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**Integrated Services Digital Network (ISDN);
Access digital section for ISDN primary rate**

ETSI

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Foreword

This European Telecommunication Standard (ETS) has been produced by the Transmission and Multiplexing (TM) Technical Committee of the European Telecommunications Standards Institute (ETSI).

Annexes A to C of this ETS are normative whereas Annexes D and E are informative.

NOTE: ITU-T Recommendation G.962 (1993) is based upon this ETS.

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1 Scope

This ETS specifies the characteristics of an access digital section for the Integrated Services Digital Network (ISDN) primary rate access between the user-network interface (at the T reference point, defined in ETS 300 011 [1]) and the local exchange (at the V.3 reference point, defined in CCITT Recommendation Q.512 [4]) supporting the primary rate interface channel structure defined in CCITT Recommendation I.412 [3] and ETS 300 011 [1] and the additional functions required for operation and maintenance of the access digital section according to ETR 001 [2], Option 2.

NOTE: ITU-T Recommendation G.962 (1993) is based upon this ETS.

The requirements of this ETS satisfy network performance requirements of CCITT Recommendations G.821 [5] on error performance as well as CCITT Recommendations G.801 and I.350 with regard to availability.

Annex A (normative) to this ETS specifies requirements for interworking between the Primary Rate Access Digital Section (DS) and the Exchange Termination (ET) and the definition of the ET layer 1 state machine which are outside the scope of this ETS but which are nevertheless important.

Annex B (normative) specifies a modification of the requirements when Line Termination (LT) and ET functions are combined in one unit.

Annex C (normative), to be provided, will specify the requirements for conformance testing.

This ETS does not specify the requirements of the digital transmission system used within the access digital section.

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] ETS 300 011 (1992): "Integrated Services Digital Network (ISDN); Primary rate user-network interface; layer 1 specification and test principles".
- [2] ETR 001: "Integrated Services Digital Network (ISDN); Customer access maintenance".
- [3] CCITT Recommendation I.412 (1988): "ISDN user-network interfaces - Interface structures and access capabilities".
- [4] CCITT Recommendation Q.512 (1988): "Exchange interfaces for subscriber access".
- [5] CCITT Recommendation G.821 (1988): "Error performance of an international digital connection forming part of an integrated services digital network".
- [6] CCITT Recommendation G.823 (1988): "The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy".
- [7] CCITT Recommendation G.706 (1988): "Frame alignment and cyclic redundancy check (CRC) procedures relating to basic frame structures defined in Recommendation G.704".
- [8] CCITT Recommendation G.703 (1988): "Physical/electrical characteristics of hierarchical digital interfaces".

- [9] CCITT Recommendation G.704 (1988): "Synchronous frame structures used at primary and secondary hierarchical levels".
- [10] CCITT Recommendation Q.940 (1988): "ISDN user-network interface protocol for management - general aspects".
- [11] CCITT Recommendation I.411 (1988): "ISDN user-network interfaces - Reference configuration".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETS, unless otherwise indicated, the term TE is used to indicate terminating layer 1 aspects of TE1, TA and NT2 functional groups.

When the term TE indicates terminating layer 1 aspects of TE1, then according to figure 2 of CCITT Recommendation I.411 [11], the S and T reference points coincide.

In this ETS references to LT only concern the LT inside the access digital section.

3.2 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

AIS	Alarm Indication Signal
AUXP	AUXiliary Pattern
CRC-4	Cyclic Redundancy Check
DS	Primary Rate Access Digital Section
ET	Exchange Termination
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FC4	Failure Condition
FE	Function Element
µs	micro second
HDLC	High Level Data Link Control
ISDN	Integrated Services Digital Network
LFA	Loss of Frame Alignment
LOS	Loss of Signal
LT	Line Termination
NF	Normal Frame
NOF	Normal Operational Frames
NT	Network Termination

PH	Packet Handler
RAI	Remote Alarm Indication
SIG	Signal between LT and NT1
TE	Terminal Equipment

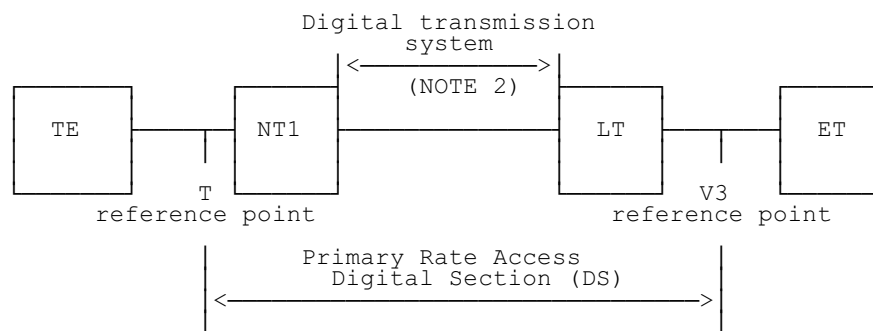
4 Configuration and application

4.1 Configuration

Figure 1 below shows the boundaries of the access digital section in relation to the digital transmission system definition.

The concept of the access digital section is used in order to allow a functional and procedural description and a definition of the network requirements.

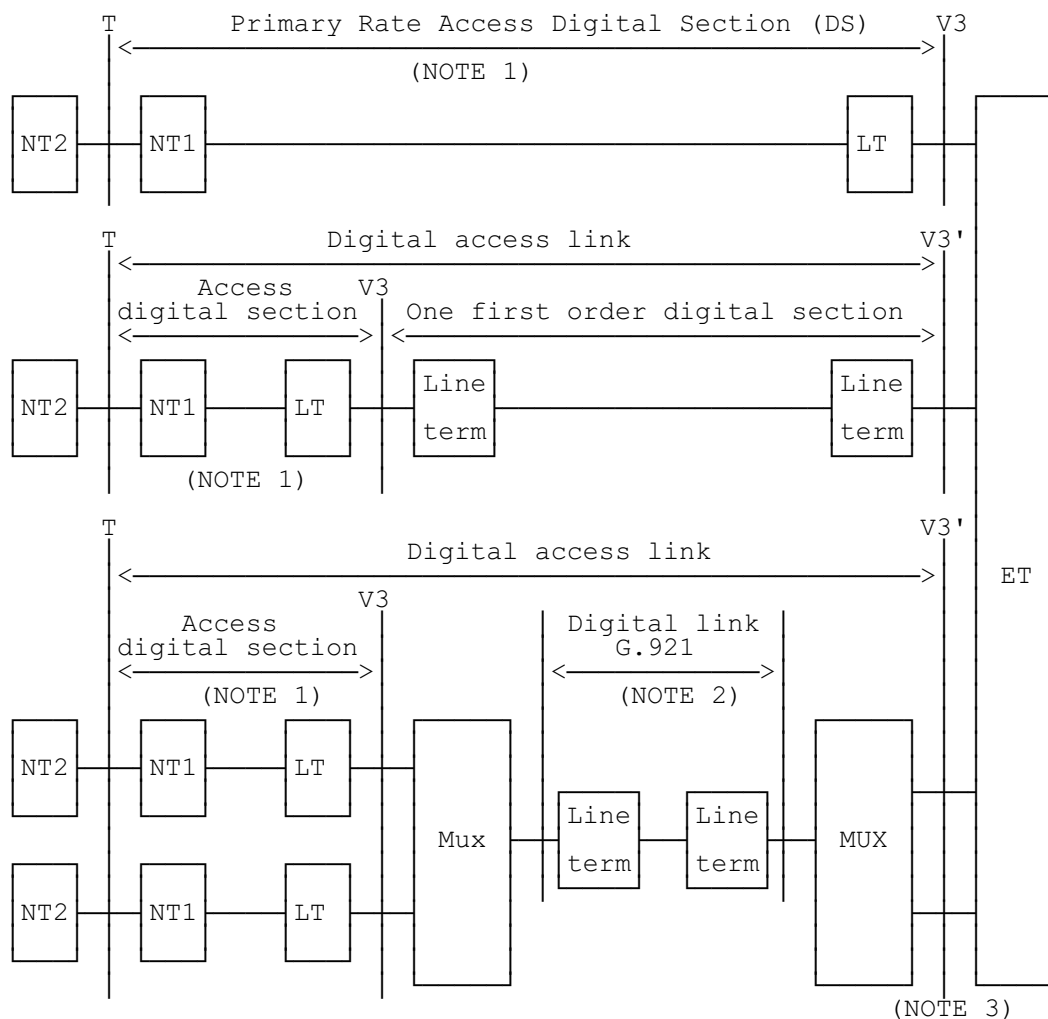
The concept of a digital transmission system is used in order to describe the characteristics of an implementation, using a specific medium, in support of the access digital section.



NOTE 1: From a functional point of view the information transferred via the reference points T and V3 are different and, therefore, the digital section is not symmetrical.

NOTE 2: Digital transmission system refers to either a line system using metallic media or optical fibres or to a radio system.

Figure 1: Access digital section and transmission system boundaries



- NOTE 1: The access digital sections may include one or more regenerators.
- NOTE 2: Multiple applications of digital links and multiplexors may be possible, but see also subclause 7.2 "Jitter at the V3 reference point".
- NOTE 3: In the case of remote access, the digital access link is terminated at the ET by a V3' reference point which is functionally and electrically identical with the V3 reference point in the case of the direct access.
- NOTE 4: The Line Terminations (LTs) forming part of the first order digital section or the digital link are outside the scope of this ETS.

Figure 2: Examples of equipment configurations in the ISDN primary rate access

4.2 Application

The Primary Rate Access Digital Section (DS) may be applied as given in figure 2 for:

- direct access to the local exchange;
- remote access via one first order digital section or via higher order multiplex equipment forming a digital access link to the local exchange.

4.3 Modelling and relationship between the access digital section and the ET

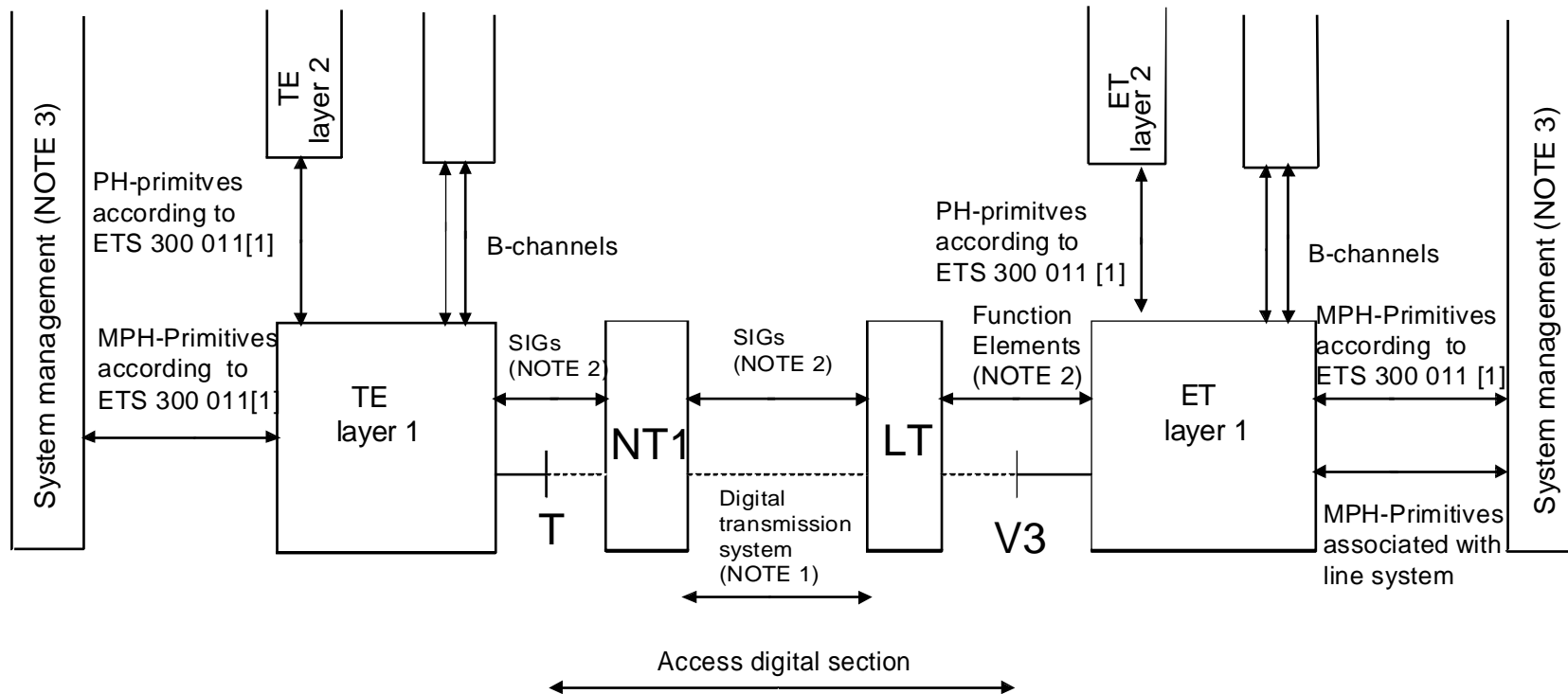
The general model, as shown in figure 3, depicts the whole ISDN customer access layer 1 and adjacent entities. It also provides the basis to describe the functions performed by the access digital section and those performed by TE, ET and system management and how various functions are grouped. In particular, according to this model, the maintenance functions specified in this ETS are not confined to functions performed by the access digital section but include functions associated with ET layer 1.

This model includes primitive procedures between ET layer 1, ET layer 2 and system management:

- a) ETS 300 011 [1] and CCITT Recommendations Q.920/Q.921 interactions between ET layer 1 and ET layer 2 and system management based on Packet Handler (PH) and MPH primitives, respectively, as defined in ETS 300 011 [1]. These interactions are for the support of functions specified in CCITT Recommendations Q.920 and Q.921;
- b) interactions between ET layer 1 and system management for the support of functions associated with the access digital section, based on MPH primitives.

The primitive procedures within TE comply with the specification according to ETS 300 011 [1].

This model does not constrain layer 1 arrangements between LT and NT1, nor the digital transmission system technology.



NOTE 1: The digital transmission system refers to either a digital system using a metallic pair of wires, optical fibre or radio system.

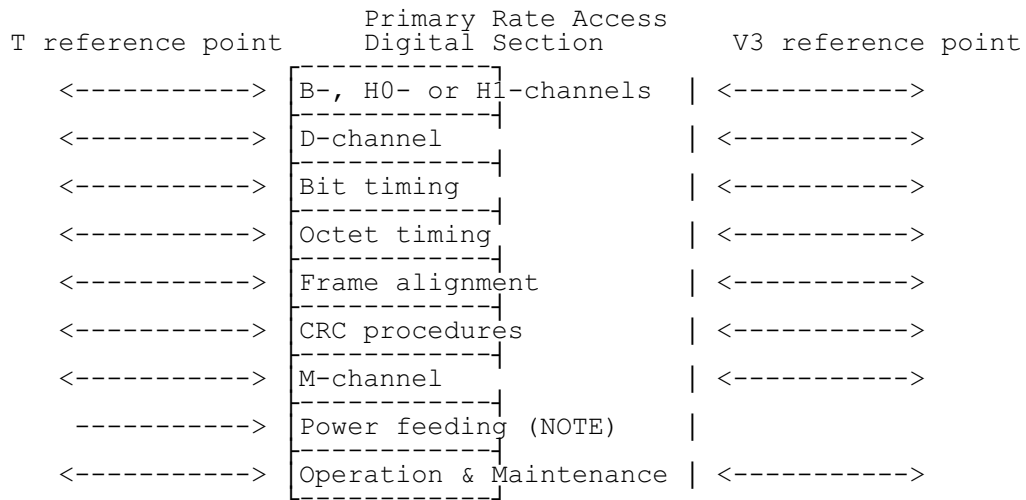
NOTE 2: SIG, FE and primitives refer to an exchange of information. It does not imply any specific coding nor implementation. Some of these functions may be terminated in the LT and do not pass the digital transmission system.

