INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.962

(03/93)

DIGITAL SECTIONS AND DIGITAL LINE SYSTEMS

ACCESS DIGITAL SECTION FOR ISDN PRIMARY RATE AT 2048 kbit/s

ITU-T Recommendation G.962

(Previously “CCITT Recommendation”)

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation G.962 was prepared by the ITU-T Study Group XVIII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

© ITU 1993

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the ITU.

CONTENTS

			Page
1	General		1
	1.1	Scope	1
	1.2	Configuration	1
	1.3	Application	2
	1.4	Abbreviations	2
2	Modelling and relationship between the digital section and the ET		2
3	Functions		5
	3.1	B-channel	5
	3.2	H0-channel	6
	3.3	H1-channel	6
	3.4	D-channel	6
	3.5	Bit timing	6
	3.6	Octet timing	6
	3.7	Frame alignment	6
	3.8	CRC procedure	6
	3.9	M-channel	6
	3.10	Power feeding	6
	3.11	Operation and maintenance	6
4	Network performance		7
	4.1	Availability	7
	4.2	Signal transfer delay	7
	4.3	Error performance	7
	4.4	Jitter	7
5	Operation and maintenance		7
	5.1	General	7
	5.2	Control facilities	8
	5.3	Monitoring	8
6	Operation and maintenance procedures		11
	6.1	Partitioning of functions	11
	6.2	Definitions of signals at the T reference point	12
	6.3	Definition of DS state machine	12
	6.4	Definition of ET layer 1 state machine	12
Annex A – System management requirements			13
	A.1	Introduction	13
	A.2	System management requirements	14
Annex B – Allocation of signal codings and DS state transition tables for option 2 according to Recommendation I.604 at 2 Mbit/s			24
	B.1	Introduction	24
	B.2	DS state transition table	24
	B.3	Coding of signals at V3 reference point	44
	B.4	Allocation of signal elements to functional elements	44
	B.5	Indication of CRC-4 errors detected at the T reference point to the ET	46

Page

Annex C – Allocation of signal codings and DS state transition tables for option 3 according to Recommendation I.604 at 2 Mbit/s 46

C.1 Introduction 46

C.2 Signals at the V3 reference point 46

C.3 Definition of function elements (FEs) at the V3 reference point 48

C.4 FEs at the V3 reference point 48

C.5 Performance criteria 48

C.6 Access digital section (DS) state machine 49

ACCESS DIGITAL SECTION FOR ISDN PRIMARY RATE AT 2048 kbit/s

(Helsinki, 1993)

1 General

1.1 Scope

This Recommendation describes the characteristics of an access digital section for the ISDN primary rate access between the user network interface (at the T reference point, defined in Recommendation I.411) and the local exchange (at the V3 reference point, defined in Recommendation Q.512) supporting the primary rate interface structures defined in Recommendation I.412 and the required additional functions.

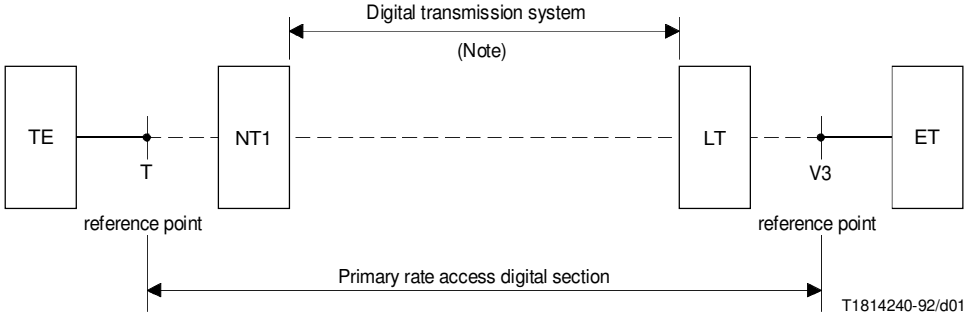
In this Recommendation and unless otherwise indicated, the term TE is used to indicate terminating layer 1 aspects of TE1, TA and NT2 functional groups.

When the term TE indicates terminating layer 1 aspects of TE1, then according to Figure 2/I.411, the S and T reference points coincide.

The terminology used in this Recommendation is contained in Recommendations I.112 and G.701.

1.2 Configuration

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



NOTE – Digital transmission system refers to either a line system using metallic media, optical fibres or radio systems.

FIGURE 1/G.962

Access digital section and transmission system boundaries

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.

NOTE – 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.

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 – The T and V reference points are defined in Recommendations I.411 and Q.512.

1.3 Application

The primary rate access digital section may be applied as given in Figure 2 for:

– direct access to the local exchange;

– remote access via a first order digital section or via higher order multiplex equipment forming a digital link to the local exchange.

NOTE – In this Recommendation, references to LT only concern the LT inside the access digital section.

1.4 Abbreviations

A number of abbreviations are used in this Recommendation, some of them are commonly used in the ISDN reference configuration while others are created only for this Recommendation. These are given in the following:

DS Access digital section

SIG Signals between LT and NT1

2 Modelling and relationship between the digital section and the ET

The general model shown in Figure 3 depicts the whole ISDN customer access layer 1 and adjacent entities and 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 Recommendation are not confined to functions performed by the access digital section but include functions associated with ET layer 1.

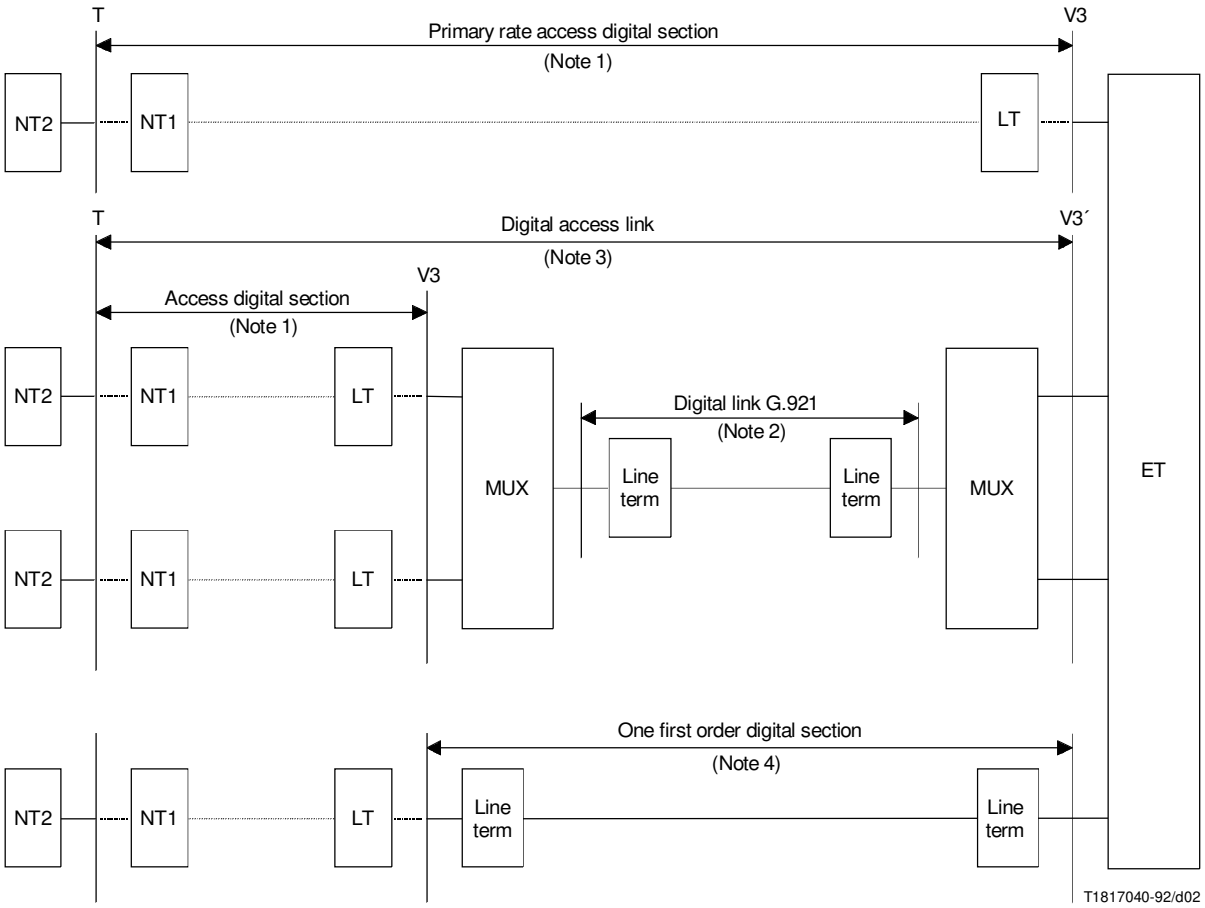
This model includes primitive procedures between ET layer 1, ET layer 2 and system management:

i) I.431 and Q.920/Q.921 interactions between ET layer 1 and ET layer 2 and system management based on PH and MPH primitives, respectively, as defined in Recommendation I.431. These interactions are for the support of functions specified in Recommendations Q.920/Q.921;

ii) 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 Recommendation I.431.

This model does not constrain layer 1 arrangements between LT and NT1, or the digital transmission system technology.



NOTES

1 The access digital sections may include one or more regenerators.

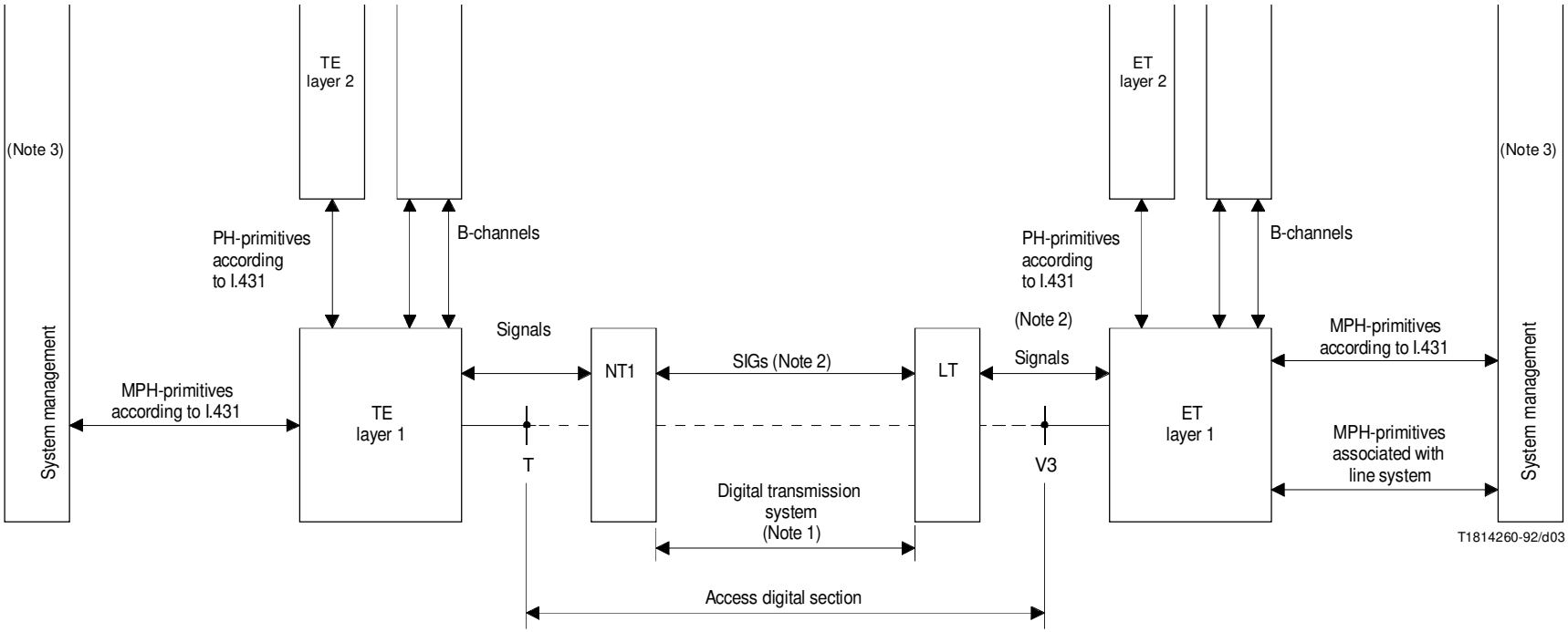
2 Multiple application of digital links and multiplexers may be possible, but see 4.4.2 “Jitter at the V3 reference point”.

