5i’

APPENDIX IV
(to Recommendation G.961)

Electrical characteristics of an AMI transmission system

using a TCM method

IV.1 *Line code*

For both directions of the transmission, the line code is AMI. The coding scheme will be performed in such a way that a binary ZERO is represented by no line signal, while a binary ONE is represented by a positive or negative pulse alternately.

IV.2 *Symbol rate*

The symbol rate is determined by the line code, rate of the information stream and the frame structure. The bit symbol rate is 320 kbauds.

IV.2.1 *Clock requirements*

IV.2.1.1 *NT1 free running clock accuracy*

The accuracy of the free running clock in the NT1 shall be ± | 0 ppm.

IV.2.1.2 *NT1 clock tolerance*

The NT1 shall accept a clock accuracy from the LT of ± | 0 ppm.

IV.2.1.3 *LT clock tolerance*

The LT shall accept a clock accuracy from the ET of ± | 0 ppm.

IV.3 *Frame structure*

The frame structure contains a frame word, N times (2B + D) and a CL channel.

H.T. [T24.961]

lw(60p) | lw(30p) | lw(60p) | lw(12p) | lw(30p) . cw(60p) | cw(30p) | cw(60p) | cw(12p) | cw(30p) . Frame word CL channel *N* | times (2B + D) P Space

P Parity bit: The P bit is used to get an even number of binary ONEs in a frame; so it is set to binary ONE or binary ZERO when the number of binary ONEs in a frame is odd or even respectively

Table, [T24.961], p.

IV.3.1 *Frame length*

The number *N* of (2B + D) slots in one frame is twenty.

IV.3.2 *Bit allocation in direction LT-NT1*

In Figure IV-1/G.961, the bit allocation is given.

IV.3.3 *Bit allocation in direction NT1-LT*

In Figure IV-2/G.961, the bit allocation is given.

Figure IV-1/G.961 ITALIENNE [T25.961] (a traiter comme tableau MEP), p.2

Figure IV-2/G.961 ITALIENNE [T26.961] (a traiter comme tableau MEP), p.3

IV.4 *Frame word*

The frame word is used to allocate bit position to the 2B + D + CL channels. It may, however, also be used for other functions.

IV.4.1 *Frame word in direction LT-NT1*

The code for the frame word will be ‘‘100000M0’’; M is ‘‘1’’/‘‘0’’ alternating bit in every frame.

IV.4.2 *Frame word in direction NT1-LT*

The code for the frame word will be ‘‘1000000M’’; M is ‘‘1’’/‘‘0’’ alternating bit in every frame.

IV.5 *Frame alignment procedure*

The frame alignment procedure is defined as follows.

a) *Frame alignment state*

The transmission system is considered to be frame alignment state if the frame word has been identified in the same position for three consecutive frames.

b) *Loss of frame alignment state*

The transmission system is considered to be loss of frame alignment state if the frame word has not been identified in the expected frame position for six frames before identifying the frame word in the frame position for twelve frames.

IV.6 *Multiframe*

To enable bit allocation of the CL channel in more frames next to each other, a multiframe structure may be used. The start of the multiframe is determined by the frame word. The total number of frames in a multiframe is four.

IV.6.1 *Multiframe word in direction LT-NT1*

The multiframe is identified by the multiframe bit allocated in the CL channel. The code for the multiframe word, which is defined by the multiframe bits in four consecutive frames under the frame alignment state, is ‘‘1000’’.

IV.6.2 *Multiframe word in direction NT1-LT*

The same as IV.6.1.

IV.7 *Frame offset between LT-NT1 and NT1-LT frames*

The NT1 shall synchronize its frame on the frame received in the direction LT to NT1 and will transmit its frame with an offset. Relative frame position at the NT1 input/output is as follows. The first bit of each frame transmitted from the NT1 toward the LT shall be delayed by 383 up to 384 bit periods with respect to the first bit of the frame received from the LT.

IV.8 *CL channel*

IV.8.1 *Bit rate*

The bit rate for the CL channel is 3.2 kbit/s.

IV.8.2 *Structure*

a) Thirty two bits (3.2 kbit/s) are allocated in a multiframe for the use of CL channel.

b) Four bits (0.4 kbit/s) are allocated to multiframe bits.

c) Sixteen bits (1.6 kbit/s) are allocated to maintenance and operational control functions in direction LT to NT1, and to maintenance and operational information functions in direction NT1 to LT.

d) Twelve bits (1.2 kbit/s) are allocated to a cyclic redundancy check (CRC) function.

