure	13.5.5		GID
Multiple SIGNAL message operation – Variables, sequence numbers and timers	13.5.5.1		Note 1
Multiple SIGNAL message operation – Procedures	13.5.5.2		Note 1
Multiple SIGNAL message operation – Values	13.5.5.3		Note 1
List of System Parameters	13.6	All the timers defined in Table 28 (ITU-T Rec G.964), except Timer T2, shall have a maximum tolerance of $\pm 10\%$.	Note 1
AN and LE Side State Tables	13.7		GID

Note 1 “M” if 6.1.1 is supported

Note 2 “O” if 6.1.1 is supported

TABLE 10: CONTROL REQUIREMENTS AND PROTOCOL			
TITLE	ITU-T REC G.964	COMMENTS	CR
CONTROL REQUIREMENTS AND PROTOCOL	14		GID
ISDN User Port Status Indication and Control Protocol	14.1		Note 1*
PSTN User Port Status Indication and Control Protocol	14.2		Note 2*
Interface Layer 1 Maintenance Requirements and Protocol	14.3		GID

Note 1 “M” if 6.1.2 is supported. *It is optional if grading information is sent from the AN-management.

Note 2 “M” if 6.1.1 is supported. *The contents of the Information Elements are implementation dependent.

TABLE 10: CONTROL REQUIREMENTS AND PROTOCOL (continued)			
TITLE	ITU-T REC G.964	COMMENTS	CR
Control Protocol	14.4	Heading	-
Control protocol message definition and content	14.4.1		GID
PORT CONTROL message	14.4.1.1		M
PORT CONTROL ACK message	14.4.1.2		M
COMMON CONTROL message	14.4.1.3		M
COMMON CONTROL ACK message	14.4.1.4		M
General message format and information element coding	14.4.2		GID
Overview	14.4.2.1		GID
Protocol discriminator information element	14.4.2.2		M
Layer 3 (L3) address information element	14.4.2.3		M
Message type information element	14.4.2.4		M
Other information elements	14.4.2.5	Heading	-
Coding rules	14.4.2.5.1		GID
Performance grading information element	14.4.2.5.2		O
Rejection cause information element	14.4.2.5.3		O
Control function element information element	14.4.2.5.4	The contents of the control-function-element information element are implementation dependent.	M
Control function ID information element	14.4.2.5.5	The contents of the control function ID information element are implementation dependent.	M
Variant information element	14.4.2.5.6		O
Interface ID information element	14.4.2.5.7		O

TABLE 10: CONTROL REQUIREMENTS AND PROTOCOL (continued)			
TITLE	ITU-T REC G.964	COMMENTS	CR
State definitions of the control protocol	14.4.3	Heading	-
Port control protocol	14.4.3.1		M
Common control protocol	14.4.3.2		M
Control protocol procedures	14.4.4	Heading	-
General	14.4.4.1		GID
Handling of error conditions	14.4.4.2		M
Start traffic indication	14.4.4.3		M
Stop traffic indication	14.4.4.4		M
Port control protocol procedure	14.4.4.5		M
Common control protocol procedure	14.4.4.6		M
Timers for the control protocol	14.4.4.7	All the timers defined in Table 60 shall have a maximum tolerance of $\pm 10\%$.	M
AN and LE side state tables	14.4.4.8		GID
V5.1-Re-Provisioning Procedures	14.5	Heading	
General aspects	14.5.1		GID
Events and states	14.5.2		GID
Re-provisioning FSMs	14.5.3		O
Procedures	14.5.4		GID
Request Variant and ID	14.5.4.1		O
Verify Re-provisioning	14.5.4.2		O
Re-provisioning Synchronization	14.5.4.3		O
Restart procedure	14.5.4.4		GID

TITLE	ITU-T REC G.964	COMMENTS	CR
Service scenarios, architecture and functional definition of access arrangements with an AN at the LE	Annex A		GID
Use of the protocol information elements for national PSTN protocols	Annex B		GID
Basic requirements of the system management functions in the AN and the LE	Annex C		GID
Protocol architecture for PSTN and ISDN user port control	Annex D		GID
Structures used in the V5.1-interface	Annex E		M
The concept and requirements for the upgrade of an interface V5.1 into an interface V5.2	Annex F		GID
Abbreviations	Annex G		GID
AN requirement for pulse dialing	Annex H		GID
Layer 3 error detection procedure	Annex I		GID
Bibliography	Appendix I		GID

REFERENCES

- [1] ITU-T Recommendation G.703 Physical/electrical characteristics of hierarchical digital interfaces for equipment using the 2048 kbit/s-based plesiochronous or synchronous digital hierarchies.
- [2] ITU-T Recommendations G.704 and G.706 Functional characteristics of 2 Mbit/s interfaces.
- [3] ITU-T Recommendation I.430 Basic user-network interface; layer 1 specification and test principles.
- [4] ITU-T Recommendation G.960 Digital section for ISDN basic rate access.
- [5] ITU-T Recommendations Q.920 and Q.921 User-network interface data link layer specification.
- [6] ITU-T Recommendation Q.931 ISDN User-network interface layer 3 specification for basic call control.
- [7] ITU-T Recommendation G.823 The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy.