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8.1 *Bit rate*

8.1.1 *Nominal rate*

8 Electrical characteristics

The nominal bit rate is 192 kbit/s.

8.1.2 *Tolerance*

The tolerance (free running mode) is ± 100 ppm.

8.2 *Jitter and bit-phase relationship between TE input and output*

8.2.1 *Test configurations*

The jitter and phase deviation measurements are carried with four different waveforms at the TE input, in accordance with the following configurations:

i) point-to-point configuration with 6 dB attenuation measured between the two terminating resistors at 96 kHz (high capacitance cable);

ii) short passive bus with 8 TEs (including the TE under test) clustered at the far end from the signal source (high capacitance cable);

iii) short passive bus with the TE under test adjacent to the signal source and the other seven TEs clustered at the far end from the signal source. Configuration a): high capacitance cable; configuration b): low capacitance cable;

iv) ideal test signal condition, with one source connected directly to the receiver of the TE under test (i.e., without artificial line).

Examples of waveforms that correspond to the configurations i), ii), iiia) and iiib) are given in Figure 6/I.430 to Figure 9/I.430. Test configurations which can generate these signals are given in Annex D.

8.2.2 *Timing extraction jitter*

Timing extraction jitter, as observed at the TE output, shall be within —7% to +7% of a bit period, when the jitter is measured using a high pass filter with a cut-off frequency (3 dB point) of 30 Hz under the test conditions described in § 8.2.1. The limitation applies with an output data sequence having binary ZEROs in both B-channels and with input data sequences described in a) to c) below. The limitation applies to the phase of all zero-volt crossings of all adjacent binary ZEROs in the output data sequence.

a) A sequence consisting of continuous frames with all binary ONEs in D-, D-echo and both B-channels;

b) a sequence, repeated continuously for at least 10 seconds, consisting of:

— 40 frames with continous octets of ‘‘10101010’’ (the first bit to be transmitted is binary ONE) in both B-channels and continuous binary ONEs in D- and D-echo channels, followed by

— 40 frames with continuous binary ZEROs in D-, D-echo and both B-channels;

c) a sequence consisting of a pseudo random pattern with a length of $2^{19} — 1$ in D-, D-echo and both B-channels. (This pattern may be generated with a shift register with 19 stages with the outputs of the first, the second, the fifth and the nineteenth stages added together (modulo 2) and fed back to the input.)

Figure 6/I.430, p. 1

Figure 7/I.430, p. 2

8.2.3 *Total phase deviation input to output*

The total phase deviation (including effects of timing extraction jitter in the TE), between the transitions of signal elements at the output of the TE and the transitions of signal elements associated with the signal applied to the TE input, should not exceed the range of —7% to +15% of a bit period. This limitation applies to the output signal transitions of each frame with the phase reference defined as the average phase of the crossing of zero volts which occurs between the framing pulse and its associated balance pulse at the start of the frame and the corresponding crossings at the start of the three preceding frames of the input signal.

Figure 8/I.430, p. 3

Figure 9/I.430, p. 4

For the purpose of demonstrating compliance of an equipment, it is sufficient to use (as the input signal phase reference) only the crossing of zero volts between the framing pulse and its associated balance pulse of the individual frame. This latter method, requiring a simpler test set, may create additional jitter at frequencies higher than about 1 kHz and is therefore more restrictive. The limitation applies to the phase of the zero-volt crossings of all adjacent binary ZEROs in the output data sequence, which shall be as defined in § 8.2.2. The limitation applies under all test conditions described

in § 8.2.1, with the additional input signal conditions specified in a) to d) below, and with the superimposed jitter as specified in Figure 10/I.430 over the range of frequencies from 5 Hz to 2 kHz. The limitation applies for input bit rates of 192 kbit/s ± 100 ppm.

a) A sequence consisting of continuous frames with all binary ONEs in the D-, D-echo and both B-channels;

b) a sequence consisting of continuous frames with the octet ‘‘10101010’’ (the first bit to be transmitted is binary ONE) in both B-channels and binary ONEs in D- and D-echo channels;

c) a sequence of continuous frames with binary ZEROs in D, D-echo and both B-channels;

d) a sequence of continuous frames with a pseudo random pattern, as described in § 8.2.2 |), in D-, D-echo and both B-channels.

Figure 10/I.430, p.

8.3 *NT jitter characteristics*

The maximum jitter (peak-to-peak) in the output sequence of an NT shall be 5% of a bit period when measured using a high pass filter having a cut-off frequency (3 dB point) of 50 Hz and an asymptotic roll off of 20 dB per decade. The limitation applies for all data sequences, but for the purpose of demonstrating the compliance of an equipment, it is sufficient to measure jitter with an output data sequence consisting of binary ONEs in D- and B-channels and with an additional sequence as described in § 8.2.2 |) in D- and B-channels. The limitation applies to the phase of all zero-volt crossings of all adjacent binary ZEROs in the output data sequence.

8.4 *Termination of the line*

The interchange circuit pair termination (resistive) should be 100 ohms ± | % (see Figure 2/I.430).

8.5 *Transmitter output characteristics*

8.5.1 *Transmitter output impedance*

The following requirements apply at interface point I_A (see Figure 2/I.430) for TEs and at interface point I_B for NTs (see § 4.5 and § 8.9 regarding capacitance of the cord).

8.5.1.1 *NT transmitter output impedance*

a) When inactive or transmitting a binary ONE, the output impedance, in the frequency range of 2 kHz to 1 MHz, shall exceed the impedance indicated by the template in Figure 11/I.430. The requirement is applicable with an applied sinusoidal voltage of at least 100 mV (r.m.s. value).

Note — In some applications, the terminating resistor can be combined with the NT (see point B of Figure 2/I.430). The resulting impedance is the impedance needed to exceed the combination of the template and the 100-ohm termination.

b) When transmitting a binary ZERO, the output impedance shall be ≥" 20 ohms.

Note — The output impedance limit shall apply for two nominal load impedance (resistive) conditions: 50 ohms and 400 ohms. The output impedance for each nominal load shall be defined by determining the peak pulse amplitude for loads equal to the nominal value ± 10%. The peak amplitude shall be defined as the amplitude at the midpoint of a pulse. The limitation applies for pulses of both polarities.

Figure 11/I.430, p.