3 In the case of remote accesses, the digital access link is terminated at the ET by a V3´ reference point which is functionally and electrically identical to the V3 reference point as in the case of the direct access.

4 The line terminations being part of the first order access digital section or the digital link are outside the scope of this Recommendation.

FIGURE 2/G.962

Examples of equipment configurations in the ISDN subscriber primary rate access



NOTES

1 The digital transmission system refers to either a digital line transmission system using metallic wires, optical fibre or radio system.

2 SIG, 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.

3 The term system management corresponds to both system management and layer management as defined in Recommendation Q.940.

FIGURE 3/G.962

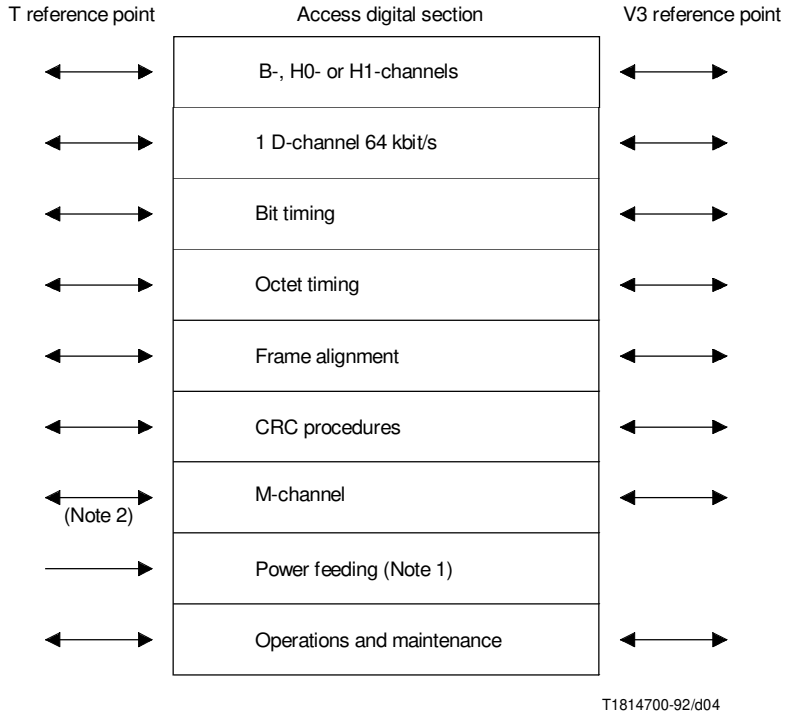
General model of ISDN customer access layer 1 and adjacent entities

3 Functions

For each direction of transmission the following 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 following 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, and maintenance.

Figure 4 shows the functions which have to be supported by the primary rate access digital section.



NOTES

1 This power-feed-function is optional and is dependent on the transmission medium used. Only the NT1 may be powered from the interface at the T reference point. (See Recommendation I.431.)

2 The M-channel is not available at the T reference point in option 3 implementations as described in Recommendation I.604.

FIGURE 4/G.962

Functions supported in the access digital section

3.1 B-channel

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

3.2 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 Recommendation I.412.

3.3 H1-channel

This function provides for the bi-directional transmission of one H1-channel having a bit rate of 1920 kbit/s as defined in Recommendation I.412.

3.4 D-channel

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

3.5 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.

3.6 Octet timing

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

3.7 Frame alignment

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

3.8 CRC procedure

This function provides for the protection against false framing and for error performance monitoring of the access digital section. This includes the multiframe procedure defined in Recommendation G.704.

3.9 M-channel

For option 2 implementations, 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 the Sa bit 4 of timeslot 0 of the non-frame alignment signal in accordance with Recommendation G.704.

For option 3 implementations, this function provides a bi-directional 4 kbit/s channel for the operational and management requirements for the access digital section. It shall be transported in the Sa4 bit of timeslot 0, of the non-frame alignment signal in accordance with Recommendation G.704.

3.10 Power feeding

This optional function provides for remote feeding of the NT1 via the user network interface in accordance with Recommendation I.431.

3.11 Operation and maintenance

This function supports required actions and information for operating and maintaining the access digital section controlled by the ET as defined in Recommendation I.604.

The following categories of function have been identified:

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

4 Network performance

4.1 Availability

The definition of availability is given in Annex A/G.821. The availability objective of the access digital section should be consistent with the availability requirement for the hypothetical reference digital section as given in Recommendations G.801 and I.350.

4.2 Signal transfer delay

Signal transfer delay is specified for B- and D-channels and is defined as absolute signal delay between T and V3 reference points for each direction of transmission. The value shall be less than 2 ms when a system for metallic wires, optical fibre or radio system is used. The application of a satellite system in the access digital section is also possible. However, for speech services, Recommendation G.114 may limit such an application until appropriate methods to control double satellite hops and switching of echo control devices are available. These methods are outside the scope of this Recommendation.

In the case of remote application of the access digital section (see Figure 2 with a digital link between the access digital section and the ET) the signal transfer delay is defined for the access digital section between T and V3 reference points.

The relevant Recommendations have to be taken into account (e.g. signal transmission delay when the signal represents speech must be taken into account as one component of the end-to-end delay requirement of Recommendation G.114).

4.3 Error performance

Error performance must be consistent with the requirements given in Recommendation G.821, local grade.

4.4 Jitter

4.4.1 Output/input jitter at T reference point

The requirements are defined in 5.4/I.431.

4.4.2 Jitter at the V3 reference point

The input jitter limits are described in Recommendation G.823.

NOTE – If models described in Figure 2 are used to connect a customer to the ET, a jitter reducer is not required at V3.

5 Operation and maintenance

5.1 General

This subclause describes the operation and maintenance functions for the access digital section of the ISDN primary rate access.

Further assumptions regarding the system management are given in Annex A.

The maintenance functions recommended in I.604 provide the capability to maintain the access digital section to the level of network performance given in 4. It also describes optional implementations depending on the elements of the access digital section that have CRC procedures.

Option 3 has CRC procedures implemented between each element of the access digital section, whereas option 2 has CRC procedures implemented between the ET and NT1 and the NT1 and TE.

It must be possible to test and maintain the access digital section in accordance with Recommendation I.604 regardless of the subscriber installation.

The main features are:

a) control of maintenance and test support facilities;

b) monitoring of the functional elements to provide operating and performance information and fault condition indications;

c) maintenance communication facility.

Due to the different options described in Recommendation I.604, the allocation of the functions and signals to protocol and bit coding at interface V3 cannot be specified in a unique way. Options and bit rate specific definition of the codings are described in individual annexes.

5.2 Control facilities

5.2.1 Loopbacks

5.2.1.1 Loopback implementation

The location and characteristics of loopbacks are defined in Recommendation I.604. They are:

i) loopback 1 – a complete, transparent loopback located in the LT;

ii) loopback 2 – a complete, transparent loopback located in the NT1.

5.2.1.2 Loopback procedure

Loopbacks 1 and 2 shall be controlled by the ET.

A normal call set-up request cannot 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 (as described in Annex B) of the loop command shall be detected before action is to be taken. Conversely, when the receipt of 8 consecutive signals with no loopback command have been detected, the loopback shall be released.

5.3 Monitoring

5.3.1 Functions

The following operational conditions are monitored throughout the access digital section:

a) the defect conditions;

b) loss of power in the NT1;

c) transmission performance.

5.3.2 Implementation aspects

Monitoring capabilities must be provided in the access digital section (see Recommendation I.604). The handling and processing of the information is implementation-dependent.

In option 2 implementations, information is transferred to the exchange, either when a defect condition occurs or on a regular basis. This information is then processed by entities outside the access digital section.

In option 3 implementations, registers/counters are used in the functional groups, and explicit commands and responses to establish status reports.

5.3.3 Anomaly and defect conditions and consequent action

5.3.3.1 Detection of defect conditions

The functional requirements for the maintenance of the access digital section is based on the provision of functions in the ET and TE as defined in the G and F state tables of Recommendation I.431.

The access digital section shall support the means (see Recommendations G.704 and G.706) by which indications from the ET or the TE can be transmitted across the access digital section. The means to transmit indications of detected defect conditions at the interface at the T reference point shall be as described in Recommendation I.431.

Anomalies and defects detected by the access digital section shall be transmitted to the ET or the TE as appropriate.

5.3.3.2 Detection of defect indication signals

The following defect indications shall be detected by either:

a) within the access digital section:

- loss of incoming signal, loss of frame alignment or optionally excessive errors at the line side of NT1;
- loss of incoming signal or optionally loss of frame alignment or excessive errors at the line side of LT;
- loss of power at NT1 (if relevant);
- AIS at line side of NT1.

b) at the interface at the T reference point:

- loss of incoming signal or loss of frame alignment;
- excessive CRC errors (optional);
- loss of power (if relevant).

c) at the interface at the V3 reference point:

- loss of incoming signal or optionally loss of frame alignment or excessive errors;
- AIS (optional).

5.3.3.3 Definition of defect indication signals

The following signals are necessary in addition to the signals defined in 3.4.1/I.431 to indicate defects in respect to the access digital section:

normal frames (NF): These are frames without defect indication 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 Sa bits defect indication signals generated in the NT1 and transmitted towards the ET or loopback request towards the access digital section.

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 (FC4) is indicated towards the ET by means of Sa bits 6. The A-bit is set to ZERO.

5.3.3.4 Definition of detection algorithm

The detection algorithms of the signals are described as follows:

normal operational frames (NOF): The algorithm shall be in accordance with 4.1.2 and 4.2/G.706.

loss of frame alignment (LFA): The algorithm shall be in accordance with 4.1.1/G.706.

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 time duration of at least 1 ms, more than 20 dB below the nominal output amplitude defined in Recommendation G.703 for this interface. This event shall also cause "loss of frame alignment".

NOTE – Loss of signal at the line side of the NT1 and LT is implementation-dependent and therefore not a subject of this Recommendation.

alarm indication signal (AIS): An alarm indication signal is detected when both of the two following conditions occur:

- loss of frame alignment; and
- reception of 512 bit periods containing less than 3 binary ZEROs.

5.3.3.5 Consequent actions

The DS state tables as described in the annexes to this Recommendation give the actions that the access digital section has to take after defect detection or defect indication detection.

A defect indication is automatically transmitted from the access digital section to the ET or the TE when either:

- a defect condition that has been detected; or
- a defect condition has disappeared; or
- a defect indication that has been detected; or
- a defect indication has disappeared.

The defect indication (after any internal processing) to the ET or to the TE shall be sent or removed with a maximum delay of 10 ms. This shall not be interpreted as a guard time, therefore even the detection of a single event shall be reported.

5.3.4 Error performance monitoring

5.3.4.1 General

Provision has to be made in order to monitor the error performance of the access digital section and to report on such performance. (Not for option 1 according to Recommendation I.604.)

5.3.4.2 Error performance parameters

The access digital section must deliver to the ET the necessary information to allow it to evaluate the error performance parameters defined in Recommendation G.821. In option 3 implementations (Annex C), the evaluation of error performance parameters as defined in Recommendation G.821 is performed within the access digital section.

5.3.5 Status report functions

Status report functions cover information which relate to the overall operation and performance of the access digital section. The information may be transmitted either automatically or under request or ET.

Listed below are descriptions of the status report functions:

i) Transmission errors

This information, derived in the access digital section, allows the ET to evaluate the transmission error performance or in the case of Annex C, the evaluated error performance is automatically transmitted to the ET.

ii) Loopback 1 status

This information, sent from the LT, gives the status of loopback 1.

iii) Loopback 2 status

This information, sent from the NT1, gives the status of loopback 2.

iv) User network interface power feed status

This information indicates the status of the power feed at the user network interface at the T reference point (not option 2 according to Recommendation I.604).

v) User network power feed fault

This information indicates a failure of the normal power source (not option 3 according to Recommendation I.604).

vi) Defect indication information

This information is transmitted automatically under conditions specified in 5.3.3.1.

