5i’

MONTAGE: REC. G.956 EN T | TE DE CETTE PAGE

Recommendation G.960

DIGITAL SECTION FOR ISDN BASIC RATE ACCESS

(Melbourne, 1988)

1 General
9.6 Digital section and digital transmission systems for ISDN customer access

1.1 *Scope*

This Recommendation describes the characteristics of a digital section for the ISDN basic rate access between the user network interface (at T reference point, defined in Recommendation I.411) and the local exchange (at V_1 reference point defined in Recommendation Q.512) supporting the recommended channel structure 2B + D 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 very specific and not contained in the relevant terminology Recommendations. Therefore Annex B to this Recommendation provides terms and definitions used in this Recommendation.

1.2 *Configuration*

Figure 1/G.960 shows the boundaries of the digital section in relation to the digital system definition.

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

Note that reference point T and V_1 are not identical and therefore the digital section is not symmetric.

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

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

Figure 1/G.960, p.1

1.3 *Application*

The basic access digital section may be applied as given in Figure 2/G.960 for:

— direct access to the local exchange (V_1-reference point);

— access via a basic access multiplex equipment (V_4-interface) to the local exchange;

— access via a basic access concentrator (V_2-interface) to the local exchange;

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. The last one are given in the following:

$C_{V\backslash d1}$ Control Channel at V_1 reference point

DS Digital Section

FE Function Element used between ET and LT

FII Failure Indication Information

INFO Information element defined at the user network interface

SIG Signal between LT an NT1

2 Modelling and relationship between the digital section and the ET

The general model shown in Figure 3/G.960 depicts the whole ISDN customer access layer 1 and adjacent entities and provides the basis to describe the functions performed by the digital section and those performed by TE, ET and system management and how various functions are grouped. In particular, according to this model the activation/deactivation procedures and maintenance functions specified in this Recommendation are not confined to

functions performed by the digital section but include functions associated with ET layer 1.

.rs

Figure 2/G.960 p.2

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

i) I.430 to I.440/I.441 interactions between ET layer 1 and ET layer 2, and ET layer 1 and system management based on PH and MPH primitives, respectively, as defined in Recommendation I.430. These interactions are for the support of functions specified in Recommendations I.440 and I.441;

ii) interactions between ET layer 1 and system management for the support of functions associated with the digital section, based on MPH primitives.

The primitive procedures within TE comply with the specification according to Recommendation I.430.

This model does not constrain layer 1 arrangements between LT and NT1, (it is also applicable to remote access as shown in Figure 2/G.960), or the digital transmission system technology.

Figure 3/G.960, p.

3 Functions

Figure 4/G.960 shows the functions which have to be supported by the basic access digital section.

3.1 *B channel*

This function provides, for each direction of transmission, two independent 64 kbit/s channels for use as B Channels (as defined in Recommendation I.412).

3.2 *D channel*

This function provides, for each direction of transmission, one D Channel at a bit rate of 16 kbit/s (as defined in Recommendation I.412).

3.3 *Bit timing*

This function provides bit (signal element) timing to enable the receiving equipment to recover information from the aggregate bit stream. Regarding the V_1 reference point, the bit timing function is used for both transmit and receive data.

3.4 *Octet timing*

This function provides 8 kHz octet timing for the B Channels.

Figure 4/G.960, p.4

3.5 *Activation*

3.5.1 *Activation from ET*

This function places all the functions of the digital section into a normal operating mode and supports the activation of the interface at the T reference point according to Recommendation I.430. This takes into account:

— power down mode;

— initial power up;

— a failure condition.

The procedures and exchange of information are described in § 5 of this Recommendation.

An activation should be possible to a state which allows maintenance actions to be performed in the digital section even when there is no customer equipment connected to the T reference point.

In the case of a basic access digital section making use of a digital transmission system for a metallic line one additional mode of operation may be applied for activation/deactivation, which is to activate/deactivate the digital section only. This is optional.

3.5.2 *Request for activation from TE*

This function supports activation of the digital section and of the interface at the T reference point according to Recommendation I.430.

These functions are conveyed by the $C_{V\backslash d1}$ channel (see § 7).

3.6 *Deactivation*

This function is specified in order to permit the interface at the T reference point and the digital section to be placed in a low power consumption mode. The procedures and exchange of information are described in § 5 of this Recommendation.

Deactivation should be initiated only by the exchange (ET).

This function is conveyed by the $C_{V\backslash d1}$ channel (see § 7).

3.7 *Power feeding*

This function provides for remote power feeding of NT1 and optionally the TE via the user network interface in accordance with Recommendation I.430, § 9.

3.8 *Operation and maintenance*

This function supports required actions and information for operating and maintaining the digital section controlled by the ET as defined in Recommendation I.603.

Four categories of functions have been identified:

— commands regarding LT, regenerator, or NT1;

— information from LT, regenerator, or NT1;

— indications of fault conditions;

— control of digital section power feeding.

These functions are conveyed by the $C_{V\backslash d1}$ channel (see § 7).

4 Network performance

4.1 *Availability*

The definition of availability is given in Annex A of Recommendation G.821. The availability objective of the 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 Channels and is defined as absolute signal delay between T and V_1 reference points for each direction of transmission. The value is for further study. 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.

4.4 *Jitter*

4.4.1 *Output/input jitter at T reference point*

The requirements are defined in § 8 of Recommendation I.430.

4.4.2 *Jitter at V*

The input jitter limits are for further study.

5 *Activation/deactivation*

5.1 *Functional capabilities*

The digital section provides the layer 1 signalling capability and the necessary procedures to enable:

5.1.1 *Customer equipment at the user side of reference point T*

to activate the layer 1 of the user-network interface at reference point T and, if not already activated, the digital section.

5.1.2 *Equipment at the network side of V*

a) activate:

1) the layer 1 of the user-network interface at reference point T and, if not already activated, the digital section (this activation is related to call control), or

2) the digital section only (this activation is related to controlling the configuration of the access; it is a network opinion),

b) deactivate:

1) the layer 1 of the user-network interface at reference point T and the digital section, or

2) the layer 1 of the user-network interface at reference point T only.

The functional capabilities defined in § 5.1.2 |) |) allow maintenance actions in the digital section which do not impact the deactivated user-network interface at reference point T to be performed and make provision for the implementation of a non-transparent loopback 2. If required in some applications, they also permit the digital section to be placed in a mode where the full information transfer capability is available while the user-network interface at reference point T remains deactivated.

The procedures for the activation or deactivation of the layer 1 of the user-network interface at reference point T comply with the Recommendation I.430, § 6.2. These procedures are based on a repertoire of INFO signals as defined in Recommendation I.430 (Table 2/I.430).

The procedures at V_1 reference point are based on a repertoire of function elements (FEs). These FEs have specific relationships to primitives between the ET layer 1 and ET layer 2, and ET layer 1 and system management for the activation or deactivation of the layer 1 of the user-network interface in accordance with Recommendation I.430, § 6.2 and Recommendation I.440 and I.441. The means for defining these interactions are the primitive procedures (see Figure 5/1.430) based on a repertoire of PH- and MPH-primitives.

5.2 *Modelling*

5.2.1 *General*

The model for activation/deactivation procedures is given in § 2.

It is recognized that activation/deactivation is a process between customer equipment and local exchange requiring appropriate functionality at both ends. The model contained in § 2 includes the functional blocks relevant to activation/deactivation and depicts the primitives related to the activation/deactivation procedures.

5.2.2 *Partitioning of functions*

Recommendation I.430 defines the network side of the user-network interface at reference point T as one functional block which supports the layer 1 activation/deactivation 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.430.

In order to describe the relationship between signals across the user-network interface at reference point T and function elements across reference point V_1, and the relationship between function elements across reference point V_1 and primitives, two state machines are defined. One in the digital section (DS virtual state machine), and one at

the network side of the V_1 reference point (ET layer 1 virtual state machine). Figure 5/G.960 illustrates this approach.

In addition to primitives defined in Recommendation I.430 and I.441 related to call control, Figure 5/G.960 also introduces a new set of primitives related to configuration control and the control of loopbacks. Partitioning of activation/deactivation 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, not intended to imply any particular implementation.

However, in order to implement a customer access the virtual DS state machine has to be partitioned further. Figure 6/G.960 shows the partition of the DS state machine into NT1 state machine (NT-states) and LT state machine (LT-states).

The NT1 state machine supports user-network interface procedures in accordance with Recommendation I.430 based on the INFOs, 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 function elements (FEs). The ET layer 1 state machine contains those states which represent the local exchange view of the status of the interface at reference point T and the digital section. It supports the already specified primitive procedures to provide services to ET layer 2 and system management in accordance with Recommendation I.430, and additional primitive procedures for the support of functions associated with the digital section.

Figure 5/G.960, p.5

Figure 6/G.960 provides information for the description of the transmission system which is given in Recommendation G.961.

Figure 6/G.960, p.

1 reference point to13

5.2.3 *Location of timers T1 and T2*

In the following description of the DS and ET layer 1 state machines, timer T1 will be associated with ET layer 1 (ET layer 1 state machine) while timer T2 will be associated with the digital section (DS state machine).

The association of timer T1 with layer 1 of the ET is applied for the convenience of easy description but may be implemented anywhere while being functional part of the ET. The exact location of timer T2 within the digital section does not impact the description of the DS state machine.

5.3 *Activation/deactivation procedures*

The procedures allow the activation/deactivation of the user-network interface at reference point T. The activation may be invoked by either side while deactivation may only be invoked by the network. The overall activation/deactivation procedures can be divided into three classes:

a) basic procedures for call control used to activate the layer 1 of the user-network interface at the T reference point and if not already activated, the digital section;

b) procedures to control loopbacks;

c) procedures to control the configuration.

5.3.1 *Basic characteristics of the procedures*

5.3.1.1 *Priority*

Priority refers to contention resolution between activation/deactivation requests which have been invoked concurrently.

If contention between conflicting activation/deactivation requests from layer 2 and system management occurs it is resolved in the ET layer 1 state machine, which will then pass to the V_1 reference point a coordinated set of Function Elements (FEs). Table 1/G.960 shows the ET layer 1 state machine priority order.

H.T. [T1.960]

TABLE 1/G.960

Priority order of request in the ET layer 1 state machine

Type of request	Priority order
Deactivation request	3 (highest)
Loopback	2
{ Call control activation request }	1
{ Digital section only activation/deactivation request from the ET side }	0 (lowest)

Table 1/G.960 [T1.960], p.

If contention between conflicting activation/deactivation requests from ET side and user side occurs it is resolved in the DS state machine. Table 2/G.960 shows the DS state machine priority order.

H.T. [T2.960]

TABLE 2/G.960

Priority order of requests in the DS state machine

Type of request	Priority order

{
Request from ET side except digital section only activation
}
	2 (highest)

{
Call control activation request from user side
}
	1

{
Digital section only activation/deactivation request from the ET side
}
	0 (lowest)

Table 2/G.960 [T2.960], p.

1 reference point to15

5.3.1.2 *System management*

Some assumptions related to the system management are described in Annex A.

5.3.1.3 *Loopbacks*

In case a transparent loopback 2 is applied, the NT1 shall send INFO 4 frames toward the user with the D-echo-channel set to binary ZERO.

With a transparent loopback 1, the NT1 (when able to activate the user-network interface at the T reference point) shall send INFO 4 frames toward the user with the D-echo-channel set to binary ZERO or operating normally.

5.3.1.4 *Protection of layer 2 frames*

According to Recommendation I.430 § 6.2.6.1 a TE is allowed to take up to 100 ms to synchronize on INFO 2, no lower time limit is defined. The different time each TE may take to synchronize on INFO 2 affects the offering of an incoming call in layer 1 multiple terminal arrangements. The fastest TE notifies to the network that the access is activated and the message offering the incoming call (SETUP) may be transmitted (TE ready to receive the message) while other TEs are not yet ready to receive the message.

This could result in the slow TEs loosing all or part of the incoming messages (layer 2 frames).

The protection mechanism is for further study.

5.3.1.5 *Structure of the tables*

Both the DS state transition table and the ET layer 1 state transition table are structured such that the three classes of the activation/deactivation procedures described at the beginning of § 5.3 are clearly separated. This allows implementation of the basic procedure only.

5.3.1.6 *Transmission of INFO 2*

In the following procedures two different internal events of the digital section are considered to start transmission of INFO 2:

a) the transmission system is synchronized in the direction LT to NT1

b) the transmission system is synchronized in both directions of transmission (see Note 2, Table 3/G.960)

5.4 *Description of the state transtition tables*

5.4.1 *Description of the DS state transition table*

5.4.1.1 *Digital section states (DS-states)*

Hereafter are defined the states that the digital section may enter as a result of: INFOs received across reference point T, function elements (FEs) received across reference point V_1, or internal events.

The DS-states are classified according to the functionality they support as follows:

i) DS 1.X states for the support of functionality according to Recomendation I.430;

ii) DS 2.X states for the support of functionality related to loopbacks (these states complement DS 1.X states);

iii) DS 3.X states for the support of functionality related to digital section only activation/deactivation (these states complement DS 1.X states).

The X represents the specific state within each mode. Some values of X are not used in mode 2 and 3 in order to have a consistent use of them.

5.4.1.1.1 State DS 1.0 (fully deactivated): in this state state, the digital section is in a non-operational mode and as seen from the user side of reference point T, the network side is in state G1 according to Recommendation I.430 § 6.2.1.2.1.

5.4.1.1.2 State DS 1.1 (pending activation access): this transitional state is entered when an activation of the access was requested by the network (by means of either the PH- or MPH-ACTIVATE-REQUEST primitive) or the user (by means of INFO 1 across T reference point) while the digital section was in the state DS 1.0. An awake process takes place to establish the digital section conditions which allow the transmission of INFO 2 across T reference point. As seen from the user side of reference point T, the network side is in state G1 according to Recommendation I.430 § 6.2.1.2.1.

5.4.1.1.3 State DS 1.2 (transitional state access activation): when entering this transitional state the network initiates transmission of INFO 2 across reference point while waiting for the digital section to be fully synchronized and the receipt of INFO 3. As seen from the user side of reference point T, the network side is in state G2 according to Recommendation I.430 § 6.2.1.2.2.

5.4.1.1.4 State DS 1.3 (digital section fully activated): in this transitional state, the digital section is synchronized in both directions of transmission and the network sends INFO 2 across T reference point while waiting for INFO 3. As seen from the user side of reference point T, the network side is in state G2 according to Recommendation I.430 § 6.2.1.2.2. This state is also entered if loss of synchronization occurs at reference point T while in the state DS 1.5.

5.4.1.1.5 State DS 1.5 (interface at T activated): this is the normal active stable state where the layer 1 service is available to the higher layers. The network sends INFO 4 across T reference point and as seen from the user side, the network side is in state G3 according to Recommendation I.430 § 6.2.1.2.3.

5.4.1.1.6 State DS 1.6 (pending deactivation access): this transitional state is entered if the system management instructed the digital section to deactivate the access. As seen from the user side of reference point T, the network side is in state G4 according to Recommendation I.430 § 6.2.1.2.4.

5.4.1.1.7 State DS 1.7 (transitional state access deactivation): in this transitional state, the interface at reference point T is already deactivated. The deactivation of the digital section is in progress. As seen from the user side of reference point T, the network side is in state G1 according to Recommendation I.430 § 6.2.1.2.1.

5.4.1.1.8 State DS 1.8 (transitional state access deactivation): in this transitional state, the digital section is already deactivated. The deactivation of the interface at reference point T is in progress. As seen from the user side of reference point T, the network side is in state G4 according to Recommendation I.430 § 6.2.1.2.4.

5.4.1.1.9 States DS 2.X: for further study.

5.4.1.1.10 State DS 3.1 (pending activation digital section only): this transitional state is entered when an activation of the digital section only was requested by the network (by means of the MPH-DIGITAL SECTION ACTIVATE-REQUEST primitive, MHP-DSAR). The digital section was previously in the state DS 1.0 or a deactivation of the access was previously in progress. As seen from the user side of reference point T, the network side is in state G1 according to Recommendation I.430 § 6.2.1.2.1.

5.4.1.1.11 State DS 3.2 (transitional state digital section activation): this transitional state is entered when an activation of the digital section only was requested by the network (by means of the MPH-DIGITAL SECTION ACTIVATE-REQUEST primitive, MPH-DSAR). The deactivation of the access was previously in progress. As seen from the user side of reference point T, the network side is in state G4 according to Recommendation I.430 § 6.2.1.2.4.

5.4.1.1.12 State DS 3.3 (digital section only activated): in this stable state, the digital section is synchronized in both directions of transmission and this has been notified to the system management by means of the MPH-DIGITAL SECTION ACTIVATE-INDICATION primitive (MPH-DSAI). The network sends INFO 0 across T reference point. As seen from the user side of reference point T, the network side is in state G1 according to Recommendation I.430 § 6.2.1.2.1.

5.4.1.1.13 State DS 3.4 (pending activation interface): this transitional state is entered when an activation of the interface was requested by the network (by means of either the PH- or MPH-ACTIVATE-REQUEST primitive) or the user (by means of INFO 1 across the T reference point) while the digital section was already in the activated state, state DS 3.3. The network immediately transmits INFO 2 across the T reference point. As seen from the user side of reference point T, the network side is in state G2 according to Recommendation I.430 § 6.2.1.2.2.

5.4.1.1.14 State DS 3.6 (pending deactivation interface): this transitional state is entered if the system managemnt instructed the digital section to deactivate the interface at reference point T but to remain activated. As seen from the user side of reference point T, the network side is in state G4 according to Recommendation I.430 § 6.2.1.2.4.

5.4.1.2 *Repertoire of signals across the user-network interface at the T reference point*

The definition of INFO signals is contained in Recommendation I.430 § 6.2.2.

5.4.1.3 *Repertoire of function elements at the V*

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 not longer available to initiate one more state transition.

The following repertoire of function elements associated with the activation/deactivation procedures is defined:

— FE 1 (LT ← ET): activation request for the interface at reference point T

— FE 2 (LT ET): request to start timer T1 within ET layer 1

— FE 3 (LT ET): the digital section is activated

— FE 4 (LT ET): user-network interface at the T reference point is activated or loopback is operated

— FE 5 (LT ← ET): deactivation request for the digital section and interface at reference point T

— FE 6 (LT ET): the digital section is deactivated and the interface at reference point T will be or has been deactivated

— FE 7 (LT ET): error indication

— FE 8 (LT ← ET): activation request for loopback 2

— FE 9 (LT ← ET): activation request for loopback 1

— FE 10 (LT ← ET): activation request for loopback 1A

— FE 11 (LT ← ET): request to enter a state where the digital section only is activated

5.4.1.4 *Specification of the procedures*

5.4.1.4.1 *Procedures across the user-network interface at reference point T*

The digital section supports the procedures across the user-network interface at reference point T in accordance with Recommendation I.430 § 6.2.

5.4.1.4.2 *Digital section state transition table*

The state transition table, see Table 3/G.960, specifies the procedures. It includes the actions to be taken on various events while in a specific state (see § 5.4.1.1 for the definition of the states). In particular, the actions to support the activation/deactivation procedures across the reference point T in accordance with Recommendation I.430 (sequence of INFOs in compliance with I.430). The procedures for loopback operation require further study.

H.T. [1T3.960]

TABLE 3/G.960
{
State transition table of digital section (DS state machine)
}

State number DS-states related to loopbacks } INFO SENT	DS 1.0 **(Note 2)** INFO 0	DS 1.1 **(Note 2)** INFO 0	DS 1.2 (Note 2) INFO 2	DS 1.3 (Note 2) INFO 2	DS 1.5 **(Note 2)** INFO 4	DS 1.6 **(Note 2)** INFO 0
FE 1	DS 1.1	na	na	na	na	DS 1.1
FE 5	na	Start T2 DS 1.6	Start T2 DS 1.6	Start T2 DS 1.6	Start T2 DS 1.6	na
Receiving INFO 0 (Note 1)	—	—	—	—	FE 7 DS 1.3	**FE 7** DS 1.7
Receiving INFO 0	FE 2 DS 1.1	—	—	—	/	—
Receiving INFO 3	/	—	—	FE 4 DS 1.5	—	—
Lost framing at T (Note 1)	/	—	—	—	FE 7 DS 1.3	—
Expiry of timer T2	—	—	—	—	—	**FE 7** DS 1.7
Ready to transmit INFO 2	—	**FE 7** DS 1.2	—	—	—	—

{
Digital section fully activated
}
	—	—	FE 3 DS 1.3	—	—	—

{
Digital section fully deactivated
}
	—	—	—	—	—	FE 6 DS 1.8

Tableau 3/G.960 [1T3.960] (a l'italienne), p.

H.T. [2T3.960]

{
TABLE 3/G.960 *(cont.)*
}

State number DS-states related to loopbacks } INFO sent	DS 1.0 **(Note 2)** INFO 0	DS 1.1 **(Note 2)** INFO 0	DS 1.2 (Note 2) INFO 2	DS 1.3 (Note 2) INFO 2	DS 1.5 **(Note 2)** INFO 4	DS 1.6 **(Note 2)** INFO 0
FE 8						
FE 9						
FE 10 FE 11	**FE 6** DS 3.1	—	—	Start T2 DS 3.6	Start T2 DS 3.6	**FE 6** DS 3.2

Remarques du tableau 3/G.960 [2T3.960], p.

5.4.2 *Description of the ET layer 1 state transition table*

5.4.2.1 *ET layer 1 states (ET-states)*

Hereafter are defined the states that the ET layer 1 may enter as a result of: function elements (FEs) received across reference point V_1, service primitives received (PH-, MPH-primitives), or internal events.

The ET-states are classified according to the functionality they support as follows:

i) ET 1.X states for the support of functionality according to Recommendation I.430;

ii) ET 2.X states for the support of functionality related to loopbacks (these states complement ET 1.X states);

iii) ET 3.X states for the support of functionality related to digital section only activation/deactivation (these states complement ET 1.X states).

5.4.2.1.1 State ET 1.0: the access (interface at reference point T and digital section) is in a stable state (deactivated or activated). Timer T1 is not running.

5.4.2.1.2 State ET 1.1: an activation has been initiated to establish a call. Timer T1 is running.

5.4.2.1.3 State ET 2.0: the access is in a loopback state. Timer T1 is not running.

5.4.2.1.4 State ET 2.1: a loopback request has been issued. Timer T1 is running.

5.4.2.1.5 State ET 3.0: the access is in a stable state. The digital section only is activated while the interface at the T reference point is deactivated or activated. Timer T1 is not running.

5.4.2.1.6 State ET 3.1: an activation has been initiated to establish a call. When the activation of the interface at the T reference point was invoked, the digital section was already activated. Timer T1 is running.

5.4.2.1.7 State ET 3.2: this is a transitional state which is entered when the digital section only activation has been invoked. Timer T1 is running.

5.4.2.2 *Repertoire of PH- and MPH-primitives within ET for the suppport of functions specified in Recommendations I.440 and I.441. They are related to call control*

The repertoire of these primitives is defined in Recommendations I.430 § 6.2.1 and I.441 § 4.1.

The MPH-EI primitive used in this Recommendation includes the MPH-EI primitive as defined in Recommendation I.430, § 6.2.1.5. In addition, it notifies to the system management configuration control an error condition if the activation or loopback operation attempt failed (see § 5.4.2.3).

5.4.2.3 *Repertoire of MPH-primitives within ET for the support of functions associated with the digital section*

The primitives below permit the digital section to change between two modes. In the first one, full information transfer capability of the digital section is available whatever the status of the user-network interface at reference point T is. In the second one, full information transfer capability of the digital section is available only if the user-network interface at reference point T has to be or is activated. They are related to configuration control.

i) MPH-DIGITAl SECTION ACTIVATE-REQUEST (MPH-DSAR)

The MPH-DSAR primitive is used to request the digital section to maintain the full information transfer capability disregarding the state of the T reference point. The configuration control has to make provision that this primitive is issued only if the access is deactived.

ii) MPH-DIGITAL SECTION ACTIVATE-INDICATION (MPH-DSAI)

The MPH-DSAI primitive is used to indicate that the digital section is in a mode capable to maintain the full information transfer capability whatever the status of the user-network interface at reference point T is.

iii) MPH-DIGITAL SECTION DEACTIVATE-REQUEST (MPH-DSDR)

The MPH-DSDR primitive is used to restore the mode where the status of the digital section is controlled by those primitives (PH-ACTIVATE-REQUEST, or MPH-ACTIVATE-REQUEST as appropriate, and MPH-DEACTIVATE-REQUEST) which are used for the activation/deactivation of the interface at reference point T. This includes the deactivation of the digital section if the interface at reference point T has previously been deactivated. The configuration control has to make provision that this primitive is issued only if the interface at reference point T is deactivated.

iv) MPH-DIGITAL SECTION DEACTIVATE-INDICATION (MPH-DSDI)

This primitive supports a confirmed deactivation service. It is issued when the digital section is fully deactivated. Depending on deactivation procedures the interface at the T reference point is already or not yet deactivated.

v) MPH-ERROR-INDICATION (MPH-EI)

The MPH-EI primitive is used to notify the system management if the activation or loopback operation attempt failed.

vi) MPH-AWAKE-INDICATION (MPH-AWI)

This primitive notifies the network side management that the activation of the interface at reference point T has been invoked by the user side. It may be used by the ET to assign the resources required to support layer 2.

The primitives below are associated with maintenance functions based on loopbacks. The activate request primitives include the activation of the digital section and possibly the user-network interface at reference point T. The establishment of the requested loopback is notified to the requester by means of the MPH-AI primitive. The deactivation of a loopback is invoked by means of the MPH-DSDR primitive, or alternatively the MPH-DR primitive, as appropriate.

MPH-L2AR: activation request for loopback 2

MPH-L1AR: activation request for loopback 1

MPH-L1AAR: activation request for loopback 1A

The primitives below are used for other test purposes than loopbacks (continuidy test).

MPH-AR: activation request of the interface at the T reference point and the digital section for continuity test purpose.

MPH-AI: activation indication of the interface at the T reference point and of the digital section.

5.4.2.4 *ET layer 1 state transition table*

The state transition table, Table 4/G.960, specifies the procedures. It includes the actions to be taken on various events while in a specific state (see § 5.4.2.1 for the definition of the states). 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.430 (sequences of PH- and MPH-primitives in compliance with I.430) and the interactions across the layer interface between ET layer 1 and system management for the support of functions associated with the digital section (see § 5.4.2.3 for the definition of the related MPH-primitives).

H.T. [1T4.960]

TABLE 4/G.960

State transition table of ET layer 1

(ET layer 1 state machine)

State Event	ET 1.0	ET 1.1	ET 2.0	ET 2.1
PH-AR/ MPH-AR	Start T1 FE 1 ET 1.1	—	PH-DI —	PH-DI —
MPH-DR	PH-DI FE 5 —	|	FE 5 ET 1.0	|
FE 2 Restart T1 MPH-AWI ET 3.1 }	Start T1 MPH-AWI ET 1.1	(Note 3) MPH-AWI —	/	—
Expiry of timer T1	/	MPH-EI ET 1.0	/	MPH-EI ET 1.0
FE 3	(Note 4) MPH-DSAI —	MPH-DSAI —	To be specified	To be specified
FE 4 Stop T1 PH-AI MPH-AI ET 1.0 } Stop T1 MPH-AI **MPH-AI** ET 2.0 } (Note 4) **MPH-AWI** — } Stop T1 PH-AI MPH-AI ET 3.0 }	(Note 4) MPH-AI — To be specified { { /	{ {		
FE 6	MPH-DSDI —	/	To be specified	To be specified
FE 7	MPH-DI MPH-EI	/	To be specified	To be specified
MPH-L2AR	Start T1 FE 8 ET 2.1	|	|	|
MPH-L1AR	Start T1 FE 9 TC 2.1	|	|	|
MPH-L1AAR	Start T1 FE 10 TC 2.1	|	|	|
MPH-DSAR (Note 1) (Note 2) **MPH-AI** ET 3.1 }	Start T1 FE 11 ET 3.2 |	{ |	|	|
MPH-DSDR (Note 1) | — No state change, no action when event occurs | Impossible event by the definition of the layer 1 service / Impossible event due to internal reasons or peer-to-peer procedures }	(Note 5) FE 5 —	|	FE 5 ET 1.0	|

Tableau 4/G.960 [1T4.960], p.

H.T. [2T4.960]

PH-AI
Issue PH-ACTIVATE-INDICATION primitive
PH-DI
Issue PH-DEACTIVATE-INDICATION primitive
MPH-AWI
Issue MPH-AWAKE-INDICATION primitive

MPH-AI
Issue MPH-ACTIVATE-INDICATION primitive

MPH-DI
Issue MPH-DEACTIVATE-INDICATION primitive

MPH-DSDI
Issue MPH-DIGITAL SECTION DEACTIVATE-INDICATION primitive
MPH-EI
Issue MPH-ERROR-INDICATION primitive

FE..
Issue function element FE.. across V1 reference point

ET ab
Enter state ET a.b

Note 1 — The primitives MPH-DSAR and MPH-DSDR are allowed only if the T reference point is deactivated. The management has to meet this requirement.

Note 2 — This event occurs in the case of a collision between the MPH-DSAR primitive and the MPH-AWI primitive (or the MPH-DSAI primitive, if management ignores the MPH-AWI primitive) at the boundary between ET layer 1 and management. This collision has been caused by concurrent invokation of digital section only activation and access activation from the user side.

Note 3 — This event occurs in the case of a collision between the function elements FE 1 and FE 2 at reference point V1. This collision has been caused by concurrent invokation of an activation of the interface from the user side and network side.

Note 4 — These events occur if timer T1 expires concurrently with the completion of a task which the digital section indicates fo ET layer 1 by means of the appropriate function element (FE 3 and FE 4). It is a situation caused by excessive delay within the digital section. In some cases it is advantageous to issue the appropriate primitive to notify to management the status of the customer access subsequent to the error indication which would have been conveyed in an MPH-EI primitive. This provides the management with the information to initiate the optimum recovery procedure.

Note 5 — This event occurs if timer T1 expired and management invokes a deactivation as a consequence of the receipt of the MPH-EI primitive. In particular this recovery seems to be useful in case of excessive delays (see Note 4).