NOTE 3: The term system management corresponds to both system management and layer management as defined in CCITT Recommendation Q.940 [10].

Figure 3: General model of ISDN customer access layer 1 and adjacent entities

5 Functions

Figure 4 below shows the functions which shall be supported by the Primary Rate Access Digital Section.



NOTE: This power-feed-function is optional and depends on the transmission medium used. Only the NT1 may be powered from the interface at the T reference point (see ETS 300 011 [1]).

Figure 4: Functions supported in the access digital section

For each direction of transmission the following functions shall be provided:

- 30 timeslots at 64 kbit/s (numbered 1 to 15 and 17 to 31) for the transport of any appropriate allocation of the B-, H0- and H1-channels;
- 1 timeslot at 64 kbit/s (numbered 16) for the transport of a D-channel;
- 1 timeslot at 64 kbit/s (numbered 0) for frame alignment, and to follow the procedures for multiframe alignment, CRC-4 procedures and maintenance.

5.1 B-channel

This function provides for the bi-directional transmission of up to 30 independent B-channels, each having a bit rate of 64 kbit/s as defined in CCITT Recommendation I.412 [3].

5.2 H0-channel

This function provides for the bi-directional transmission of up to 5 independent H0-channels, each having a bit rate of 384 kbit/s as defined in CCITT Recommendation I.412 [3].

5.3 H1-channel

This function provides for the bi-directional transmission of one H1-channel having a bit rate of 1 920 kbit/s as defined in CCITT Recommendation I.412 [3].

5.4 D-channel

This function provides for the bi-directional transmission of one D-channel at a bit rate of 64 kbit/s as defined in CCITT Recommendation I.412 [3].

5.5 Bit timing

This function provides bit (signal element) timing to enable the TE, the access digital section or the ET to recover information from the aggregate bit stream.

5.6 Octet timing

This function provides 8 kHz timing towards to the TE, the access digital section or the ET to enable voice codecs to recover an octet structure and for other timing purposes as required.

5.7 Frame alignment

This function provides information to enable the TE, the access digital section or the ET to recover the time-division multiplexed channels.

5.8 CRC-4 procedure

This function provides protection against false framing and for error performance monitoring of the access digital section. The CRC-4 procedure shall be implemented according to ETR 001 [2], Option 2. This includes the multiframe procedure defined in CCITT Recommendation G.704 [9].

5.9 M-channel

This function provides a bi-directional 4 kbit/s data channel for the implementation of management features between ET and TE which is transparently transported in Sa4-bit of timeslot 0.

5.10 Power feeding

This optional function provides for remote feeding of the NT1 via the user-network interface as specified in ETS 300 011 [1].

5.11 Operation and maintenance of the access digital section

This function supports actions and information required for control of the operation and maintenance of the access digital section controlled by the ET as defined in ETR 001 [2], and utilises Sa5- and Sa6-bit as defined in subclause 9.3.

The following categories of functions have been identified:

- commands regarding LT or NT1;
- information from LT or NT1;
- indications of defect conditions.

NOTE: The control of possible regenerators and additional maintenance functions concerning the transmission system is outside the responsibility of the ET and is therefore not part of the scope of this ETS, although it may be performed by the LT.

6 Signal transfer delay

The mean one way delay on the B-channels between the T and the V3 reference points shall not exceed 1 250 μ s. In accordance with CCITT Recommendation G.114, this value is the mean of the propagation times in the two directions of transmission.

7 Jitter

7.1 Output/input jitter at T reference point

The requirements shall be as specified in ETS 300 011 [1].

7.2 Jitter at the V3 reference point

The input jitter limits shall be as specified in CCITT Recommendation G.823 [6].

If the models shown in figure 2 are used to connect a customer to the ET, a jitter reducer shall not be required at the V3 reference point.

8 Operation and maintenance

This Clause specifies the operation and maintenance functions.

It shall be possible to test and maintain the access digital section in accordance with ETR 001 [2] without consideration of the subscriber's installation or procedures.

The operation and maintenance functions shall be based on the assumptions regarding the system management given in Annex A (normative).

8.1 Control facilities

8.1.1 Loopbacks

8.1.1.1 Loopback implementation

The following loopbacks shall be implemented:

- a) loopback 1 - a complete, transparent loopback located in the LT as specified in ETR 001 [2];
- b) loopback 2 - a complete, transparent loopback located in the NT1 as specified in ETS 300 011 [1].

8.1.1.2 Loopback procedure

Loopbacks 1 and 2 shall be controlled by the ET.

A normal call set-up request shall not override a request for loopback 1 or 2.

The loopback shall be operated whenever the loopback command is detected regardless of the DS state. A sequence of 8 consecutive codewords of loop command (as specified in Clause 9) shall be detected before action is to be taken. Conversely, when the receipt of 8 consecutive loopback release commands (as specified in Clause 9) or any other 8 consecutive signals with no loopback command have been detected, the loopback shall be released.

8.2 Monitoring

8.2.1 Functions

The following operational conditions shall be monitored throughout the access digital section:

- a) the defect conditions;
- b) loss of power in the NT1;
- c) transmission performance.

8.2.2 Defect conditions and consequent actions

8.2.2.1 Detection of defect conditions

The functional requirements for the maintenance of the access digital section are based on the provision of functions in the ET and the TE as defined in the G and F state tables of ETS 300 011 [1].

The access digital section shall provide the means to transmit indications of detected defect conditions at the interface at the T reference point in accordance with ETS 300 011 [1].

Defects detected by the access digital section shall be reported to the ET or the TE as appropriate.

8.2.2.2 Definition of defect indication signals

During normal operation of the DS and all failure conditions allowing the use of framed signals, except FC4, the information in timeslots 1 to 31, the A-, Sa4-, Sa7- and Sa8-bit, pass transparently through the access digital section; the frame and the multiframe alignment, the CRC-4 bits and the CRC error information (E-bit) in both directions and the Sa5- and the Sa6-bit only towards the ET are generated in the NT1.

The following signals used to indicate defects are specified in ETS 300 011 [1], Clause 6, table 1:

- Normal Operational Frames (NOF);
- Remote Alarm Indication (RAI);
- Loss of Signal (LOS);
- Alarm Indication Signal (AIS).

The following additional signals are necessary to indicate defects in respect to the access digital section:

- Normal Frames (NF): these are frames without defect indications or loopback requests generated by the ET or the TE, where the value of the A-bit, set to ONE or ZERO, is not relevant for the access digital section;
- Frames: these are frames which may, in addition to the Normal Frames, contain in the Sa6-bits defect indication signals generated in the NT1 and transmitted towards the ET or loopback requests transmitted from the ET to the DS;
- Substituted Frames: these are frames generated by the NT1 in case of Loss of Signal (LOS) or Loss of Frame Alignment (LFA) at the T reference point. The defect condition (FC 4) is indicated towards the ET by means of Sa6-bits. The A-bit is set to ZERO. The Sa4-, Sa5-, Sa7- and Sa8-bits as well as the bits of timeslots 1 to 31 containing the B-and D-channels are set to ONE;
- Loss of Frame Alignment (LFA);
- Loss of Power in the NT1 or LT;
- Auxiliary Pattern (AUXP): this is an unframed and continuous bitstream of alternating ONEs and ZEROS (...10101010...) transmitted from the LT in both directions of transmission when Loss of Signal (LOS) is detected at the corresponding receiver.

8.2.2.3 Detection of defect indication signals

The following conditions of the access digital section shall be detected and reported to the ET:

- a) within the access digital section:
 - LOS or LFA at line side of NT1;
 - LOS at line side of LT;
 - Loss of power at NT1 (if relevant);
 - AIS at line side of NT1, which is generated in the network and passed transparently through the LT.

- b) at V3 reference point:
 - LOS.

- c) at T reference point:
 - LOS or LFA;
 - Loss of Power (if relevant).

8.2.2.4 Definition of detection algorithms

The detection algorithms of the signal are described as follows:

- Normal Operational Frames: the algorithm shall be in accordance with CCITT Recommendation G.706 [7], subclauses 4.1.2 and 4.2;
- Loss of Frame Alignment (LFA): the algorithm shall be in accordance with CCITT Recommendation G.706 [7], subclause 4.1.1;
- Loss of Signal (LOS) at the T and V3 reference point: the equipment shall assume "Loss of Signal" when the incoming signal amplitude is, for a period of at least 1 ms, more than 20 dB below the nominal output amplitude defined in CCITT Recommendation G.703 [8] for this interface.

This event shall also cause "Loss of Frame Alignment".

NOTE: The detection of LOS at the line side of NT1 and LT is implementation dependent and, therefore, not subject to this ETS.

- AIS: AIS is detected when both of the two following conditions occur:
 - 1) LFA; and
 - 2) reception of 512 bit periods containing less than 3 binary ZEROs (reference is made to CCITT Recommendation O.162, subclause 3.3.2);

- Loss of Power in the NT 1: the equipment shall assume "Loss of Power" when the voltage at the input is below the minimum value defined in ETS 300 011 [1] and the operating condition of the NT1 cannot be maintained;

- Loss of Power in the LT: the equipment shall assume "Loss of Power" when the supply voltage is below the value that is necessary to maintain the operating condition.

8.2.2.5 Consequent actions

When either:

- a defect condition has been detected, or
- a defect condition has disappeared, or
- a defect indication has been received, or
- a defect indication has disappeared,

the defect indication to the ET or to the TE shall be sent or removed with a maximum delay of 10 ms, which shall not be interpreted as a guard time. The detection of a single event shall be reported.

8.3 Error performance monitoring

The NT1 in the access digital section shall support error performance monitoring by detecting CRC-4 blocks in error in the received signals, using the CRC-4 procedure specified in CCITT Recommendation G.704 [9], subclause 2.3.3, and transmit CRC error information accordingly.

The access digital section shall indicate to the ET:

- CRC blocks in error detected at the line side of the NT1 by using the CRC error information which is E-bit set to ZERO;
- CRC blocks in error detected at the T reference point of the NT1 by utilizing Sa6-bits as defined in table 4 (optional);
- CRC error indication received from the TE in the E-bits by utilizing Sa6-bits as defined in table 4 (optional);
- CRC blocks in error detected at the T reference point of the NT1 and simultaneously received CRC error information from the TE by utilising Sa6-bits as defined in table 4 (optional).

NOTE: Error performance evaluation in the ET is outside the scope of this ETS, but information is given in Annex A, Clause A.3.

9 Operation and maintenance procedures

9.1 Partitioning of functions

ETS 300 011 [1] defines the network side of the user-network interface at reference point T as one functional block which supports the operation and maintenance procedures across the T reference point and the primitive procedures at the ET layer 1/ET layer 2 boundary and ET layer 1/system management boundary. This block includes the functional groupings NT1, LT and ET layer 1.

This concept is described in terms of a state machine, referred to as the G state machine in ETS 300 011 [1].

In order to describe the relationship between signals across the user-network interface at reference point T, which are indicated as SIGNAL (SIG) in figure 3 of this ETS and defined in ETS 300 011 [1], and signals across reference point V3, which are indicated as FUNCTION ELEMENT (FE) in figure 3 and defined in subclause 9.3, and the relationship between these function elements and primitives, two state machines are defined. One is in the access digital section (DS state machine), and the other on the network side of the V3 reference point (ET layer 1 state machine). Figure 5 illustrates this approach.

In addition to primitives defined in ETS 300 011 [1] and ETS 300 125 related to basic call control, figure 5 also introduces a new set of primitives related to configuration control and the control of loopbacks.

Partitioning of operation and maintenance procedures between the two state machines is used for the convenience of easy and accurate description. The ET layer 1 state machine is to be viewed as virtual, and is not intended to imply any particular implementation, although the functional behaviour shall be as defined in the ET state tables (see Annex A). It is required to interwork with the access digital section state machine defined in this ETS and to satisfy the requirements specified in the G state table in ETS 300 011 [1].

However, in order to implement a customer access, the DS state machine shall be partitioned further. Figure 6 shows the partition of the DS state machine into an NT1 state machine (NT-states) and an LT state machine (LT-states).

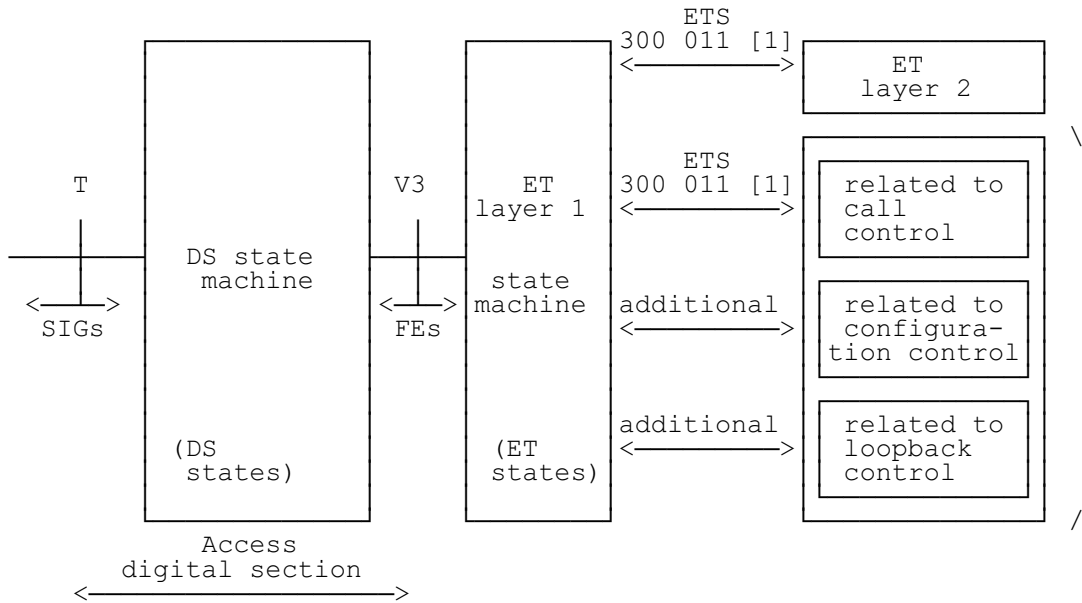


Figure 5: State machines

The NT1 state machine supports user-network interface procedures in accordance with ETS 300 011 [1] based on signals and interacts with the LT state machine by means of a signal repertoire which shall be supported by the digital transmission system. The LT state machine interacts with the ET layer 1 state machine by means of a set of function elements. The ET layer 1 state machine contains those states which represent the local exchange view of the status of the interface at reference point T and the digital section. It supports the already specified primitive procedures to provide services to ET layer 2 and system management in accordance with ETS 300 011 [1], and additional primitive procedures for the support of functions associated with the access digital section.