6 Operation and maintenance procedures

6.1 Partitioning of functions

Recommendation I.431 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, called the G state machine in Recommendation I.431.

In order to describe the relationship between signals across the user-network interface at reference point T, which are indicated as signals (SIGs) in Figure 3 and defined in Recommendation I.431, and signals across reference point V3, which are also indicated as signals in Figure 3 and defined in Annexes B and C of this Recommendation. To show the relationship between signals and primitives, two state machines are defined. One in the access digital section (DS state machine), and one at the network side of the V3 reference point (ET layer 1 state machine). Figure 5 illustrates this approach.

In addition to primitives defined in Recommendations I.431 and I.440 related to 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 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, however the functional behaviour shall be as defined in the ET state tables (see Table 2). This is required to interwork with the access digital section state machine defined in the Recommendation and to satisfy the requirements specified in the G state table in Recommendation I.431.

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

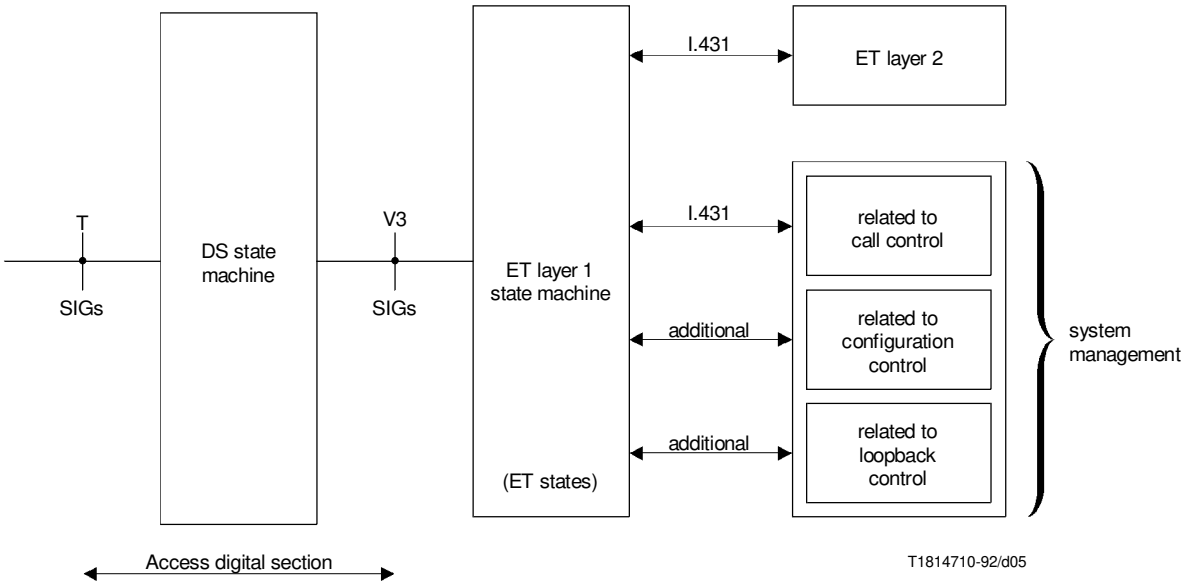


FIGURE 5/G.962

State machines

The NT1 state machine supports user-network interface procedures in accordance with Recommendation I.431 based on signals, and interacts with the LT state machine by means of a signal repertoire (SIGs) which has to be supported by the line transmission system. The LT state machine interacts with the ET layer 1 state machine by means of a set of signals. 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 access digital section. It supports the already specified primitive procedures to provide services to ET layer 2 and system management in accordance with Recommendation I.431, and additional primitive procedures for the support of functions associated with the access digital section.

Figure 6 provides information for the description of the transmission system which is outside the scope of this Recommendation.

6.2 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 Table 1/I.431.

6.3 Definition of DS state machine

The definitions of the DS layer 1 state machines are described in Annex B for option 2 implementations and Annex C for option 3 implementations.

6.4 Definition of ET layer 1 state machine

The definition of the ET layer 1 state machine is outside the scope of this Recommendation, but because it is important for the understanding of the behaviour of the access digital section, information on this issue is given in A.2.7.

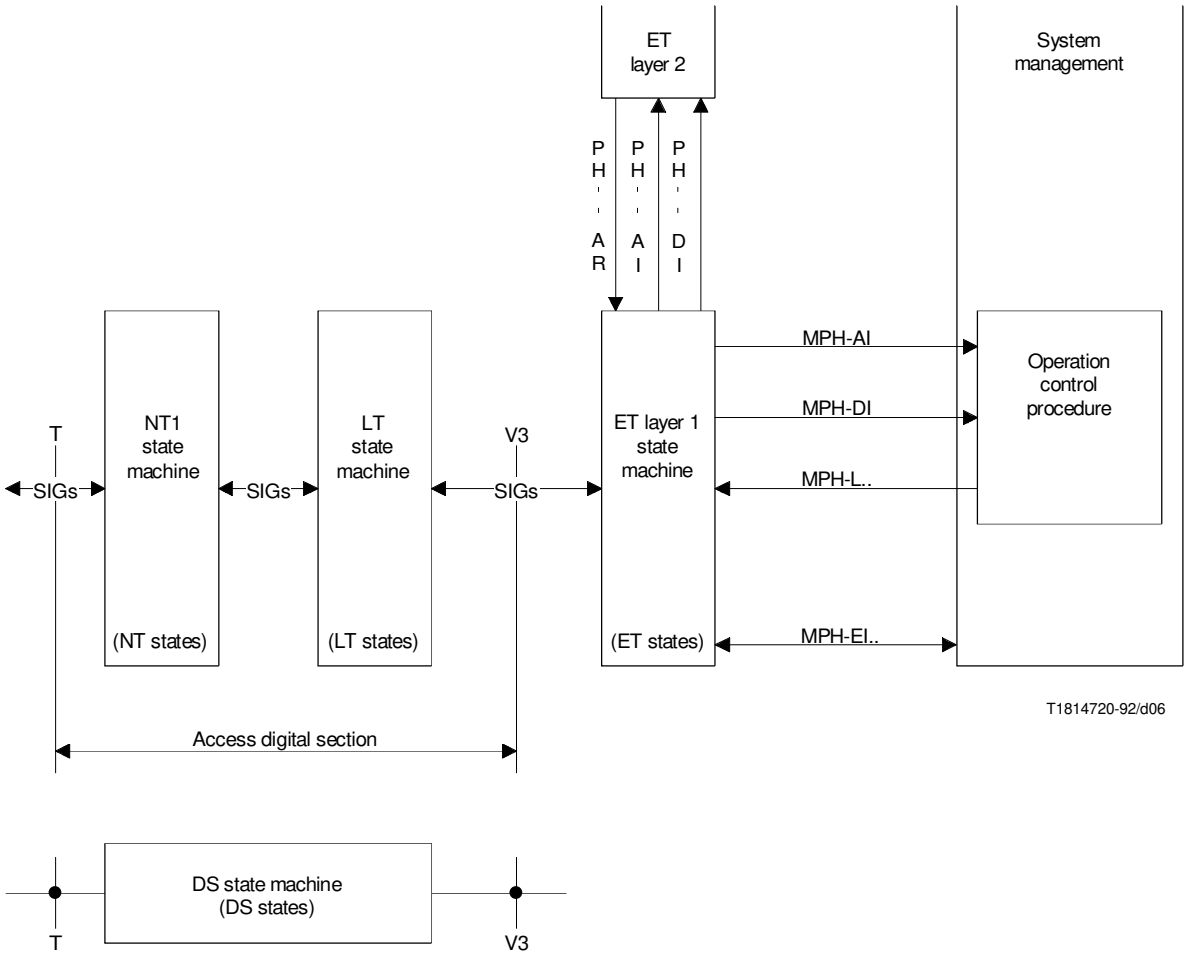


FIGURE 6/G.962

Partitioning of DS state machine

Annex A

(to Recommendation G.962)

System management requirements

(This annex forms an integral part of this Recommendation)

A.1 Introduction

This annex provides further information required for the interaction of the access digital section and the ET layer 1. In order to ensure correct operation, it is necessary to take into account the assumptions made about the management functions involved in the ET. It is assumed that the structure of the management is as given in Recommendation Q.940.

In this Recommendation, 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 Recommendation Q.940.

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 system management and the corresponding primitive which confirms completion of the task.

A.2.2 Error indications

The management entity takes account of the sequence of primitives before and after the reception of MPH-EI. From the sequence of the primitives, the system management may determine the cause of the MPH-EI primitive (e.g. loss of synchronization 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 the primitive MPH-EI. The system management must decide which appropriate actions should be taken (e.g. hold or abandon call).

A.2.3 Loopback operations

The system management should 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 will be ignored by ET layer 1.

The setting of loopback is initiated by the system management by issuing a primitive MPH-Lx AR whereby x indicates the type of loopback 2 or 1.

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

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 HDLC pattern. However, it is the responsibility of the system management to decide to send the required pattern for fault localization.

A.2.5 Configuration control

The system management shall ensure that any action related to configuration control will be issued only while the access is not active with user traffic.

A.2.6 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 Recommendation I.604, and
- excessive CRC errors as described in Table 8/I.431 and 5.9.3.3.3/I.431.

A.2.7 Definition of ET layer 1 state machine

A.2.7.1 ET layer 1 states

Hereafter are defined the states that the ET layer 1 may enter as a result of: signals received across reference point V3, service primitives received (PH-, MPH-primitives), or internal events.

These states are shown in the ET layer 1 state transition tables described in A.2.8.

A.2.8 ET layer 1 state transition table

The state transition table, Table A.1, specifies the procedures. It includes the action to be taken on various events whilst in a specific state. It specifies the interactions with ET layer 2 and system management which are required to support the layer interface procedures in accordance with Recommendation I.431 (sequences of PH- and MPH-primitives in compliance with I.431) and the interactions across the layer interface between ET layer 1 and system management for the support of functions associated with the access digital section.

The following signs and defect indicating primitives are used in the ET state table:

–	No state change.
/	Impossible event due to internal reasons.
|	Impossible situation by the definition of the layer 1 service.
MPH-EI 0	Error indication for loss of power at NT1.
MPH-EI 1 to 4	Error indication for failure conditions FC1 to FC4, as defined in Figure A.1.
MPH-EI 5	Error indication for failure condition “FC DLd” or “FC3” or “FC2”.
MPH-EI P	Error indication “power off at ET”.
MPH-EI DLd	Error indication “failure between V3 and V3′ reference point” downstream (see Figure 2).
MPH-EI DLu	Error indication “failure between V3 and V3′ reference point” upstream (see Figure 2).
MPH-EI L	Error indication “failure at V3 reference point from LT to ET”.
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 loopback.
MPH-EI ES1	Errored seconds in the ET to LT section.
MPH-EI ES2	Errored seconds in the LT to NT1 section.
MPH-EI ES3	Errored seconds in the NT1 to LT section.
MPH-EI ES4	Errored seconds in the NT2 to NT1 section.
MPH-EI DM1	Degraded minutes due to errors in the ET to LT section.
MPH-E1 DM2	Degraded minutes due to errors in the LT to NT1 section.
MPH-EI DM3	Degraded minutes due to errors in the NT1 to LT section.
MPH-EI DM4	Degraded minutes due to errors in the NT2 to NT1 section.

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

ET0.X ET problems.

ET1 Operational.

ET2.X DS problems, including V3 and possibly concurrent user side (of T) problems.

ET3.X Not used in this Recommendation.

ET4.X User side (of T) problems.

ET5.X Loopbacks.

ET6.X Problems in the digital link between reference points V3 and V3′.