H.T. [T5.960]

TABLE 5/G.960

Defect conditions and consequent actions

Equipment	Defect conditions	FII	Consequent actions	
			Signal at V 1	Signal at T
LT Line side	Excessive error rate (Note 1) Loss of signal Loss of frame	Yes Yes Yes	FFS FE 7 (Note 4) FE 7 (Note 4)	FFS INFO (Note 5) INFO (Note 5)
NT Line side	Excessive error rate (Note 1) Loss of signal Loss of frame	Yes Yes Yes	FFS Not applicable Not applicable	FFS INFO (Note 5) INFO (Note 5)
NT at T	Loss of signal Loss of frame	Yes (Note 3) Yes (Note 3)	FE 7 (Note 4) FE 7 (Note 4)	Not applicable (Note 3) Not applicable
NT INFO 0 FFS For further study }	Loss of power	Yes (Note 2)	FFS	{

Note 1 — If processed in the digital section.

Note 2 — Depending on power feed arrangements, optional.

Note 3 — Optional.

Note 4 — This signal is defined in § 5.

Note 5 — Whether an existing INFO as defined in Recommendation I.430 may be used is for further study.

Remarques du tableau 4/G.960 [2T4.960], p.

5.4.2.5 *Primitive procedures for the support of functions specified in Recommendations I.440 and I.441*

The sequences of PH- and MPH-primitives which are valid between ET layer 1 and ET layer 2. and ET layer 1 and system management, respectively, for the support of functions specified in Recommendations I.440 and I.441 and the ET layer 1 states as perceived by ET layer 2 and system management as a result of primitives transferred between entities are specified in Recommendation I.430 § 6.2.1.6.

5.4.2.6 *Primitve procedures for the support of functions associated with the digital section*

The allowed sequences of MPH-primitives between ET layer 1 and system management for the support of functions associated with the digital section are specified in the state transition diagram, Figure 7/G.960. This state transition diagram defines the ET layer 1 states that system management perceives ET layer 1 to be in as a result of primitives transferred across the corresponding layer interface.

Figure 7/G.960, p.

5.5 *Activation time*

For activation from the user side the activation time is measured at the T reference point between the initiation of the sending of INFO 1 to the interface at the T reference point and the receipt of INFO 4 from the digital section.

For activation from the network side the activation time is defined between Functional Element 1 and Functional Element 4 at the V_1 reference point.

The activation time is specified for a digital section on which a bit error rate lower than the value x (see Note 1) can be achieved when activated.

5.5.1 *Maximum activation time (see Note 2) for activation occuring immediately after a deactivation (without any intervening loopback or powering action) (see Note 4)* :

Metallic pair cable transmission system

i) without regenerator: 300 ms

ii) with regenerator: 600 ms

5.5.2 *Maximum activation time (see Note 2) for activation occurring after the first powering on of a digital section:*

i) without regenerator: 10 sec

ii) with regenerator: 10 sec

Note 1 — The exact test conditions are for further study.

Note 2 — The specified value for activation time is understood as a 95%-value. This means that for 95% of performed activations the activation time must be lower than the specified value.

Note 3 — The values take into account the response time of TE for sending INFO 3 on receipt of INFO 2.

Note 4 — Timer T1 being a functional part of the ET it may be physically implemented in the ET. In this case, its value may be adjusted according to the characteristics of the transmission system between the ET and the digital section when it exists (e.g. in case of a satellite transmission system a value of 1000 ms has to be taken into account).

6 Operation and maintenance

6.1 *General*

This paragraph describes the operation and maintenance functions for the digital section of the ISDN basic rate access. For the time being only functions for a digital transmission system for a metallic line are defined.

Operation functions related to activation/deactivation procedure are specified in § 5.

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

The maintenance functions recommended in I.603 provide the capability to maintain the digital section to the level of Network Performance given in § 4 of this Recommendation.

It must be possible to test and maintain the digital section in accordance with Recommendation I.603 regardless of the customer equipment.

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.

6.2 *Control facilities*

6.2.1 *Loopbacks*

6.2.1.1 Loopback implementation

The location and characteristics of loopbacks are defined in Recommendation I.603.

6.2.1.2 *Loopback procedure*

The loopbacks are controlled by ET system management.

A normal call activation request cannot override a request for loopback 1, 1a or 2.

The procedure for loopback operation always starts from the deactivated state of the digital section.

One possible sequence is:

a) ET generates an operation command for the required loopback;

b) ET receives MPH-AI;

c) ET performs the test;

d) ET generates a release command;

e) ET receives MPH-DI.

6.2.2 *Auxiliary equipment line switchover*

The function provides control of switchovers across the V_1 reference point:

a) to switch the line from the LT to a line measurement device;

b) to switch the line from the normal LT to a standby LT;

c) to switch the LT to test NT1 located in the local exchange.

This function is optional. The function definition, control options and procedures are for further study.

6.2.3 *Control of functions in the NT1*

This function allows control of specific functions within the NT1 and is for further study.

An example of such a function: control of switching between normal and restricted power at the user network interface.

6.2.4 *Information request*

This function allows the ET to request from the LT, regenerator and NT1 specific status reports.

6.2.5 *Power switch on/off to the line*

This function allows switching of the power to the line, and may be automatically applied upon reception of a power feed failure indication.

6.2.6 *Continuity test*

The continuity test is described in Recommendation I.603.

The continuity test is controlled by the ET and is initiated by MPH-AR. System management decides when the test is passed (i.e. on reception of MPH-DSAI or MPH-AI). When the system management receives MPH-EI (expiry T1) the test is considered to be failed. See also Annex A to this Recommendation.

6.3 *Monitoring*

6.3.1 *Functions*

The following operational conditions are monitored throughout the section:

a) the defect conditions;

b) the power feed arrangements;

c) transmission performance.

6.3.2 *Implementation aspects*

Monitoring capabilities must be provided in the digital section (see Recommendation I.603). The handling and processing of the information is implementation dependent. For example:

a) the use of registers/counters in functional groups, the use of explicit commands and responses to establish status reports;

b) the transfer of information to the exchange, either when a defect condition occurs or on a regular basis. This information is then processed by entities outside the digital section.

6.3.3 *Anomaly and defect conditions and consequent action*

6.3.3.1 *Defect conditions*

The following defect conditions are examples:

i) excessive error rate;

ii) loss of incoming signal;

iii) loss of frame alignment;

iv) power feed failure.

Note — One example of an anomaly is a transmission error.

6.3.3.2 *Consequent actions*

Further to the detection of a defect condition appropriate actions should be taken as specified in Table 5/G.960.

Defect indication information (FII) is automatically transmitted from the digital section to the ET.

H.T. [T5.960]

TABLE 5/G.960

Defect conditions and consequent actions

Equipment	Defect conditions	. FII	Consequent actions	
			Signal at V 1	Signal at T
LT Line side	Excessive error rate (Note 1) Loss of signal Loss of frame	Yes Yes Yes	FFS FE 7 (Note 4) FE 7 (Note 4)	FFS INFO (Note 5) INFO (Note 5)
NT Line side	Excessive error rate (Note 1) Loss of signal Loss of frame	Yes Yes Yes	FFS Not applicable Not applicable	FFS INFO (Note 5) INFO (Note 5)
NT at T	Loss of signal Loss of frame	Yes (Note 3) Yes (Note 3)	FE 7 (Note 4) FE 7 (Note 4)	Not applicable (Note 3) Not applicable
NT INFO 0 FFS For further study }	Loss of power	Yes (Note 2)	FFS	{

Note 1 — If processed in the digital section.

Note 2 — Depending on power feed arrangements, optional.

Note 3 — Optional.

Note 4 — This signal is defined in § 5.

