Excerpts from ITU-T I.430:

Layer 1 of the ISDN Basic Rate USER-NETWORK Interface

SECTION 3

ISDN USER-NETWORK INTERFACES: LAYER 1 RECOMMENDATIONS

Recommendation I.430

BASIC USER-NETWORK INTERFACE – LAYER 1 SPECIFICATION

(Malaga-Torremolinos, 1984; amended at Melbourne, 1988)

1 General

This Recommendation defines the layer 1 characteristics of the user-network interface to be applied at the S or T reference points for the basic interface structure defined in Recommendation I.412. The reference configurations for the interface is defined in Recommendation I.411 and is reproduced in Figure 1/I.430.

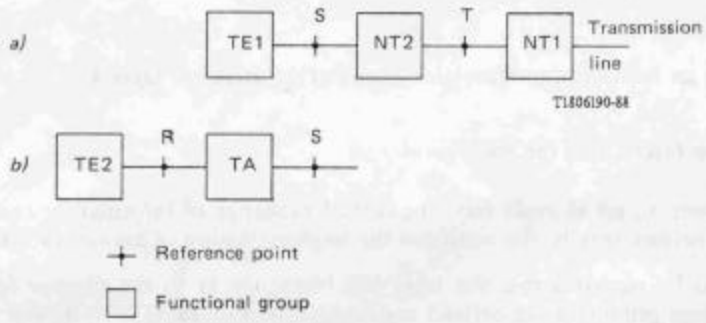


FIGURE 1/I.430

Reference configurations for the ISDN user-network interfaces

In this Recommendation, the term "NT" is used to indicate network terminating layer 1 aspects of NT1 and NT2 functional groups, and the term "TE" is used to indicate terminal terminating layer 1 aspects of TE1, TA and NT2 functional groups, unless otherwise indicated. However, in § 6.2 only, the terms "NT" and "TE" have the following meaning: the term "NT" is used to indicate the layer 1 network side of the basic access interface; the term "TE" is used to indicate the layer 1 terminal side of the basic access interface.

The terminology used in this Recommendation is very specific and not contained in the relevant terminology Recommendations. Therefore Annex E to this Recommendation provides terms and definitions used in this Recommendation.

5.4 *Frame structure*

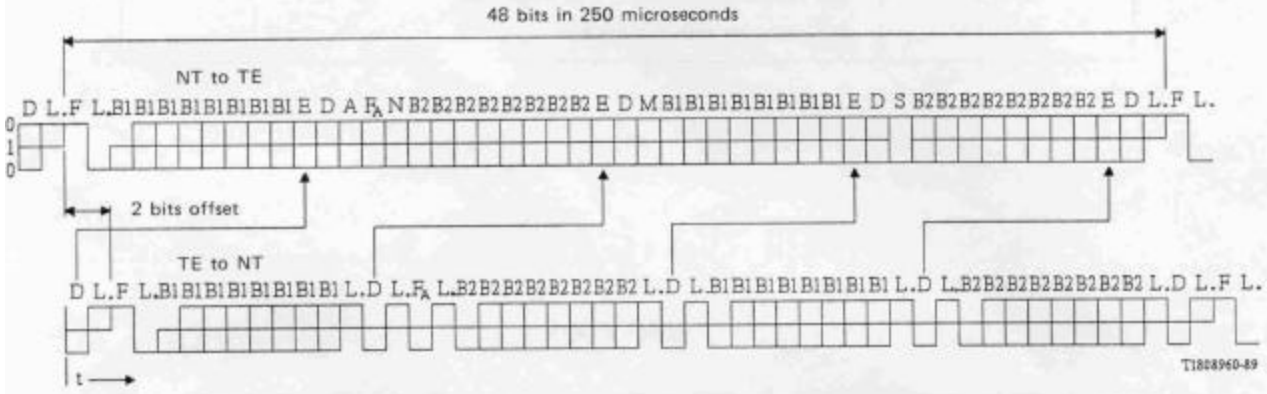
In both directions of transmission, the bits shall be grouped into frames of 48 bits each. The frame structure shall be identical for all configurations (point-to-point and point-to-multipoint).

5.4.1 *Bit rate*

The nominal transmitted bit rate at the interfaces shall be 192 kbit/s in both directions of transmission.