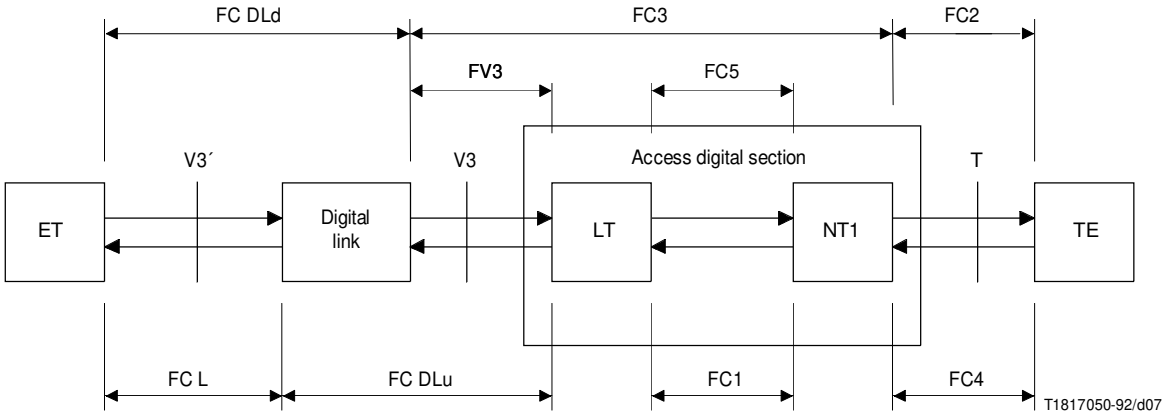


FIGURE A.1/G.962

Applicability of failure conditions to locations

TABLE A.1/G.962

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	Power off at ET	Power on at ET or LOS/LFA	Internal (Note 7)	Operational
Signals transmitted towards V3 reference point	No signal	Normal frames with RAI	AIS	Normal operational frames

Event	Indication option 3 (Note 8)	Indication option 2				
Loss of ET power	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	Return of ET power	ET0.2	/	/	/
Normal operational frames	Bit A = “0” Sa5 = “0”	Bit A = “0” Sa6 = “0000” Sa5 = “1”	/	PH-AI MPH-AI ET1	/	– (Note 6)
FC1	SES (2)	AUXP	/	MPH-AI MPH-EI 1 ET2.1	MPH-EI 1 – (Note 4)	PH-DI MPH-EI 1 ET2.1
FC2	Bit A = “1” (RAI) Sa5 = “0”	Bit A = “1” (RAI) Sa6 = “0000” Sa5 = “1”	/	MPH-AI MPH-EI 2 ET4.1	/	PH-DI MPH-EI 2 ET4.1
FC3 (Note 5)	Bit A = “1” (RAI) SES (3) Sa5 = “0”	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” SES (4) Sa5 = “0”	Bit A = “0” Sa6 = “1100” Sa5 = “1”	/	MPH-AI MPH-EI 4 ET4.2	/	PH-DI MPH-EI 4 ET4.2
NT power off	Not applicable	Bit A = “0” 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” SES (3) SES (4) Sa5 = “0”	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	Not applicable	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)	Loss of signal (LOS) Loss of frame alignment (LFA)	/	–	MPH-EI L – (Note 4)	PH-DI MPH-EI L ET0.2
Loopback 1 request	Not applicable	MPH-L1 AR	/	ET5.1	|	PH-DI ET5.1
Loopback 2 request	Not applicable	MPH-L2 AR	/	ET5.3	|	PH-DI ET5.3
Loopback release request	Not applicable	MPH-DR	/	|	|	|
Loopback indication	Not applicable	Sa5 = “0”	/	MPH-EI LB2 ET5.6	MPH-EI LB2 (Note 4)	MPH-EI LB2 ET5.6
Loopback indication	Not applicable	Sa5 = “1”	/	(Note 2)	(Note 2)	(Note 2)
ET internal failure	Not applicable	ET failure	/	MPH-AI MPH-EI ET ET0.3	–	PH-DI MPH-EI ET ET0.3
ET failure recovered	Not applicable	ET failure recovered	/	/	ET0.2	/
LOS or AIS at LT from ET	Bit A = “1” (RAI) SES (1) Sa5 = “0”	Bit A = “1” (RAI) Sa6 = “1111” Sa5 = “1”	/	MPH-AI MPH-EI DLd ET6.2	–	PH-DI MPH-EI DLd ET6.2
LOS or AIS at LT from ET & FC4	Bit A = “0” SES (1) SES (4) Sa5 = “0”	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	AIS	/	MPH-AI MPH-EI DLu ET6.1	MPH-EI DLu – (Note 4)	PH-DI MPH-EI DLu ET6.1

TABLE A.1/G.962 *(continued)*

ET state table – Digital section failure conditions and user side (of T) problems

State	ET2.5	ET2.6	ET2.7
Corresponding G-state	(Note 7)	(Note 7)	(Note 7)
Operational or failure condition as seen from the ET	Operational NT dying gasp phase	FC4 & NT dying gasp phase	Downstream & NT dying gasp phase
Signals transmitted towards V3 reference point	Normal operational frames	Normal frames with RAI	Normal operational frames

Event	Indication option 3	Indication option 2			
Loss of ET power	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	Return of ET power	/	/	/
Normal operational frames	Bit A = "0" Sa5 = "0"	Bit A = "0" Sa6 = "0000" Sa5 = "1"	PH-AI MPH-AI ET1	PH-AI MPH-AI ET1	(Note 1)
FC1	SES (2)	AUXP	MPH-EI 1 ET2.4	MPH-EI 1 ET2.4	MPH-EI 1 ET2.4
FC2	Bit A = "1" (RAI) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "0000" Sa5 = "1"	(Note 1)	(Note 1)	MPH-AI MPH-EI 2 ET4.1
FC3 (Note 5)	Bit A = "1" (RAI) SES (3) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1110" Sa5 = "1"	(Note 1)	(Note 1)	MPH-AI MPH-EI 3 ET2.2
FC4	Bit A = "0" SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1100" Sa5 = "1"	MPH-AI MPH-EI 4 ET4.2	MPH-AI MPH-EI 4 ET4.2	(Note 1)
NT power off	Not applicable	Bit A = "0" Sa6 = "1000" Sa5 = "1"	–	–	MPH-EI 4 ET2.6
FC3 & FC4	Bit A = "0" SES (3) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1110" Sa5 = "1"	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	Not applicable	Bit A = "1" (RAI) Sa6 = "1000" Sa5 = "1"	MPH-EI 5 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)	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	Not applicable	MPH-L1 AR	ET5.1	ET5.1	ET5.1
Loopback 2 request	Not applicable	MPH-L2 AR	ET5.3	ET5.3	ET5.3
Loopback release request	Not applicable	MPH-DR	|	|	|
Loopback indication	Not applicable	Sa5 = "0"	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6
Loopback indication	Not applicable	Sa5 = "1"	(Note 2)	(Note 2)	(Note 2)
ET internal failure	Not applicable	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	Not applicable	ET failure recovered	/	/	/
LOS or AIS at LT from ET	Bit A = "1" (RAI) SES (1) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1111" Sa5 = "1"	(Note 1)	(Note 1)	MPH-AI MPH-EI DLd ET6.2
LOS or AIS at LT from ET & FC4	Bit A = "0" SES (1) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1111" Sa5 = "1"	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	AIS	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1

TABLE A.1/G.962 *(continued)*

ET state table – Digital section failure conditions and user side (of T) problems

State	ET2.1	ET2.2	ET2.3	ET2.4
Corresponding G-state	G0, G2, G4, G5	G4	G4	G0
Operational or failure condition as seen from the ET	FC1	FC3	FC3 & FC4	NT power off
Signals transmitted towards V3 reference point	Normal frames with RAI	Normal operational frames	Normal frames with RAI	Normal frames with RAI

Event	Indication option 3	Indication option 2				
Loss of ET power	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
Return of ET power	Return of ET power	Return of ET power	/	/	/	/
Normal operational frames	Bit A = "0" Sa5 = "0"	Bit A = "0" Sa6 = "0000" Sa5 = "1"	PH-AI MPH-AI ET1	PH-AI MPH-AI ET1	(Note 1)	PH-AI MPH-AI ET1
FC1	SES (2)	AUXP	–	MPH-EI 1 ET2.1	MPH-EI 1 ET2.1	–
FC2	Bit A = "1" (RAI) Sa5 = "0"	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
FC3 (Note 5)	Bit A = "1" (RAI) SES (3) Sa5 = "0"	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
FC4	Bit A = "0" SES (4) Sa5 = "0"	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
NT power off	Not applicable	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
FC3 & FC4	Bit A = "0" SES (3) SES (4) Sa5 = "0"	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
NT power off & LOS/LFA at TE	Not applicable	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
LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	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
Loopback 1 request	Not applicable	MPH-L1 AR	ET5.1	ET5.1	ET5.1	ET5.1
Loopback 2 request	Not applicable	MPH-L2 AR	ET5.3	ET5.3	ET5.3	ET5.3
Loopback release request	Not applicable	MPH-DR	|	|	|	|
Loopback indication	Not applicable	Sa5 = "0"	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6
Loopback indication	Not applicable	Sa5 = "1"	(Note 2)	(Note 2)	(Note 2)	(Note 2)
ET internal failure	Not applicable	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	Not applicable	ET failure recovered	/	/	/	/
LOS or AIS at LT from ET	Bit A = "1" (RAI) SES (1) Sa5 = "0"	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
LOS or AIS at LT from ET & FC4	Bit A = "0" SES (1) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1111" Sa5 = "1"	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	(Note 1)	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3
Failure in digital link upstream	AIS	AIS	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1

TABLE A.1/G.962 *(continued)*

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 option 3	Indication option 2		
Loss of ET power	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	Return of ET power	/	/
Normal operational frames	Bit A = "0" Sa5 = "0"	Bit A = "0" Sa6 = "0000" Sa5 = "1"	PH-AI MPH-AI ET1	PH-AI MPH-AI ET1
FC1	SES (2)	AUXP	MPH-EI 1 ET2.1	MPH-EI 1 ET2.1
FC2	Bit A = "1" (RAI) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "0000" Sa5 = "1"	–	MPH-AI MPH-EI 2 ET4.1
FC3 (Note 5)	Bit A = "1" (RAI) SES (3) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1110" Sa5 = "1"	MPH-EI 3 ET2.2	(Note 1)
FC4	Bit A = "0" SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1100" Sa5 = "1"	MPH-EI 4 ET4.2	–
NT power off	Not applicable	Bit A = "0" Sa6 = "1000" Sa5 = "1"	(Note 1)	MPH-EI 0 ET2.6
FC3 & FC4	Bit A = "0" SES (3) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1110" Sa5 = "1"	(Note 1)	MPH-EI 3 ET2.3
NT power off & LOS/LFA at TE	Not applicable	Bit A = "1" (RAI) Sa6 = "1000" Sa5 = "1"	MPH-EI 0 ET2.7	(Note 1)
LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	Loss of signal (LOS) Loss of frame alignment (LFA)	MPH-EI L ET0.2	MPH-EI L ET0.2
Loopback 1 request	Not applicable	MPH-L1 AR	ET5.1	ET5.1
Loopback 2 request	Not applicable	MPH-L2 AR	ET5.3	ET5.3
Loopback release request	Not applicable	MPH-DR	|	|
Loopback indication	Not applicable	Sa5 = "0"	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6
Loopback indication	Not applicable	Sa5 = "1"	(Note 2)	(Note 2)
ET internal failure	Not applicable	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	Not applicable	ET failure recovered	/	/
LOS or AIS at LT from ET	Bit A = "1" (RAI) SES (1) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1111" Sa5 = "1"	MPH-EI DLd ET6.2	(Note 1)
LOS or AIS at LT from ET & FC4	Bit A = "0" SES (1) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1111" Sa5 = "1"	(Note 1)	MPH-EI DLd ET6.3
Failure in digital link upstream	AIS	AIS	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1

TABLE A.1/G.962 *(continued)*

ET state table – Loopbacks

State	ET5.1	ET5.2	ET5.3	ET5.4
Corresponding G-state	F.s. (Note 7)	F.s. (Note 7)	F.s. (Note 7)	F.s. (Note 7)
Operational or failure condition as seen from the ET	Loopback 1 activation invoked	Loopback 1 activation	Loopback 2 activation invoked	Loopback 2 activation
Signals transmitted towards V3 reference point	Normal frame with RAI Sa6 = "1111"	Normal frame with RAI Sa6 = "1111"	Normal frame with RAI Sa6 = "1010"	Normal frame with RAI Sa6 = "1010"