8.5.1.2 *TE transmitter output impedance*

a) In the inactive and powered-down states or when transmitting a binary ONE, the following requirements apply:

i) The output impedance, in the frequency range of 2 kHz to 1 MHz, should exceed the impedance indicated by the template in Figure 12/I.430. This requirement is applicable with an applied sinusoidal voltage of at least 100 mV (r.m.s. value).

ii) At a frequency of 96 kHz, the peak current which results from an applied voltage of up to 1.2 V (peak value) should not exceed 0.6 mA (peak value).

b) When transmitting a binary ZERO, the output impedance shall be ≥" 20 ohms.

Note — The output impedance limit shall apply for two nominal load impedance (resistive) conditions: 50 ohms and 400 ohms. The output impedance for each nominal load shall be defined by determining the peak pulse amplitude for loads equal to the nominal value ± 10%. The peak amplitude shall be defined as the amplitude at the midpoint of a pulse. The limitation applies for pulses of both polarities.

Figure 12/I.430, p.

8.5.2 *Test load impedance*

The test load impedance shall be 50 ohms (unless otherwise indicated).

8.5.3 *Pulse shape and amplitude (binary ZERO)*

8.5.3.1 *Pulse shape*

Except for overshoot, limited as follows, pulses shall be within the mask of Figure 13/I.430. Overshoot, at the leading edge of pulses, of up to

5% of the pulse amplitude at the middle of a signal element, is permitted, provided that such overshoot has, at 1/2 of its amplitude, a duration of less than 0.25 µs.

Figure 13/I.430, p.

8.5.3.2 *Nominal pulse amplitude*

The nominal pulse amplitude shall be 750 mV, zero to peak.

A positive pulse (in particular, a framing pulse) at the output port of the NT and TE is defined as a positive polarity of the voltage measured between access leads e to f and d to c respectively (see Figure 20/I.430). (See Table 9/I.430 for the relationship to connector pins

8.5.4 *Pulse unbalance*

The ‘‘pulse unbalance’’, i.e., the relative difference in ∫*U* (*t*)d*t* for positive pulses and ∫*U* (*t*)d*t* for negative pulses shall be 5%.

8.5.5 *Voltage on other test loads* (TE only)

The following requirements are intended to assure compatibility with the condition where multiple TEs are simultaneously transmitting pulses on to a passive bus.

8.5.5.1 *400-ohm load*

A pulse (binary ZERO) shall conform to the limits of the mask shown in Figure 14/I.430 when the transmitter is terminated in a 400-ohm load.

8.5.5.2 *5.6-ohm load*

To limit the current flow with two drivers having opposite polarities, the pulse amplitude (peak) with a 5.6-ohm load shall be 20% of the nominal pulse amplitude.

8.5.6 *Unbalance about earth*

The following requirements apply under all possible power feeding conditions, under all possible connections of the equipment to ground, and with two 100-ohm terminations across the transmit and receive ports.

8.5.6.1 *Longitudinal conversion loss*

Longitudinal conversion loss (LCL) which is measured in accordance with Recommendation G.117, § 4.1.3 (see Figure 15/I.430), shall meet the following requirements:

a) 10 kHz < *f* 300 kHz: ≥" 54 dB

b) 300 kHz < *f* 1 MHz: minimum value decreasing from 54 dB at 20 dB/decade.

8.5.6.2 *Output signal balance*

Output signal balance which is measured in accordance with Recommendation G.117, § 4.3.1 (see Figure 16/I.430), shall meet the following requirements:

a) *f* = 96 kHz: ≥" 54 dB

b) 96 kHz < *f* 1 MHz: minimum value decreasing from 54 dB at 20 dB/decade.

8.6 *Receiver input characteristics*

8.6.1 *Receiver input impedance*

8.6.1.1 *TE receiver input impedance*

TEs shall meet the same input impedance requirements as specified in § 8.5.1.2 |) for the input impedance.

8.6.1.2 *NT receiver input impedance*

In the inactive and powered-down states, the following requirements apply:

i) the input impedance in the frequency range of 2 kHz to 1 MHz, should exceed the impedance indicated by the template in Figure 11/I.430. This requirement is applicable with an applied sinusoidal voltage of at least 100 mV (r.m.s. value);

ii) at a frequency of 96 kHz, the peak current which results from an applied voltage of up to 1.2 V (peak value) should not exceed 0.5 mA (peak value).

Note — In some applications, the 100-ohm terminating resistor can be combined with the NT (see point B of Figure 2/I.430). The resulting impedance is the impedance needed to exceed the combination of the template and the 100-ohm termination.

Figure 14/I.430, p. 9

Figure 15/I.430, p. 10

Figure 16/I.430, p. 11

8.6.2 *Receiver sensitivity — Noise and distortion immunity*

Requirements applicable to TEs and NTs for three different interface wiring configurations are given in the following sections. TEs and/or NTs shall receive, without errors (for a period of at least one minute), an input with a pseudo-random sequence (word length ≥" 511 bits) in all information channels (combination of B-channel, D-channel and, if applicable, the D-echo channel).

The receiver shall operate, with any input sequence, over the full range indicated by the waveform mask.

8.6.2.1 *TEs*

TEs shall operate with the input signals conforming to the waveforms specified in § 8.2.1. For the waveforms in Figures 7/I.430 to 9/I.430, TEs shall operate with the input signals having any amplitude in the range of +1.5 dB to —3.5 dB relative to the nominal amplitude of the transmitted signal as specified in § 8.5.3.2. For signals conforming to the waveform in Figure 6/I.430, operation shall be accomplished for signals having any amplitude in the range of +1.5 to —7.5 dB relative to the nominal amplitude of the transmitted signal as specified in § 8.5.3.2. In addition, TEs shall operate with signals conforming to each waveform with jitter up to the maximum permiteed (see § 8.3) in the output signal of NTs superimposed on the input signals.

Additionally, for input signals having the waveform shown in Figure 6/I.430, the TEs shall operate with sinusoidal signals having an amplitude of 100 mV (peak-to-peak value) at frequencies of 200 kHz and 2 MHz superimposed individually on the input signals along with jitter.

8.6.2.2 *NTs for short passive bus (fixed timing)*

NTs designed to operate with only short passive bus wiring configurations shall operate when receiving input signals indicated by the waveform mask shown in Figure 17/I.430. NTs shall operate, with the input signals having any amplitude in the range of +1.5 dB to —3.5 dB relative to the nominal amplitude of the transmitted signal as specified in § 8.5.3.2.

Figure 17/I.430, p.

8.6.2.3 *NTs for both point-to-point and short passive bus configurations (adaptive timing)*

NTs designed to operate with either point-to-point or short passive bus wiring configurations shall operate when receiving input signals indicated by the waveform mask shown in Figure 18/I.430. These NTs shall operate with

the input signals having any amplitude in the range of +1.5 dB to —3.5 dB relative to the nominal amplitude of the transmitted signal as specified in § 8.5.3.2. These NTs shall also operate when receiving signals conforming to the waveform in Figure 6/I.430. For signals conforming to this waveform, operation shall be accomplished for signals having any amplitude in the range of +1.5 to —7.5 dB relative to the nominal amplitude of the transmitted signal as specified in § 8.5.3.2. Additionally, these NTs shall operate with the sinusoidal signals, as specified in § 8.6.2.1, and with jitter up to the maximum permitted in the output signal of TEs (see § 8.2.2), superimposed on the input signals having the waveform in Figure 6/I.430.

Figure 18/I.430, p.

8.6.2.4 *NTs for extended passive bus wiring configurations*

NTs designed to operate with extended passive bus wiring configurations shall operate when receiving input signals indicated by the waveform mask shown in Figure 19/I.430. These NTs shall operate with the input signals having any amplitude in the range of +1.5 dB to —5.5 dB relative to the nominal amplitude of the transmitted signal as specified in § 8.5.3.2. Additionally, these NTs shall operate with the sinusoidal signals, as specified in § 8.6.2.1, superimposed on the input signals having the waveform shown in Figure 19/I.430. (The above values assume a maximum cable loss of 3.8 dB. NTs may be implemented to accommodate higher cable loss).

8.6.2.5 *NTs for point-to-point configurations only*

NTs designed to operate with only point-to-point wiring configurations shall operate when receiving input signals having the waveform

shown in Figure 6/I.430. These NTs shall operate with the input signals having any amplitude in the range of +1.5 to —7.5 dB relative to the nominal amplitude of the transmitted signal as specified in § 8.5.3.2. Additionally, these NTs shall operate with the sinusoidal signals, as specified in § 8.6.2.1, and with jitter up to the maximum permitted in the output signal of TEs (see § 8.2.2) superimposed on the input signals having the waveform shown in Figure 6/I.430.

8.6.3 *NT receiver input delay characteristics*

Note — Round trip delay is always measured between the zero-volt crossings of the framing pulse and its associated and balance bit pulse at the transmit and receive side of the NT (see also Annex A).

Figure 19/I.430, p.

8.6.3.1 *NT or short passive bus*

NTs shall accommodate round trip delays of the complete installation, including TEs, in the range 10 to 14 µs.

8.6.3.2 *NT for both point-to-point and passive bus*

NTs shall accommodate round trip delays (for passive bus configurations) in the range 10 to 13 µs.

NTs shall accommodate round trip delays (for point-to-point configurations) in the range 10 to 42 µs.

8.6.3.3 *NT for extended passive bus*

NTs shall accommodate round trip delays in the range 10 to 42 µs, provided that the differential delay of signals from different TEs is in the range 0 to 2 µs.

8.6.3.4 *NT for point-to-point only*

NTs shall accommodate round trip delays specified in § 8.6.3.2 for point-to-point configurations.

8.6.4 *Unbalance about earth*

Longitudinal conversion loss (LCL) of receiver inputs, measured in accordance with Recommendation G.117, § 4.1.3, by considering the power feeding and two 100-ohm terminations at each port, shall meet the following requirements (see Figure 15/I.430):

a) 10 kHz f 300 kHz: ≥" 54 dB

b) 300 kHz < f 1 MHz: minimum value decreasing from 54 dB with 20 dB/decade.

8.7 *Isolation from external voltages*

IEC Publication 479-1, Second Issue 1984, specifies current limitation dealing with human safety. According to that publication, the value of a touchable leakage alternating current measured through a resistor of 2 kohms is limited. The application of this requirement to the user-network interface is not a subject of this Recommendation, but should be recognized that an apportionment of this limited current to each mains powered equipment connected to the passive bus is necessary.

8.8 *Interconnecting media characteristics*

Longitudinal conversion loss of pairs at 96 kHz shall be ≥" 43 dB.

8.9 *Standard ISDN basic access TE cord*

A connecting cord for use with a TE designed for connection with a ‘‘standard ISDN basic access TE cord’’ shall have a maximum length of 10 metres and shall conform to the following:

a) Cords having a maximum length of 7 metres:

— the maximum capacitance of pairs for transmit and receive functions shall be less than 300 pF;

— the characteristic impedance of pairs used for transmit and receive functions shall be greater than 75 ohms at 96 kHz;

— the crosstalk loss , at 96 kHz, between any pair and a pair to be used for transmit or receive functions shall be greater than 60 dB with terminations of 100 ohms;

— the resistance of an individual conductor shall not exceed 3 ohms;

— cords shall be terminated at both ends in plugs (individual conductors shall be connected to the same contact in the plug at each end);

b) Cords having a length greater than 7 metres:

— cords shall conform to the above requirements except that a capacitance of 350 pF is permitted;

— TEs may be designed that include a connecting cord which is part of the TE. In this case the requirements for a standard ISDN basic access TE cord do not apply.

9 Power feeding

9.1 *Reference configuration*

The reference configuration for power feeding, which is based on an eight-pin interface connector, is described in Figure 20/I.430. The access lead designations, ‘‘a’’ through ‘‘h’’, are not intended to reflect particular pin assignments, which, as indicated in § 10, are to be specified in an ISO standard. The use of leads c, d, e and f is mandatory. The use of leads a, b, g and h is optional.

The reference configuration allows unique physical and electrical characteristics, for the interface at reference points S and T, which are independent of the choice of internal or external power source arrangements.

