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DIGITAL SECTIONS AND DIGITAL LINE SYSTEMS

ACCESS DIGITAL SECTION FOR ISDN BASIC RATE ACCESS

ITU-T Recommendation G.960

(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.960 was revised 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 Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.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.

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Recommendation G.960**ACCESS DIGITAL SECTION FOR ISDN BASIC RATE ACCESS***(Melbourne, 1988; revised Helsinki, 1993)***1 General****1.1 Scope**

This Recommendation describes the characteristics of an access 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 V₁ 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 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.

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 that reference point T and V₁ are not identical and therefore the access digital section is not symmetric.

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

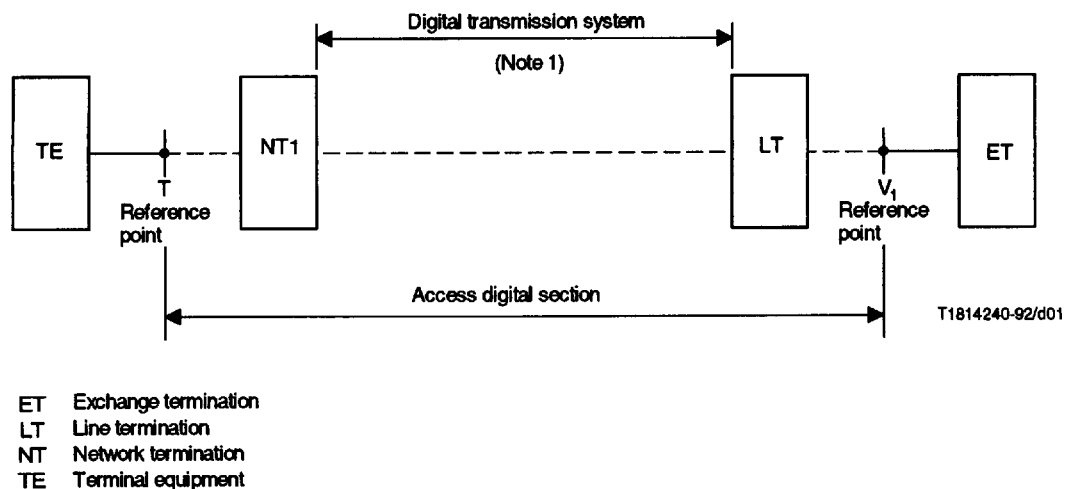
The basic access digital section may be applied as given in Figure 2 for:

- direct access to the local exchange (V₁-reference point);
- access via a basic access multiplex equipment (V₄-interface) to the local exchange;
- access via a basic access concentrator (V₂-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 latter are given below:

C _{V₁}	Control Channel at V ₁ reference point
DS	Access digital section
FE	Function Element used between ET and LT
INFO	Information element defined at the user network interface
SIG	Signal between LT and NT1
DTS	Digital Transmission System



NOTES

- 1 Digital transmission system refers to a line system using metallic pairs, optical fibres or radio systems.
- 2 The line transceivers in the NT1 and LT are part of the digital transmission system.