Event	Indication option 3	Indication option 2				
Loss of ET power	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
Return of ET power	Return of ET power	Return of ET power	/	/	/	/
Normal operational frames	Bit A = "0" Sa5 = "0"	Bit A = "0" Sa6 = "0000" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
FC1	SES (2)	AUXP	MPH-EI 1 – (Note 4)	/	MPH-EI 1 – (Note 4)	MPH-EI 1 – (Note 4)
FC2	Bit A = "1" (RAI) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "0000" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
FC3 (Note 5)	Bit A = "1" (RAI) SES (3) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1110" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
FC4	Bit A = "0" SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1100" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
NT power off	Not applicable	Bit A = "0" Sa6 = "1000" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
FC3 & FC4	Bit A = "0" SES (3) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1110" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
NT power off & LOS/LFA at TE	Not applicable	Bit A = "1" (RAI) Sa6 = "1000" Sa5 = "1"	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)	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)
Loopback 1 request	Not applicable	MPH-L1 AR	|	|	|	|
Loopback 2 request	Not applicable	MPH-L2 AR	|	|	|	|
Loopback release request	Not applicable	MPH-DR	ET5.5	ET5.5	ET5.5	ET5.5
Loopback indication	Not applicable	Sa5 = "0"	MPH-AI ET5.2	–	MPH-AI ET5.4	–
Loopback indication	Not applicable	Sa5 = "1"	–	MPH-EI LB1	–	MPH-EI LB1
ET internal failure	Not applicable	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	Not applicable	ET failure recovered	/	/	/	/
LOS or AIS at LT from ET	Bit A = "1" (RAI) SES (1) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1111" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
LOS or AIS at LT from ET & FC4	Bit A = "0" SES (1) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1111" Sa5 = "1"	Don't care	Don't care	Don't care	Don't care
Failure in digital link upstream	AIS	AIS	MPH-EI DLu – (Note 4)	MPH-EI DLu – (Note 4)	MPH-EI DLu – (Note 4)	MPH-EI DLu – (Note 4)

TABLE A.1/G.962 *(continued)*

ET state table – Loopbacks

State	ET5.5	ET5.6
Corresponding G-state	F.s (Note 7)	F.s (Note 7)
Operational or failure condition as seen from the ET	Loopback release invoked	Unintended loopback
Signals transmitted towards V3 reference point	Normal frames with RAI Sa6 = "0000"	Normal frames with RAI Sa6 = "0000"

Event	Indication option 3	Indication option 2		
Loss of ET power	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	Return of ET power	/	/
Normal operational frames	Bit A = "0" Sa5 = "0"	Bit A = "0" Sa6 = "0000" Sa5 = "1"	Don't care	Don't care
FC1	SES (2)	AUXP	Don't care	MPH-EI 1 ET2.1
FC2	Bit A = "1" (RAI) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "0000" Sa5 = "1"	Don't care	Don't care
FC3 (Note 5)	Bit A = "1" (RAI) SES (3) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1110" Sa5 = "1"	Don't care	Don't care
FC4	Bit A = "0" SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1100" Sa5 = "1"	Don't care	Don't care
NT power off	Not applicable	Bit A = "0" Sa6 = "1000" Sa5 = "1"	Don't care	Don't care
FC3 & FC4	Bit A = "0" SES (3) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1110" Sa5 = "1"	Don't care	Don't care
NT power off & LOS/LFA at TE	Not applicable	Bit A = "1" (RAI) Sa6 = "1000" Sa5 = "1"	Don't care	Don't care
LOS/LFA at ET	Loss of signal (LOS) Loss of frame alignment (LFA)	Loss of signal (LOS) Loss of frame alignment (LFA)	MPH-EI L – (Note 4)	MPH-EI L ET0.2
Loopback 1 request	Not applicable	MPH-L1 AR	ET5.1	–
Loopback 2 request	Not applicable	MPH-L2 AR	ET5.3	–
Loopback release request	Not applicable	MPH-DR	|	–
Loopback indication	Not applicable	Sa5 = "0"	–	–
Loopback indication	Not applicable	Sa5 = "1"	ET0.2	ET0.2
ET internal failure	Not applicable	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	Not applicable	ET failure recovered	/	/
LOS or AIS at LT from ET	Bit A = "1" (RAI) SES (1) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1111" Sa5 = "1"	Don't care	Don't care
LOS or AIS at LT from ET & FC4	Bit A = "0" SES (1) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1111" Sa5 = "1"	Don't care	Don't care
Failure in digital link upstream	AIS	AIS	Don't care	MPH-EI DLu – (Note 4)

TABLE A.1/G.962 *(end)*

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	CL failure upstream	CL failure downstream	CL failure downstream & FC4
	Signals transmitted towards V3 reference point	Normal frames with RAI	Normal operational frames	Normal frames with RAI
Event	Indication option 3	Indication option 2			
Loss of ET power	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	Return of ET power	/	/	/
Normal operational frames	Bit A = "0" Sa5 = "0"	Bit A = "0" Sa6 = "0000" Sa5 = "1"	PH-AI MPH-AI ET1	PH-AI MPH-AI ET1	(Note 1)
FC1	SES (2)	AUXP	MPH-AI MPH-EI 1 ET2.1	MPH-EI 1 ET2.1	MPH-EI 1 ET2.1
FC2	Bit A = "1" (RAI) Sa5 = "0"	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) SES (3) Sa5 = "0"	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" SES (4) Sa5 = "0"	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	Not applicable	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" SES (3) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1110" Sa5 = "1"	MPH-AI MPH-EI 3 MPH-EI 4 ET2.3	(Note 1)	MPH-EI 3 ET2.3
NT power off & LOS/LFA at TE	Not applicable	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)	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	Not applicable	MPH-L1 AR	ET5.1	ET5.1	ET5.1
Loopback 2 request	Not applicable	MPH-L2 AR	ET5.3	ET5.3	ET5.3
Loopback release request	Not applicable	MPH-DR	|	|	|
Loopback indication	Not applicable	Sa5 = "0"	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6	MPH-EI LB2 ET5.6
Loopback indication	Not applicable	Sa5 = "1"	(Note 2)	(Note 2)	(Note 2)
ET internal failure	Not applicable	ET failure	MPH-EI ET ET0.3	MPH-EI ET ET0.3	MPH-EI ET ET0.3
ET failure recovered	Not applicable	ET failure recovered	/	/	/
LOS or AIS at LT from ET	Bit A = "1" (RAI) SES (1) Sa5 = "0"	Bit A = "1" (RAI) Sa6 = "1111" Sa5 = "1"	MPH-AI MPH-EI DLd ET6.2	–	MPH-AI MPH-EI DLd ET6.2
LOS or AIS at LT from ET & FC4	Bit A = "0" SES (1) SES (4) Sa5 = "0"	Bit A = "0" Sa6 = "1111" Sa5 = "1"	MPH-AI MPH-EI DLd MPH-EI 4 ET6.3	MPH-EI 4 ET6.3	–
Failure in digital link upstream	AIS	AIS	–	MPH-EI DLu ET6.1	MPH-EI DLu ET6.1

NOTES

1 This event does not occur while in this state. It is assumed that failure conditions (FC) are detected one by one in a random order i.e. a direct transition from a n-tipple FC situation to an (n-2)-tipple FC situation, or vice versa, is prohibited, e.g. a 0-tipple into a 2-tipple FC situation.

2 If no loopback is invoked or activated, bit Sa5 = ONE is ignored.

3 This event is when bit Sa5 = ZERO is received in error at the ET. This could be interpreted as an "unintentional loopback" situation.

4 The ET issues the MPH-EI appropriate to the failure condition but remains in the state it was before the event occurred. The ET makes provision that this MPH-EI is not issued repetitively.

5 For option 2, FC3 includes failure conditions between LT and NT1 (FC5) and at the input of the LT (FC3) whereas for option 3, FC3 includes failure conditions between LT and NT1 (FC5) only.

6 For option 3 additional primitives MPH-EI ES1 to 4 and MPH-EI DM1 to 4 can be received without any state change.

7 Not implemented in option 3.

8 For the definition of signals SES (n) see Annex C.2.

Annex B

Allocation of signal codings and DS state transition tables for option 2 according to Recommendation I.604 at 2 Mbit/s

(This annex forms are integral part of this Recommendation)

B.1 Introduction

This annex specifies the allocation of signal codings allocated to the DS state transition tables for the access digital section using option 2 as described in Recommendation I.604.

B.2 DS state transition table

The DS state table consists of ten parts described in Table B.1. The states DS have been numbered to form classes referring to problems as follows:

Generic form DS A.BCD

Whereby A, B, C, D combinations indicate problems as defined below:

General condition A

A=0 Powering problems

A=1 Digital section (DS) normal

A=2 DS internal failure (e.g. FC1)

A=3 DS interface problems (e.g. FC4)

A=4 DS internal failure and interface problems

A=5 Loopbacks

A=6 Problems with additional digital link

LT status B

B=0 Powering problems

B=1 LT normal

B=2 LT problems at side to NT

B=3 LT problems at side to interface V3

B=4 LT problems at side to LT and side to interface V3

B=5 Loopback 1 established

B=6 Receiving signal AIS at interface V3

B=7 Receiving signal AIS at interface V3 and LT problems at line side to NT

NT status C

C=0 Powering problems

C=1 NT normal

C=2 NT problems at side to LT

C=3 NT problems at side to user-network interface

C=4 NT problems at side to LT and side to user-network interface

C=5 Loopback 2 established

C=6 Receiving signal AIS from LT

C=7 Receiving signal AIS from LT and NT1 problems at user-network side of interface

NT status D (applicable if C=0)

D=0 Loss of NT1 power

D=1 NT1 dying gasp phase and NT1 normal transmission condition

D=3 NT1 dying gasp phase and NT1 problems at user-network side of interface

D=4 NT1 dying gasp phase and NT1 problems at line side to LT and at user-network side of interface

D=5 NT1 dying gasp phase and loopback 2 established

D=6 NT1 dying gasp phase and receiving signal AIS from LT

D=7 NT1 dying gasp phase and receiving signal AIS from LT and NT1 problems at user-network side of interface

Figure B.1 helps with the understanding of the fault conditions FCx described in these state tables.

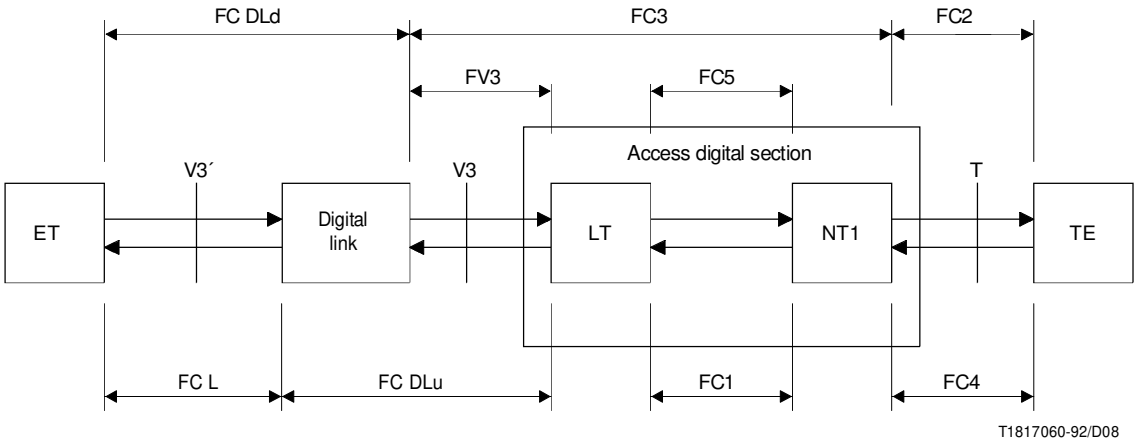


FIGURE B.1/G.962

Applicability of failure conditions to locations

TABLE B.1/G.962

DS state table – LT and/or NT power off

State	DS 0.000	DS 0.002	DS 0.004	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 u/n interface	No signal	AIS	AIS	AIS	AIS	No signal	No signal	No signal
Event								
Normal frames (Note 1) at V3 and u/n 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
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 u/n 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	/	/	/	/	/	/	/	/
Loopback 1 command received AND not (FC5 OR FC4) (Note 10)	/	/	/	/	/	/	/	/
Loopback 1 command received from ET side AND FC5 (Note 10)	/	/	/	/	/	DS 5.500	DS 5.500	DS 5.500
Loopback 1 command received from ET side AND FC4 (Note 10)	/	/	/	/	/	/	/	/
Loopback 1 command received AND FC5 AND FC4 (Note 10)	/	/	/	/	/	/	/	/
Loopback 2 command received from ET side not FC1 (Note 10)	/	/	/	/	/	/	/	/
Loopback 2 command received from ET side AND FC1 (Note 10)	/	/	/	/	/	/	/	/