Power source 1 may derive its power from the network and/or locally (mains and/or batteries). While the source for restricted power is an integral part of the NT, the source for normal conditions may be physically separate and may be connected at any point in the interface wiring. Note that such a separate source should be considered functionally part of the NT. However, the provision of such a source is subject to the approval of the Administration/network provider. To avoid interworking problems, it is not permitted to connect such a separate source of phantom mode power in wiring associated with NTs having an internal source for normal conditions. Where a separate source of phantom mode power is provided, its compatibility with a source for restricted power that is part of the associated NT must be assured by the provider of the separate source. In particular, the resolution of power contention, which may result from the provision of the separate source, between the separate source and a restricted power condition source internal to an NT, is not specified in this Recommendation and must be taken into account. In addition, any effects on the transmission characteristics of interface cabling must also be accounted for, e.g., the impedance of a power source that bridges the interchange circuit pairs may require a reduction in the number of TEs that can be accommodated on a passive bus.

Power source 2 derives its power locally (mains and/or batteries). Power source 2 may be located in (or associated with) the NT as indicated, or it may be located separately.

Figure 20/I.430, p.

9.1.1 *Functions specified at the access leads*

The eight access leads for TE and NT shall be applied as follows:

i) Access lead pairs c-d and e-f are for the bidirectional transmission of the digital signal and may provide a phantom circuit for power transfer from NT to TE (power source 1).

ii) Access lead pair g-h may be used for additional power transfer from the NT to TE (power source 2).

iii) Access lead pair a-b may also be used for power transfer (power source 3) in TE-TE interconnection; this is not the subject of a CCITT Recommendation.

9.1.2 *Provision of power sources and sinks*

Power source 1 may not always be provided. Provision of power source 2 is subject to the decision of individual Administrations. Power source 3 is not subject to CCITT Recommendation. Power sink 1 is optional. Administrations may limit the use of power from power source 1 to those TEs capable of providing a minimum service. Power sink 2 is optional.

Note — It should be noted that a TE that is to be portable (for example from network to network, country to country) cannot rely exclusively on phantom power for its operation.

9.2 *Power available from NT*

It is desirable for power sources to include current limiting provisions to provide short-circuit protection

9.2.1 *Power source 1 normal and restricted power conditions*

Power source 1 may provide either normal or restricted power conditions or both.

When power source 1 is provided, the power conditions are considered as follows:

i) Where power is provided under normal conditions, the power available from power source 1 is the responsibility of the individual Administration/network provider. However, power source 1 together with any separate source, as described in § 9.1, shall provide at least the power for the consumption of 1 watt (the maximum specified in § 9.3.1 that a TE may draw; see also note to § 9.3.1.1) at TE interfaces. The power required to be available from the NT may depend upon the possible provision of a separate source and the cable configuration.

ii) Under restricted power conditions, the minimum power available from power source 1 shall be 420 mW. When power source 1 enters a condition where it is able to supply only restricted power, it should indicate this condition by reversing its polarity. In this condition, only the unrestricted power functions of TEs are allowed to consume power from source 1.

iii) If power source 1 (and any separate source combination) can supply power in both normal and restricted power conditions, the change of condition of power source 1 from the normal to restricted power condition may occur when power source 1 (and any separate source combination) is unable to supply the ‘‘nominal’’ level of power. [The ‘‘nominal’’ level of power is defined as the minimum power that the power source 1 (or separate power source) is designed to supply.] In any case, the transition from normal to restricted condition shall occur when the power described in i) above is not available from power source 1 (as a result of a loss of its source of power).

9.2.2 *Minimum voltage at NT from power source 1*

9.2.2.1 *Normal power conditions*

Under normal power conditions, the nominal value of voltage of power source 1, if provided, at the output of the NT shall be 40 V and the tolerances shall be +5% and —15% when supplying up to the maximum available power.

9.2.2.2 *Restricted power conditions*

Under restricted power conditions, the nominal value of the voltage of power source 1, if provided, at the output of the NT shall be 40 V and the tolerances shall be +5% and —15% when supplying up to 420 mW.

9.2.3 *Minimum voltage of power source 2*

The nominal voltage of power source 2 (optional third pair) shall be 40 V. The maximum voltage shall be 40 V + 5% and the minimum voltage shall assure compliance with the requirements specified in § 9.3.2 concerning power available at a TE.

9.3 *Power available at a TE*

9.3.1 *Power source 1 — phantom mode*

9.3.1.1 *Normal power conditions*

Under normal power conditions, the maximum voltage at the interface of a TE shall be 40 V + 5% and the minimum voltage shall be 40 V — 40% (24 V) when drawing up to a maximum permitted power consumption of 1 watt.

Note — For a period until the end of 1988, TEs which cannot meet this requirement may consume up to 1.5 watts, subject to this power being available.

9.3.1.2 *Restricted power conditions*

In restricted power conditions, the nominal value of the voltages at the inputs of TEs (from power source 1) shall be 40 V and the tolerance shall be +5% abd —20% when drawing a power of up to 400 mW (380 mW for a designated TE and 20 mW for other TEs).

9.3.2 *Power source 2 — optional third pair*

9.3.2.1 *Normal power conditions*

Under normal power conditions, the voltage at the interface of a TE shall be a maximum of 40 V + 5% and a minimum voltage of 40 V — 20% when the TE is drawing a power of up to the minimum available power of 7 watts.

9.3.2.2 *Restricted power conditions*

When power source 2 is unable to provide 7 watts, it may go to a restricted power condition where it will provide a minimum power of 2 watts. The provision of this restricted power condition is subject to the power source 2 provider's assumed responsibility. The nominal value of the voltages at the inputs of the TEs shall be 40 V and the tolerance shall be +5% and —20%. The mechanism to indicate this condition to the TEs is for further study.

9.4 *Current transient*

The rate of change of current drawn by a TE (for example, when connected or as a result of a change in polarity when a change from the normal condition to the restricted power condition occurs) shall not exceed 5 mA/µs.

9.5 *Power source 1 consumption*

The different values concerning the power source 1 consumption are summarized in Table 8/I.430.

9.5.1 *Normal power conditions*

Under normal power conditions and in the activated state, a TE which draws power from power source 1 shall draw no more than 1 watt (see Note of § 9.3.1.1). When a TE is not involved in a call, it is desirable that it minimize its power consumption (see Note below).

When in the deactivated state, a TE which draws power from power source 1 shall draw no more than 100 mW. However, if a local action has to be initiated in the TE when the interface is not activated, this TE shall not enter a ''local action'' state.