5.4.2 *Binary organization of the frame*

The frame structures are different for each direction of transmission. Both structures are illustrated diagrammatically in Figure 3/I.430.



F Framing bit
L D.C. balancing bit
D D-channel bit
E D-echo-channel bit
F_A Auxiliary framing bit (see § 6.3)

N Bit set to a binary value $N = \overline{F}_A$ (NT to TE)
B1 Bit within B-channel 1
B2 Bit within B-channel 2
A Bit used for activation
S Use of this bit is for further study
M Multiframing bit

Note 1 – Dots demarcate those parts of the frame that are independently d.c.-balanced.

Note 2 – The F_A bit in the direction TE to NT is used as a Q bit in every fifth frame if the Q-channel capability is applied (see § 6.3.3).

Note 3 – The nominal 2-bit offset is as seen from the TE (I_A in Figure 2/I.430). The corresponding offset at the NT may be greater due to delay in the interface cable and varies by configuration.

FIGURE 3/I.430

Frame structure at reference points S and T

5.4.2.1 *TE to NT*

Each frame consists of the groups of bits shown in Table 2/I.430; each individual group is d.c.-balanced by its last bit (L bit).

5.4.2.2 *NT to TE*

Frames transmitted by the NT contain an echo channel (E bits) used to retransmit the D bits received from the TEs. The D-echo channel is used for D-channel access control. The last bit of the frame (L bit) is used for balancing each complete frame.

The bits are grouped as shown in Table 3/I.430.

TABLE 2/I.430

Bit position	Group
1 and 2	Framing signal with balance bit
3 - 11	B1-channel (first octet) with balance bit
12 and 13	D-channel bit with balance bit
14 and 15	F_A auxiliary framing bit or Q bit with balance bit
16 - 24	B2-channel (first octet) with balance bit
25 and 26	D-channel bit with balance bit
27 - 35	B1-channel (second octet) with balance bit
36 and 37	D-channel bit with balance bit
38 - 46	B2-channel (second octet) with balance bit
47 and 48	D-channel bit with balance bit

TABLE 3/I.430

Bit position	Group
1 and 2	Framing signal with balance bit
3 - 10	B1-channel (first octet)
11	E, D-echo-channel bit
12	D-channel bit
13	Bit A used for activation
14	F_A auxiliary framing bit
15	N bit (coded as defined in § 6.3)
16 - 23	B2-channel (first octet)
24	E, D-echo-channel bit
25	D-channel bit
26	M, multiframing bit
27 - 34	B1-channel (second octet)
35	E, D-echo-channel bit
36	D-channel bit
37	S, The use of this bit is for further study
38 - 45	B2-channel (second octet)
46	E, D-echo-channel bit
47	D-channel bit
48	Frame balance bit

Note – S is set to binary ZERO.

5.4.2.3 *Relative bit positions*

At the TEs, timing in the direction TE to NT shall be derived from the frames received from the NT.

The first bit of each frame transmitted from a TE towards the NT shall be delayed, nominally, by two bit periods with respect to the first bit of the frame received from the NT. Figure 3/I.430 illustrates the relative bit positions for both transmitted and received frames.

5.5 *Line code*

For both directions of transmission, pseudo-ternary coding is used with 100% pulse width as shown in Figure 4/I.430. Coding is performed in such a way that a binary ONE is represented by no line signal; whereas, a binary ZERO is represented by a positive or negative pulse. The first binary ZERO following the framing bit-balance bit is of the same polarity as the framing bit-balance bit. Subsequent binary ZEROs must alternate in polarity. A balance bit is a binary ZERO if the number of binary ZEROs following the previous balance bit is odd. A balance bit is a binary ONE if the number of binary ZEROs following the previous balance bit is even.

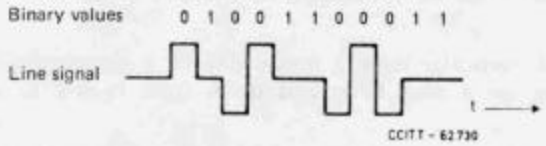


FIGURE 4/I.430

Pseudo-ternary code – example of application

5.6 *Timing considerations*

The NT shall derive its timing from the network clock. A TE shall derive its timing (bit, octet, frame) from the signal received from the NT and use this derived timing to synchronize its transmitted signal.