TABLE B.1/G.962 *(cont.)*

DS state table – LT and/or NT power off

State	DS 0.000	DS 0.002	DS 0.004	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 u/n interface	No signal	AIS	AIS	AIS	AIS	No signal	No signal	No signal

Event								
AIS at interface V3	/	/	/	/	/	/	/	/
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 B.1/G.962 *(cont.)*

DS state table – NT dying gasp phase

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 RAI (Note 2); Sa5 = "1"; Sa6 = "1000"	AUXP	Frames RAI (Note 2); Sa5 = "1"; Sa6 = "1000"	AUXP
Signals transmitted towards u/n interface	Normal frames (Note 7)	Normal frames (Note 7)	AIS	AIS	AIS	AIS

Event						
Normal frames (Note 1) at V3 and u/n 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
Failure FC1 no loopback command from ET side	DS 0.201	–	(Note 6)	DS 0.201	(Note 6)	DS 0.201
Failure FC5 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 u/n 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 (FC5 OR FC4) (Note 10)	DS 5.501	DS 5.501	Note 6	(Note 6)	DS 5.501	DS 5.501
Loopback 1 command received from ET side AND FC5 (Note 10)	(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 10)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
Loopback 1 command received AND FC5 AND FC4 (Note 10)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
Loopback 2 command received from ET side not FC1 (Note 10)	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 10)	(Note 6)	DS 5.205 (Note 9)	(Note 6)	DS 5.205 (Note 9)	(Note 6)	DS 5.205 (Note 9)

TABLE B.1/G.962 *(cont.)*

DS state table – NT dying gasp phase

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 RAI (Note 2); Sa5 = "1"; Sa6 = "1000"	AUXP	Frames RAI (Note 2); Sa5 = "1"; Sa6 = "1000"	AUXP
Signals transmitted towards u/n interface	Normal frames (Note 7)	Normal frames (Note 7)	AIS	AIS	AIS	AIS

Event						
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 B.1/G.962 *(cont.)*

DS state table – NT dying gasp phase

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/FC5
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 u/n interface	Normal Frames (Note 7)	Normal Frames with RAI (Note 4); bit E = "0"	AIS	AIS	AIS	AIS

Event						
Normal frames (Note 1) at V3 and u/n 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	DS 0.004	DS 0.004
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 3.13	DS 4.23	DS 4.14	DS 4.24	DS 4.34	DS 4.44
Failure FC1 no loopback command from ET side	(Note 6)	DS 0.201	(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)
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 u/n 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/FC3&FC4	(Note 6)	DS 0.404	(Note 6)	DS 0.404	DS 0.404	–
Loopback 1 command received AND not (FC5 OR FC4) (Note 10)	(Note 6)	(Note 6)	Note 6	(Note 6)	(Note 6)	(Note 6)
Loopback 1 command received from ET side AND FC5 (Note 10)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
Loopback 1 command received from ET side AND FC4 (Note 10)	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 10)	(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 10)	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 10)	(Note 6)	DS 5.205 (Note 9)	DS 5.205	DS 5.205 (Note 9)	(Note 6)	DS 5.205 (Note 9)

TABLE B.1/G.962 *(cont.)*

DS state table – NT dying gasp phase

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/FC5
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 u/n interface	Normal frames (Note 7)	Normal frames with RAI (Note 4); bit E = "0"	AIS	AIS	AIS	AIS

Event						
AIS at interface V3	(Note 6)	(Note 6)	(Note 6)	(Note 6)	DS 0.606	(Note 6)
AIS&FC5	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
AIS&FC3	(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 B.1/G.962 *(cont.)*

DS state table – NT dying gasp phase

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.	NTdying AND ET fail. AND FC1	NTdying AND ET fail. AND FC5	NTdying AND ET fail., FC1, FC5	NTdying AND ET fail. AND FC4	NTdying AND ET fail., FC1, FC4	NTdying AND ET fail., FC5, FC4	NTdying 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 RAI (Note 2); Sa5 = "1"; Sa6 = "1000"	AUXP	Frames 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 u/n interface	AIS	AIS	AIS	AIS	AIS	AIS	AIS	AIS

Event								
Normal frames (Note 1) at V3 and u/n 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
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 (FV3/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 u/n 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
Loopback 1 command received AND not (FC5 OR FC4) (Note 10)	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 10)	(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 10)	(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 10)	(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 10)	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 10)	(Note 6)	DS 5.205 (Note 9)	(Note 6)	(Note 6)	(Note 6)	DS 5.205 (Note 9)	(Note 9)	(Note 6)

TABLE B.1/G.962 *(cont.)*

DS state table – NT dying gasp phase

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	NTdying AND ET fail. AND FC1	NTdying AND ET fail. AND FC5	NTdying AND ET fail., FC1, FC5	NTdying AND ET fail. AND FC4	NTdying AND ET fail., FC1, FC4	NTdying AND ET fail., FC5, FC4	NTdying 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 RAI (Note 2); Sa5 = "1"; Sa6 = "1000"	AUXP	Frames 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 u/n interface	AIS	AIS	AIS	AIS	AIS	AIS	AIS	AIS

Event								
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 B.1/G.962 (cont.)

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	DS 2.22	DS 3.13
State name Operational or 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 u/n interface	Normal frames	AIS	Normal frames with RAI (Note 4); bit E = "1"	AIS	Frames with RAI (Note 4); bit E = "0"

Event					
Normal frames (Note 1) at V3 and u/n 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)
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 u/n 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	State	(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 10)	DS 5.51	(Note 6)	DS 5.51	(Note 6)	(Note 6)
Loopback 1 command received from ET side AND FC5 (Note 10)	(Note 6)	DS 5.52	(Note 6)	DS 5.52	(Note 6)
Loopback 1 command received from ET side AND FC4 (Note 10)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	DS 5.53
Loopback 1 command received AND FC5 AND FC4 (Note 10)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
Loopback 2 command received from ET side not FC1 (Note 10)	DS 5.15	DS 5.15	(Note 6)	(Note 6)	DS 5.15
Loopback 2 command received from ET side AND FC1 (Note 10)	(Note 6)	(Note 6)	DS 5.25 (Note 9)	DS 5.25 (Note 9)	(Note 6)

TABLE B.1/G.962 (cont.)

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	DS 2.22	DS 3.13
State name Operational or 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 u/n interface	Normal frames	AIS	Normal frames with RAI (Note 4); bit E = "1"	AIS	Frames with RAI (Note 4); bit E = "0"

Event					
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 B.1/G.962 *(cont.)*

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 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 = "1110"	AUXP
Signals transmitted towards u/n interface	AIS	Normal frames with RAI (Note 4); bit E = "0"	AIS	AIS	AIS	AIS	AIS

Event							
Normal frames (Note 1) at V3 and u/n 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
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 u/n 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	–
Loopback 1 command received AND not (FC5 OR FC4) (Note 10)	(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 10)	(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 10)	(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 10)	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 10)	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 10)	(Note 6)	DS 5.25 (Note 9)	(Note 6)	DS 5.25 (Note 9)	DS 5.25 (Note 9)	(Note 6)	DS 5.25 (Note 9)

TABLE B.1/G.962 *(cont.)*

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 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 = "1110"	AUXP
Signals transmitted towards u/n interface	AIS	Normal frames with RAI (Note 4); bit E = "0"	AIS	AIS	AIS	AIS	AIS

Event							
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 6.62	(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	DS 6.74	(Note 6)	DS 6.74

TABLE B.1/G.962 *(cont.)*

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 normal OR FC4)&FC1
Corresponding ET-state	ET 5.2	ET 5.2	ET	ET	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 u/n interface	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "1"; Sa6 = "1010"	Frames RAI (Note 4); bit E = "1"; Sa6 = "1010"
Event						
Normal frames (Note 1) at V3 and u/n interfaces NOT (FC1 OR FC5 OR loopback command)	DS 1.11 (Note 13)	(Note 6)	(Note 6)	(Note 6)	DS 1.11 (Note 13)	DS 2.21 (Note 13)
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	/	/	/	/	/	/
Return of NT power	/	/	/	/	/	/
Failure FC1 no loopback command from ET side	DS 2.21 (Note 11)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	DS 2.21 (Note 13)
Failure FC5 no loopback command from ET side	(Note 6)	DS 2.12 (Note 13)	(Note 6)	(Note 6)	DS 2.12 (Note 13)	(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 u/n interface FC4 (Note 5) no loopback command	(Note 6)	(Note 6)	DS 3.13 (Note 13)	(Note 6)	DS 3.13 (Note 12)	(Note 6)
FC1&FC5 no loopback command	(Note 6)	DS 2.22 (Note 11)	(Note 6)	(Note 6)	(Note 6)	DS 2.22
FC1&FC4 no loopback command	(Note 6)	(Note 6)	DS 4.23 (Note 11)	(Note 6)	(Note 6)	DS 4.23 (Note 11)
FC5&FC4 no loopback command	(Note 6)	(Note 6)	(Note 6)	DS.4.14 (Note 13)	DS.4.14 (Note 12)	(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 11)	(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
Loopback 1 command received AND not (FC5 OR FC4) (Note 10)	–	DS 5.51	DS 5.51	(Note 6)	DS 5.51 (Note 13)	DS 5.51 (Note 13)
Loopback 1 command received from ET side AND FC5 (Note 10)	DS 5.52	–	(Note 6)	DS 5.52	(Note 6)	(Note 6)
Loopback 1 command received from ET side AND FC4 (Note 10)	DS 5.53	(Note 6)	–	DS 5.53	DS 5.53 (Note 12)	DS 5.53 (Note 12)
Loopback 1 command received AND FC5 AND FC4 (Note 10)	(Note 6)	DS 5.54	DS 5.54	–	(Note 6)	(Note 6)
Loopback 2 command received from ET side not FC1 (Note 10)	DS 5.15	(Note 6)	DS 5.15	(Note 6)	–	DS 5.15
Loopback 2 command received from ET side AND FC1 (Note 10)	DS 5.25 (Note 9)	(Note 6)	DS 5.25 (Note 9)	(Note 6)	DS 5.25	–

TABLE B.1/G.962 *(cont.)*

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 normal OR FC4)&FC1
Corresponding ET-state	ET 5.2	ET 5.2	ET	ET	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 u/n interface	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "1"; Sa6 = "1010"	Frames RAI (Note 4); bit E = "1"; Sa6 = "1010"

Event						
AIS at interface V3	DS 6.66 (Note 13)	(Note 6)	(Note 6)	(Note 6)	DS 6.66 (Note 13)	(Note 6)
AIS&FC1	DS 6.76 (Note 11)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	DS 6.76 (Note 13)
AIS&FC5	(Note 6)	DS 6.62 (Note 13)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
AIS&FC4	(Note 6)	(Note 6)	DS 6.67 (Note 13)	(Note 6)	DS 6.67 (Note 13)	(Note 6)
AIS&FC1&FC5	(Note 6)	DS 6.72 (Note 11)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
AIS&FC1&FC4	(Note 6)	(Note 6)	DS 6.77 (Note 11)	(Note 6)	(Note 6)	DS 6.77 (Note 12)
AIS&FC5&FC4	(Note 6)	(Note 6)	(Note 6)	DS 6.64 (Note 13)	(Note 6)	(Note 6)
AIS&FC1&FC5&FC4	(Note 6)	(Note 6)	(Note 6)	DS 6.74 (Note 11)	(Note 6)	(Note 6)

TABLE B.1/G.962 *(cont.)*

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	ET	ET	ET	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"	Frames received from ET at interface V3; Sa5 = "0" Sa6 = "1000"	AUXP
Signals transmitted towards u/n interface	No signal	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "0"; Sa6 = "1010"	Frames RAI (Note 4); bit E = "0"; Sa6 = "1010"