In this ''local action'' state the TE may consume up to 1 watt if the following conditions are assured:

— the corresponding power is provided by the NT (e.g., this service is supported by the NT);

— the ''local action'' state is not a permanent one. (A typical example of the use of this state is the modification of prestored dialing numbers in the TE.).

Note — The definition of ''not involved in a call'' mode may be based on the knowledge of the status of layer 2 (link established or not). When this limitation is applied in the design of a TE, a maximum value of 380 mW is recommended.

9.5.2 *Restricted power conditions*

9.5.2.1 *Power available to the TE ‘‘designated’’ for restricted power operation*

A TE which is permitted to draw power from power source 1 under restricted power conditions shall consume no more than 380 mW.

In restricted power conditions, a designated TE which is powered down may consume power from power source 1 only to maintain a line activity detector and to retain its Terminal Endpoint Identifier (TEI) value. The value of the power down mode consumption shall be 25 mW (see Note below).

Note — For a period until the end of 1988, TEs may consume up to 100 mW subject to this power being available.

H.T. [T8.430]

TABLE 8/I.430

Summary of the different possible power source 1 consumptions

TE type and state	Maximum consumption
Normal conditions	
{ TE drawing power from PS1 Active state }	1 W (Note 1)
{ TE drawing power from PS1 Deactivated state }	100 mW
{ TE drawing power from PS1 Local action state }	1 W (Note 2)
Restricted conditions	
{ TE drawing power from PS1 Designated TE; Active state }	380 mW
{ TE drawing power from PS1 Designated; Deactivated state }	25 mW (Note 3)
{ TE drawing power from PS1 Not designated }	0 mW
{ TE drawing power from PS1 Designated; Local action state }	380 mW (Note 2)
{ Locally powered TE using connected detector Any state }	3 mW
{ Locally powered TE not using connected detector Any state }	0 mW

PS1 Power source 1

Note 1 — See note to § 9.3.1.1.

Note 2 — Subject to the provision of the corresponding amount of power by power source 1.

Note 3 — See note to § 9.5.2.1.

Table 8/I.430 [T8.430], p.

9.5.2.2 *Power available to ‘‘non-designated’’ TEs*

Non-designated locally powered TEs which make use of a connected/disconnected detector may consume no more than 3 mW from power source 1 in restricted power conditions.

Non-designated locally powered TEs which do not make use of a connected/disconnected detector and non-designated TEs which are normally powered from power source 1 (normal conditions) shall not consume any power from power source 1 in restricted power conditions.

9.6 *Galvanic isolation*

TEs that provide power sinks 1 or 2 shall provide galvanic isolation between power sources 1 or 2 and the earths of additional sources of power and/or of other equipment. (This provision is intended to preclude earth loops or paths which could result in currents that would interfere with the satisfactory operation of the TE. It is independent of any requirement, for such isolation, related to safety which may result from the study under way in the IEC. It shall not be interpreted to require isolation which conflicts with necessary provisions for safety.) The way in which the galvanic isolation is to be implemented is left for further study.

10 Interface connector contact assignments

The interface connector and the contact assignments are the subject of an ISO standard. Table 9/I.430 is reproduced from the Draft International Standard, DIS 8877, dated November 1985. For the transmit and receive leads, pole numbers 3 through 6, the polarity indicated is for the polarity of the framing pulses. For the power leads, pole numbers 1, 2, 7 and 8, the polarity indicated is for the polarity of the d.c. voltages. See Figure 20/I.430 for the polarity of the power provided in the phantom mode. In that figure, the leads that are lettered a, b, c, d, e, f, g and h, correspond with pole numbers 1, 2, 3, 6, 5, 4, 7 and 8, respectively.

H.T. [T9.430]

TABLE 9/I.430

Pole (contact) assignments for 8-pole connections
(plugs and jacks)

Pole number	Function		Polarity
	TE	NT	
1	Power source 3	Power sink 3	+
2	Power source 3	Power sink 3	—
3	Transmit	Receive	+
4	Receive	Transmit	+
5	Receive	Transmit	—
6	Transmit	Receive	—
7	Power sink 2	Power source 2	—
8	Power sink 2	Power source 2	+

Note — This reference is only provisional.

Table 9/I.430 [T9.430], p.

ANNEX A
(to Recommendation I.430)

Wiring configurations and round trip delay considerations

used as a basis for electrical characteristics

A.1 *Introduction*

A.1.1 In § 4, two major wiring arrangements are identified. These are point-to-point configuration and a point-to-multipoint configuration using a passive bus

While these configurations may be considered to be the limiting cases for the definition of the interfaces and the design of the associated TE and NT equipments, other significant arrangements should be considered.

A.1.2 The values of overall length, in terms of cable loss and delay assumed for each of the possible arrangements, are indicated below.

A.1.3 Figure 2/I.430 is a composite of the individual configurations. These individual configurations are shown in this annex.

A.2 *Wiring configurations*

A.2.1 *Point-to-multipoint*

A.2.1.1 The point-to-multipoint wiring configuration identified in § 4.2 may be provided by the ''short passive bus'' or other configurations such as an ''extended passive bus''.

A.2.1.2 *Short passive bus* (Figure A-1/I.430)

An essential configuration to be considered is a passive bus in which the TE devices may be connected at random points along the full length of the cable. This means that the NT receiver must cater for pulses arriving with different delays from various terminals. For this reason, the length limit for this configuration is a function of the maximum round trip delay and not of the attenuation.

An NT receiver with fixed timing can be used if the round trip delay is between 10 to 14 µs. This relates to a maximum operational distance from the NT in the order of 100-200 metres (d_2 in Figure A-1/I.430) [200 m in the case of a high impedance cable (Z_C = 150 ohms) and 100 m in the case of a low impedance cable (Z_C = 75 ohms)]. It should be noted that the TE connections act as stubs on the cable thus reducing the NT receiver margin over that of a point-to-point configuration. A maximum number of 8 TEs with connections of 10 m in length are to be accommodated.