6 Interface procedures

6.1 *D-channel access procedure*

The following procedure allows for a number of TEs connected in a multipoint configuration to gain access to the D-channel in an orderly fashion. The procedure always ensures that, even in cases where two or more TEs attempt to access the D-channel simultaneously, one, but only one, of the TEs will be successful in completing transmission of its information. This procedure relies upon the use of layer 2 frames delimited by flags consisting of the binary pattern "01111110" and the use of zero bit insertion to prevent flag imitation (see Recommendation I.441).

The procedure also permits TEs to operate in a point-to-point manner.

6.1.1 *Interframe (layer 2) time fill*

When a TE has no layer 2 frames to transmit, it shall send binary ONEs on the D-channel, i.e., the interframe time fill in the TE-to-NT direction shall be binary ONEs.

When an NT has no layer 2 frames to transmit, it shall send binary ONEs or HDLC flags, i.e., the interframe time fill in the NT-to-TE direction shall be either all binary ONEs or repetitions of the octet "01111110". When the interframe time fill is HDLC flags, the flag which defines the end of a frame may define the start of the next frame.

6.1.2 *D-echo channel*

The NT, on receipt of a D-channel bit from TE or TEs, shall reflect the binary value in the next available D-echo channel bit position towards the TE. (It may be necessary to force the D-echo channel bits to all binary ZEROs during certain loopbacks – see Note 4 of Table I.1/I.430 and § 5 of Recommendation G.960).

6.1.3 *D-channel monitoring*

A TE, while in the active condition, shall monitor the D-echo channel, counting the number of consecutive binary ONEs. If a ZERO bit is detected, the TE shall restart counting the number of consecutive ONE bits. The current value of the count is called C.

Note – C need not be incremented after the value eleven has been reached.

6.1.4 *Priority mechanism*

Layer 2 frames are transmitted in such a way that signalling information is given priority (priority class 1) over all other types of information (priority class 2). Furthermore, to ensure that within each priority class all competing TEs are given a fair access to the D-channel, once a TE has successfully completed the transmission of a frame, it is given a lower level of priority within that class. The TE is given back its normal level within a priority class when all TEs have had an opportunity to transmit information at the normal level within that priority class.

The priority class of a particular layer 2 frame may be a characteristic of the TE which is preset at manufacture or at installation, or it may be passed down from layer 2 as a parameter of the PH-DATA REQUEST primitive.

The priority mechanism is based on the requirement that a TE may start layer 2 frame transmission only when C (see § 6.1.3) is equal to, or exceeds, the value X_1 for priority class 1 or is equal to, or exceeds, the value X_2 for priority class 2. The value of X_1 shall be eight for the normal level and nine for the lower level of priority. The value of X_2 shall be ten for the normal level and eleven for the lower level of priority.

In a priority class the value of the normal level of priority is changed into the value of the lower level of priority (i.e. higher value) when a TE has successfully transmitted a layer 2 frame of that priority class.

The value of the lower level of priority is changed back to the value of the normal level of priority when C (see § 6.1.3) equals the value of the lower level of priority, (i.e. higher value).

6.1.5 *Collision detection*

While transmitting information in the D-channel, the TE shall monitor the received D-echo channel and compare the last transmitted bit with the next available D-echo bit. If the transmitted bit is the same as the received echo, the TE shall continue its transmission. If, however, the received echo is different from the transmitted bit, the TE shall cease transmission immediately and return to the D-channel monitoring state.

6.1.6 *Priority system*

Annex B describes an example of how the priority system may be implemented.

6.2 *Activation/deactivation*

6.2.1 *Definitions*

6.2.1.1 *TE states*

6.2.1.1.1 State F1 (inactive): In this inactive state the TE is not transmitting. In the case of locally powered TEs which cannot detect the appearance/disappearance of power source 1 or 2, this state is entered when local power is not present. For TEs which can detect power source 1 or power source 2, this state is entered whenever loss of power (required to support all TEI functions) is detected, or when the absence of power from source 1 or 2, whichever power source is used for determining the connection status, is detected.

6.2.1.1.2 State F2 (sensing): This state is entered after the TE has been powered on but has not determined the type of signal (if any) that the TE is receiving.

ANNEX B

(to Recommendation I.430)

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