Event							
Normal frames (Note 1) at V3 and u/n interfaces NOT (FC1 OR FC5 OR loopback command)	/	DS 0.101 (Note 13)	(Note 6)	(Note 6)	(Note 6)	DS 0.101 (Note 13)	(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
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 13)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	DS 0.201 (Note 13)
Failure FC5 no loopback command from ET side	/	(Note 6)	DS 0.102 (Note 13)	(Note 6)	(Note 6)	DS 0.102 (Note 13)	(Note 6)
Loss of frames (Note 5) at interface V3 (FV3/FC5) not AIS	/	DS 0.302 (Note 13)	DS 0.302 (Note 13)	(Note 6)	(Note 6)	DS 0.302 (Note 13)	(Note 6)
Loss of frames at u/n interface FC4 (Note 5) no loopback command	/	(Note 6)	(Note 6)	DS 0.103 (Note 13)	(Note 6)	DS 0.103 (Note 13)	(Note 6)
FC1&FC5 no loopback command	/	(Note 6)	DS 0.202 (Note 11)	(Note 6)	(Note 6)	(Note 6)	DS 0.202 (Note 13)
FC1&FC4 no loopback command	/	(Note 6)	(Note 6)	DS 0.203 (Note 11)	(Note 6)	(Note 6)	DS 0.203 (Note 12)
FC5&FC4 no loopback command	/	(Note 6)	(Note 6)	(Note 6)	DS 0.104 (Note 13)	DS 0.104 (Note 12)	(Note 6)
FC1&FV3/FC5	DS 0.400	DS 0.402 (Note 11)	DS 0.402 (Note 11)	(Note 6)	(Note 6)	(Note 6)	DS 0.402 (Note 13)
FC1&FC5&FC4 no loopback command	/	(Note 6)	(Note 6)	(Note 6)	DS 0.204 (Note 11)	(Note 6)	DS 0.204 (Note 12)
FV3/FC5&FC4	/	(Note 6)	(Note 6)	DS 0.304 (Note 13)	DS 0.304 (Note 13)	DS 0.304 (Note 12)	(Note 6)
FC1&FV3/FC5&FC4	/	(Note 6)	(Note 6)	DS 0.404 (Note 11)	DS 0.404 (Note 11)	(Note 6)	DS 0.404 (Note 12)
Loopback 1 command received AND not (FC5 OR FC4) (Note 10)	/	–	DS 5.501	DS 5.501	(Note 6)	DS 5.501 (Note 13)	DS 5.501 (Note 13)
Loopback 1 command received from ET side AND FC5 (Note 10)	/	DS 5.502	–	(Note 6)	DS 5.502	(Note 6)	(Note 6)
Loopback 1 command received from ET side AND FC4 (Note 10)	/	DS 5.503	(Note 6)	–	DS 5.503	DS 5.503 (Note 12)	DS 5.503 (Note 12)
Loopback 1 command received AND FC5 AND FC4 (Note 10)	/	(Note 6)	DS 5.504	DS 5.504	–	(Note 6)	(Note 6)
Loopback 2 command received from ET side not FC1 (Note 10)	/	DS 5.105	(Note 6)	DS 5.105	(Note 6)	–	DS 5.105
Loopback 2 command received from ET side AND FC1 (Note 10)	/	DS 5.205 (Note 9)	(Note 6)	DS 5.205 (Note 9)	(Note 6)	DS 5.205	–

TABLE B.1/G.962 *(cont.)*

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	ET	ET	ET	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"	Frames received from ET at interface V3; Sa5 = "0" Sa6 = "1000"	AUXP
Signals transmitted towards u/n interface	No signal	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "1"; Sa6 = "1111"	AIS	Frames RAI (Note 4); bit E = "0"; Sa6 = "1010"	Frames RAI (Note 4); bit E = "0"; Sa6 = "1010"

Event							
AIS at interface V3	/	DS 0.606 (Note 13)	(Note 6)	(Note 6)	(Note 6)	DS 0.606 (Note 13)	(Note 6)
AIS&FC1	DS 0.700	DS 0.706 (Note 11)	(Note 6)	(Note 6)	(Note 6)	(Note 6)	DS 0.706 (Note 13)
AIS&FC5	/	(Note 6)	DS 0.602 (Note 13)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
AIS&FC4	/	(Note 6)	(Note 6)	DS 0.607 (Note 13)	(Note 6)	DS 0.607 (Note 12)	(Note 6)
AIS&FC1&FC5	/	(Note 6)	DS 0.702 (Note 11)	(Note 6)	(Note 6)	(Note 6)	(Note 6)
AIS&FC1&FC4	/	(Note 6)	(Note 6)	DS 0.707 (Note 11)	(Note 6)	(Note 6)	DS 0.707 (Note 12)
AIS&FC5&FC4	/	(Note 6)	(Note 6)	(Note 6)	DS 0.604 (Note 13)	(Note 6)	(Note 6)
AIS&FC1&FC5&FC4	/	(Note 6)	(Note 6)	(Note 6)	DS 0.704 (Note 11)	(Note 6)	(Note 6)

TABLE B.1/G.962 (cont.)

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	ET 0.3 ET 2.2	ET 0.3 ET 6.3	ET 0.3 ET	ET 0.3 ET	ET 0.3 ET 2.3	ET 0.3 ET ....
Signals transmitted towards interface V3	Frames RAI (Note 2); Sa5 = "1"; Sa6 = "1111"	AUXP	Frames 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 u/n interface	AIS	AIS	AIS	AIS	AIS	AIS	AIS	AIS

Event								
Normal frames (Note 1) at V3 and u/n interfaces 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	/	/	/	/	/	/	/	/
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 u/n 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 4.42	(Note 6)	(Note 6)	DS 4.42	(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
Loopback 1 command received AND not (FC5 OR FC4) (Note 10)	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 10)	(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 10)	(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 10)	(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 10)	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 10)	(Note 6)	DS 5.25 (Note 9)	(Note 6)	(Note 6)	(Note 6)	DS 5.25 (Note 9)	(Note 6)	(Note 6)

TABLE B.1/G.962 (concluded)

DS state table – Digital section receiving AIS at interface V3

Etat	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	ET 0.3 ET 2.2	ET 0.3 ET 6.3	ET 0.3 ET	ET 0.3 ET	ET 0.3 ET 2.3	ET 0.3 ET ....
Signals transmitted towards interface V3	Frames RAI (Note 2); Sa5 = "1"; Sa6 = "1111"	AUXP	Frames 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 u/n interface	AIS	AIS	AIS	AIS	AIS	AIS	AIS	AIS

Event								
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	–

NOTES

1 "Normal frames" include operational frames ant the signal RAI, which of thes applies depends ont the ET and the user side equipment, 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 user side equipment). These conditions depend on events detected by the ET and/or the user side equipment; "access operational", "FC2", "LOS/LFA at ET", "FC2 and LOS/LFA at ET". The state of the digital section is not affected although the signals at the interface differ. The signals received at the user-network interface are transparently passed to the interface V3 and vice versa.

2 The signal RAI (Bit A set to ONE) received at the user-network interface is transparently passed to interface V3.

3 "Frames" can include the signal RAI or not, which of these applies depends on the user side equipment.

4 The signal RAI received at the interface V3 is transparently passed to the user-network interface.

5 Loss of frames includes loss of frame alignment (LFA) and loss of signal (LOS).

6 This event does not occur while in this state. It is assumed that failure conditions (FC) are detected one by one in a random order i.e. a direct transition from an n-tiple FC situation into an (n-2)-tiple FC situation, or vice versa, is prohibited, e.g. a 4-tiple into a 2-tiple FC situation.

7 "Normal Frames" include normal operational frames (state ET 2.5) and the signal RAI (state ET 2.6), which of these depends on the ET.

8 The text of this note has been removed.

9 In this failure situation the DS is able to establish the requested loopback but the ET receives neither a loopback confirmation nor the transmitted test pattern.

10 The LT and the NT1 are non-latching with respect to loopbacks i.e. an established loopback is retained only as long as the appropriate control signal is detected (Sa6 = "1111" for LT and Sa6 = "1010" for NT1).

11 It is assumed that the LT when releasing loopback 1 detects a FC1 condition until frame alignment is achieved.

12 It is assumed that the NT1 when releasing loopback 2 detects a FC4 condition until frame alignment is achieved.

13 This event should not occur according to Notes 11 et 12.

B.3 Coding of signals at V3 reference point

The following Sa bits are used to perform the functions required to operate and maintain the primary rate access digital section.

Sa4 not used.

Sa5 direction indication from ET to NT1 (required to support loopback status). Loopback indication from NT1 to ET.

Sa6 Loopback control from ET to NT1 Layer 1 status from NT1 to ET.

Sa7 not used.

Sa8 not used.

In addition, a signal "auxiliary pattern" (AUXP) consisting of a continuous bit stream...0101010... has been defined to permit the LT to notify FC1.

The bits Sa6 are numbered Sa61, Sa62, Sa63, Sa64 within the sub-multi-frame (SMF) according to Table 4.b/G.704. This makes provision to exploit the full code set and guaranties the flexibility to support various configurations between V3 and T reference point as already identified in the lower part of Figure 2/I.604. It should be noted that the generator side of the bits Sa6 (coding) has to synchronise the bits Sa6 with the sub-multi-frame while the receiver side (decoding) depends on the code set which is used in a particular configuration. The code set defined in this annex to be mandatory is for the support of the "simple" ET-LT-NT1-NT2 configuration as defined in the upper part of Figure 2/I.604 and does not require synchronisation at the receiving side.

B.4 Allocation of signal elements to functional elements

Table B.3 relates the code points of the various signals to the functions for operations and maintenance at the V3 reference point and also defines where these signals are generated. These functions include failure situations, loopbacks and CRC-4 error procedures. Intersections of signals and functions are left blank if there is no relationship between them. The codings of signal elements referring to failure situations are correct for single failures. The signals depicted in Table B.1 imply that LT and NT1 functional groupings perform functions as follows:

B.4.1 At the LT

– generates the signal AUXP towards the V3 reference point (notification of FC1) when the signal received from NT1 causes LOS or optionally LFA. However, the support of the additional digital link requires that LFA is detected in the LT.

– generates the signal AUXP towards the T reference point when the signal received from ET side causes LOS or optionally is a signal other than AIS and causes LFA.

– passes the signal AIS received from the ET side towards the T reference point.

– loops back bit Sa5 towards V3 reference point if loopback 1 is activated.

– monitors bit Sa6 received from ET to control loopback 1.

B.4.2 At the NT1

– generates the bit SA6 codes towards the V3 reference point to notify the ET of its layer 1 status; FV3/FC3 → "1110", FC4 →"1100", loss of power →"1000", otherwise Sa6 →"0000".

– generates the signal AIS towards the T reference point when the signal received from LT causes LOS or is a signal other than AIS (including AUXP) and causes LFA.

– upon detection of FC4, generates towards the V3 reference point a signal with bit A set to binary ZERO, bits Sa4, Sa7 and Sa8 set to binary ONE.

– generates the bit Sa6 code "1000" towards V3 reference point to notify loss of power at NT1.

TABLE B.2/G.962

Allocation of signal elements to functions

Loss of power at NT1	Failure conditions (FCs) indication						Loopbacks				CRS-4 error indication			Simultaneous CRC-4 errors at T-IF		
	FC1	FC2	FC3	FC4	LOS/LFA at LT (ET to LT) (Note 2 of Table B.1)	AIS at LT (ET to LT) (Note 3 of Table B.1)	Control of loopbacks from ET		Loopback indication to ET (Note 1 of Table B.1)		CRC-4 error in NT1 (ET to NT1)	E-bit received at NT1 from NT2	CRC-4 error in NT1 (NT2 to NT1)			
							1	2	1	2						
	AUXP	Framed	Framed	Framed	Framed	Framed									Frame to ET	Signals at V3
Bit A = 0	Not appl.	BIT A = 1(RAI)	BIT A = 1(RAI)	BIT A = 0 (RAI)	BIT A = 1(RAI)	BIT A = 1(RAI)									Bit A to ET	
Sa6 = 1000	Not appl.	Sa6 = 0000	Sa6 = 1110	Sa6 = 1100	Sa6 = 1110	Sa6 = 1111									Bit Sa6 to ET	
							Sa6 = 1111	Sa6 = 1010							Bit Sa6 from ET	
							Sa5 = 0	Sa5 = 0							Bit Sa5 from ET	
									Sa5 = 0	Sa5 = 0					Bit Sa5 to ET	
											conveyed to ET in bit E				CRC-4 error notifications to ET	
												Sa6 = 0001	Sa6 = 0010			
														Sa6 = 0011		

– monitors bit Sa6 received from ET to control loopback 2.