Note 5 — Whether an existing INFO as defined in Recommendation I.430 may be used is for further study.

Table 5/G.960 [T5.960], p.

6.3.4 *Error performance monitoring*

6.3.4.1 *General*

Provision has to be made in order to monitor the error performance of the digital section and to report on such performance.

6.3.4.2 *Error performance parameters*

The digital section must deliver to the ET the necessary information to allow it to evaluate the error performance parameters defined in Recommendation G.821.

6.3.5 *Status report functions*

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

Listed below are descriptions of the status report functions:

i) *Transmission errors*

This information, derived in the digital section, allows the ET to evaluate the transmission error performance.

ii) *Loopback 1 status*

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

iii) *Loopback 1A status*

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

iv) *Loopback 2 status*

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

v) *User network interface power feed status*

This information indicates the status of the user network interface at T reference point power feed, e.g. normal or restricted power feed mode.

vi) *User network interface power feed fault*

This information indicates a failure of the normal or restricted power source.

This function may be split into two reports.

This information is reported on request of the ET.

vii) *User network interface power feed overload*

This information indicates that the power drawn from any source within the NT1 exceeds the maximum power that is available.

This information is reported on request of the ET.

viii) *Defect indication information*

This information is transmitted automatically under conditions specified in § 6.3.3.1.

H.T. [T6.960]

TABLE 6/G.960

Status report functions

Function	Location	Mandatory/optional
Transmission errors	LT	M
.	REG.	O
.	NT	O
Loopback 1 status (Note)	LT	M
Loopback 1A status (Note)	REG.	M
Loopback 2 status (Note)	NT1	M
{ T reference point power feed status }	NT1	O
{ T reference point power feed fault }	NT1	O
{ T reference point power feed overload }	NT1	O
FII	LT	M
.	REG.	M
.	NT	M

Note — The information may be implicit (e.g., activation indication).

Tableau 6/G.960 [T6.960], p.

6.3.6 *System dependent status report functions*

These status reports will be dependent upon the type of digital transmission system used and require further study.

Some examples of a particular system are given in Table 7/G.960.

H.T. [T7.960]

TABLE 7/G.960

System dependent status report functions

Function	Location
Line test relay state	LT
LT test relay state	LT
Remote power switch state	LT
Remote power feed	LT
Induced overvoltage on line	LT
Abnormal current condition	LT

Receive eye opening
{
Echo cancellation coefficients
}
	LT REG. NT1
	
	LT REG. NT1

Battery test	NT

Table 7/G.960 [T7.960], p.

7 Control channel C↓V↓1

This control channel provides, for each direction of transmission, the capability to transfer the commands, status report information and FII.

Although described as a single channel, the control channel may be realized by a number of sub-channels which may use different transport mechanisms (as appropriate to the functions). Even though some of the functions mentioned in § 6 have optional status, the $C_{V\backslash d1}$ channel shall have the capability to convey all the control information to allow their implementation.

ANNEX A

(to Recommendation G.960)

SYSTEM MANAGEMENT REQUIREMENTS

A.1 *Introduction*

This Recommendation specifies the required functions of the 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. It is assumed that the structure of the management is as given in CCITT 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. unsuccessful activation of the interface, unsuccessfull activation of the access, loss of synchronization or signal at the interface at reference point T).

Upon the occurence of an error, the ET layer shall notify this 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, initiate MPH-DR or MPH-DSDR).

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 a loopback is initiated by the system management by issuing a primitive MPH-LxAR where by x indicates the type of loopback 2, 1 or 1A.

The setting of the loopbacks 1, 2 and 1A is confirmed to the system management by means of the MPH-AI primitive. The system management should be able to interpret this MPH-AI as a loopback confirmation and not as a normal activation indication by taking into account the sequence of the primitives.

A.2.4 *Continuity test*

The continuity test is initiated by the system management using the primitive MPH-AR. The system management must decide when the test is passed (i.e. on reception of MPH-DSAI or MPH-AI). If the system management receives MPH-EI (expiry T1) the test is considered to be failed.

If the test is passed, the system management should check whether a call establishment has been progressed or if there is a call available before sending MPH-DR.

A.2.5 *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 in the responsibility of the system management to decide to send the required pattern for fault localisation.

A.2.6 *Configuration control*

The system management shall ensure that any action related to configuration control will be issued only when the T reference point is deactivated.

ANNEX B
(to Recommendation G.960)

Vocabulary of terms used in connection with

Recommendations I.430, I.431, G.960 and G.961

Introduction

This Annex provides a vocabulary of terms and definitions that are appropriate to layer 1 aspects of the ISDN customer access for basic access and primary rate access.

It should be considered in relation to Recommendations I.430, I.431, G.960 and G.961 since its scope is limited to these Recommendations. It is provided for a clear understanding of these Recommendations and will be reviewed during the next Study Period for alignment with Recommendations produced by other bodies.

A small number of terms in this Annex are duplicated in other Recommendations (e.g. Recommendation I.112 and/or Recommendation G.701). References to these are given in parenthesis as an aid to ensuring consistency between the Recommendations in the event of future amendments (e.g. ‘‘complete loopback { .12 } *U). Where the term is defined differently, but the spirit is maintained, the reference is shown as in the following example: ‘‘functional group { .112, 41 } ’’.

According to the conventions applied in this Annex any term in common usage, but whose use is deprecated in the sense defined, is shown after the recommended term as in the following example: ‘‘line [loop]’’.

Where a truncated term is widely used in an understood context the complete term is quoted following the colloquial form, for example: ‘‘multiplex, digital multiplex equipment’’.

Paragraph B.7 contains an alphabetical list of all of the terms contained in this Recommendation.

Paragraph B.8 illustrates the general aspects of the terminology.

Paragraph B.9 explains the V reference point, V interface, and interface point concept.

B.1 *General*

101 **basic access, basic rate access**

A user-network access arrangement that corresponds to the interface structure composed of two B-channels and one D-channel. The bit rate of the D-channel for this type of access is 16 kbit/s.

102 **primary rate access**

A user-network access arrangement that corresponds to the primary rates of 1544 kbit/s and 2048 kbit/s. The bit rate of the D-channel for this type of access is 64 kbit/s. The typical primary rate interface structures are as given in Recommendations I.412 and I.431.

103 **local exchange, ISDN local exchange**

The exchange which, in addition to the switching function, contains the exchange termination for the ISDN customer accesses.

104 **line termination (LT) (abbreviated)**

The functional group containing at least the transmit and receive functions terminating one end of a digital transmission system.

105 **exchange termination (ET) (abbreviated)**

The functional group containing at least the layer 2 and layer 3 network side functions of the I.420 interface at the T reference point.

Note 1 — This may not be true if concentrators or other intelligent equipment are located in the local line distribution network.

Note 2 — The ET is not the switching function. The extent to which the ET supports call control processing and management is not defined.

106 **network termination (NT) (abbreviated)**

The functional group on the network side of a user-network interface.

Note — In Recommendations I.430 and I.431, ‘‘NT’’ is used to indicate network terminating layer 1 aspects of NT1 and NT2 functional groups.

107 **terminal equipment (TE) (abbreviated)**

The functional group on the user side of a user network interface.

Note — In Recommendations I.430 and I.431, ‘‘TE’’ is used to indicate terminal terminating layer 1 aspects of TE1, TA and NT2 functional groups.

108 **functional group** { .112, 41 }

A set of functions that may be performed by a single equipment.

Note 1 — The transmission medium is not part of any functional group.

Note 2 — Regenerators, multiplexers and concentrators are functional groups which are outside the scope of Recommendation I.411.

109 **access connection element [subscriber access]** { .32 }

The equipment providing the concatenation of functional groups between and including the exchange termination and the NT1. The term should be qualified by the type of access supported. That is:

— basic access connection element

— primary rate access connection element.