This information is provided for the specification of the digital transmission system which is outside the scope of this ETS.

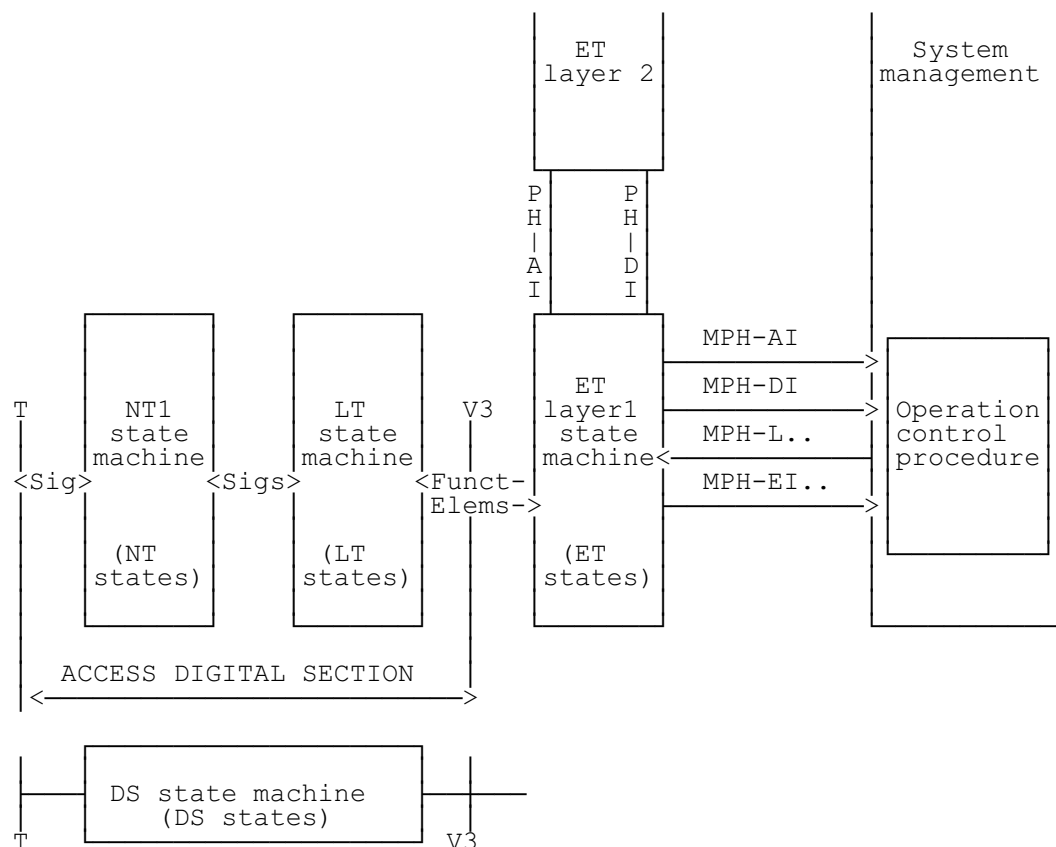


Figure 6: Partitioning of the DS state machine

9.2 Definitions of signals at the T reference point

Signals exchanged between the access digital section and the TE via the interface at the T reference point under normal and defect conditions are defined in ETS 300 011 [1], Clause 6, table 1.

9.3 Definition of signals at the V3 reference point

In this subclause, signals are defined which are called Function Elements (FE) and exchanged between the access digital section and the ET under normal and fault conditions to perform the functions required to operate and maintain the primary rate access digital section.

In addition to the signals RAI (A-bit set to ONE), AIS and AUXP, as defined in subclause 8.2.2.3, and CRC error information (E-bit) as defined in subclause 8.3, a set of new signals is used to define these function elements. These new signals are:

- Sa5-bit for direction indication and loopback indication from the NT1 to the ET;
- codewords built of four Sa6-bits (as specified in tables 2 to 4) for loopback control from the ET to the NT1 and Layer 1 status indication from the NT1 to the ET.

Sa5 in the direction from the DS to the ET is set in the NT1 and transmitted towards the ET according to the following rules:

- Loopback 2 not activated: Sa5 = 1;
- Loopback 2 activated: Sa5 = 0.

NOTE 1: It is important that the value of Sa5 is directly related to the actual state of the loopback rather than to the loopback command. This allows detection both of failure to comply with a command and of unintentional loopbacks.

The bits Sa6 are numbered Sa6₁, Sa6₂, Sa6₃, Sa6₄ and synchronized to the sub-multiframe according to table 1 (which corresponds to table 4b of CCITT Recommendation G.704 [9]), where Sa6₁ indicates the bit transmitted first. This makes provision to exploit the full code set of sixteen codewords and guarantees the flexibility to support various configurations between the V3 (V3') and T reference points as already identified in the lower part of figure 2.

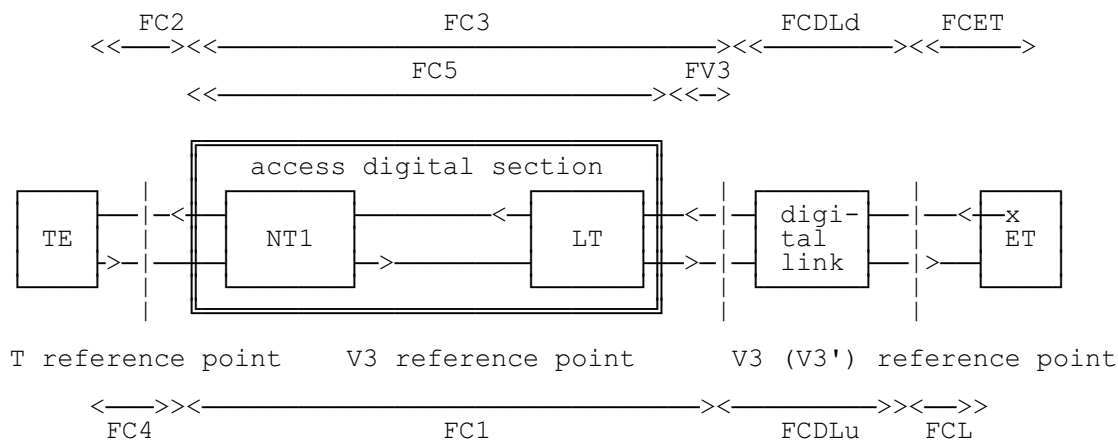
NOTE 2: The three reporting channels provided in the A-, the Sa5- and the Sa6-bit respectively are independent of each other. Not all FEs specified in tables 2 to 4 are defined by a specific coding in all three channels. This allows simultaneous reporting of more than one condition.

For example: DS-ET A Sa₅ Sa₆
 --> 1 0001

includes normal operation of the DS (FE A), FC2 (FE D) and CRC-4 errors reported from TE (FE W).

Table 1: CRC-4 multiframe structure

	Sub-multiframe	Frame number	Bits 1 to 8 of the frame							
			1	2	3	4	5	6	7	8
Multi-frame	I	0	C1	0	0	1	1	0	1	1
		1	0	1	A	Sa4	Sa5	Sa61	Sa7	Sa8
		2	C2	0	0	1	1	0	1	1
		3	0	1	A	Sa4	Sa5	Sa62	Sa7	Sa8
		4	C3	0	0	1	1	0	1	1
		5	1	1	A	Sa4	Sa5	Sa63	Sa7	Sa8
		6	C4	0	0	1	1	0	1	1
	7	0	1	A	Sa4	Sa5	Sa64	Sa7	Sa8	
	II	8	C1	0	0	1	1	0	1	1
		9	1	1	A	Sa4	Sa5	Sa61	Sa7	Sa8
		10	C2	0	0	1	1	0	1	1
		11	1	1	A	Sa4	Sa5	Sa62	Sa7	Sa8
		12	C3	0	0	1	1	0	1	1
		13	E	1	A	Sa4	Sa5	Sa63	Sa7	Sa8
		14	C4	0	0	1	1	0	1	1
15		E	1	A	Sa4	Sa5	Sa64	Sa7	Sa8	



- FC1 to FC4 Failure conditions according to ETS 300 011 [1].
- FC5 Failure condition inside the access digital section downstream (NOTE).
- FV3 Failure condition at the V3 reference point of the LT (NOTE).
- FCDL Failure condition in the digital link between the V3 and the V3' reference point upstream and downstream.
- FCL Failure condition at the V3 or the V3' reference point of the ET receive side.
- FCET Internal failure condition in the ET.

NOTE: With no loopbacks applied, the failure conditions FC5 and FV3 cause identical indications at the T and the V3 (V3') reference point and can, therefore, not be distinguished from outside the DS. Both of them are covered by FC3 as defined in ETS 300 011 [1]. A distribution is only possible by means of loopback 1.

Figure 7: Location of defects

Legend and NOTES to tables 2 to 4: LOS/LFA means Loss of Signal and/or Loss of Frame Alignment. Underscored letters show the relevance of this signal for the indication of the state x = value may be 1 or 0 and is not significant for this state.

Table 2: FEs related to operation and maintenance

State	DS-ET	A	Sa5	Sa6	FE	Remarks
Normal operation of the DS	-->	x	1	00xx	A	
Normal operation of the ET	<--	x	0	0000	B	
Unintentional loopback	-->	x	0	xxxx	C	NOTE 1
LOS/LFA at TE (FC2)	-->	1	1	00xx	D	NOTE 8
LOS at line side of NT1 or at V3 reference point of LT only (FC3)	-->	1	1	1110	E	NOTES 2 and 8
LOS/LFA at V3 (V3') refer. point of ET (FCL)	<--	1	0	0000	F	
LOS/LFA at T refer. point of NT1 (FC4)	-->	0	1	1100	G	
FC3 and FC4 simultaneously	-->	0	1	1110	H	NOTE 8
Loss of power at NT1	-->	0	1	1000	I	NOTES 6 and 7
Loss of power at NT1 and LOS/LFA at TE simultaneously	-->	1	1	1000	K	NOTES 6 and 7
LOS at line side of LT (FC1)	-->			AUXP	L	NOTES 2 and 4
Reception of AIS at V3 refer. point of LT (Reaction to FC DL or FCET)	-->	1	1	1111	M	NOTES 5 and 8
Reception of AIS at V3 refer. point of LT and FC4 simultaneously	-->	0	1	1111	N	NOTES 5 and 8
Defect FCET in the ET or FC DLd in the digital link between V3' and V3	<--			AIS	O	
Defect FC DLu between the refer. points V3 and V3' (according figures 2 and 7)	-->			AIS	P	
NOTE 1: When a loopback is completed, the Sa5-bit sent from the DS to the ET shall be a binary ZERO. It can be used as a loopback acknowledge in loopback 1 by looping the Sa5-bit coming from the ET back to the ET and in loopback 2 by actively setting the Sa5-bit to Zero in the NT1.						
NOTE 2: In case of Loss Of Signal (LOS) at either side of the LT, the LT shall send AUXP, as defined in subclause 8.2.2.2, in the relevant direction.						
NOTE 3: When the NT1 receives AUXP it detects Loss of Frame Alignment (LFA), informs the ET accordingly and generates AIS towards the TE.						
NOTE 4: If LT and ET are combined in one unit (see Annex B).						
NOTE 5: AIS generated by the ET or the digital link between the V3' and the V3 reference points (according to figure 2) and received by the access digital section shall be transmitted transparently to the NT1 and further to the TE. The NT1 shall inform the ET accordingly.						
NOTE 6: This function element and the corresponding state shall have priority over all others.						
NOTE 7: This state may be a transient one, but shall last for at least 60 ms.						
NOTE 8: The ET shall be able to detect these FEs even with the deviation from the network timing by ± 50 ppm.						

Table 3: FEs related to loopback operation

State	DS-ET	A	Sa5	Sa6	FE	Remarks
Loopback 1 command	<--	1	0	1111	Q	NOTE 2
Loopback 2 command	<--	1	0	1010	R	
Loopback acknowledge	-->	1	0	xxxx	S	NOTE 1
Loopback release command	<--	x	0	0000	T	NOTE 3
NOTE 1: When a loopback is completed, the Sa5-bit sent from the DS to the ET shall be a binary ZERO. It can be used as a loopback acknowledge in loopback 1 by looping the Sa5-bit coming from the ET back to the ET, and in loopback 2 by actively setting the Sa5-bit to Zero in the NT1. NOTE 2: If LT and ET are combined in one unit (see Annex B). NOTE 3: See subclause 8.1.1.2.						

Table 4: FEs related to CRC-4 error detection

State	DS-ET	A	Sa5	Sa6	E-bit	FE	Remarks
CRC error report from NT1 line side	-->	x	1	xxxx	0	U	
CRC error information from ET	<--	x	0	0000	0	V	
CRC error reported from TE	-->	x	1	0001	x	W	NOTE
CRC error detected at T ref. point of NT1	-->	x	1	0010	x	X	NOTE
Simultaneous occurrence of FE W and FE X	-->	x	1	0011	x	Y	NOTE
NOTE: When this state coincides with one of the states FE E, FE G, FE I and FE M the latter shall have priority.							

9.4 Definition of ET layer 1 state machine

This definition is outside the scope of this ETS, but because it is important for understanding the interworking with the access digital section, the required functionality of the ET is given in Annex A, Clause A.4.

9.5 Definition of DS state machine

9.5.1 DS states

This subclause defines the states the digital section may enter as a result of:

- signals received across the interface at the T reference point;
- internal events; or
- FEs received across the reference point V3.

9.5.2 DS state transition table

Tables 5a to 5h, specify the procedures. They include the actions to be taken when various events are detected by the access digital section while in a defined state.

9.5.2.1 Assumptions

The following assumptions are made in the definition of the DS state tables and shall be taken into account for a correct interpretation:

- a state change occurs only if signals crossing the T or the V3 reference point change and are detected. This change is signalled to the TE or the ET as appropriate. Changes of signals inside the access digital section which are not visible at the reference points cannot cause any state change;
- indication by the DS of a new defect condition means that the preceding defect condition with a higher significance has disappeared;
- the signal RAI (A-bit set to ONE), generated by the ET or the TE, is transparently passed through the access digital section without any monitoring; therefore the DS does not react to changes of the A-bit;
- in the NT1 the frame and the multiframe, the CRC-4 bits and the CRC-4 error information are reinserted in both directions. The Sa5- and Sa6-bits are reinserted only in the direction to the ET. The other bits A, Sa4, Sa7 and Sa8 and the information in the timeslots 1 to 31 are transparently passed through the NT1, except in the case of FC4 when these bits shall also be reinserted in direction to the ET;
- loss of frames includes Loss of Frame Alignment (LFA) and Loss Of Signal (LOS);
- loopbacks in the LT and the NT1 are non-latching; so an established loopback is retained only as long as the appropriate control signal is detected;
- the LT and the ET shall not be able to detect the receipt of frames instantaneously when the power supply returns to the "Power On at..." states and the DS shall inform the TE and the ET accordingly;
- the LT may detect a FC1 failure condition when releasing loopback 1 until stable signal recognition is achieved;
- the NT1 may detect a FC4 failure condition when releasing loopback 2 until stable signal recognition is achieved.