– passes the signal AIS received from LT side towards the T reference point and indicates the receipt of this signal by setting the bit Sa6 code towards the V3 reference point to "1111".

– sets bit Sa5 in the direction DS to ET and transmits it towards the ET according to the following rules:

  – loopback 2 not activiated Sa5 = 1

  – loopback 2 activated Sa5 = 0

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

B.5 Indication of CRC-4 errors detected at the T reference point to the ET

For enhanced maintenance capabilities CRC-4 errors detected at the interface at the T reference point may as an option, be reported to the ET by the DS. This requires the following report functions of CRC-4 errors:

– between NT1 and TE, detected by the TE and reported to the NT1 by means of E-bit;

– between TE and NT1, detected by the NT1;

– between NT1 and TE and between TE and NT1 simultaneously.

Additional code points for the Sa bit 6 are defined in Table B.2.

When applying this optional reporting function the "simple" configuration as defined in B.3 is no longer applicable. For the receiving side synchronization of the Sa bit 6 to the sub-multiframe is required as well. An ET applying asychronous detection of Sa bit 6 will misinterpret such CRC-4 error reports from the NT1 with other defect indications i.e. loss of power at NT1 or FC4.

Annex C

(to Recommendation G.962)

Allocation of signal codings and DS state transition tables for option 3 according to Recommendation I.604 at 2 Mbit/s

(This annex forms an integral part of this Recommendation)

C.1 Introduction

This annex describes the operation and maintenance functions as outlined in option 3 of Annex A/I.604. It uses the Sa bits 4, 5, 6, 7 and 8 to transport the "in-service" error analysis information which is based on the G.821 error analysis scheme and a CRC-4 error monitoring algorithm. The allocation of the Sa bits are as follows:

Sa4 reserved for a Maintenance Channel to carry messages containing disturbance reports and patching commands to and from the ET from the LT and NT1.

Sa5 direction indication bit – set to ONE in the ET to NT1 direction and ZERO in the NT1 to ET direction.

Sa6, 7, 8 these bits are used within each SMF to indicate the error performance and position of errors as specified in subclause C.2.

C.2 Signals at the V3 reference point

The signals described in section 3.4.1/I.431 are those which traverse the user-to-network interface (interface at the T reference point). An additional number of signals are required at the V3 reference point. Table C.1 lists the signals required to cater for the scheme.

TABLE C.1/G.962

Signals between the ET and access digital section

Name	Condition
NOF(U)	Operational frames with: – Sa5 to 8 set to ZERO – no defect indication – active associated CRC-4 bits
NOF(D)	Operational frames with: – Sa5 to 8 set to ONE – no defect indication – active associated CRC-4 bits
RAI	Operational frames with: – active associated CRC-4 bits – remote alarm indication
LOS	no received signal (see 5.3.3.4)
AIS	Continuous stream of ONEs
ES(n)	Operational frames with: – frames q & p of the CRC-4 multiframe containing: Sa8 set to a ONE
SES(n)	Operational frames with: – frames q & p of the CRC-4 multiframe containing: Sa6 set to a ONE
DM(n)	Operational frames with: – frames q & p of the CRC-4 multiframe containing: Sa7 set to a ONE

NOTES

1 n indicates the sections of the link (see Annex A/I.604, option 3) as follows:
n = 1 indicates monitored section (ET to LT) or (LT to ET)
n = 2 indicates monitored section NT1 to LT
n = 3 indicates monitored section LT to NT1
n = 4 indicates monitored section NT2 to NT1

2 q and p are directly related to n as follows:
for n = 1, q = 1 and p = 9
for n = 2, q = 3 and p = 11
for n = 3, q = 5 and p = 13
for n = 4, q = 7 and p = 15

3 NOF(U) stands for Normal operational frame in the NT1 to ET direction.
NOF(D) stands for Normal operational frame in the ET to NT1 direction.
AIS, CRC, LOS and RAI are as stated in Recommendation I.431.

C.3 Definition of function elements (FEs) at the V3 reference point

The function elements represent input signals which are consumed if a state transition occurs, even if it is a null transition (remain in the same state), and are no longer available to initiate one more state transition.

C.4 FEs at the V3 reference point

The function elements required at the V3 reference point for this scheme are shown in two tables. Table C.2 indicates the function elements for the NT2 to ET direction while Table C.3 indicates the function elements in the ET to NT2 direction.

TABLE C.2/G.962

Relationship between function elements and signals in the direction access digital section to ET

Function elements (FEs)		Signals
FE No	Contents of FEs	
B	Operational frames	NOF(U)
	Loss of layer 1 frames	
E1	LT to ET	SES (1)
E2	NT1 to LT (FC1)	SES (2)
E3	LT to NT1 (FC3)	SES (3)
E4	NT2 to NT1 (FC4)	SES (4)
E5	ET to LT	SES (1)
E6	NT1 to NT2 (FC2)	RAI
	Degraded performance frames	
H1	ET to LT	ES(1)/DM(1)
H2	LT to NT1 (FC3)	ES(3)/DM(3)
H3	NT2 to NT1 (FC4)	ES(4)/DM(4)
H4	NT1 to LT (FC1)	ES(2)/DM(2)
H5	LT to ET	ES(1)/DM(1)

C.5 Performance criteria

The access digital section error performance parameters as indicated in Table C.2 are indicated to the ET by changing from a ZERO to a ONE condition. The criteria for each of the parameters changing logic level is as follows:

– SES > 832 CRC-4 ERRORS IN ONE SECOND

– DM > 123 CRC-4 ERRORS IN ONE MINUTE

– ES > 1 CRC-4 ERROR IN ONE SECOND.

For each occurrence, the appropriate bit shall be set to binary ONE by the LT or the NT1 for 125 successive CRC-4 multiframes after the one second or minute analysis period is completed.

TABLE C.3/G.962

Relationship between access functional elements and signals (ET to digital section)

Function element (FEs)		Signals
FE No	Contents of the FEs	
A	Operational frames	NOF(D
	Loss of layer 1 frames	
D	LT to ET	RAI
D	NT1 to ET	RAI
D	LT to NT1	RAI
D	NT2 to NT1	RAI
D	ET to LT	RAI
K	Request for loopback 1	Under study
J	Request for loopback 2	Under study
O	Loopback release	Under study
T	Faulty ET	AIS

C.6 Access digital section (DS) state machine

C.6.1 DS state definitions

The DS state machine for the 2048 kbit/s primary rate access specifies the relationship between signals at reference point T and function elements at reference point V3 in failure condition and looback procedures.

DS states are classified into the following six groups:

STATE DS 0.x: NT power on/off. In these states LT power is on;

STATE DS 1.x: LT power on/off. In these states NT1 power is on;

STATE DS 2.x: DS is operational and detects the failure condition at reference point T;

STATE DS 3.x: Internal DS failure exists;

STATE DS 4.x: DS is operational and detects the failure condition at reference point V3.

DS 0.1 State: NT1 power off

– In general, DS can neither transmit nor receive signals at reference point T.

DS 0.2 State: NT1 power on

– This is a transient state, and DS may change state after detection of the signal received.

DS 1.1 State: LT power off

– In general, DS can neither transmit nor receive signals at reference point V3.

DS 1.2 State: LT power on

– This is a transient state and DS may change state after detection of a signal received.

DS 2.1 State: Operational condition

– Network timing and layer 1 service are available.

– The DS transmits and receives operational frames and performance messages.

DS 2.2 State: Fault Condition No.2

– Network timing is not available at reference point T.

– The DS state receives operational frames with the RAI priority message from the reference point T and operational frames from reference point V3.

– The DS transmits operational frames to the reference point T and operational frames with the RAI priority message to the reference point V3.

DS 2.3 State: Fault Condition No.4

– Network timing is available at reference point T.

– The DS recognises a LOS or LFA at reference point T and receives operational frames with RAI priority message from the reference point V3.

– The DS transmits operational frames with RAI priority to the reference point T and maintenance signal to the reference point V3.

DS 3.1 State: Fault Condition No.1

– Network timing is available at reference point T.

– The DS receives operational frames from reference point T and operational frames with the RAI priority message from the reference point V3.

– The DS transmits operational frames with RAI priority to the reference point T and a maintenance signal to the reference point V3.0.

DS 3.2 State: Fault Condition No.3

– Network timing is not available at reference point T.

– The DS receives operational frames with the RAI priority message from reference point T and operational frames from the reference point V3.

– The DS transmits AIS to the reference point T and a maintenance signal to the reference point V3.

DS 3.3 State: AIS from ET

– The DS transmits operational frames with AIS to the reference point T and maintenance to the reference point V3.

DS 4.2 State: RAI from ET

– The DS transmits operational frames with the RAI priority message to reference point T and operational frames to the reference point V3.

C.6.2 DS State Matrix

Table C.4 provides the DS state matrix for the 2048 kbit/s primary rate access digital section. The indication of network failure to the ET should have priority over the indication of user-network failure to the ET, and the indication of an upstream failure to the ET should have priority over the indication of a downstream failure to the ET.

The signal specifications and state tables for the user and network sides of reference point T are contained in Recommendation I.431.

TABLE C.4/G.962

DS state table

State number	DS 0.1	DS 0.2	DS 1.1	DS 1.2	DS 2.1	DS 2.2	DS 2.3	DS 3.1	DS 3.2	DS 3.3	DS 4.1	DS 4.2
Operational condition or failure condition	NT1 power off	NT1 power on	LT power off	LT power on	Operation-nal	FC2	FC4	FC1	FC3 W/O FC1	FC3 with FC1	AIS from ET	RAI from ET
Transmitted signal to V3 (Sig's)	No signal	No signal	No signal	No signal	NOF (U)	RAI	NOF (U)	NOF (U)	NOF (U)	NOF (U)	NOF (U)	NOF (U)
Signal at T (Sig's)	No signal	No signal	AIS	AIS	NOF (D)	NOF (D)	RAI	RAI	AIS	AIS	AIS	RAI
Reception of NOF from TE	/	/	/	/	–	B DS 2.1	B DS 2.1	–	/	–	/	–
At T: Reception of RAI from TE	/	C	–	C	DS 2.2	/	/	–	–	–	–	C
Loss of incoming signal/Loss of frame alignment at T	/	E 4 DS 2.3	–	E 4 DS 2.3	E 4 DS 2.3	E 4 DS 2.3	–	–	–	–	–	E 4 DS 2.3
No internal network failure	/	–	/	–	–	–	–	B DS 2.1	B DS 2.1	B DS 2.1	–	–
FC1	/	E 2 DS 3.1	/	E 2 DS 3.1	E 2 DS 3.1	E 2 DS 3.1	E 2 DS 3.1	–	E 2 DS 3.1	–	–	E 2 DS 3.1
FC3	/	E 3 DS 3.2	/	E 3 DS 3.2	E 3 DS 3.2	E 3 DS 3.2	E 3 DS 3.2	–	–	–	–	E 3 DS 3.2
Internal: loss of NT1 power	/	DS 0.1	/	DS 0.1	DS 0.1	DS 0.1	DS 0.1	–	DS 0.1	–	DS 0.1	DS 0.1
Internal: return of NT1 power	DS 0.2	/	/	/	/	/	/	/	/	/	/	/
Loss of LT power	–	DS 1.1	–	DS 1.1	DS 1.1	DS 1.1	DS 1.1	DS 1.1	DS 1.1	DS 1.1	DS 1.1	DS 1.1
Return of LT power	–	DS 1.2	DS 1.2	/	/	/	/	/	/	/	/	/
Reception of NOF from ET	/	/	/	/	–	–	/	–	–	–	B DS 2.1	B DS 2.1
AT V3: reception of AIS from ET	/	E 5 DS 4.1	–	E 5 DS 4.1	E 5 DS 4.1	E 5 DS 4.1	E 5 DS 4.1	DS 4.1	E 5 DS 4.1	E 5 DS 4.1	–	E 5 DS 4.1
Reception of RAI from ET	/	DS 4.2	/	DS 4.2	DS 4.2	–	–	–	–	–	DS 4.2	–