The range of 10 to 14 µs for the round trip delay is composed as follows. The lower value of 10 µs is composed of two bits offset delay (see Figure 3/I.430) and the negative phase deviation of —7% (see § 8.2.3). In this case the TE is located directly at the NT. The higher value of 14 µs is calculated assuming the TE is located at the far end of a passive bus. This value is composed of the offset delay between frames of two bits (10.4 µs), the round trip delay of the unloaded bus installation (2 µs), the additional delay due to the load of TEs (i.e. 0.7 µs) and the maximum delay of the TE transmitter according to § 8.2.3 (15% = 0.8 µs).

Figure A-1/I.430, p.

A.2.1.3 *Extended passive bus* (Figure A-2/I.430)

A configuration which may be used at an intermediate distance in the order of 100 to 1000 metres is known as an extended passive bus. This configuration takes advantage of the fact that terminal connection points are restricted to a grouping at the far end of the cable from the NT. This places a restriction on the differential distance between TEs. The differential round trip delay is defined as that between zero-volt crossings of signals from different TEs and is restricted to 2 µs.

This differential round trip delay is composed of a TE differential delay of 22% or 1.15 µs according to § 8.2.3, the round trip delay of the unloaded bus installation of 0.5 µs (line length 25 to 50 metres) and an additional delay due to the load of 4 TEs (0.35 µs).

The objective from this extended passive bus configuration is a total length of at least 500 metres (d_4 in Figure A-2/I.430) and a differential distance between TE connection points of 25 to 50 metres (d_3 in Figure A-2/I.430). (d_3 depends on the characteristics of the cable to be used.) However, an appropriate combination of the total length, the differential distance between TE connection points and the number of TEs connected to the cable may be determined by individual Administrations.

Figure A-2/I.430, p.

A.2.2. *Point-to-point* (Figure A-3/I.430)

This configuration provides for one transmitter/receiver only at each end of the cable (see Figure A-3/I.430). It is, therefore, necessary to determine the maximum permissible attenuation between the ends of the cable to establish the transmitter output level and the range of receiver input levels. In addition, it is necessary to establish the maximum round trip delay for any signal which must be returned from one end to the other within a specified time period (limited by D-echo bits).

A general objective for the operational distance between TE and NT or NT1 and NT2 is 1000 meters (d_1 in Figure A-3/I.430). It is agreed to satisfy this general objective with a maximum cable attenuation of 6 dB at 96 kHz. The round trip delay is between 10 to 42 µs.

Figure A-3/I.430, p.

The lower value of 10 μs is derived in the same way as for the passive bus configuration. The upper value is composed of the following elements:

— 2 bits due to frame offset (2 × 5.2 μs = 10.4 μs, see § 5.4.2.3.);

— maximum 6 bits delay permitted due to the distance between NT and TE and the required processing time (6. × 5.2 ms = 31.2 ms);

— the fraction (+15%) of a bit period due to phase deviation between TE input and output (see § 8.2.3, 0.15 × 5.2 ms = 0.8 μs).

It should be noted that an adaptive timing device at the receiver is required at the NT to meet these limits.

For the NT used for both point-to-point and passive bus configurations (see § 8.6.3.2), the tolerable round trip delay in passive bus wiring configurations is reduced to 13 μs due to the extra tolerance required for the adaptive timing. Using this type of wiring configuration, it is also possible to provide point-to-multipoint mode of operation at layer 1.

Note — Point-to-multipoint operation can be accommodated using only point-to-point wiring. One suitable arrangement is an NT1 STAR illustrated in Figure A-4/I.430. In such an implementation, bit streams from TEs must be buffered to provide for operation of the D-echo channel(s) to provide for contention resolution, but only layer 1 functionality is required. It is also possible to support passive bus wiring configurations on the ports of NT1 STARs. Support of this configuration does not affect the provisions of Recommendations I.430, I.441 or I.451.

Figure A-4/I.430, p.

ANNEX B
(to Recommendation I.430)

**SDL representation of a possible implementation of the D-Channel |
access**

Figure, p.

ANNEX C
(to Recommendation I.430)

(see Table 5/I.430)

C.1 *SDL representation of activation/deactivation procedures for TEs which can detect power source 1 or power source 2*

C.2 In § 6.2.3 the procedure at the terminal is specified in form of a finite state matrix given in Table 5/I.430. This Annex provides finite state matrices for two TE types in Tables C-1/I.430 and C-2/I.430.

C.3 *SDl representation of activation/deactivation procedures for NTs* (see Table 6/I.430)

Blanc

Figure C-1/I.430 (feuillet 1 de 2), p. 23

Figure C-1/I.430 (feuillet 2 de 2), p. 28

H.T. [1T10.430]

TABLE C-1/I.430
{
Activation/deactivation for TEs
TEs locally powered and unable to detect power source 1 or 2
}

State name / State number / Event	Inactive F1	Sensing F2	Deactivated F3	Awaiting signal F4	Identifying input F5	Synchro- nized F6	Activated F7	Lost framing F8
INFO sent	INFO 0	INFO 0	INFO 0	INFO 0	INFO 1	INFO 0	INFO 3	INFO 3 | INFO 0
Loss of power (Note 2) MPH-II(d), MPH-DI, PH-DI; F1 } MPH-II(d), MPH-DI, PH-DI; F1 } MPH-II(d), MPH-DI, PH-DI; F1 } MPH-II(d), MPH-DI, PH-DI; F1 } MPH-II(d), MPH-DI, PH-DI; F1 }	/ { { { {	F1	MPH-II(d); F1	{				

{
Application of power (Note 2)
}
	F2	/	/	/	/	/	/	/

Tableau C-1/I.430 [1T10.430], p. 24

H.T. [2T10.430]

{
TABLE C-1/I.430 *(cont.)*
}

Event	State name / State number / INFO sent	Inactive F1 INFO 0	Sensing F2 INFO 0	Deactivated F3 INFO 0	Awaiting signal F4 INFO 0	Identifying input F5 INFO 1	Synchro- nized F6 INFO 0	Activated F7 INFO 3	Lost framing F8 INFO 3 | INFO 0
Receiving any signal (Note 2)		/	—	—	F5	—	/	/	—
Receiving INFO 2		/	MPH-II(c); F6	F6	F6 (Note 3)	F6	—	MPH-EI1; F6	MPH-EI2; F6
Receiving INFO 4		/	MPH-II(c), PH-AI, MPH-AI; F7	PH-AI, MPH-AI; F7	PH-AI, MPH-AI; F7 (Note 3)	PH-AI, MPH-AI; F7	PH-AI, MPH-AI, MPH-EI2; F7	—	PH-AI, MPH-AI, MPH-EI2; F7
Lost framing		/	/	/	/	/	MPH-EI1; F8	MPH-EI1; F8	—