110 **customer equipment [subscriber installation]** { .32 }

The concatenation of equipment on the user side of the T reference point (i.e. TAs, TE2s, TE1s NT2 and associated transmission media). In the case of multiple access, the customer equipment includes all the equipment on the user side of all those accesses comprising the multiple access.

Note 1 — This term should not imply or restrict ownership or responsibility for providing equipment.

Note 2 — The terms ‘‘user equipment’’ and ‘‘subscriber equipment’’ are deprecated.

111 **ISDN customer access [ISDN subscriber access]**

The equipment providing the concatenation of all functional groups relevant to an individual or group of related access connection elements (i.e. customer equipment and access connection element).

Note — This term should not imply or restrict ownership or responsibility for providing equipment.

112 **direct access, direct access connection element**

A specific access connection element in which the basic access digital section or primary rate access digital section is directly connected to the exchange termination at a V_1 or $_3$ reference point respectively.

113 **remote access, remote access connection element**

A specific access connection element in which the digital section is not directly connected to the exchange termination but is connected through a multiplexer or concentrator.

114 **reference point** { .112, 42 }

A conceptual point at the conjunction of two non-overlapping functional groups.

Note — Each reference point is assigned a prefix letter, for example: T reference point.

115 **interface, physical interface** { .112, 408; G.701, 100 }

The common boundary between physical equipment.

116 **user network interface [customer network interface]** { .112, 40 }

An interface, at which the access protocols apply, and which is located at the S or T reference point.

117 **V interface**

A digital interface which usually coincides with the V reference point.

Note 1 — A specific V interface is denoted by a suffix number.

Note 2 — The V interfaces are internal network interfaces.

118 **V↓1 reference point**

A V reference point at the network side of a basic access digital section for the provision of a single basic access.

Note — The V_1 interface is a functional boundary between the exchange termination and the line termination and may or may not exist as a physical interface. The V_1 interface structure is comprised of two B-channels, one D-channel, and a $C_{v\backslash d1}$-channel.

119 **V↓2 reference point**

A V reference point at the network side of a concentrator for the provision of a number of basic and/or primary rate accesses.

120 **V↓3 reference point**

A V reference point at the network side of a primary rate access digital section for the provision of a single primary rate access.

121 **V↓4 reference point**

A V reference point at the network side of a multiplexer supporting several basic access digital sections.

B.2 *Digital transmission*

201 **Digital link, digital transmission link** { .112, 302; G.701, 300 }

The whole of the means of digital transmission of a digital signal of specified rate between specified reference points.

Note — A digital link comprises one or more digital sections and may include either a multiplexer or concentrator, but not switching.

202 **digital access link**

A digital link between the T reference point and the V reference point in the case of remote access only.

203 **digital section [section]** { .701, 300 }

The whole of the means of digital transmission of a digital signal of specified rate between two consecutive reference points. The term should be qualified by the type of access supported, or by a prefix denoting the V interface at the digital section boundaries. For example:

— basic access digital section;

— primary rate access digital section;

— V_x digital section.

204 **digital section boundaries**

The reference points at the near and far ends of the digital section.

205 **digital system, digital transmission system [system]** { .701, 301 }

A specific means of providing a digital section.

Note — For a specific type of system this term may be qualified by the insertion of the name of the transmission medium employed by that specific system. Some examples are:

— digital line transmission system;

— digital radio system;

— digital optical transmission system.

206 **transmission method**

The technique by which the transmission system transmits and receives signals via the transmission medium.

207 **echo cancellation**

A transmission method used in digital transmission systems in which bi-directional transmission occurs simultaneously on the same line and in the same frequency band. An echo canceller is required to attenuate the echo of the near-end transmission.

208 **time compression multiplex [burst mode]**

A transmission method used in digital transmission systems in which bi-directional transmission occurs in non-overlapping uni-directional bursts.

209 **multiplex, digital multiplex equipment** { .701, 401 }

The combination of a digital multiplexer and a digital demultiplexer at the same location, operating in opposite directions of transmission.

210 **static multiplex [fixed multiplex]**

A multiplex where each tributary channel is assigned to one or more main-stream time-slots and the assignment is fixed.

211 **dynamic multiplex [statistical multiplex]**

A multiplex where signalling information of some or all tributary D-channels is assigned to a lesser number of main-stream time-slots on a statistical basis, but the assignment of other channels is fixed.

212 **concentrator, digital concentrator**

Equipment containing the means to combine, in one direction, a number of basic accesses, and/or primary rate accesses into a lesser number of time-slots by omitting the idle channels and/or redundancy, and to perform the corresponding separation in the contra-direction.

B.3 *Signalling*

301 **INFO**

A defined layer 1 signal with specified meaning and coding at a basic access user-network interface.

302 **SIG**

A signal representing an exchange of layer 1 information between line terminations of a digital transmission system for basic access.

303 **function elements (FEs) (abbreviated)**

A signal representing a functional exchange of layer 1 information at the V_1 interface.

304 **control channel; C-channel [service channel]**

Additional dedicated transmission capability provided at a reference point or interface, or transported by a digital transmission system, to support the execution of management functions.

Note — The control channel at a specific reference point, interface or type of transmission system is denoted by an appropriate suffix. For example:

— $C_{v\backslash d1}$: channel — the control channel at the V_1 interface

— C_L: channel — the control channel at the line.

B.4 *Activation/deactivation*

401 **deactivation**

A function which places a system, or part of a system, into a non-operating or partially operating mode where the power consumption of the system may be decreased (low power consumption mode).

402 **activation**

A function which places a system, or part of a system, which may have been in a low power consumption mode during deactivation, into its fully operating mode.

403 **permanent activation**

Activation of a system, or part of a system, that will not be deactivated even when it is not required to be fully operating.

404 **line activation**

The function which requires the digital line transmission system to be activated but which may also activate the user-network interface.

405 **line-only activation**

The function which requires the activation of only the digital line transmission system and does not activate the user-network interface.

406 **one-step activation**

A type of activation which invokes a sequence of actions to activate the digital line transmission system and user-network interface from a single command.

407 **two-step activation**

A type of activation which is initiated by one command to invoke a sequence of actions to activate the digital line transmission system and continued by a second command to invoke a sequence of actions to activate the user-network interface.

408 **one-step deactivation**

Deactivation of the digital line transmission system and user-network interface invoked by a single command.

409 **user-network interface only deactivation**

Deactivation of the user-network interface which does not deactivate the digital line transmission system.

B.5 *Loopbacks*

501 **loopback, digital loopback** { .12 } **[test loop]** { .112 }

A mechanism incorporated into a piece of equipment whereby a bi-directional communication path may be connected back on itself so that some or all of the information contained in the bit stream sent on the transmit path is returned on the receive path.

502 **loopback type**

The characteristic of a loopback which specifies the relationship between information entering the loopback and the information leaving the loopback in the contra-direction.

503 **complete loopback** { .12 }

A physical layer 1 mechanism which operates on the full bit stream. At the loopback point, the receive bit stream shall be transmitted back towards the transmitting station without modification.

Note — The use of the term ‘‘complete loopback’’ is not related to implementation since such a loopback may be provided by means of active logic elements or controlled unbalance of a hybrid transformer, etc. At the control point only the information channels may be available.

504 **partial loopback** { .12 } **[echoing loopback]**

A physical layer 1 mechanism which operates on one or more specified channels multiplexed within the full bit stream. At the loopback point, the received bit stream associated with the specified channel(s) shall be transmitted back towards the transmitting station without modification.

505 **logical loopback** { .12 }

A loopback which acts selectively on certain information within a specified channel or channels and may result in some specified modification of the looped information. Logical loopbacks may be defined to apply at any layer, depending on the detailed maintenance procedures specified.