FIGURE 1/G.960

Access digital section and transmission system boundaries

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

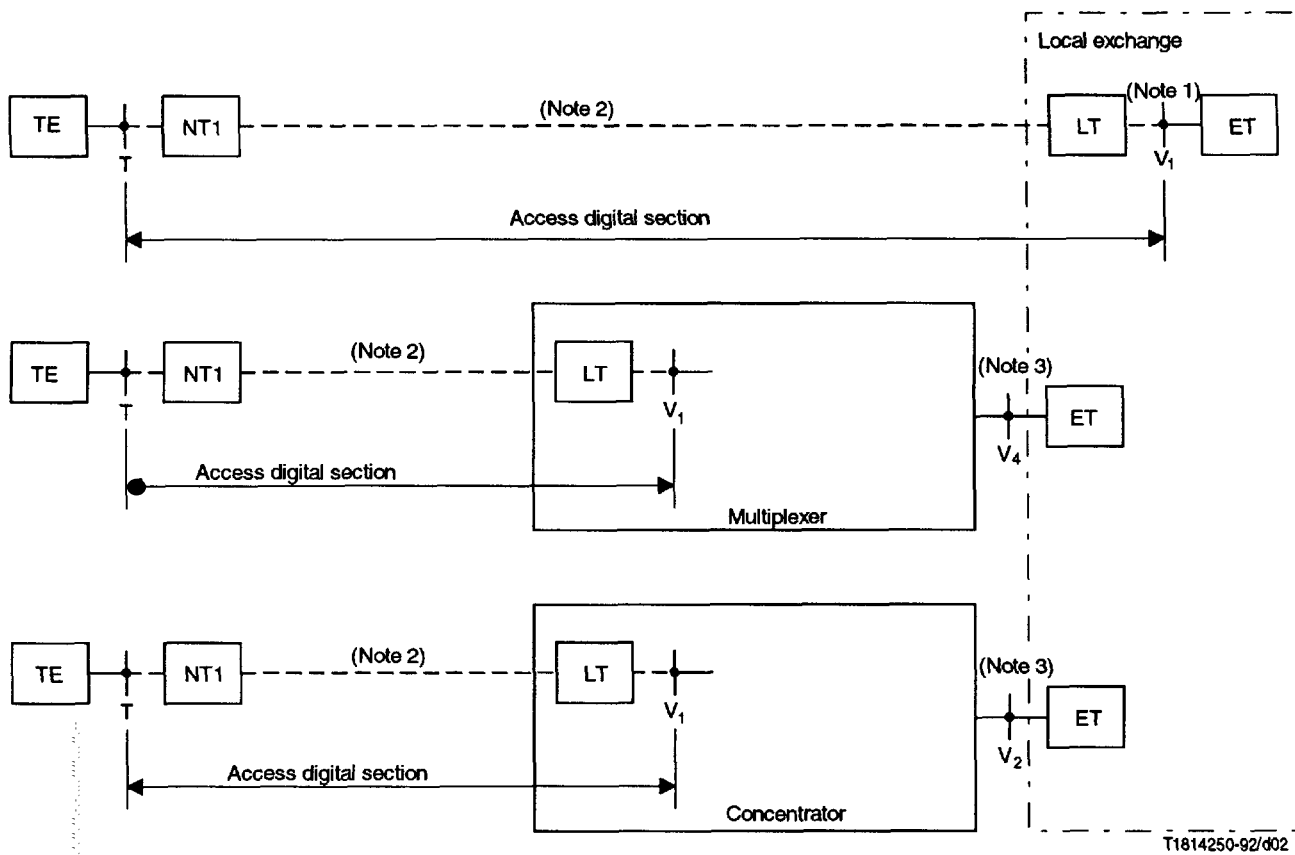
The general model shown in Figure 3 depicts the whole ISDN customer access layer 1 and adjacent entities and provides the basis to describe the functions performed by the access digital section and those performed by TE, ET and system management and how various functions are grouped. In particular, according to this model the activation/deactivation procedures and 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 as follows:

- i) Recommendations I.430 and Q.920/Q.921 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 Q.920 and 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 defined in this model do not conflict with those specified for the TE in Recommendation I.430.