IV.8.3 *Protocols and procedures*

Protocols and procedures of maintenance/operational control/information are as follows.

a) Transfer modes are bit-oriented.

b) Sending modes are continuous.

c) Identification is confirmed by identical bits receiving for three consecutive multiframes under the frame alignment state.

d) Duration of control invocations is as long as sending control is identified.

e) Duration of information invocations is as long as causing event is identified.

IV.9 *Scrambling*

Scrambling will be applied on 2B + D channels and the scrambling algorithm shall be as follows.

— In direction LT-NT1: $x^9 \oplus x^5 \oplus 1$

— In direction NT1-LT: $x^9 \oplus x^5 \oplus 1$

IV.10 *Activation/deactivation*

Activation/deactivation is defined in Recommendation G.960, § 5. Applications provided by the transmission system are described as follows.

IV.10.1 *Signals used for activation*

Definition of the signals used for activation/deactivation (SIGs) are listed below. Signals used for start-up (bits in the CL channel are not available) and bits in the CL channel (in already established frames) are defined.

a) Signals used for start-up (CL not available):

— SIG 0 (NT1 to LT and LT to NT1): No line signal.

— SIG 1 (LT to NT1): A signal which deactivates the line and the interface at T reference point.

— SIG 2 (NT1 to LT): An awake signal to invoke the LT layer 1 that it has to enter the power up state and provide for the activation of the line and the interface at T reference point. It is invoked by receiving the signal INFO 1 across the T reference point in case of the activation from the user side. This signal is also used as awake acknowledgement on receiving of the signal SIG 3 in case of the activation from the network side.

— SIG 3 (LT to NT1): An awake signal to invoke the NT1 layer 1 that it has to enter the power up state and prepare for synchronization on an incoming signal from the LT. This signal is also used as awake acknowledgement on receiving of the signal SIG 2 in case of the activation from the user side.

— SIG 4 (LT to NT1): A signal which contains framing information and allows the synchronization of the receiver in the NT1.

— SIG 5 (NT1 to LT): A signal which contains framing information and allows the synchronization of the receiver in the LT. It informs the LT that the NT1 has synchronized on the signal SIG 4.

b) Bits in CL channel in already established frame:

— SIG 6 (LT to NT1): A signal which requires the NT1 to establish the full layer 1 information transfer capability available between the NT1 and LT, and requires the NT1 to activate the T interface by sending the signal INFO 2 across the T reference point.

— SIG 7 (LT to NT1): A signal which requires the NT1 to establish the full layer 1 information transfer capability available between TE and the ET by sending the signal INFO 4 across the T reference point.

— SIG 8 (NT1 to LT): A signal which indicates that the interface at T reference point is activated, and requires the LT to provide the full layer 1 information transfer capability available between TE and the ET. It is invoked by receiving of the signal INFO 3 across the T reference point.

— SIG 9 (LT to NT1): A signal which requires the NT1 to establish the full layer 1 information transfer capability available between the NT1 and LT, and requires the NT1 to activate the loopback 2.

— SIG 10 (NT1 to LT): A signal which indicates that the loopback 2 is activated in the NT1, and requires the LT to provide the full layer 1 information transfer capability available between the NT1 and ET.

— SIG 11 (LT to NT1 and NT1 to LT): A synchronization signal which contains framing information and 2B + D + CL channels.

— SIG 12 (NT1 to LT): A signal which indicates that the receiver on the T interface side of the NT1 has entered lost framing state.

— SIG 13 (LT to NT1): A signal which indicates that the receiver on the line side of the LT has entered lost framing state. This signal also contains a function as the signal SIG 4.

— SIG 14 (NT1 to LT): A synchronization signal which contains framing information and 2B + D+ CL channels; bits in the 2B + D channels are set to be idle.

Note — Definition of the function element (FEs) across the V reference point is described in Recommendation G.960, § 5.4. FEs used for activation/deactivation are relisted in Table IV-1/G.961.