—	No change, no action
|	Impossible by the definition of the layer 1 service
/	Impossible situation
a, b; Fn	Issue primitives ‘‘a’’ and ‘‘b’’ and then go to state ‘‘Fn’’
PH-AI	Primitive PH-ACTIVATE INDICATION
PH-DI	Primitive PH-DEACTIVATE INDICATION
MPH-AI	Primitive MPH-ACTIVATE INDICATION
MPH-DI	Primitive MPH-DEACTIVATE INDICATION
MPH-EI1	Primitive MPH-ERROR INDICATION reporting error
MPH-EI2	Primitive MPH-ERROR INDICATION reporting recovery from error
MPH-II(c)	Primitive MPH-INFORMATION INDICATION (connected)
MPH-II(d)	Primitive MPH-INFORMATION INDICATION (disconnected)
ST.T3	Start timer T3
Power S	

Power source 1 or power source 2		
}		
{		
Primitives are signals in a conceptual queue and will be cleared on recognition, while the INFO signals are continuous signals which are available all the time.		
}		

Note 1 — This event reflects the case where a signal is received and the TE has not (yet) determined whether it is INFO 2 or INFO 4.

Note 2 — The term ‘‘power’’ could be the full operational power or backup power. Backup power is defined such that it is enough to hold the TEI values in memory and maintain the capability of receiving and transmitting layer 2 frames associated with the TEI procedures.

Note 3 — If INFO 2 or INFO 4 is not recognized within 5 ms after the appearance of a signal, TEs must go to F5.

Tableau C-1/I.430 [2T10.430], p. 25

H.T. [1T11.430]

TABLE C-2/I.430
{
Activation/deactivation for TEs
TEs locally powered and able to detect power source 1
or 2.
Use confined to NTs which provide power source 1 or 2
}

| | | | | | | | | |

State name | Inactive Power off | Power on | Sensing | Deactivated | Awaiting signal | Identifying input | Synchro- nized | Activated | Lost framing

State number | F1.0 | F1.1 | F2 | F3 | F4 | F5 | F6 | F7 | F8

Event | | || || | INFO sent | | | | | | INFO 0 | INFO 0 | INFO 0 | INFO 0 | INFO 1 | INFO 0 | INFO 3 | INFO 3 | INFO 0

Loss of power (Note 2) / F1.0 F1.0 MPH-II(d); F1.0 {
MPH-II(d),
MPH-DI,
PH-DI;
F1.0
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.0
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.0
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.0
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.0
}

{
Application of power
(Note 2)
} F1.1 / / / / / / / /

Detect power S / F2 / / / / / / /

Disappearence of power S / / F1.1 MPH-II(d); F1.1 {
MPH-II(d),
MPH-DI,
PH-DI;
F1.1
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.1
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.1
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.1
} {
MPH-II(d),
MPH-DI,
PH-DI;
F1.1
}

PH-ACR REQ	/	|	|	ST.T3 F4	|	|	—	|	—	
Expiry T3	/	—	—	—	MPH-DI, PH-DI; F3	MPH-DI, PH-DI; F3	MPH-DI, PH-DI; F3	—	—	

Tableau C-2/I.430 [1T11.430], p. 26

H.T. [2T11.430]

{
TABLE C-2/I.430 *(cont.)*
}

State name	Inactive Power off F1.0 INFO sent | | | | | |	Inactive Power on F1.1 INFO 0	Sensing	Deactivated	Awaiting signal	Identifying input	Synchro- nized	Activated	Lost framing
	/	/							
	/	/							
	/	/							
	PH-AI, MPH-AI; F7	{							
	PH-AI, MPH-AI; F7	{							
	—	{							
	/	/							

For notation and notes, see Table C-1/I.430.

Tableau C-2/I.430 [2T11.430], p. 27

Figure C-2/I.430 (feuillet 1 de 2), p. 29

Figure C-2/I.430 (feuillet 2 de 2), p. 30

ANNEX D

(to Recommendation I.430)

Test configuration

In § 8, waveforms are shown for testing NT and TE equipment. This Annex describes configurations, for testing TE equipment, which can be used to generate these waveforms (see Figure D-1/I.430). Similar configurations can be used to test NT equipment.

Table D-1/I.430 gives the parameters for the artificial lines reproduced in Figure D-1/I.430. The artificial lines are used to derive the waveforms. For test configurations ii) and iii), the cable length used corresponds to a signal delay of 1 µs.

Figure D-1/I.430, p.

H.T. [T12.430]
TABLE D-1/I.430
Parameters for the artificial lines

Table D-1/I.430 [T12.430], p.

ANNEX E
(to Recommendation I.430)

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’’.

§ E.7 contains an alphabetical list of all of the terms contained in this Recommendation.

§ E.8 illustrates the general aspects of the terminology.

§ E.9 explains the V reference point, V interface, and interface point concept.

E.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)**

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

105 **exchange termination (ET)**

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)**

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)**

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** { .412 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 — A specific V interface is denoted by a suffix number.

Note — 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.

E.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.

E.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)**

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.

E.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.

E.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 sream 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 loop-back is activated, is the same as the received signal at the loopback point. See Figure E-1/I.430.

Figure E-1/I.430, 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 E-2/I.430.

Figure E-2/I.430, p.

E.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)**

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

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

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.

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

E.8 *Ilustration of the general aspects of the terminology*

Figure E-3/I.430, p.

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

E.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 E-4/I.430.

Figure E-4/I.430, p.

E.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 with regard to the functions transported by the interface. In such a case, two further interface points would be required. See Figure E-5/I.430.

Figure E-5/I.430, p.

E.9.3 A group of individual accesses may be multiplexed or concentrated together to comprise a higher order access (i.e. V_2 or $_6$ 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 E-6/I.430.

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 (I.430/I.431);

— does not contradict Recommendation Q.512.

Figure E-6/I.430, p.

APPENDIX I

(to Recommendation I.430)

Test loopbacks defined for the basic user-network interface

I.1 *Introduction*

Recommendations in the I.600-Series specify an overall approach to be employed in maintaining the ISDN basic access the failure confirmation and failure localization phases of network maintenance.