9.5.2.2 Classification of DS states

The DS states have been numbered to form classes of problems as follows:

DS0.x	Power problems;
DS1	Access digital section normal state;
DS2.x	Failure inside the access digital section;
DS3	Failure between TE and NT1;
DS4.x	Failure inside the access digital section and additional between TE and NT1;
DS5.x	Loopback states;
DS6.x	Failure in the additional digital link between the reference points V3' and V3.

9.5.2.3 Definition of notations

The following notations are used in the DS state tables:

- = No state change;
- / = Impossible event due to internal reasons.

Failure conditions are indicated according to figure 7.

Table 5a: DS state table - LT and/or NT power off

State	DS 0.0000	DS 0.0002	DS 0.0004	DS 0.02	DS 0.04	DS 0.200	DS 0.400	DS 0.700
State Name Operational or failure condition of DS	LT power off AND NT power off	LT power off AND NT dying AND not FC4	LT power off AND NT dying AND FC4	LT power off AND not FC4	LT power off AND FC4	NT power off	NT power off AND FV3	NT power off AND AIS at V3
Corresponding ET state	ET 0.2	ET 0.2	ET 0.2	ET 0.2	ET 0.2	ET 2.1 ET 2.4	ET 2.1 ET 2.4	ET 0.3
Signals transmitted towards interface V3	No signal	No signal	No signal	No signal	No signal	AUXP	AUXP	AUXP
Signals transmitted towards T interface	No signal	AIS	AIS	AIS	AIS	No signal	No signal	No signal
Event								
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR loopback command)	/	/	/	/	/	/	/	/
Loss of LT power	-	-	-	-	-	DS 0.000	DS 0.000	DS 0.000
Return of LT power	DS 0.200	DS 0.201	DS 0.203	DS 4.42	DS 4.44	/	/	/
NT dying gasp phase	/	-	-	DS 0.002	DS 0.004	/	/	/
NT power off	-	DS 0.000	DS 0.000	/	/	-	-	-
Return of NT power	DS 0.04	DS 0.02	DS 0.04	/	/	DS 4.24	DS 4.44	DS 6.74

(continued)

Table 5a: DS state table - LT and/or NT power off (continued)

Failure FC1 no loopback command from ET side	/	/	/	/	/	-	DS 0.200	DS 0.200
Failure FC5 no loopback command from ET side	/	-	DS 0.002	-	DS 0.02	/	/	/
Loss of frames (NOTE 5) at interface V3 (FV3/FC5) not AIS	/	/	/	/	/	/	/	/
Loss of frames at T interface FC4 (NOTE 5) no loopback command	/	/	/	/	/	/	/	/
FC1&FC5 no loopback command	/	/	/	/	/	/	/	/
FC1&FC4 no loopback command	/	/	/	/	/	/	/	/
FC5&FC4 no loopback command	/	DS 0.004	-	DS 0.04	-	/	/	/
FC1&FV3/FC5	/	/	/	/	/	DS 0.400	-	DS 0.400
FC1&FC5&FC4 no loopback command	/	/	/	/	-	/	/	/
FV3/FC5&FC4	/	/	/	/	/	/	/	/
FC1&FV3/FC5&FC4	/	/	/	/	/	/	/	/

(continued)

Table 5a: DS state table - LT and/or NT power off (concluded)

Loopback 1 command received AND not (FC5 OR FC4) (NOTE 9)	/	/	/	/	/	/	/	/
Loopback 1 command received from ET side AND FC5 (NOTE 9)	/	/	/	/	/	DS 5.500	DS 5.500	DS 5.500
Loopback 1 command received from ET side AND FC4 (NOTE 9)	/	/	/	/	/	/	/	/
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	/	/	/	/	/	/	/	/
Loopback 2 command received from ET side not FC1 (NOTE 10)	/	/	/	/	/	/	/	/
Loopback 2 command received from ET side AND FC1 (NOTE 9)	/	/	/	/	/	/	/	/
AIS at: V3 ref. point	/	/	/	/	/	/	/	/
AIS&FC1	/	/	/	/	/	DS 0.700	DS 0.700	-
AIS&FC5	/	/	/	/	/	/	/	/
AIS&FC4	/	/	/	/	/	/	/	/
AIS&FC1&FC5	/	/	/	/	/	/	/	/
AIS&FC1&FC4	/	/	/	/	/	/	/	/
AIS&FC5&FC4	/	/	/	/	/	/	/	/
AIS&FC1&FC5&FC4	/	/	/	/	/	/	/	/

Table 5b: DS state table - NT dying

State	DS 0.101	DS 0.201	DS 0.102	DS 0.202	DS 0.302	DS 0.402
State Name Operational or failure condition of DS	NT dying	NT dying AND FC1	NT dying AND FC5	NT dying AND FC1 AND FC5	NT dying AND FV3/FC5	NT dying AND FV3/FC5 AND FC1
Corresponding ET-state	ET 2.5, 2.6, 2.7	ET 2.1 ET 2.4	ET 2.7	ET 2.1	ET 2.7	ET 2.1
Signals transmitted towards interface V3	Frames (NOTE 3) Sa5 = "1"; Sa6 = "1000".	AUXP	Frames with RAI (NOTE 2); Sa5 = "1"; Sa6 = "1000".	AUXP	Frames with RAI (NOTE 2); Sa5 = "1"; Sa6 = "1000".	AUXP
Signals transmitted towards T interface	Normal frames (NOTE 7)	Normal frames with RAI (NOTE 4)	AIS	AIS	AIS	AIS
Event						
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR loopback command)	-	DS 0.101	DS 0.101	(NOTE 6)	DS 0.101	(NOTE 6)
Loss of LT power	DS 0.002	DS 0.002	DS 0.002	DS 0.002	DS 0.002	DS 0.002
Return of LT power	/	/	/	/	/	/
NT dying gasp phase	-	-	-	-	-	-
NT power off	DS 0.200	DS 0.200	DS 0.200	DS 0.200	DS 0.400	DS 0.400
Return of NT power	DS 1.11	DS 2.21	DS 2.12	DS 2.22	DS 4.32	DS 4.42

(continued)

Table 5b: DS state table - NT dying (continued)

Failure FC 1 no loopback command from ET side	DS 0.201	-	(NOTE 6)	DS 0.201	(NOTE 6)	DS 0.201
Failure FC 5 no loopback command from ET side	DS 0.102	(NOTE 6)	-	DS 0.102	DS 0.102	(NOTE 6)
Loss of frames (NOTE 5) at interface V3(FV3/FC5) not AIS	DS 0.302	(NOTE 6)	DS 0.302	(NOTE 6)	-	DS 0.302
Loss of frames at T interface FC4 (NOTE 5) no loopback command	DS 0.103	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FC5 no loopback command	(NOTE 6)	DS 0.202	DS 0.202	-	(NOTE 6)	DS 0.202
FC1&FC4 no loopback command	(NOTE 6)	DS 0.203	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	DS 0.104	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FV3/FC5	(NOTE 6)	DS 0.402	(NOTE 6)	DS 0.402	DS 0.402	-
FC1&FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.204	(NOTE 6)	(NOTE 6)
FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.304	(NOTE 6)
FC1&FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.404
Loopback 1 command received AND not (FC5ORFC4) (NOTE 9)	DS 5.501	DS 5.501	(NOTE 6)	(NOTE 6)	DS 5.501	DS 5.501

(continued)

Table 5b: DS state table - NT dying (concluded)

Loopback 1 command received from ET side AND FC5 (NOTE 9)	(NOTE 6)	(NOTE 6)	DS 5.502	DS 5.502	DS 5.502	DS 5.502
Loopback 1 command received from ET side AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 2 command received from ET side not FC1 (NOTE 9)	DS 5.105	(NOTE 6)	DS 5.105	(NOTE 6)	DS 5.105	(NOTE 6)
Loopback 2 command received from ET side AND FC1 (NOTE 9)	(NOTE 6)	DS 5.205 (NOTE 8)	(NOTE 6)	DS 5.205 (NOTE 8)	(NOTE 6)	DS 5.205 (NOTE 8)
AIS at interface V3	DS 0.606	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.606	(NOTE 6)
AIS&FC1	(NOTE 6)	DS 0.706	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.706
AIS&FC5	(NOTE 6)	(NOTE 6)	DS 0.602	(NOTE 6)	DS 0.602	(NOTE 6)
AIS&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC5	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.702	(NOTE 6)	DS 0.702
AIS&FC1&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)

Table 5c: DS state table - NT dying

State	DS 0.103	DS 0.203	DS 0.104	DS 0.204	DS 0.304	DS 0.404
State Name Operational or failure condition of DS	NT dying AND FC4	NT dying AND FC1 AND FC4	NT dying AND FC5 AND FC4	NT dying AND FC1, FC5, FC4	NT dying AND FC4, FV3, FC5	NT dying AND FC1, FC4,FV3/FV5
Corresponding ET-state	ET 2.5 ET 2.6	ET 2.1	ET 2.6	ET 2.1	ET 2.6	ET 2.1
Signals transmitted towards interface V3	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6 = "1000".	AUXP	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6 = "1000".	AUXP	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6 = "1000".	AUXP
Signals transmitted towards T interface	Normal frames with RAI (NOTE 4) Bit E = "0"	Normal frames with RAI (NOTE 4) Bit E = "0"	AIS	AIS	AIS	AIS
Event						
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR loopback command)	DS 0.101	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of LT power	DS 0.004	DS 0.004	DS 0.004	DS 0.004	DS0.004	DS0.004
Return of LT power	/	/	/	/	/	/
NT dying gasp phase	-	-	-	-	-	-

(continued)

Table 5c: DS state table - NT dying (continued)

NT power off	DS 0.200	DS 0.200	DS 0.200	DS 0.200	DS 0.400	DS 0.400
Return of NT power	DS 3.13	DS 4.23	DS 4.14	DS 4.24	DS 4.34	DS 4.44
Failure FC 1 no loopback command from ET side	(NOTE 6)	DS 0.201	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Failure FC 5 no loopback command from ET side	(NOTE 6)	(NOTE 6)	DS 0.102	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of frames (NOTE 5) at interface V3 (FV3/FC5) not AIS	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.302	(NOTE 6)
Loss of frames at T interface FC4 (NOTE 5) no loopback command	-	DS 0.103	DS 0.103	(NOTE 6)	DS 0.103	(NOTE 6)
FC1&FC5 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.202	(NOTE 6)	(NOTE 6)
FC1&FC4 no loopback command	DS 0.203	-	(NOTE 6)	DS 0.203	(NOTE 6)	DS 0.203
FC5&FC4 no loopback command	DS 0.104	(NOTE 6)	-	DS 0.104	DS 0.104	(NOTE 6)
FC1&FV3/FC5	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.402
FC1&FC5&FC4 no loopback command	(NOTE 6)	DS 0.204	DS 0.204	-	(NOTE 6)	DS 0.204
FV3/FC5&FC4	DS 0.304	(NOTE 6)	DS 0.304	(NOTE 6)	-	DS 0.304
FC1&FV3/FC5&FC4	(NOTE 6)	DS 0.404	(NOTE 6)	DS 0.404	DS 0.404	-
Loopback 1 command received AND not (FC5OR FC4) (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)

(continued)

Table 5c: DS state table - NT dying (concluded)

Loopback 1 command received from ET side AND FC5 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC4 (NOTE 9)	DS 5.503	DS 5.503	(NOTE 6)	(NOTE 6)	DS 5.503	DS 5.503
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	DS 5.504	DS 5.504	DS 5.504	DS 5.504
Loopback 2 command received from ET side not FC1 (NOTE 9)	DS 5.105	(NOTE 6)	DS 5.105	(NOTE 6)	DS 5.105	(NOTE 6)
Loopback 2 command received from ET side AND FC1 (NOTE 9)	(NOTE 6)	DS 5.205	DS 5.205	DS 5.205	(NOTE 6)	DS 5.205
AIS at interface V3	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.606	(NOTE 6)
AIS&FC1	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC5	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.602	(NOTE 6)
AIS&FC4	DS 0.607	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.607	(NOTE 6)
AIS&FC1&FC5	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC4	(NOTE 6)	DS 0.707	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.707
AIS&FC5&FC4	(NOTE 6)	(NOTE 6)	DS 0.604	(NOTE 6)	DS 0.604	(NOTE 6)
AIS&FC1&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.704	(NOTE 6)	DS 0.704

Table 5d: DS state table - NT dying

State	DS 0.606	DS 0.706	DS 0.602	DS 0.702	DS 0.607	DS 0.707	DS 0.604	DS 0.704
State Name Operational or failure condition of DS	NT dying AND ET fail.	NT dying AND ET fail. AND FC1	NT dying AND ET fail. AND FC5	NT dying AND ET fail. FC1, FC5	NT dying AND ET fail. AND FC4	NT dying AND ET fail. FC1 FC4	NT dying AND ET fail. FC5 FC4	NT dying AND ET fail. FC1 FC5 FC4
Corresponding ET-state	ET 0.3 ET 2.7	ET 0.3 ET 6.1	ET 0.3 ET 2.7	ET 0.3 ET 6.1	ET 0.3	ET 0.3 ET 6.1	ET 0.3	ET 0.3 ET 6.1
Signals transmitted towards interface V3	Frames with RAI (NOTE 2); Sa5 = "1"; Sa6="1000".	AUXP	Frames with RAI (NOTE 2); Sa5 = "1"; Sa6="1000".	AUXP	time slot other than 0 set to all binary "1"; bit A - "0"; Sa5 = "1"; Sa6="1000".	AUXP	time slot other than 0 set to All binary "1"; bit A = "0"; Sa5 = "1"; Sa6="1000"	AUXP
Signals transmitted towards T interface	AIS	AIS	AIS	AIS	AIS	AIS	AIS	AIS
Event								
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR Loopback command	DS 0.101	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of LT power	DS 0.002	DS 0.002	DS 0.002	DS 0.002	DS 0.004	DS 0.004	DS 0.004	DS 0.004
Return of LT power	/	/	/	/	/	/	/	/
NT dying gasp phase	-	-	-	-	-	-	-	-
NT power off	DS 0.700	DS 0.700	DS 0.700	DS 0.700	DS 0.700	DS 0.700	DS 0.700	DS 0.700

(continued)

Table 5d: DS state table - NT dying (continued)

Return of NT power	DS 6.66	DS 6.76	DS 6.62	DS 6.72	DS 6.67	DS 6.77	DS 6.64	DS 6.74
Failure FC1 no loopback command from ET side	(NOTE 6)	DS 0.201	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Failure FC5 no loopback command from ET side	(NOTE 6)	(NOTE 6)	DS 0.102	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of frames (NOTE 5) at interface V3 (FV2/FC5) not AIS	DS 0.302	(NOTE 6)	DS 0.302	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of frames at T interface FC4 (NOTE 5) no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.103	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FC5 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.202	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.203	(NOTE 6)	(NOTE 6)
FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.104	(NOTE 6)
FC1&FV3/FC5	(NOTE 6)	DS 0.402	(NOTE 6)	DS 0.402	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.204
FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.304	(NOTE 6)	DS 0.304	(NOTE 6)
FC1&FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.404	(NOTE 6)	DS 0.404