H.T. [T28.961]

TABLE IV-1/G.961

The repertoire of function elements associated with the activation/desactivation procedures

FEs	Direction	Repertoire
FE 1 Activation request for the interface at T reference point }	ET to LT	{
FE 5 Deactivation request for the line and the interface at T reference point }	ET to LT	{
FE 9 Activation request for loopback 1 }	ET to LT	{
FE 8 Activation request for loopback 2 }	ET to LT	{
FE 4 The T interface is activated or a loopback is provided respectively }	LT to ET	{
FE 3	LT to ET	The line is activated
FE 6 The line and the interface at T reference point are deactivated }	LT to ET	{
FE 7	LT to ET	Error indication
FE 2 Request to start timer T1 within the ET layer 1 }	LT to ET	{

Tableau IV-1/G.961 [T28.961], p.

IV.10.2 *Definition of internal timers*

Timer T2 (see Recommendation I.430, § 6) resides within the LT layer 1.

IV.10.3 *Description of the activation procedure*

a) Activation from the network side: See Figure IV-3/G.961.

b) Activation from the user side: See Figure IV-4/G.961.

c) Deactivation from the network side: See Figure IV-5/G.961.

d) Activation of loopback 2: See Figure IV-6/G.961.

Note 1 — Activating the line system only, where the full information transfer capability is available while the interface at T reference point remains deactivated, is not provided.

Note 2 — A non-transparent loopback 1 is provided where no line signal is transmitted at the LT 2-wire point.

Note 3 — A non-transparent loopback 2 is provided where INFO 0 is sent from the NT1 at the interface at T reference point.

Note 4 — A repeater is not applicable.

Figure IV-3/G.961, p.

Figure IV-4/G.961, p.

Figure IV-5/G.961, p.

Figure IV-6/G.961, p.

IV.10.4 *State transition table NT1*

State transition table NT1 as a function of INFOs and SIGs is defined in Table IV-2/G.961.

IV.10.5 *State transition table LT*

State transition table LT as a function of FEs, SIGs and the internal timer T2 is defined in Table IV-3/G.961.

H.T. [T29.961]

TABLE IV-2/G.961
{
State transition table NT1
}

Event	State name State code Tx	Deactive T- interface pre-active Loopback 2 active NT 1.0	Pending power activation T- interface active NT 1.1	{ { NT 1.2	NT 1.3	NT 1.4
SIG 1	/	NT 1.0	NT 1.0	NT 1.0	NT 1.0	NT 1.0
SIG 3	NT 1.2	NT 1.2	—	—	/	/
Line of NT1 side active	/	/	NT 1.3	—	—	—
SIG 6	/	/	/	NT 1.4	—	—
SIG 7	/	/	/	/	/	NT 1.6
SIG 9	/	/	/	NT 2.1	/	/
SIG 13	/	/	/	—	NT 1.3	NT 1.3
Lost framing of T interface	/	/	/	/	/	NT 1.7

{
Lost framing of line at NT1 side
}
	/	/	/	NT 1.2	NT 1.2	NT 1.2

Receiving INFO 1	NT 1.1	—	—	—	—	/
Receving INFO 3	/	/	/	/	NT 1.5	—
Loopback 2 established	/	/	/	/	/	/

/ Impossible event

— No state change

Tableau IV-2/G.961 ITALIENNE [T29.961], p.9

H.T. [T30.961]

TABLE IV-3/G.961
{
State transition table LT
}

Event	State name State code Tx	Deactive LT 1.0	Pending activation of line LT 1.1	Line active LT 1.2	T- interface active LT 1.3	Pending deac LT 1.
SIG 2	FE 2 LT 1.1	—	—	/	/	—
Line fully active	/	FE 3 LT 1.2	—	—	—	FE 3 LT
SIG 8	/	/	FE 4 LT 1.3	—	—	/
SIG 10	/	/	/	/	/	/
Lost framing of line	/	/	FE 7 LT 1.5	FE 7 LT 1.5	—	—
SIG 12	/	/	/	FE 7 LT 1.2	—	/
Expiry of timer T2	/	/	/	/	LT 1.0	/
FE 1	LT 1.1	/	/	/	/	/
FE 5	/	ST.T2 LT 1.4	ST.T2 LT 1.4	ST.T2 LT 1.4	/	ST.T2 L
FE 8	2.1	/	/	/	/	/

/ Impossible event

— No state change

Tableau IV-3/G.961 ITALIENNE [T30.961], p.10

IV.10.6 *Activation times*

See Recommendation G.960, §§ 5.5.1 and 5.5.2.