Detailed specifications of how such loopbacks are to be used may be found in the I.600-Series Recommendations. However, since the required loopbacks may impact the design of terminating pieces of equipment, a brief description of the loopbacks and their characteristics is presented in this Appendix.

I.2 *Loopback mechanism definitions*

This section defines the terminology used in specifying the characteristics of loopbacks.

The loopback point is the location of the loopback.

The control point is the location from which activation/deactivation of the loopback is controlled.

Note — The generation of the test pattern used over the loopback may not be located at the control point.

The following three types of loopback mechanisms are defined:

a) Complete loopback — a complete loopback is a layer 1 mechanism which operates on the full bit stream. At the loopback point, the received 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 access point only the information channels may be available.

b) Partial loopback — a partial loopback is a 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.

c) Logical loopback — a logical loopback acts selectively on certain information within a channel or channels and may result in some specified modification of the looped information. Logical loopbacks may be defined at any layer of the OSI model and depend on the detailed maintenance procedures specified.

For each of the above three types of loopback mechanisms, the loopback may be further categorized as either transparent or non-transparent.

i) 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 I-1/I.430.

Figure I-1/I.430, p.

ii) 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 I-2/I.430.

Figure I-2/I.430, p.

Note — Whether or not a transparent loopback is used, the loopback should not be affected by facilities connected beyond the point at which the loop is provided, e.g. by the presence of short circuits, open circuits or foreign voltages.

I.3 *Test loopback reference configuration*

Figure I-3/I.430 shows the possible locations of test loopbacks pertaining to the maintenance of the ISDN basic user-network interface. Recommended and desirable loopbacks are drawn in solid lines. Optional loopbacks are drawn with dashed lines. These optional loopbacks may not be provided by all equipments. The characteristics of each of these loopbacks are given in Tables I-1/I.430 and I-2/I.430, respectively.

Figure I-3/I.430, p.

I.4 *Test loopback characteristics*

Tables I-1/I.430 and I-2/I.430 present the characteristics applicable to each recommended, desirable and optional loopback. In particular, the control point, control mechanism, loopback type, and loopback location are identified.

The loopback type indicates whether a complete, partial or logical loopback is required and whether the loopback should be transparent or non-transparent.

The loopback location is specified in a somewhat approximate manner, since the precise location may be implementation dependent.

The choice of loopback mechanism is dictated by the protocol layers available at the looping point and the addressing requirements. Thus, for instance, loopback 3 is controlled via layer 3 since selection of a particular S interface may be required.

Table I-3/I.430 lists characteristics of those loopbacks whose use and parameters are for further study.

Blanc

H.T. [T13.430]
TABLE I-1/I.430
Characteristics of recommended loopbacks

{ Loopback (see Figure I-3/I.430) }	Location	Channel(s) looped	Loopback type	Control point	Control mechanism	Implementation
2 In NT1, as near as possible to T reference point, towards the ET (Note 1) } Complete, transparent or non-transparent (see Note to § I.2) (Note 4) } Under control of local exchange } Layer 1 signals in transmission system }	{ 2B + D channels { { Recommended	{				
3	{			Desirable (Note 3)		

Note 1 — In the case of a combined NT1 and NT2 (i.e., an NT12), loopback 2 is located at the position within the NT12 which equates to the T reference point.

Note 2 — Activation/deactivation of loopback 3 may be initiated by request from a remote maintenance server by layer 3 messages in the D channel or other signalling in the B channel. However, the generation of the test pattern over the loopback would be by the NT2.

Note 3 — From a technical viewpoint, it is desirable (although not mandatory) that loopback 3 can always be implemented, therefore the design of protocols for loopback control should include the operation of loopback 3.

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

Tableau I-1/I.430 [T13.430, p. 42

Blanc

H.T. [T14.430]
TABLE I-2/I.430
Characteristics of optional loopbacks

{ Loopbacks (see Figure I-3/I.430) }	Location	Channel(s) looped	Loopback type	Control point	Control mechanism	Implementation
C	Inside NT1	B 1, B 2 (Note 4)	{	{		
B 1 Inside the NT2, at subscriber side (Note 3) } Partial, transparent or non-transparent }	{ B 1, B 2 (Note 4) TE, NT2	{ Layer 1 or Layer 3	Optional			
B 2 Inside the NT2, at the network side } These loopbacks are optional in the TE/NT2. When used, e.g. as part of an internal test, no information should be sent towards the network interface, (i.e. INFO 0 is transmitted to the interface). } A	{ { Inside the TE					
4 Partial, transparent or non-transparent } NT2 local exchange, remote maintenance server or remote user }	Inside the TA or TE { Layer 3	B 1, B 2 (Note 4) Optional	{			

Note 1 — An exchange of layer 3 service messages may take place between TE (or NT2) and the exchange prior to the use of the layer 1 control mechanism. However, there are situations where the TE (or NT2) may not receive a reply:

a) the message may not be transmitted when the interface is in a failure situation;

b) a network that does not support the layer 3 signalling option, need not respond.

The definition of layer 1 control signal from TE (or NT2) towards NT1 (based on the use of the optional multi-frame) is for further study.

Note 2 — The control mechanism in this case could be the same as in Note 1 except that the network controls the loopback by spare capacity in the transmission system.

Note 3 — Loopback B 1 is applicable to each individual interface at reference point S.

Note 4 — The B 1- and B 2-channel loopbacks are controlled by separate control signals. However, both loopbacks may be applied at the same time.

Tableau I-2/I.430 [T14.430], p. 43

H.T. [T15.430]
TABLE I-3/I.430
Characteristics of loopbacks whose need and parameters are for further study

{
Loopbacks (see Figure I-3/I.430)
}
	Location	Channel(s) looped	Loopback type	Control point	Control mechanism	Implementation

2 1 Within the NT1, not impacting the network interface } Partial, transparent or non-transparent } Under control of the local exchange } Layer 1 signals in the transmission system }	{ B 1, B 2 (Note) { { Optional	{				

Note — The B 1- and B 2-channel loopbacks are controlled by separate control signals; however, both loopbacks may be applied at the same time.

Tableau I-3/I.430 [T15.430], p. 44