(continued)

Table 5d: DS state table - NT dying (concluded)

Loopback 1 command received AND not (FC5 OR FC4) (NOTE 9)	DS 5.501	DS 5.501	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC5 (NOTE 9)	(NOTE 6)	(NOTE 6)	DS 5.502	DS 5.502	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.503	DS 5.503	(NOTE 6)	(NOTE 6)
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.504	DS 5.504
Loopback 2 command received from ET side not FC1 (NOTE 9)	DS 5.105	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.105	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 2 command received from ET side AND FC1 (NOTE 9)	(NOTE 6)	DS 5.205 (NOTE 8)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.205 (NOTE 8)	(NOTE 6)	(NOTE 6)
AIS at interface V3	-	DS 0.606	DS 0.606	(NOTE 6)	DS 0.606	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1	DS 0.706	-	(NOTE 6)	DS 0.706	(NOTE 6)	DS 0.706	(NOTE 6)	(NOTE 6)
AIS&FC5	DS 0.602	(NOTE 6)	-	DS 0.602	(NOTE 6)	(NOTE 6)	DS 0.602	(NOTE 6)
AIS&FC4	DS 0.607	(NOTE 6)	(NOTE 6)	(NOTE 6)	-	DS 0.607	DS 0.607	(NOTE 6)
AIS&FC1&FC5	(NOTE 6)	DS 0.702	DS 0.702	-	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.702
AIS&FC1&FC4	(NOTE 6)	DS 0.707	(NOTE 6)	(NOTE 6)	DS 0.707	-	(NOTE 6)	DS 0.707
AIS&FC5&FC4	(NOTE 6)	(NOTE 6)	DS 0.604	(NOTE 6)	DS 0.604	(NOTE 6)	-	DS 0.604
AIS&FC1&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.704	(NOTE 6)	DS 0.704	DS 0.704	-

Table 5e: DS state table - Digital section normal OR FC within digital section OR FC at interface

State	DS 1.11	DS 2.12	DS 2.21	DS2.22	DS 3.13
State Name Operational for failure condition of DS	Digital section normal	FC5	FC1	FC1 & FC5	FC4
Corresponding ET-state	ET 1, 4.1 , 0.2	ET 2.2	ET 2.1	ET 2.1	ET 4.2
Signals transmitted towards interface V3	Normal frames Sa5 = "1"; Sa6 = "0000".	Frames RAI (NOTE 2); Sa5 = "1"; Sa6 = "1110".	AUXP	AUXP	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6 = "1100".
Signals transmitted towards T interface	Normal frames	AIS	Normal frames with RAI (NOTE 4)	AIS	Normal frames with RAI (NOTE 4), Bit E = "0".
Event					
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR loopback command)	-	DS 1.11	DS 1.11	(NOTE 6)	DS 1.11
Loss of LT power	DS 0.02	DS 0.02	DS 0.02	DS 0.02	DS 0.04
Return of LT power	/	/	/	/	/
NT dying gasp phase	DS 0.101	DS 0.102	DS 0.201	DS 0.202	DS 0.103
NT power off	/	/	/	/	/
Return of NT power	/	/	/	/	/
Failure FC1 no loopback command from ET side	DS 2.21	(NOTE 6)	-	DS 2.21	(NOTE 6)

(continued)

**Table 5e: DS state table - Digital section normal OR FC within digital section OR FC at interface
(continued)**

Failure FC5 no loopback command from ET side	DS 2.12	-	(NOTE 6)	DS 2.12	(NOTE 6)
Loss of frames (NOTE 5) at interface V3 (FV3/FC5) not AIS	DS 4.32	DS 4.32	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of frames at T interface FC4 (NOTE 5) no loopback command	DS 3.13	(NOTE 6)	(NOTE 6)	(NOTE 6)	-
FC1&FC5 no loopback command	(NOTE 6)	DS 2.22	DS 2.22	-	(NOTE 6)
FC1&FC4 no loopback command	(NOTE 6)	(NOTE 6)	DS 4.23	(NOTE 6)	DS 4.23
FC5&FC4 no loopback command	(NOTE 6)	DS 4.14	(NOTE 6)	(NOTE 6)	DS 4.14
FC1&FV3/FC5	(NOTE 6)	(NOTE 6)	DS 4.42	DS 4.42	(NOTE 6)
FC1&FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.24	(NOTE 6)
FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.34
FC1&FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 1 command received AND not (FC5 OR FC4 (NOTE 9))	DS 5.51	(NOTE 6)	DS 5.51	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC5 (NOTE 9)	(NOTE 6)	DS 5.52	(NOTE 6)	DS 5.52	(NOTE 6)

(continued)

**Table 5e: DS state table - Digital section normal OR FC within digital section OR FC at interface
(concluded)**

Loopback 1 command received from ET side AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.53
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 2 command received from ET side not FC1 (NOTE 9)	DS 5.15	DS 5.15	(NOTE 6)	(NOTE 6)	DS 5.15
Loopback 2 command received from ET side and FC1 (NOTE 9)	(NOTE 6)	(NOTE 6)	DS 5.25 (NOTE 8)	DS 5.25 (NOTE 8)	(NOTE 6)
AIS at interface V3	DS 6.66	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1	(NOTE 6)	(NOTE 6)	DS 6.76	(NOTE 6)	(NOTE 6)
AIS&FC5	(NOTE 6)	DS 6.62	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.67
AIS&FC1&FC5	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.72	(NOTE 6)
AIS&FC1&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)

Table 5f: DS state table - FC within digital section AND FC at interface

State	DS 4.14	DS 4.23	DS 4.32	DS 4.24	DS 4.42	DS 4.34	DS 4.44
State Name Operational or failure condition of DS	FC5&FC4	FC1&FC4	FV3/FC5	FC1&FC5& FC4	FC1&FV3/ FC5	FV3/FC5& FC4	FC1&FV3/ FC5&FC4
Corresponding ET-state	ET 2.3	ET 2.1	ET 2.2	ET 2.1	ET 2.1	ET 2.3	ET 2.1
Signals transmitted towards interface V3	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6 = "1110".	AUXP	Frames with AL(NOTE 2); Sa5 = "1"; Sa6 = "1110".	AUXP	AUXP	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6 = "1110".	AUXP
Signals transmitted towards T interface	AIS	Normal frames with RAI (NOTE 4), Bit E = "0".	AIS	AIS	AIS	AIS	AIS
Event							
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR loopback command)	(NOTE 6)	(NOTE 6)	DS 1.11	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of LT power	DS 0.04	DS 0.04	DS 0.02	DS 0.04	DS 0.02	DS 0.04	DS 0.04
Return of LT power	/	/	/	/	/	/	/
NT dying gasp phase	DS 0.104	DS 0.203	DS 0.302	DS 0.204	DS 0.402	DS 0.304	DS 0.404

(continued)

Table 5f: DS state table - FC within digital section AND FC at interface (continued)

NT power off	/	/	/	/	/	/	/
Return of NT power	/	/	/	/	/	/	/
Failure FC1 no loopback command from ET side	(NOTE 6)	DS 2.21	(NOTE 6)	(NOTE 6)	DS 2.21	(NOTE 6)	(NOTE 6)
Failure FC5 no loopback command from ET side	DS 2.12	(NOTE 6)	DS 2.12	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of frames (NOTE 5) at interface V3(FV3/FC5) not AIS	(NOTE 6)	(NOTE 6)	-	(NOTE 6)	DS 4.32	DS 4.32	(NOTE 6)
Loss of frames at T interface FC4 (NOTE 5) no loopback command	DS 3.13	DS 3.13	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 3.13	(NOTE 6)
FC1&FC5 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 2.22	DS 2.22	(NOTE 6)	(NOTE 6)
FC1&FC4 no loopback command	(NOTE 6)	-	(NOTE 6)	DS 4.23	(NOTE 6)	(NOTE 6)	DS 4.23
FC5&FC4 no loopback command	-	(NOTE 6)	(NOTE 6)	DS 4.14	(NOTE 6)	DS 4.14	(NOTE 6)
FC1&FV3/FC5	(NOTE 6)	(NOTE 6)	DS 4.42	(NOTE 6)	-	(NOTE 6)	DS 4.42
FC1&FC5&FC4 no loopback command	DS 4.24	DS 4.24	(NOTE 6)	-	(NOTE 6)	(NOTE 6)	DS 4.24
FV3/FC5&FC4	DS 4.34	(NOTE 6)	DS 4.34	(NOTE 6)	(NOTE 6)	-	DS 4.34
FC1&FV3/FC5&FC4	(NOTE 6)	DS 4.44	(NOTE 6)	DS 4.44	DS 4.44	DS 4.44	-

(continued)

Table 5f: DS state table - FC within digital section AND FC at interface (concluded)

Loopback 1 command received AND not (FC5ORFC4) (NOTE 9)	(NOTE 6)	DS 5.51	DS 5.51	(NOTE 6)	DS 5.51	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC5 (NOTE 9)	(NOTE 6)	(NOTE 6)	DS 5.52	(NOTE 6)	DS 5.52	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC4 (NOTE 9)	(NOTE 6)	DS 5.53	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.53	DS 5.53
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	DS 5.54	(NOTE 6)	(NOTE 6)	DS 5.54	(NOTE 6)	DS 5.54	DS 5.54
Loopback 2 command received from ET side not FC1 (NOTE 9)	DS 5.15	(NOTE 6)	DS 5.15	(NOTE 6)	(NOTE 6)	DS 5.15	(NOTE 6)
Loopback 2 command received from ET side AND FC1 (NOTE 9)	(NOTE 6)	DS 5.25 (NOTE 8)	(NOTE 6)	DS 5.25 (NOTE 8)	DS 5.25 (NOTE 8)	(NOTE 6)	DS 5.25 (NOTE 8)
AIS at interface V3	(NOTE 6)	(NOTE 6)	DS 6.66	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.76	(NOTE 6)	(NOTE 6)
AIS&FC5	(NOTE 6)	(NOTE 6)	DS 6.82	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC5	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.72	(NOTE 6)	(NOTE 6)
AIS&FC1&FC4	(NOTE 6)	DS 6.77	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC5&FC4	DS 6.64	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.64	(NOTE 6)
AIS&FC1&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.74	(NOTE 6)	(NOTE 6)	DS 6.74

Table 5g: DS state table - Loopbacks while access normal power condition

State	DS 5.51	DS 5.52	DS 5.53	DS 5.54	DS 5.15	DS 5.25
State Name Operational or failure condition of DS	Loopback 1 LT normal OR FC1	Loopback 1 FC5	Loopback 1 FC4	Loopback 1 FC5 AND FC4	Loopback 2 NT normal OR FC4	Loopback 2 (NT norm OR FC4)&FC1
Corresponding ET-state	ET 5.2	ET 5.2	ET 5.2	ET 5.2	ET 5.4	ET 5.4
Signals transmitted towards interface V3	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3, Sa5 = "0".	AUXP
Signals transmitted towards T interface	Frames with RAI (NOTE 4), Sa6="1111".	AIS	Frames with RAI (NOTE 4); Bit E = "0", Sa6="1111".	AIS	Frames with RAI (NOTE 4), Sa6 = "1010".	Frames with RAI (NOTE 4), Sa6 = "1010".
Event						
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR loopback command)	DS 1.11 (NOTE 12)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 1.11 (NOTE 12)	DS 2.21 (NOTE 12)
Loss of LT power	DS 0.02	DS 0.02	DS 0.04	DS 0.04	DS 0.04	DS 0.04
Return of LT power	/	/	/	/	/	/
NT dying gasp phase	DS 5.501	DS 5.502	DS 5.503	DS 5.504	DS 0.105	DS 0.205
NT power off	/	/	/	/	/	/

(continued)

Table 5g: DS state table - Loopbacks while access normal power condition (continued)

Return of NT power	/	/	/	/	/	/
Failure FC 1 no loopback command from ET side	DS 2.21 (NOTE 12)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 2.21 (NOTE 12)
Failure FC5 no loopback command from ET side	(NOTE 6)	DS 2.12 (NOTE 12)	(NOTE 6)	(NOTE 6)	DS 2.12 (NOTE 12)	(NOTE 6)
Loss of frames (NOTE 5) at interface V3 (FV3/FC5) not AIS	DS 4.32	DS 4.32	(NOTE 6)	(NOTE 6)	DS 4.32	(NOTE 6)
Loss of frames at T interface FC4 (NOTE 5) no loopback command	(NOTE 6)	(NOTE 6)	DS 3.13 (NOTE 12)	(NOTE 6)	DS 3.13 (NOTE 11)	(NOTE 6)
FC1&FC5 no loopback command	(NOTE 6)	DS 2.22 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 2.22
FC1&FC4 no loopback command	(NOTE 6)	(NOTE 6)	DS 4.23 (NOTE 10)	(NOTE 6)	(NOTE 6)	DS 4.23 (NOTE 11)
FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.14 (NOTE 12)	DS 4.14 (NOTE 11)	(NOTE 6)
FC1&FV3/FC5	DS 4.42	DS 4.42	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.42
FC1&FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.24 (NOTE 10)	(NOTE 6)	DS 4.24
FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	DS 4.34	DS 4.34	DS 4.34	(NOTE 6)
FC1&FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	DS 4.44	DS 4.44	(NOTE 6)	DS 4.44

(continued)

Table 5g: DS state table - Loopbacks while access normal power condition (continued)

Loopback 1 command received AND not (FC5 OR FC4) (NOTE 9)	-	DS 5.51	DS 5.51	(NOTE 6)	DS 5.51 (NOTE 12)	DS 5.51 (NOTE 12)
Loopback 1 command received from ET side AND FC5 (NOTE 9)	DS 5.52	-	(NOTE 6)	DS 5.52	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side and FC4 (NOTE 9)	DS 5.53	(NOTE 6)	-	DS 5.53	DS 5.53 (NOTE 11)	DS 5.53 (NOTE 11)
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	(NOTE 6)	DS 5.54	DS 5.54	-	(NOTE 6)	(NOTE 6)
Loopback 2 command received from ET side not FC1 (NOTE 9)	DS 5.15	(NOTE 6)	DS 5.15	(NOTE 6)	-	DS 5.15
Loopback 2 command received from ET side AND FC1 (NOTE 9)	DS 5.25 (NOTE 8)	(NOTE 6)	DS 5.25 (NOTE 8)	(NOTE 6)	DS 5.25	-
AIS at interface V3	DS 6.66 (NOTE 12)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.66 (NOTE 12)	(NOTE 6)
AIS&FC1	DS 6.76 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.76 (NOTE 12)
AIS&FC5	(NOTE 6)	DS 6.62 (NOTE 12)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC4	(NOTE 6)	(NOTE 6)	DS 6.67 (NOTE 12)	(NOTE 6)	DS 6.67 (NOTE 11)	(NOTE 6)

(continued)

Table 5g: DS state table - Loopbacks while access normal power condition (concluded)