IV.11 *Jitter*

Jitter tolerance is intended to ensure that the limits of Recommendation I.430 are supported by the jitter limits of the transmission system on local lines. The jitter limits given below must be satisfied regardless of the length of the local line and the inclusion of one regenerator, provided that they are covered by the transmission media characteristics (see § 3). The limits must be met regardless of bit patterns in the B, D and CL channels.

IV.11.1 *NT1 input signal jitter tolerance*

The NT1 shall meet the performance objective with wander/jitter at the maximum magnitudes indicated in Figure IV-7/G.961, for single jitter frequencies in the range of 3 Hz to 80 kHz, superimposed on the test signal source. The NT1 shall also meet the performance objectives with wander per day of up to 0.1 UI peak-to-peak where the maximum rate of change of phase is 1.0 UI/hour.

Figure IV-7/G.961 [T27.961] (à traiter comme tableau MEP), p.

IV.11.2 *NT1 output jitter limitations*

With the wander/jitter as specified in IV.11.1 superimposed on the NT1 input signal, the jitter on the transmitted signal on the NT1 toward the network shall conform to following:

a) The jitter shall be equal to or less than 0.1 UI peak-to-peak and less than 0.25 UI rms when measured with a high-pass filter having a 20 dB/decade roll-off below 90 Hz.

b) The jitter in the phase of the output signal relative to the phase of the input signal (from the network) shall not exceed 0.12 UI peak-to-peak or 0.025 UI rms when measured with a band-pass filter having a 20 dB/decade roll-off above 90 Hz and a 20 dB/decade roll-off below 0.3 Hz. This applies with superimposed jitter in the phase of the input signal as specified in § IV.11.1 for single frequency up to F_2 Hz.

IV.11.3 *Test conditions for jitter measurements*

Due to bidirectional transmission on the 2-wire and due to severe intersymbol interference no well defined signal transitions are available at the NT1 2-wire point.

Note — Two possible solutions are proposed:

a) A test point in the NT1 is provided to measure jitter an undisturbed signal.

b) A standard LT transceiver including an artificial local line is defined as a test instrument.

IV.12 *Transmitter output characteristics of NT1 and LT*

The following specification apply with a load impedance of 110 ohms.

IV.12.1 *Pulse amplitude*

The zero to peak nominal amplitude of the largest pulse shall be 6 V and the tolerance shall be ± | 0%.

IV.12.2 *Pulse shape*

The pulse shape shall meet the pulse mask of Figure IV-8/G.961.

Figure IV-8/G.961, p.

IV.12.3 *Signal power*

The average power shall be between 14.5 dBm and 17.1 dBm.

IV.12.4 *Power spectrum*

The upper bound of the power spectral density shall be within the template in Figure IV-9/G.961.

Figure IV-9/G.961, p.

IV.12.5 *Transmitter signal nonlinearity*

This is a measure of the deviations from ideal pulse heights and the individual pulse nonlinearity.

The deviation between positive and negative pulse heights shall be less than 5%.

The measurement method is for further study.

IV.13 *Transmitter/receiver termination*

IV.13.1 *Impedance*

a) The nominal input impedance looking toward the NT1 or LT respectively shall be 110 ohms.

b) The nominal output impedance looking toward the NT1 or LT respectively shall be less than 30 ohms when driving pulses, and shall be 110 ohms when not driving pulses.

IV.13.2 *Return loss*

The return loss of the impedance shall be greater than shown in the template Figure IV-10/G.961.

Figure IV-10/G.961, p.

IV.13.3 *Longitudinal conversion loss*

The minimum longitudinal conversion loss shall be greater than shown in the template Figure IV-11/G.961.

Figure IV-11/G.961, p.

APPENDIX V
(to Recommendation G.961)

A digital line system for ISDN basic rate access using binary

bi-phase line code

V.0 *Electrical characteristics*

This appendix describes a 160 kbit/s transparent transmission system using echo cancelling techniques. The transmission rate will support 64 kbit/s B channels and one 16 kbit/s D channel as defined in Recommendation I.412. The remaining 16 kbit/s capacity will allow for framing and auxiliary channel information.

Data scrambling is performed on the entirety of the framed data using different polynomials at exchange end and subscriber end. Bi-phase coding is used for the line code. The encoded signal is filtered and transmitted to the line at a symbol rate of 160 kbauds. The bi-phase signalling element transitions allow data-derived clock extraction with low jitter, and equalisation can be accomplished by a short decision-feedback structure. Binary decision-making gives best immunity to residual inter-symbol interference and residual echo and simplifies receiver design by not requiring AGC/decision references.