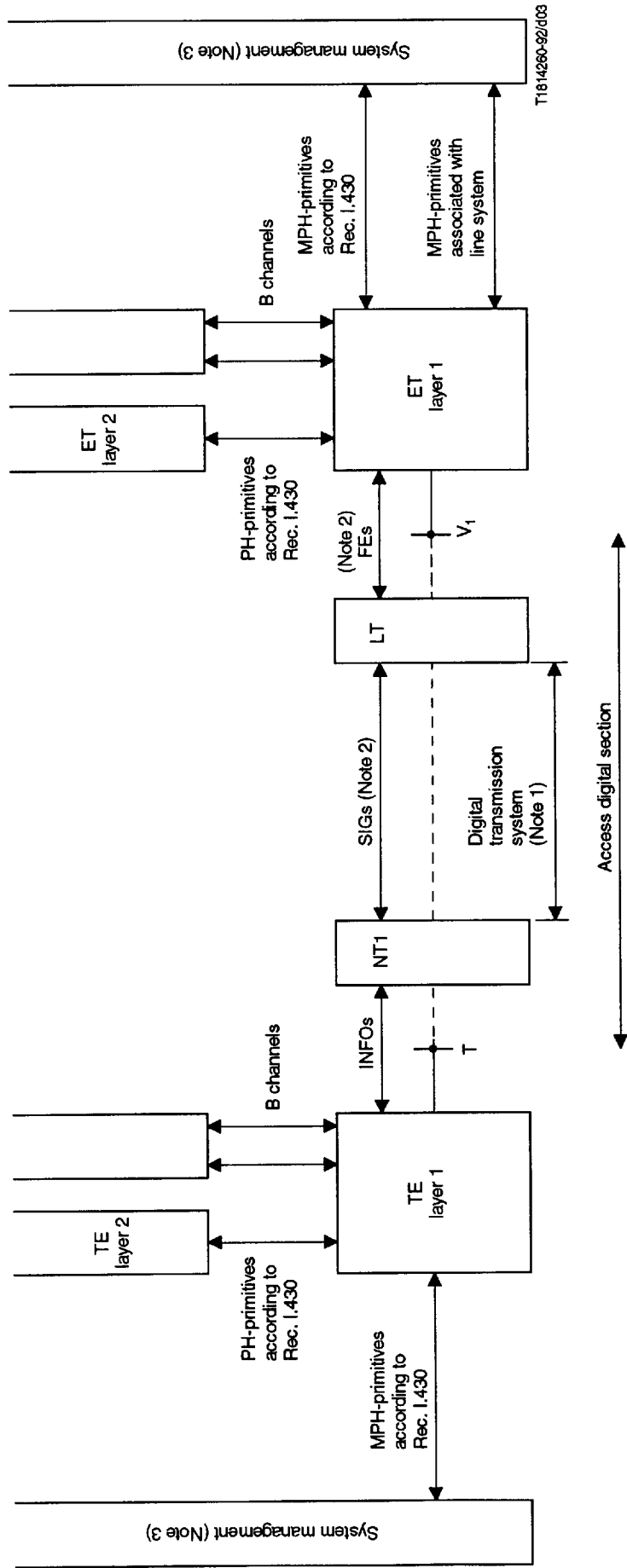
This model does not constrain layer 1 arrangements between LT and NT1, (it is also applicable to remote access application as shown in Figure 2), or the digital transmission system technology.



NOTES

- 1 The LT may be integrated together with the ET or separate (as integral part or outside of the local exchange).
- 2 The application of one regenerator in an access digital section using a digital transmissions system for metallic pairs may be foreseen.
- 3 Local and remote application are envisaged. For the remote case a transparent link between the remote multiplexer or concentrator and the local exchange will be used.