AIS&FC1&FC5	(NOTE 6)	DS 6.72 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC4	(NOTE 6)	(NOTE 6)	DS 6.77 (NOTE 10)	(NOTE 6)	(NOTE 6)	DS 6.77 (NOTE 10)
AIS&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.64 (NOTE 12)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.74 (NOTE 10)	(NOTE 6)	(NOTE 6)

Table 5h: DS state table - Loopbacks while access abnormal power condition

State	DS 5.500	DS 5.501	DS 5.502	DS 5.503	DS 5.504	DS 5.105	DS 5.205
State Name Operational or failure condition of DS	Loopback 1 NT power off	Loopback 1 NT dying	Loopback 1 NT dying AND FC5	Loopback 1 NT dying AND FC4	Loopback 1 NT dying AND FC5 FC4	Loopback 2 NT dying	Loopback 2 NT dying AND FC1
Corresponding ET-state	ET 5.2	ET 5.2	ET 5.2	ET 5.2	ET 5.2	ET 5.4	ET 5.4
Signals transmitted towards interface V3	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3, Sa5 = "02".	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3, Sa5 = "0".	Frames received from ET at interface V3; Sa5 = "0", Sa6 = "1000".	AUXP
Signals transmitted towards T interface	No signal	Frames RAI (NOTE 4), Sa6 = "1111".	AIS	Frames RAI (NOTE 4); Bit E = "0"; Sa6="1111".	AIS	Frame RAI (NOTE 4), Sa6="1010".	Frame RAI (NOTE 4), Sa6="1010".
Event							
Normal frames (NOTE 1) at V3 and T interfaces NOT (FC1 OR FC5 OR loopback command)	/	DS 0.101 (NOTE 12)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.101 (NOTE 12)	(NOTE 6)
Loss of LT power	DS 0.000	DS 0.002	DS 0.002	DS 0.004	DS 0.004	DS 0.004	DS 0.004
Return of LT power	/	/	/	/	/	/	/
NT dying gasp phase	/	-	-	-	-	-	-
NT power off	-	DS 5.500	DS 5.500	DS 5.500	DS 5.500	DS 0.200	DS 0.200

(continued)

Table 5h: DS state table - Loopbacks while access abnormal power condition (continued)

Return of NT power	DS 5.54	DS 5.51	DS 5.52	DS 5.53	DS 5.54	DS 5.15	DS 5.25
Failure FC1 no loopback command from ET side	DS 0.200	DS 0.201 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.201 (NOTE 12)
Failure FC5 no loopback command from ET side	/	(NOTE 6)	DS 0.102 (NOTE 12)	(NOTE 6)	(NOTE 6)	DS 0.102 (NOTE 12)	(NOTE 6)
Loss of frames (NOTE 5) at interface V3 (FV3/FC5) not AIS	/	DS 0.302 (NOTE 12)	DS 0.302 (NOTE 12)	(NOTE 6)	(NOTE 6)	DS 0.302 (NOTE 12)	(NOTE 6)
Loss of frames at T interface FC4 (NOTE 5) no loopback command	/	(NOTE 6)	(NOTE 6)	DS 0.103 (NOTE 12)	(NOTE 6)	DS 0.103 (NOTE 11)	(NOTE 6)
FC1&FC5 no loopback command	/	(NOTE 6)	DS 0.202 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.202 (NOTE 12)
FC1&FC4 no loopback command	/	(NOTE 6)	(NOTE 6)	DS 0.203 (NOTE 10)	(NOTE 6)	(NOTE 6)	DS 0.203 (NOTE 11)
FC5&FC4 no loopback command	/	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.104 (NOTE 12)	DS 0.104 (NOTE 11)	(NOTE 6)
FC1&FV3/FC5	DS 0.400	DS 0.402 (NOTE 10)	DS 0.402 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.402 (NOTE 12)
FC1&FC5&FC4 no loopback command	/	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.204 (NOTE 10)	(NOTE 6)	DS 0.204 (NOTE 11)
FV3/FC5&FC4	/	(NOTE 6)	(NOTE 6)	DS 0.304 (NOTE 12)	DS 0.304 (NOTE 12)	DS 0.304 (NOTE 11)	(NOTE 6)

(continued)

Table 5h: DS state table - Loopbacks while access abnormal power condition (continued)

FC1&FV3/FC5&FC4	/	(NOTE 6)	(NOTE 6)	DS 0.404 (NOTE 10)	DS 0.404 (NOTE 10)	(NOTE 6)	DS 0.404 (NOTE 11)
Loopback 1 command received AND not (FC5 OR FC4) (NOTE 9)	/	-	DS 5.501	DS 5.501	(NOTE 6)	DS 5.501 (NOTE 12)	DS 5.501 (NOTE 12)
Loopback 1 command received from ET side AND FC5 (NOTE 9)	/	DS 5.502	-	(NOTE 6)	DS 5.502	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC4 (NOTE 9)	/	DS 5.503	(NOTE 6)	-	DS 5.503	DS 5.503 (NOTE 11)	DS 5.503 (NOTE 11)
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	/	(NOTE 6)	DS 5.504	DS 5.504	-	(NOTE 6)	(NOTE 6)
Loopback 2 command received from ET side not FC1 (NOTE 9)	/	DS 5.105	(NOTE 6)	DS 5.105	(NOTE 6)	-	DS 5.105
Loopback 2 command received from ET side AND FC1 (NOTE 9)	/	DS 5.205 (NOTE 8)	(NOTE 6)	DS 5.205 (NOTE 8)	(NOTE 6)	DS 5.205	-
AIS at interface V3	/	DS 0.606 (NOTE 12)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.606 (NOTE 12)	(NOTE 6)
AIS&FC1	DS 0.700	DS 0.706 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.706 (NOTE 12)
AIS&FC5	/	(NOTE 6)	DS 0.602 (NOTE 12)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)

(continued)

Table 5h: DS state table - Loopbacks while access abnormal power condition (concluded)

AIS&FC4	/	(NOTE 6)	(NOTE 6)	DS 0.607 (NOTE 12)	(NOTE 6)	DS 0.607 (NOTE 11)	(NOTE 6)
AIS&FC1&FC5	/	(NOTE 6)	DS 0.702 (NOTE 10)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC4	/	(NOTE 6)	(NOTE 6)	DS 7.707 (NOTE 10)	(NOTE 6)	(NOTE 6)	DS 0.707 (NOTE 11)
AIS&FC5&FC4	/	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.604 (NOTE 12)	(NOTE 6)	(NOTE 6)
AIS&FC1&FC5&FC4	/	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 0.704 (NOTE 10)	(NOTE 6)	(NOTE 6)

Table 5j: DS state table - Digital section receiving AIS at interface V3

State	DS 6.66	DS 6.76	DS 6.62	DS 6.67	DS 6.72	DS 6.77	DS 6.64	DS 6.74
State Name Operational or failure condition of DS	AIS at V3	AIS at V3& FC1	AIS at V3& FC5	AIS at V3& FC4	AIS at V3& FC1&FC5	AIS at V3& FC1&FC4	AIS at V3& FC5&FC4	AIS at V3& FC1&FC5& FC4
Corresponding ET-state	ET 0.3 ET 6.2	ET 0.3 ET 6.1	ET 0.3 ET 2.2	ET 0.3 ET 6.3	ET 0.3 ET 6.1	ET 0.3 ET 6.1	ET 0.3 ET 2.3	ET 0.3 ET 6.1
Signals transmitted towards interface V3	Frames with RAI (NOTE 2); Sa5 = "1"; Sa6="1111".	AUXP	Frames with RAI (NOTE 2); Sa5 = "1"; Sa6="1110".	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6="1111".	AUXP	AUXP	time slot other than 0 set to all binary "1"; bit A = "0"; Sa5 = "1"; Sa6="1110".	AUXP
Signals transmitted towards T interface	AIS	AIS	AIS	AIS	AIS	AIS	AIS	AIS
Event								
Normal frames (NOTE 1) at V3 and T interface NOT (FC1 OR FC5 OR loopback command)	DS 1.11	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of LT power	DS 0.02	DS 0.02	DS 0.02	DS 0.04	DS 0.02	DS 0.04	DS 0.04	DS 0.04
Return of LT power	/	/	/	/	/	/	/	/
NT dying gasp phase	DS 0.606	DS 0.706	DS 0.602	DS 0.607	DS 0.702	DS 0.707	DS 0.604	DS 0.704
NT power off	/	/	/	/	/	/	/	/

(continued)

Table 5j: DS state table - Digital section receiving AIS at interface V3 (continued)

Return of NT power	/	/	/	/	/	/	/	/
Failure FC1 no loopback command from ET side	(NOTE 6)	DS 2.21	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Failure FC5 no loopback command from ET side	(NOTE 6)	(NOTE 6)	DS 2.12	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of frames (NOTE 5) at interface V3 (FV3/FC5) not AIS	DS 4.32	(NOTE 6)	DS 4.32	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loss of frames at T interface FC4 (NOTE 5) no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 3.13	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FC5 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 2.22	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.23	(NOTE 6)	(NOTE 6)
FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.14	(NOTE 6)
FC1&FV3/FC5	(NOTE 6)	DS 4.22	(NOTE 6)	(NOTE 6)	DS 4.22	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FC5&FC4 no loopback command	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.24
FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.34	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
FC1&FV3/FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 4.44	(NOTE 6)	DS 4.44

(continued)

Table 5j: DS state table - Digital section receiving AIS at interface V3 (concluded)

Loopback 1 command received AND not (FC5 OR FC4) (NOTE 9)	DS 5.51	DS 5.51	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC5 (NOTE 9)	(NOTE 6)	(NOTE 6)	DS 5.52	(NOTE 6)	DS 5.52	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 1 command received from ET side AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.53	(NOTE 6)	DS 5.53	(NOTE 6)	(NOTE 6)
Loopback 1 command received AND FC5 AND FC4 (NOTE 9)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.54	DS 5.54
Loopback 2 command received from ET side not FC1 (NOTE 9)	DS 5.15	(NOTE 6)	(NOTE 6)	DS 5.15	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
Loopback 2 command received from ET side AND FC1 (NOTE 9)	(NOTE 6)	DS 5.25 (NOTE 8)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 5.25 (NOTE 8)	(NOTE 6)	(NOTE 6)
AIS at interface V3	-	DS 6.66	DS 6.66	DS 6.66	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)
AIS&FC1	DS 6.76	-	(NOTE 6)	(NOTE 6)	DS 6.76	DS 6.76	(NOTE 6)	(NOTE 6)
AIS&FC5	DS 6.62	(NOTE 6)	-	(NOTE 6)	DS 6.62	(NOTE 6)	DS 6.62	(NOTE 6)
AIS&FC4	DS 6.67	(NOTE 6)	(NOTE 6)	-	(NOTE 6)	DS 6.67	DS 6.67	(NOTE 6)
AIS&FC1&FC5	(NOTE 6)	DS 6.72	DS 6.72	(NOTE 6)	-	(NOTE 6)	(NOTE 6)	DS 6.72
AIS&FC1&FC4	(NOTE 6)	DS 6.77	(NOTE 6)	DS 6.77	(NOTE 6)	-	(NOTE 6)	DS 6.77
AIS&FC5&FC4	(NOTE 6)	(NOTE 6)	DS 6.64	DS 6.64	(NOTE 6)	(NOTE 6)	-	DS 6.64
AIS&FC1&FC5&FC4	(NOTE 6)	(NOTE 6)	(NOTE 6)	(NOTE 6)	DS 6.74	DS 6.74	DS 6.74	-

9.5.2.4 NOTES to DS state tables 5a to 5j

- NOTE 1: Normal frames, as defined in subclause 8.2.2.2 include normal operational frames and the signal RAI. Which of these applies depends on the ET and the TE respectively. This event is related to state DS 1.11 "Digital Section normal" which includes four conditions in relation to the status of the whole access (ET, DS and TE). These conditions depend on events detected by the ET and/or the TE: "access operational", "FC2", "LOS/LFA at ET" and "FC2 and LOS/LFA at ET". The state of the digital section is not affected although the signals at the interfaces differ. The signals received at the T reference point are transparently passed to the V3 reference point and vice versa.
- NOTE 2: The signal RAI (A-bit set to ONE) received at the T reference point is transparently passed to the V3 reference point.
- NOTE 3: These frames can include the signal RAI (A-bit set to One) or not, which of these applies depends on the TE.
- NOTE 4: The signal RAI (A-bit set to One) received at the V3 reference point is transparently passed to the T reference point.
- NOTE 5: Loss of frames includes loss of frame alignment (LFA) and loss of signal (LOS).
- NOTE 6: This event does not occur while in this state. It is assumed that failure conditions (FCs) are detected one by one in a random order, so a direct transition from a n-tuple to a (n-2)-tuple FC-situation or vice versa is prohibited.
- NOTE 7: This normal frames can include the signal RAI (state ET 2.6) or not (state ET 2.5), which of these applies depends on the ET.
- NOTE 8: In this failure situation the DS is able to establish the requested loopback but the ET receives neither a loopback confirmation nor the transmitted testpattern.
- NOTE 9: The LT and the NT1 are non-latching with respect to loopbacks, therefore an established loopback is retained only as long as the appropriate control signal is detected.
- NOTE 10: It is assumed that the LT when releasing loopback 1 detects a FC1 condition until frame alignment is achieved.
- NOTE 11: It is assumed that the NT1 when releasing loopback 2 detects a FC4 condition until frame alignment is achieved.
- NOTE 12: This event should not occur, according to NOTES 10 and 11.

Annex A (normative): System management requirements

A.1 Introduction

This Annex specifies requirements for the interworking of the access digital section and the ET layer 1. In order to ensure correct operation, assumptions made about the management functions involved in the ET need to be taken into account.

In this ETS, distinction is made between ET layer 1 and system management only. Where the term system management is used it corresponds to both system management and layer management as defined in CCITT Recommendation Q.940 [10].

A.2 System management requirements

A.2.1 General

System management shall not initiate more than one action at a time towards the ET layer 1. An action is delimited by the primitive which is issued by the system management and the corresponding primitive which confirms completion of the task.

A.2.2 Error indications

The management entity shall take account of the sequence of primitives before and after the reception of MPH-Elx. From the sequence of the primitives, the system management may determine the cause of the MPH-Elx primitive (e.g. loss of synchronisation or loss of signal at the interface at reference point T).

Upon the occurrence of an error, the ET layer 1 shall notify the event to the system management by means of a primitive MPH-Elx. The system management shall determine the appropriate actions to be taken (e.g. hold or abandon call).

A.2.3 Loopback operations

The system management shall take into account that when the ET layer 1 is in loopback operation it does not send any primitives to ET layer 2. If a primitive is sent by ET layer 2 to ET layer 1 during loopback operation, it shall be ignored by ET layer 1.

The setting of a loopback is initiated by the system management by issuing a primitive MPH-LxAR whereby x indicates the type of the loopback.

The setting of loopbacks 1 and 2 is confirmed to the system management by means of the loopback acknowledge primitive. The system management shall be able to interpret this loopback acknowledge as a loopback confirmation.

The sequence for the loopback procedure when controlled by the ET system management shall be:

- a) the ET generates an operation command for the required loopback;
- b) the ET receives loopback acknowledgement;
- c) the ET performs the test;
- d) the ET generates a release command;
- e) the ET detects the release of the loopback.