506 **loopback point** { .12 }

The precise location of the loopback.

507 **loopback control mechanism [control mechanism]** { .12 }

The means by which the loopback is operated and released from the loopback control point.

508 **loopback control point [control point]** { .12 }

The point which has the ability to directly control loopbacks. The loopback control point may receive requests for loopback operation from several loopback requesting points.

509 **loopback requesting point** { .12 }

The point which requests the loopback control point to operate loopbacks.

510 **loopback application** { .12 }

The maintenance phase for which the loopback operation is used.

511 **forward signal**

The signal transmitted beyond the loopback point.

Note — The forward signal may be a defined signal or unspecified.

512 **loopback test pattern** { .12 }

The information transmitted during the operation of the loopback in the channel or channels which are to be redirected by the loopback.

513 **transparent loopback** { .12 }

A transparent loopback is one in which the signal transmitted beyond the loopback point (the forward signal) when the loopback is activated, is the same as the received signal at the loopback point. See Figure B-1/G.960.

Figure B-1/G.960, p.

514 **non-transparent loopback** { .12 }

A non-transparent loopback is one in which the signal transmitted beyond the loopback point (the forward signal) when the loopback is activated is not the same as the received signal at the loopback point. The forward signal may be a defined signal or unspecified. See Figure B-2/G.960.

Figure B-2/G.960, p.

52 *1 reference point*

B.6 *local line distribution network*

601 **local line distribution network**

A network of cables and wires which are currently installed between a local exchange and customer premises.

602 **twisted pair**

A line or part of a line which has each (insulated) conductor twisted around the other to reduce the effect of induction from stray electromagnetic and/or electrostatic fields.

Note — This definition also applies to twisted quad except that two pairs are twisted together.

603 **exchange cable**

A cable forming part of the local line distribution network, used in the local exchange between the line termination and main distribution frame.

604 **main cable**

A cable used in the local line distribution network between the main distribution frame and a cross connection point.

605 **distribution cable**

A cable used in the local line distribution network between the cross connection point and a distribution point.

606 **installation cable [subscriber cable]**

A cable or single pair of metallic wires used in the local line distribution point and the customer premises.

607 **bridged tap**

A length of unused open circuit line that is ‘‘T’’ed to the customer line to provide flexibility in the local line distribution network.

Note — Bridged taps are not used in all local line distribution networks.

608 **open wire**

A pair of suspended and often uninsulated metallic wires which run parallel to each other.

Note — Overhead installation cables in common use between distribution poles and customer premises are not open wires.

609 **loading coil**

A device used to modify the electric characteristics of a line to give relatively constant attenuation over the voice-frequency range, but which gives relatively high attenuation beyond that range.

610 **crosstalk**

A phenomenon by which an unwanted signal is introduced into a line through coupling to one or more other lines.

611 **intrasystem crosstalk**

Crosstalk between lines sharing the same cable on which the same type of transmission system is used on each line.

612 **intersystem crosstalk**

Crosstalk between lines sharing the same cable and on which different types of transmission systems are used on each line.

613 **near-end crosstalk (NEXT) (abbreviated)**

Crosstalk where the coupling is occurring at or near to the transmitter.

614 **far-end crosstalk (FEXT) (abbreviated)**

Crosstalk where the coupling is occurring at or near to the end of the line furthest from the transmitter.

615 **line [loop]**

The transmission medium between line terminations. The term may be qualified by the type of medium used, for example:

— metallic line: a pair of metallic (usually copper) wires,

— optical line: one optical fibre (bi-directional transmission), or one pair of fibres (uni-directional transmission).

616 **local line [subscriber line]**

An individual line which is continuous between the line termination (LT) and the customer premises, passing through the exchange, main, distribution and installation cables.

617 **digital local line**

A local line which is used by a digital transmission system.

Note — Regenerators are not part of the line but may be inserted between two line lengths.

B.7 *Alphabetical list of terms contained in this Annex*

109 access connection element

402 activation

101 basic access

101 basic rate access

607 bridged tap

208 [burst mode]

304 C-channel

503 complete loopback

212 concentrator

304 control channel

507 [control mechanism]

508 [control point]

610 crosstalk

110 customer equipment

116 [customer network interface]

401 deactivation

202 digital access link

212 digital concentrator

201 digital link

617 digital local line

501 digital loopback

209 digital multiplex equipment

203 digital section

204 digital section boundaries

205 digital system

201 digital transmission link

205 digital transmission system

112 direct access

112 direct access connection element

605 distribution cable

211 dynamic multiplex

207 echo cancellation

504 [echoing loopback]

603 exchange cable

105 exchange termination (ET) (abbreviated)

614 far-end crosstalk (FEXT) (abbreviated)

210 [fixed multiplex]

511 forward signal

303 function element [FEs) (abbreviated)

108 functional group

301 INFO

606 installation cable

115 interface

612 intersystem crosstalk

611 intrasystem crosstalk

111 ISDN customer access

103 ISDN local exchange

111 [ISDN subscriber access]

615 line

404 line activation

405 line-only activation

104 line termination (LT) (abbreviated)

609 loading coil

103 local exchange

616 local line

601 local line distribution network

505 logical loopback

615 [loop]

501 loopback

510 loopback application

507 loopback control mechanism

508 loopback control point

506 loopback point

509 loopback requesting point

512 loopback test pattern

502 loopback type

604 main cable

209 multiplex

613 near-end crosstalk (NEXT) (abbreviated)

106 network termination (NT) (abbreviated)

514 non-transparent loopback

406 one-step activation

408 one-step deactivation

608 open wire

504 partial loopback

403 permanent activation

115 physical interface

102 primary rate access

114 reference point

113 remote access

113 remote access connection element

203 [section]

304 [service channel]

302 SIG

210 static multiplex

211 [statistical multiplex]

109 [subscriber access]

606 [subscriber cable]

110 [subscriber installation]

616 [subscriber line]

205 [system]

107 terminal equipment; (TE) (abbreviated)

208 time compression multiplex

206 transmission method

513 transparent loopback

602 twisted pair

407 two-step activation

116 user-network interface

409 user-network interface only deactivation

117 V interface

118 V_1 reference point

119 V_2 reference point

120 V_3 reference point

121 V_4 reference point

B.8 *Illustration of the general aspects of the terminology ISDN customer access*

Figure B-3/G.960, p.

B.9 *Clarification of the V reference point, V interface, and interface point concept*

B.9.1 The V_1 reference point and the V_3 reference point are always on the network side of the line termination and are applicable to individual (low order) accesses.

A reference point, when physically realized by an interface, requires the specification of at least two interface points. See Figure B-4/G.960.

Figure B-4/G.960, p.

B.9.2 *Interface point*

One of at least two physical locations associated with an interface. The interface points mark the end of the transmission medium which supports the interface and may be the location of connectors (if used).

The reach of any interface may be extended by the use of a transmission system, providing that the transmission system is transparent in regards to the functions transported by the interface. In such a case, two further interface points would be required. See Figure B-5/G.960.

Figure B-5/G.960, p.

B.9.3 A group of individual accesses may be multiplexed or concentrated together to comprise a higher order access (i.e. V_2 or V_6 for basic access higher order interfaces).

There is only one V reference point at which the V interfaces may be implemented (between LT and ET). See Figure B-6/G.960.

This approach aligns with the use of I_B and I_A interface points in Recommendations I.430 and I.431.

— with the modelling technique used so far;

— with the terminology used so far;

— with the fact that an S or T reference point may support a range of interfaces (Recommendations I.430/I.431);

— does not contradict Recommendation Q.512.

Figure B-6/G.960, p.22

MONTAGE: REC. G.961 A LA FIN DE CETTE PAGE