V.1 *Line code*

For both the directions of transmission the line code is bi-phase. The coding scheme is as follows.

Binary ZERO is represented by a negative transition in the middle of the bit period.

Binary ONE is represented by a positive transition in the middle of the bit period.

Transitions at the bit boundary occur if successive binary data bits are identical.

The encoded binary signal is then shaped to effectively filter out the high frequency components.

V.2 *Symbol rate*

The symbol rate is determined by the line code, the bit rate of the information stream and the frame structure. The symbol rate is 160 kbauds.

V.2.1 *Clock requirements*

V.2.1.1 *NT1 free running clock accuracy*

The accuracy of the free running clock in the NT1 shall be ± | 30 ppm.

V.2.1.2 *LT clock tolerance*

The NT1 and LT shall accept a clock accuracy from the ET of ± | 0 ppm in compliance with Recommendation G.703.

V.3 *Frame structure*

The frame structure contains a frame word, *N* times (2B + D) and a CL channel.

As shown in Figure V-1/G.961, a line frame is defined as 40 ‘‘cells’’ C0 to C39, each containing 19 bits at the transmission bit rate. Cell C0 contains a frame synchronization pattern.

Cells C1 to C19 and C21 to C39 contain the subscriber B1, B2, and D channels. Cell C20 contains a CL channel.

Figure V-1/G.961, p.

V.3.1 *Frame length*

The defined frame structure and line rate results in a line frame of 760 bits and of 4.75 ms duration.

V.3.2 *Bit allocation in direction LT-NT1*

As defined in § V.3.

V.3.3 *Bit allocation in direction NT1-LT*

As defined in § V.3.

V.4 *Frame word*

V.4.1 *Frame word in direction LT-NT1*

The frame word occupies cell C0 in the frame structure, and it consists of 19 consecutive ones, which is unique within the frame bit sequence. This is ensured by defining the 19th bit in cells C1 to C39 to be permanently set to zero.

V.4.2 *Frame word in direction NT1-LT*

As defined in § V.4.1.

V.5 *Frame alignment procedure*

A 20-bit alignment pattern of 19 consecutive ones immediately preceded by a zero shall be searched for in the incoming data stream. ‘‘Frame alignment’’ is defined as the correct reception of three consecutive frames containing the alignment pattern in the expected positions within the frames.

V.5.1 *Frame alignment monitoring*

‘‘Loss of frame alignment’’, is defined as the detection of 3 consecutive frames each with one or more errors in the alignment pattern. The monitoring of frame alignment shall be a continuous process.

V.5.2 *Line polarity detection*

In the NT1, a mechanism is provided for the automatic detection of the line polarity. An 80 ms timer is started only by the inactive to active transition of the ‘‘line signal detect’’ signal, from the transmission system. The timer is held reset when ‘‘frame alignment’’ is achieved. The expiry of the timer causes the incoming and outgoing data polarity to be reversed. Once the line polarity is determined it is retained as the initial polarity for subsequent detection operations. The timer duration of 80 ms is chosen to allow for the convergence of the transmission system, plus the time required to obtain ‘‘frame alignment’’.

In order to avoid duplication of the alignment pattern by a data sequence in a data stream from a reversed line, the B1, B2 and D channels, in the LT to NT1 direction, are to be set to all ones during that part of the activation procedure before operational data is switched through. In addition, at least one bit of the auxiliary channel must also be set to a one during the activation procedure.

V.6 *Multiframe*

There is no multiframe structure.

V.7 *Frame offset between LT-NT1 and NT1-LT frames*

The LT-NT1 and NT1-LT frames at the NT1 can be in any alignment but the LT is required to align with any offset of the received line frames relative to the transmitted line frames.

V.8 *CL channel*

The purpose of the CL channel is to convey maintenance information as well as ‘‘date valid’’ and ‘‘ready for data’’ flags.

V.8.1 *Bit rate*

The bit rate of the CL channel is 3.8 kbit/s.