A.2.4 Information to be sent in the D-channel during loopback operation

The information sent in the D-channel should not imitate any High Level Data Link Control (HDLC) pattern. However, it is the responsibility of the system management to decide to send the required pattern for fault localisation.

A.2.5 Configuration control

The system management shall ensure that any action related to failure localisation (i.e. non-operational states) shall be issued only while the access is not active with user traffic.

A.3 Handling of CRC error information in the ET

The ET shall detect CRC blocks in error received from the access digital section.

The ET shall process the CRC error information according to:

- transmission quality as defined in ETR 001 [2], and
- excessive CRC errors as described in ETS 300 011 [1].

A.4 Definition of ET layer 1 state machine

A.4.1 ET layer 1 states

This subclause defines the states the ET layer 1 shall enter as a result of:

- Function Elements (FEs) received across reference point V3 (V3');
- service primitives received (PH-, MPH-primitives); or
- internal events.

A.4.2 PH and MPH primitives

A.4.2.1 The repertoire of PH and MPH primitives

MPH primitives within ET for the support of functions specified in CCITT Recommendations I.440 and I.441 are for call control. The repertoire of these primitives is defined in ETS 300 011 [1], subclause 3.4.5 and CCITT Recommendation I.441, subclause 4.1.

A.4.2.2 Repertoire of MPH primitives

MPH primitives within the ET for the support of functions associated with the digital section are given below.

MPH-AI	Activation Indication;
MPH-DI	Deactivation Indication;
MPH-EI 0	Error indication "loss of power in the NT1";
MPH-EI 1 to 4	Error indication for failure conditions FC1 to FC4, as given in figure 7;
MPH-EI 5	Error indication for failure downstream from the ET to the TE which covers ET failure or failure in the digital link downstream or FC3 or FC2 or combinations of this failure conditions;
MPH-EI P	Error indication "power off at the ET";
MPH-EI DLd	Error indication "failure in the digital link between V3' and V3 reference points downstream (see figures 2 and 7);
MPH-EI DLu	Error indication "failure in the digital link between V3 and V3' reference points upstream (see figures 2 and 7);
MPH-EI L	Error indication "failure at V3 (V3') reference point of the ET receive side";
MPH-EI ET	Error indication "failure inside the ET";

MPH-EI LB1	Error indication "interruption of activated loopback";
MPH-EI LB2	Error indication "unintended loopback";
MPH-L1 AR	Activation request for loopback 1;
MPH-L2 AR	Activation request for loopback 2;
MPH-DR	Release request for both loopbacks.

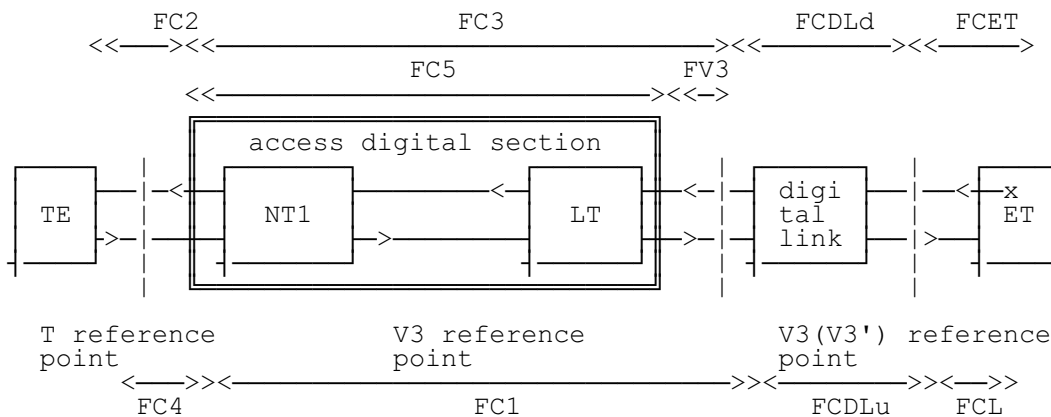
A.4.3 ET layer 1 state transition table

Table A.1, specifies the procedures. It includes the action to be taken on the receipt of various events whilst in a defined state. It specifies the interactions with the ET layer 2 and the system management which are required to support the layer interface procedures in accordance with ETS 300 011 [1] (sequences of PH- and MPH-primitives in compliance with ETS 300 011 [1]) and the interworking across the layer interface between ET layer 1 and system management for the support of functions associated with the access digital section.

A.4.3.1 Definition of notations

The following notations are used in the ET state tables:

- = no state change;
- / = impossible event due to internal reasons;
- I = impossible situation by the definition of layer 1 service.



Key to figure A.1:

FC1 to FC4	Failure conditions according to ETS 300 011 [1];
FC5	Failure condition inside the access digital section downstream (see NOTE);
FV3	Failure condition at the V3 reference point of the LT (see NOTE);
FCDL	Failure condition in the digital link between the V3 and the V3' reference point upstream and downstream;
FCL	Failure condition at the V3 or the V3' reference point of the ET receive side;
FCET	Internal failure condition in the ET.

NOTE: The failure conditions FC5 and FV3 cause identical indications at the T and the V3 (V3') reference point and, therefore, can not be distinguished from outside the DS. Both of them are covered by FC3 as defined in ETS 300 011 [1].

Figure A.1: Location of defects

A.4.3.2 Classification of ET states

The ET states have been numbered to form classes of problems as follows:

ET0.x	ET problems;
ET1	Operational;
ET2.x	Problems inside the access digital section;
ET4.x	Problems at the user side of the access digital section or inside the TE;
ET5.x	Loopbacks;
ET6.x	Problems in the digital link between reference points V3' and V3.

NOTES to tables A.1, A.2 and A.3:

- NOTE 1: This event does not occur while in this state. It is assumed that failure conditions (FCs) are detected one by one in a random order, so a direct transition from a n-tuple to a (n-2)-tuple FC-situation or vice versa is prohibited.
- NOTE 2: If no loopback is invoked or activated, Sa5 = 1 is ignored.
- NOTE 3: This event is when Sa5 = 0 is received in error at the ET. This could be interpreted as unintended loopback situation.
- NOTE 4: The ET issues the MPH Elx appropriate to the failure condition but remains in the state it was before the event occurred. The ET makes provision that this MPH Elx is not issued repetitively.

Table A.1: ET state table - Normal and ET internal problems

State	ET0.1	ET0.2	ET0.3	ET1
Corresponding G-state				G1
Operational or failure condition as seen from the ET	at ET	Power on at ET or LOS/LFA	Internal (NOTE 1)	Operational
Signals transmitted towards V3 reference point	No signal	Normal Frame width RAI	AIS	Normal operational frames

Event	Indication				
Loss of ET power	Loss of ET power	/	MPH-EI P ET0.1	MPH-EI P ET0.1	PH-DI MPH-EI P ET0.1
Return of ET power	Return of ET power	ET0.2	/	/	/
Normal operational frames	Bit A = "0"; Sa6 = "0000"; Sa5 = "1".	/	PH-AI MPH-AI ET1	/	-
FC1	AUXP	/	MPH-AI MPH-EI 1 ET2.1	MPH-EI 1 - (NOTE 4)	PH-DI MPH-EI 1 ET2.1
FC2	Bit A = "0"; Sa6 = "0000"; Sa5 = "1".	/	MPH-AI MPH-EI 2 ET4.1	/	PH-DI MPH-EI 2 ET4.1

(continued)

Table A.1: ET state table - Normal and ET internal problems (continued)

FC3	Bit A = "1" (RAI); Sa6 = "1110"; Sa5 = "1".	/	MPH-AI MPH-EI 3 ET2.2	MPH-EI 3 - (NOTE 4)	PH-DI MPH-EI 3 ET2.2
FC4	Bit A = "0"; Sa6 = "1100"; Sa5 = "1".	/	MPH-AI MPH-EI 4 ET4.2	/	PH-DI MPH-EI 4 ET4.2
NT power off	Bit A = "02; Sa6 = "1000"; Sa5 = "1".	/	MPH-AI MPH-EI 0 ET2.5	MPH-EI 0 - (NOTE 4)	MPH-EI 0 ET2.5
FC3 & FC4	Bit A = "0"; Sa6 = "1110"; Sa5 = "1".	/	MPH-AI MPH-EI 3 MPH-EI 4 ET2.3	MPH-EI 4 - (NOTE 4)	(NOTE 1)
NT power off & LOS/LFA at TE	Bit A = "1" (RAI); Sa6 = "1000"; Sa5 = "1".	/	MPH-EI 0 MPH-EI 5 ET2.7	MPH-EI 0 - (NOTE 4)	(NOTE 1)
LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	/	-	MPH-EI L - (NOTE 4)	PH-DI MPH-EI L ET0.2
Loopback 1 request	MPH-L1AR	/	ET5.1		PH-DI ET5.1
Loopback 2 request	MPH-L2AR	/	ET5.3		PH-DI ET5.3
Loopback release request	MPH-DR	/			
Loopback indication	Sa5 = "0"	/	MPH-EILB2 ET5.6	MPH-EILB2 - (NOTE 4)	MPH-EILB2 ET5.6

(continued)

Table A.1: ET state table - Normal and ET internal problems (concluded)

Loopback indication	Sa5 = "1"	/	(NOTE 2)	(NOTE 2)	(NOTE 2)
ET internal failure	ET failure	/	MPH-AI MPH-EI ET ET0.3	-	PH-DI MPH-EI ET ET0.3
ET failure recovered	ET failure recovered	/	/	ET0.2	/
AIS at LT from ET	Bit A = "1" (RAI); Sa6 = "1111"; Sa5 = "1".	/	MPH-AI MPH-EI DLd ET6.2	-	PH-DI MPH-EI DLd ET6.2
AIS at LT from ET & FC4	Bit A = "0"; Sa6 = "1111"; Sa5 = "1".	/	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	MPH-EI 4 - (NOTE 4)	(NOTE 1)
Failure in digital link upstream	AIS	/	MPH-AI MPH-EI DLu ET6.1	MPH-EI DLu - NOTE 4	PH-DI MPH-EI DLu ET6.1

Table A.2: ET state table - Digital section failure conditions and user side (of T) problems

State	ET2.1	ET2.2	ET2.3	ET2.4	ET2.5	ET2.6	ET2.7
Corresponding G-state	G0, G2, G4, G5	G4	G4	G0	(NOTE 1)	(NOTE 1)	(NOTE 1)
Operational or failure condition as seen from the ET	FC1	FC3	FC3 & FC4	NT power off	operational NT dying gasp phase	FC4 & NT dying gasp phase	downstream & NT dying gasp phase
Signals transmitted towards V3 reference point	Normal Frame with RAI	Normal operational frames	Normal Frame with RAI	Normal Frame with RAI	Normal operational frames	Normal Frame with RAI	Normal operational frames

Event	Indication							
Loss of ET power	Loss of ET power	MPH-EI P ET0.1	MPH-EI P ET0.1	MPH-EI P ET0.1	MPH-EI P ET0.1	MPH-EI P ET0.	MPH-EI P ET0.1	MPH-EI P ET0.1
Return of ET power	Return of ET power	/	/	/	/	/	/	/
Normal operational frames	Bit A = "0"; Sa6 = "0000"; Sa5 = "1".	PH-AI MPH-AI ET1	MPH-AI ET1	PH-AI (NOTE 1)	PH-AI MPH-AI ET1	PH-AI MPH-AI ET1	MPH-AI ET1	NOTE 1
FC1	AUXP	-	MPH-EI 1 ET2.1	MPH-EI 1 ET2.1	-	MPH-EI 1 ET2.4	MPH-EI 1 ET2.4	MPH-EI 1 ET2.4
FC2	Bit A = "1" (RAI); Sa6 = "0000"; Sa5 = "1".	MPH-AI MPH-EI 2 ET4.1	MPH-AI MPH-EI 2 ET4.1	(NOTE 1)	MPH-AI MPH-EI 2 ET4.1	(NOTE 1)	(NOTE 1)	MPH-AI MPH-EI 2 ET4.1
FC3	Bit A = "1" (RAI); Sa6 = "1110"; Sa5 = "1".	MPH-AI MPH-EI 3 ET2.2	-	MPH-AI MPH-EI 3 ET2.2	MPH-AI MPH-EI 3 ET2.2	(NOTE 1)	(NOTE 1)	MPH-AI MPH-EI 3 ET2.2

(continued)

Table A.2: ET state table - Digital section failure conditions and user side (of T) problems (continued)

FC4	Bit A = "0"; Sa6 = "1100"; Sa5 = "1".	MPH-AI MPH-EI 4 ET4.2	(NOTE 1)	MPH-AI MPH-EI 4 ET4.2	MPH-AI MPH-EI 4 ET4.2	MPH-AI MPH-EI 4 ET4.2	MPH-AI MPH-EI 4 ET4.2	(NOTE 1)
NT power off	Bit A = "0"; Sa6 = "1000"; Sa5 = "1".	MPH-AI MPH-EI 0 ET2.6	(NOTE 1)	MPH-EI 0 - ET2.6	MPH-AI MPH-EI 0 ET2.6	-	-	MPH-EI 4 ET2.6
FC3 & FC4	Bit A = "0"; Sa6 = "1110"; Sa5 = "1".	MPH-AI MPH-EI 3 MPH-EI 4 ET2.3	MPH-EI 4 ET2.3	-	MPH-AI MPH-EI 3 MPH-EI 4 ET2.3	MPH-AI MPH-EI 3 MPH-EI 4 ET2.3	MPH-AI MPH-EI 3 MPH-EI 4 ET2.3	(NOTE 1)
NT power off & LOS/LFA at TE	Bit A = "1" (RAI); Sa6 = "1000"; Sa5 = "1".	MPH-AI MPH-EI 0 MPH-EI 5 ET2.7	MPH-EI 0 ET2.7	(NOTE 1)	MPH-AI MPH-EI 0 MPH-EI 5 ET2.7	MPH-EI 6 ET2.7	MPH-AI MPH-EI 0 MPH-EI 5 ET2.7	-
LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	MPH-EI L ET0.2	MPH-EI L ET0.2	MPH-EI L ET0.2	MPH-EI L ET0.2	MPH-EI L ET0.2	MPH-EI L ET0.2	MPH-EI L ET0.2
Loopback 1 request	MPH-L1AR	ET5.1	ET5.1	ET5.1	ET5.1	ET5.1	ET5.1	ET5.1
Loopback 2 request	MPH-L2AR	ET5.3	ET5.3	ET5.3	ET5.3	ET5.3	ET5.3	ET5.3
Loopback release request	MPH-DR							
Loopback indication	Sa5 = "02	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6
Loopback indication	Sa5 = "1"	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)	(NOTE 2)
ET internal failure	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3

(continued)

Table A.2: ET state table - Digital section failure conditions and user side (of T) problems (concluded)

ET failure recovered	ET failure recovered	/	/	/	/	/	/	/
AIS at LT from ET	Bit A = "1" (RAI); Sa6 = "1111"; Sa5 = "1".	MPH-AI MPH-EI DLd ET6.2	MPH-AI MPH-EI DLd ET6.2	(NOTE 1)	MPH-AI MPH-EI DLd ET6.2	(NOTE 1)	(NOTE 1)	MPH-AI MPH-EI DLd ET6.2
AIS at LT from ET & FC4	Bit A = "0"; Sa6 = "1111"; Sa5 = "1".	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	(NOTE 1)	MPH-AI MPH-DI DLd MPH-EI 4 ET6.3	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	(NOTE 1)
Failure in digital link upstream	AIS	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1