FIGURE 2/G.960
Application of the access digital section



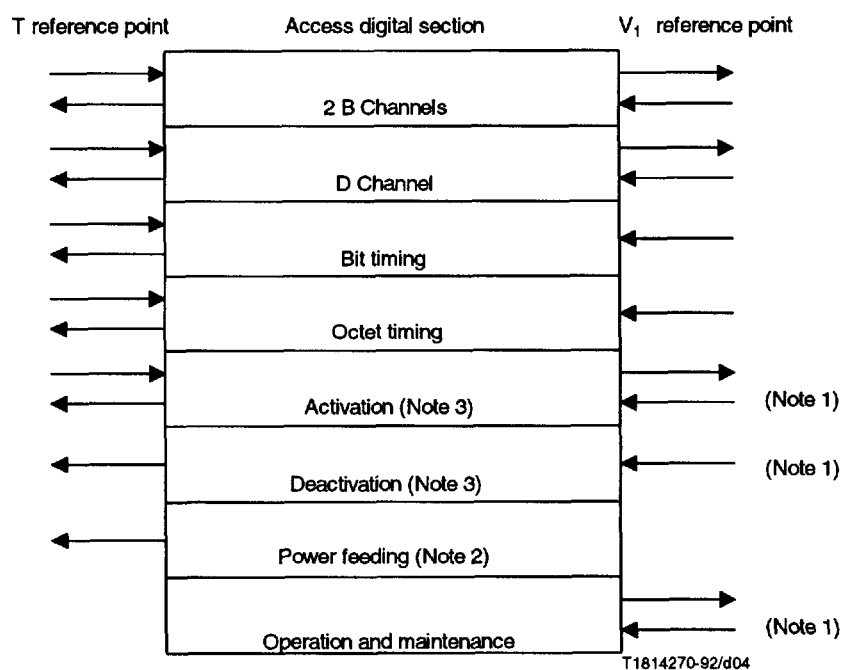
NOTES

- 1 The digital transmission system refers to a digital line transmission system using either a metallic pair of wires, optical fibre or radio system.
- 2 SIG, FE and primitives refer to an exchange of information. They do not imply any specific coding nor implementation. Some of these functions may be terminated in the LT and do not pass through 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.960
General model of ISDN customer access layer 1 and adjacent entities

3 Functions

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



NOTES

- 1 These functions are conveyed by the C_{V_1} channel across the V_1 reference point.
- 2 This function is optional.
- 3 The activation and deactivation functions are concerned with the operation of the access digital section and the user-network interface. However, for consistency with Recommendation I.430, they are described as separate functions.

FIGURE 4/G.960
Functions of the 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. At 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.

3.5 Activation

3.5.1 Activation from ET

This function places all the functions of the access 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.

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

In case a basic access digital section uses a digital transmission system for a metallic line, an additional mode of operation may be applied for activation/deactivation, which is to activate/deactivate the access digital section only (partial activation of the DS, i.e. no signal shall be sent from the NT1 to the interface at the T reference point, but signals can be received for activation from the user side). This is optional.

3.5.2 Request for activation from TE

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

These functions are conveyed by the C_{V1} -channel (see 7).

3.6 Deactivation

This function permits the interface at the T reference point and the access digital section to be placed in a low power consumption mode. The procedures and exchange of information are described in 5.

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

This function is conveyed by the C_{V1} -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 9/I.430.

3.8 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.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 access digital section power feeding.

These functions are conveyed by the C_{V1} -channel (see 7).

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 access 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 V_1 reference points for each direction of transmission. The value shall be less than 2 ms when a system for metallic pairs, optical fibre or a radio-relay 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.

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 specified in 8/1.430.

4.4.2 Jitter at V_1 reference point

Jitter on timing signals provided at V_1 reference point to the LT shall be limited to values which do not require jitter reduction in the LT.

Jitter limits at V_1 reference point from LT are not required since the timing at V_1 reference point is defined as contradirectional.

Jitter requirements additional to those given here are system dependent and outside the scope of this Recommendation and may be defined in Recommendation G.961.

5 Activation/deactivation

5.1 Functional capabilities

The access 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 access digital section.

5.1.2 Equipment at the network side of V_1 reference point to:

a) *activate:*

- 1) the layer 1 of the user-network interface at reference point T and, if not already activated, the access digital section (this activation is related to call control); or
- 2) the access digital section partially (this activation is related to controlling the configuration of the access; it is a network option);

b) *deactivate:*

- 1) the layer 1 of the user-network interface at reference point T and the access 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 a) 2) allow maintenance actions in the access digital section which do not affect the deactivated user-network interface at reference point T to be performed if required. In some applications they also permit the access 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 6.2/I.430. These procedures are based on a repertoire of INFO signals as defined in Recommendation I.430 (see Table 4/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 6.2/I.430 and Recommendations Q.920 and Q.921. The means for defining these interactions are the primitive procedures (see Figure 5/I.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 the subscriber installation 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 access digital section (DS state machine), and one at the network side of the V_1 reference point (ET layer 1 state machine). Figure 5/ illustrates this approach.

In addition to primitives defined in Recommendations I.430 and Q.921 related to call control, Figure 5 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 conceptual and does not imply any particular implementation.

The model for activation/deactivation, given in 2, requires further partitioning of the DS state machine into the NT1 state machine (NT states) and the LT state machine (LT states). This is shown in Figure 6.

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 digital 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 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.430, and additional primitive procedures for the support of functions associated with the access digital section.