V.8.2 *Structure*

Figure V-2/G.961 shows the CL channel format in the two directions LT-NT1 and NT1-LT, which is divided into the following field types:

a) M3-0: A 4 bit field for the conveyance of a ‘‘maintenance command’’ to a remote transmission termination. The termination identity is included in the command coding.

b) R3-0: A 4 bit field for the conveyance of a ‘‘maintenance response’’ to the LT.

c) DV: A ‘‘data valid’’ flag which indicates that, in the LT to NT1 direction, the B1, B2 and D channels contain operational data.

d) RFD: A ‘‘ready for data’’ flag which indicates that, in the NT1 to LT direction, the B1, B2 and D channels contain operational data.

e) D7-0: An 8 bit field for the conveyance of any ‘‘maintenance data’’ that may be associated with a ‘‘maintenance response’’.

f) K4-0: A 5 bit cyclic check code which operates on the auxiliary cell bits A17 to A5 inclusive.

Figure V-2/G.961, p.

V.8.3 *Protocols and procedures*

Maintenance operations are based on a repetitive command/echo-response protocol. A maintenance operation is initiated by the continuous transmission of the required ‘‘maintenance command’’ from the LT. When the appropriate termination receives the validated command, it is continuously echoed back to the LT as a ‘‘maintenance response’’, and the command is acted upon. If the command demands data, then this is simultaneously returned in the ‘‘maintenance data’’ field. The termination continues to echo the command and provide any data for as long as it receives appropriate validated commands. For responses which are not accompanied by data, the ‘‘maintenance data’’ field is undefined. The LT assumes the conclusion of the maintenance operation when it receives a validated response that matches the transmitted command.

Loopbacks are applied using maintenance commands, and transmission system performance data is returned using the maintenance data field. Maintenance operations can be performed whenever the Digital Section is activated.

V.8.4 *Security*

A security mechanism operates on CL channel bits A17 to A0 inclusive.

The validation procedure consists of two stages:

a) A 5 bit cyclic redundancy code K4-0 operates on CL channel bits A17 to A5 inclusive. The generator of the code is:

$$g(x) = (1 \oplus x)(1 \oplus x \oplus x^4)$$

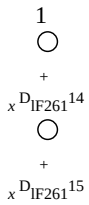
This is a Hamming code which gives single bit error detection and single bit error correction.

b) A set of CL channel bits A17 to A5 are only accepted as valid if they have been successfully checked/corrected and they match the previous two sets which were successfully checked/corrected. Note that these three sets need not necessarily have come from consecutive line frames.

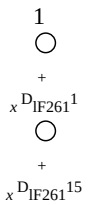
V.9 *Scrambling*

The entirety of the framed binary data stream is scrambled as follows:

a) NT1 to LT scramble polynomial



b) LT to NT1 scramble polynomial



($\bigcirc_+$ = EXCLUSIVE OR)

V.10 *Activation/deactivation*

One bit of the CL channel is allocated for use during the activation and deactivation procedures. These are the ‘‘data valid’’ flag in the LT to NT1 direction and the ‘‘ready for data’’ flag in the NT1 to LT direction. These bits are not included in the maintenance protocol described above, and operate as simple unsollicited indications.

V.10.1 *Signals used for activation/deactivation*

The signals (SIGs) used for activation/deactivation are:

LT-NT1 direction

–v’1P’

H.T. [T31.961]

Signal	Frame word	2B + D	M	DV	K
I0	Absent	Absent	Absent	Absent	Absent
I2	Normal	1	1	0	Normal
I4	Normal	Normal	Normal	1	Normal

Tableau [T31.961], p.

NT1-LT direction

–v’1P’

H.T. [T32.961]

Signal	Frame word	2B + D	R	RFD	D0-D7	K
I0	Absent	Absent	Absent	Absent	Absent	Absent
I1	0	0	0	0	0	0
I31	Normal	0	1	0	Normal	Normal
I3	Normal	Normal	Normal	1	Normal	Normal

Tableau [T32.961], p.

V.10.2 *Definition of internal timers*

The following timers are located within the LT:

— Timer 2 (T2) prevents unintentional reactivation from the TE.

— Timer A (TA) is started if, from the layer 1 active state (LT4), SIG I31 is received, indicating loss of SIG I3. If SIG I3 is not subsequently received before expiry of Timer A, deactivation is initiated.

— Timer B (TB) is started upon loss of framing. If frame recovery is not achieved before expiry of Timer B, deactivation is initiated.

Durations of internal timers are for further study.