Table A.3: ET state table - User side (of T) problems

State	ET4.1	ET4.2
Corresponding G-state	G3	G5
Operational or failure condition as seen from the ET	FC2	FC4
Signals transmitted towards V3 reference point	Normal operational frames	Normal Frames with RAI

Event	Indication		
Loss of ET power	Loss of ET power	MPH-EI P ET0.1	MPH-EI P ET0.1
Return of ET power	Return of ET power	/	/
Normal operational frames	Bit A = "0"; Sa6 = "0000"; Sa5 = "1".	PH-AI MPH-AI ET1	PH-AI MPH-AI ET1
FC1	AUXP	MPH-EI 1 ET2.1	MPH-EI 1 ET2.1
FC2	Bit A = "1" (RAI); Sa6 = "0000"; Sa5 = "1".	=	MPH-AI MPH-EI 2 ET4.1
FC3	Bit A = "1" (RAI); Sa6 = "1110"; Sa5 = "1".	MPH-EI 3 ET2.2	(NOTE 1)
FC4	Bit A = "0"; Sa6 = "1100"; Sa5 = "1".	MPH-EI 4 ET4.2	-
NT power off	Bit A = "0"; Sa6 = "1000"; Sa5 = "1".	(NOTE 1)	MPH-EI 0 ET2.5
FC3 & FC4	Bit A = "0"; Sa6 = "1110"; Sa5 = "1".	(NOTE 1)	MPH-EI 3 ET2.3
NT power off & LOS/LFA at TE	Bit A = "1" (RAI); Sa6 = "1000"; Sa5 = "1";	MPH-EI 0 ET2.7	(NOTE 1)

(continued)

Table A.3: ET state table - User side (of T) problems (concluded)

LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	MPH-EI L ET0.2	MPH-EI L ET0.2
Loopback 1 request	MPH-L1AR	ET5.1	ET5.1
Loopback 2 request	MPH-L2AR	ET5.3	ET5.3
Loopback release request	MPH-DR		
Loopback indication	Sa5 = "0"	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6
Loopback indication	Sa5 = "1"	(NOTE 2)	(NOTE 2)
ET internal failure	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	ET failure recovered	/	/
AIS at LT from ET	Bit A = "1" (RAI); Sa6 = "1111"; Sa5 = "1".	MPH-EI DLd ET6.2	(NOTE 1)
AIS at LT from ET & FC4	Bit A = "0"; Sa6 = "1111"; Sa5 = "1".	(NOTE 1)	MPH-EI DLd ET6.3
Failure in digital link upstream	AIS	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1

Table A.4: ET state table - Loopbacks

State	ET5.1	ET5.2	ET5.3	ET5.4	ET5.5	ET5.6	
Corresponding G-state	f.s	f.s	f.s	f.s	f.s	f.s	
Operational or failure as seen from the ET	loopback 1 activation invoked	loopback activation	loopback 2 activation invoked	loopback 2 activation	Loopback release invoked	unintended loopback	
Signals transmitted towards V3 reference point	Norm Frame with RAI "Sa6="1111"	Norm Frame with RAI "Sa6="1111"	Norm Frame with RAI "Sa6="1010"	Norm Frame with RAI "Sa6="1010"	Norm Frame with RAI "Sa6="0000"	Norm Frame with RAI "Sa6="0000"	
Event	Indication						
Loss of ET power	Loss of ET power	MPH-EI P ET0.1	MPH-EI P ET0.1	MPH-EI P ET0.1	MPH-EI P ET0.1	MPH-EI P ET0.1	
Return of ET power	Return of ET power	/	/	/	/	/	
Normal operational frames	Bit A = "0"; Sa6 = "0000"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	
FC1	AUXP	MPH-EI 1 - (NOTE 4)	/	MPH-EI 1 - (NOTE 4)	MPH-EI 1 - (NOTE 4)	don't care	MPH-EI 1 ET2.1
FC2	Bit A = "1" (RAI); Sa6 = "0000"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	don't care
FC3	Bit A = "1" (RAI); Sa6 = "1110"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	don't care

(continued)

Table A.4: ET state table - Loopbacks (continued)

Bit A = "0" FC4	Sa6 = "1110" Sa5 = "1"	don't care	don't care	don't care	don't care	don't care	don't care
NT power off	Bit A = "0"; Sa6 = "1000"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	don't care
FC3 & FC4	Bit A = "0"; Sa6 = "1110"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	don't care
NT power off & LOS/LFA at TE	Bit A = "1" (RAI); Sa6 = "1000"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	don't care
LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	MPH-EI L - (NOTE 4)	MPH-EI L - (NOTE 4)	MPH-EI L - (NOTE 4)	MPH-EI L - (NOTE 4)	MPH-EI L - (NOTE 4)	MPH-EI L - ET0.2
Loopback 1 request	MPH-L1AR					ET5.1	-
Loopback 2 request	MPH-L2AR					ET5.3	-
Loopback release request	MPH-DR	ET5.5	ET5.5	ET5.5	ET5.5		-
Loopback indication	Sa5 = "0"	MPH-AI ET5.2	-	MPH-AI ET5.4	-	-	-
Loopback indication	Sa5 = "1"	-	MPH-EI LB1	-	MPH-EI LB1	ET0.2	ET0.2
ET internal failure	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	ET failure recovered	/	/	/	/	/	/

(continued)

Table A.4: ET state table - Loopbacks (concluded)

AIS at LT from ET	Bit A = "1" (RAI); Sa6 = "1111"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	don't care
AIS at LT from ET & FC4	Bit A = "0"; Sa6 = "1111"; Sa5 = "1".	don't care	don't care	don't care	don't care	don't care	don't care
Failure in digital link upstream	AIS	MPH-EI DLU - (NOTE 4)	MPH-EI DLU - (NOTE 4)	MPH-EI DLU - (NOTE 4)	MPH-EI DLU - (NOTE 4)	don't care	MPH-EI DLU - (NOTE 4)

Table A.5: ET state table - Additional digital link problems

State	ET6.1	ET6.2	ET6.3
Corresponding G-state			
Operational or failure condition as seen from the ET	DL failure upstream	DL failure downstream	DL failure downstream & FC4
Signals transmitted towards V3 reference point	Normal Frames with RAI	Normal operational frames	Normal Frames with RAI

Event	Indication			
Loss of ET power	Loss of ET power	MPH-EI P ET0.1	MPH-EI P ET0.1	MPH-EI P ET0.1
Return of ET power	Return of ET power	/	/	/
Normal operational frames	Bit A = "0"; Sa6 = "0000"; Sa5 = "1".	PH-AI MPH-AI ET1	PH-AI MPH-AI ET1	(NOTE 1)
FC1	AUXP	MPH-AI MPH-EI 1 ET2.1	MPH-EI 1 ET2.1	MPH-EI 1 ET2.1
FC2	Bit A = "1" (RAI); Sa6 = "0000"; Sa5 = "1".	MPH-AI MPH-EI 2 ET4.1	MPH-AI MPH-EI 2 ET4.1	(NOTE 1)
FC3 (NOTE 5)	Bit A = "1" (RAI); Sa6 = "1110"; Sa5 = "1".	MPH-AI MPH-EI 3 ET2.2	MPH-EI 3 ET2.2	(NOTE 1)
FC4	Bit A = "0"; Sa6 = "1100"; Sa5 = "1".	MPH-AI MPH-EI 4 ET4.2	(NOTE 1)	MPH-AI MPH-EI 4 ET4.2
NT power off	Bit A = "0"; Sa6 = "1000"; Sa5 = "1".	MPH-AI MPH-EI 0 ET2.6	(NOTE 1)	MPH-EI 0 ET2.6
FC3&FC4	Bit A = "0"; Sa6 = "1110"; Sa5 = "1".	MPH-AI MPH-EI 3 MPH-EI 4 ET2.3	(NOTE 1)	MPH-EI 3 ET2.3

(continued)

Table A.5: ET state table - Additional digital link problems (concluded)

NT power off & LOS/LFA at TE	Bit A = "1" (RAI); Sa6 = "1000"; Sa5 = "1".	MPH-AI MPH-EI 0 MPH-EI 5 ET2.7	MPH-EI 0 ET2.7	(NOTE 1)
LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	MPH-EI L ET0.2	MPH-EI L ET0.2	MPH-EI L ET0.2
Loopback 1 request	MPH-L1AR	ET5.1	ET5.1	ET5.1
Loopback 2 request	MPH-L2AR	ET5.3	ET5.3	ET5.3
Loopback release request	MPH-DR			
Loopback indication	Sa5 = "0"	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6	MPH-EILB2 ET5.6
Loopback indication	Sa5 = "1"	(NOTE 2)	(NOTE 2)	(NOTE 2)
ET internal failure	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	ET failure recovered	/	/	/
AIS at LT from ET	Bit A = "1" (RAI); Sa6 = "1111"; Sa5 = "1".	MPH-AI MPH-EI DLd ET6.2	-	MPH-AI MPH-EI DId ET6.2
AIS at LT from ET & FC4	Bit A = "0"; Sa6 = "1111"; Sa5 = "1".	MPH-AI MPH-EI 4 MPH-EI DLd ET6.3	MPH-EI 4 ET6.3	-
Failure in digital link upstream	AIS	-	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1

Annex B (normative): Combined ET and LT functions

When the ET and the LT functions are physically combined in one unit it may be unnecessary to code and decode function elements which are solely interchanged between the LT and the ET by using Sa6-bits. The function elements FE I (LOS at LT as a result of FC1) and FE N (Loopback 1 command) may, in this case, be represented by a static voltage on an individual control lead. The generator of the auxiliary pattern (AUXP) may not be required towards the ET. However, the repertoire for function elements of the access digital section and the ET shall not be changed.

Annex C (normative): Conformance testing

To be provided.

Annex D (informative): Bibliography

ETS 300 125 (1991): "Integrated Services Digital Network (ISDN); User-network interface data link layer specification, Application of CCITT Recommendations Q.920/I.440 and Q.921/I.441".

CCITT Recommendation G.114 (1988): "Mean one way propagation time".

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CCITT Recommendation G.921 (1988): "Digital sections based on the 2048 kbit/s hierarchy".

CCITT Recommendation I.350 (1988): "General aspects of quality of service and network performance in digital networks, including ISDN".

CCITT Recommendation Q.920 (1988): "ISDN user-network interfaces - Reference configurations".

CCITT Recommendation Q.921 (1988): "ISDN user-network interface, data link layer - General aspects".

CCITT Recommendation I.441 (1988): "Integrated Services Digital Network (ISDN) User-network interface, data link layer specification".

CCITT Recommendation O.162: "Equipment to perform in-service monitoring on 1544 kbit/s signals".

ITU-T Recommendation G.962 (1993): "Access digital section for ISDN primary rate access at 2 048 kbit/s".

Annex E (informative): NT1 functions with 2 048 kbit/s and Option 2

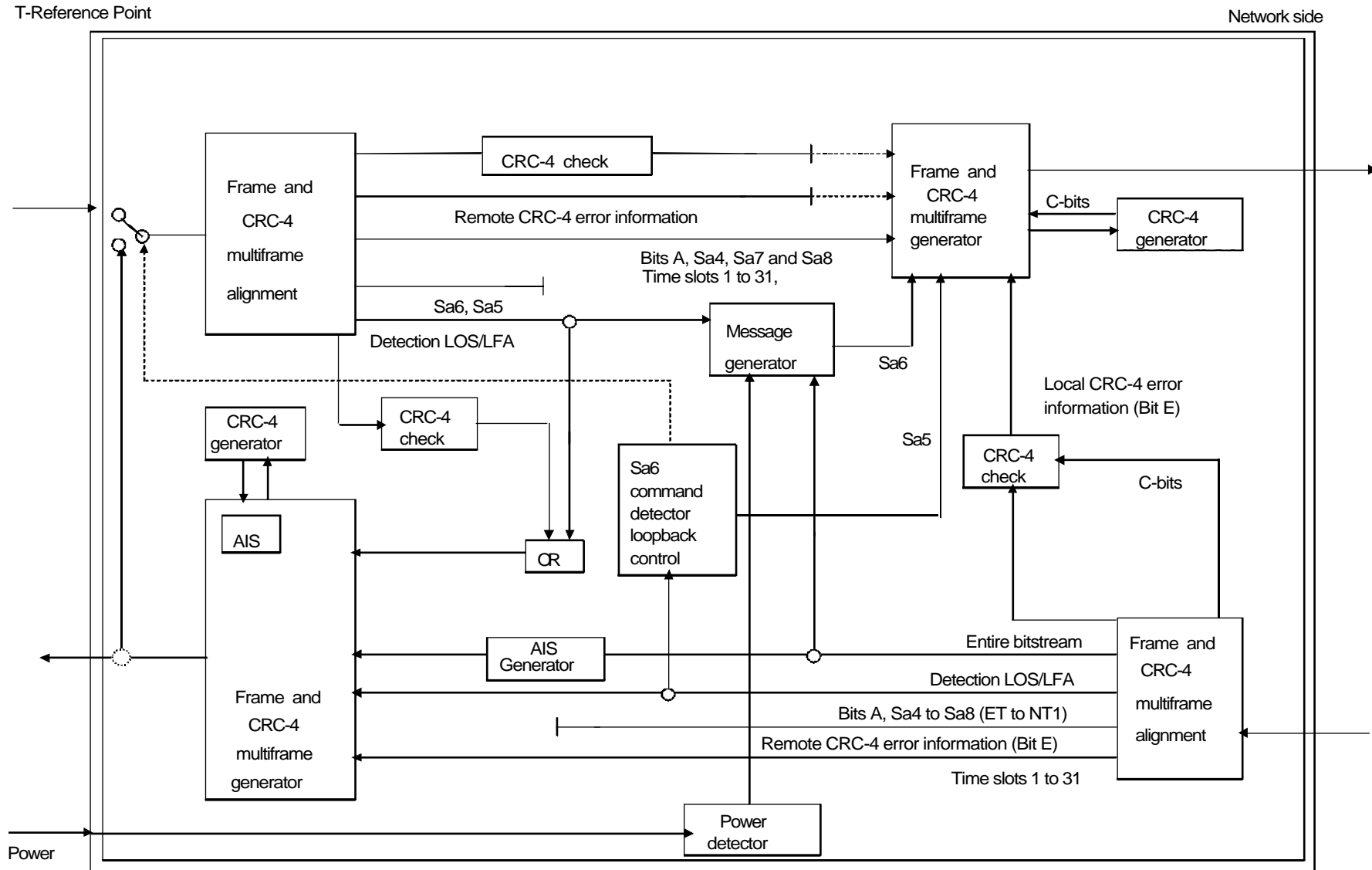


Figure E.1: Block diagram for NT1 functions with 2 048 kbit/s and Option 2

History

Document history	
May 1994	First Edition
March 1996	Converted into Adobe Acrobat Portable Document Format (PDF)