V.10.3 *Description of activation/deactivation procedures*

Figure V-3/G.961 (sheet 1 of 3) illustrates the method of activation from the network. PH ACTIVATE REQUEST causes SIG I2 to be transmitted from the network towards NT1. NT1 achieves line signal detect and frame synchronization status. At this point NT1 sends INFO 2 towards the TE and simultaneously sends SIG I31 towards the network. In time, the network achieves in synchronization status and the TE replies to INFO 2 with INFO 3. The latter event is signalled to the network from NT1 by sending SIG I3. At the network this results in ACTIVATE INDICATION. The network responds by sending SIG I4 towards NT1. Upon receipt of this signal NT1 sends INFO 4 towards the TE, thus completing the activation procedure.

Figure V-3/G.961 (sheet 2 of 3) illustrates activation from the user side. The activation process is essentially similar to that for activation from the network side, except that INFO 1 from the TE begins the process. In this case NT1 starts the process by sending SIG I1 towards the network. Line signal detect status is achieved at the network. The network sends SIG I2 towards NT1. From here on the process is as described above.

Figure V-3/G.961 (sheet 3 of 3) illustrates the method of deactivation. DEACTIVATE REQUEST causes transmission from the network to NT1 to cease (SIG I0). The NT1, on detecting this, sends SIG I1 back to the network, and INFO 0 towards the TE. The TE responds by sending INFO 0 back to the NT1, and on receipt of this, the NT1 ceases transmitting to the network (SIG I0). At the network, this results in DEACTIVATE INDICATION, thus completing the deactivation procedure.

Definitions for SIGs are given in V.10.1 and for definitions for INFOs refer to Recommendation I.430.

Figure V-3/G.961 (feuillet 1 sur 3), p.20

Figure V-3/G.961 (feuillet 2 sur 3), p.21

Figure V-3/G.961 (feuillet 3 sur 3), p.22

V.10.4 *State transition table for NT1 as a function of INFOs, SIGs*

See Table V-1/G.961.

V.10.5 *State transition table for LT as a function of FEs, SIGs, and internal timers*

See Table V-2/G.961.

V.10.6 *Activation times*

Metallic pair cable transmission system.

Maximum activation time occurring immediately after a deactivation (without intervening loopback or powering action):

a) without regenerator: 100 ms;

b) with regenerator: 200 ms.

Maximum activation time occurring after the first powering of a line:

a) without regenerator: 250 ms;

b) with regenerator: 500 ms.

V.11 *Jitter*

Jitter tolerances are intended to ensure that the limits of Recommendation I.430 are supported by the jitter limits of the transmission system on local lines.

H.T. [T33.961]

TABLE V-1/G.961

NT1 activation/deactivation state transition table

States	NT1 Deact.	NT2 Act. pendg.	NT3 Systm. act.	NT4 Wait data valid	NT5 Layer 1 act.	
Events	SIG transmitted	I0	I1	I31	I3	I3
SIG received	I0 (Deact. req.) I2 (Act. req.)	— I2 NT3	— I2 NT3	I0 NT1 —	I0 NT1 —	I0 NT1 I2 NT3
From TE	I0 (Deact. ind.) I1 (Act. req.)	— — NT2	I0 NT1 —	— /	— NT3 /	I2 NT3 /

/ No change

— Impossible

Tableau V-1/G.961 [T33.961], p.23

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TABLE V-2/G.961

LT activation/deactivation state transition table

States		LT1 Deact.	LT2 Wait for systm. act	LT3 Systm act.	LT4 Layer 1 act.	LT5 Loss of fr
Events		SIG transmitted	I0	I2	I2	I4
SIG received		I0 (Deact. ind.)	—	—	FE7 —	FE7 —
		I1 (Act. req.)	FE2 TL2	—	/	/
		Loss of framing	/	/	Start TB LT5	Start TB LT
		Frame recovery	/	/	/	/
		FE1	— LT2	/	/	/
		FE5	—	Start T2 LT6	Start T2 LT6	Start T2 LT

Deac-
tivated

Activation pend-
ing

Transmission system
activated

Wait for data
valid

Layer 1
activated

Deac-
tivated

Waiting for transmission system activa-
tion

Transmission system
activated

Layer 1
activated

Loss of fram-
ing

Waiting for deactivate indica-
tion

Start timer
T2

Stop timer

TA

Transmitter output characteristics of NT1 and LT

No

change

Transmitted/receiver *termination*