



INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

V.8 *bis*

(09/98)

SERIES V: DATA COMMUNICATION OVER THE
TELEPHONE NETWORK

General

**Procedures for the identification and selection
of common modes of operation between Data
Circuit-terminating Equipments (DCEs) and
between Data Terminal Equipments (DTEs) over
the public switched telephone network and on
leased point-to-point telephone-type circuits**

ITU-T Recommendation V.8 *bis*

(Previously CCITT Recommendation)

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DATA COMMUNICATION OVER THE TELEPHONE NETWORK

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**PROCEDURES FOR THE IDENTIFICATION AND SELECTION OF COMMON
MODES OF OPERATION BETWEEN DATA CIRCUIT-TERMINATING
EQUIPMENTS (DCEs) AND BETWEEN DATA TERMINAL EQUIPMENTS
(DTEs) OVER THE PUBLIC SWITCHED TELEPHONE NETWORK AND
ON LEASED POINT-TO-POINT TELEPHONE-TYPE CIRCUITS**

Summary

This Recommendation defines signals, messages and the procedures for exchanging these over the PSTN and on leased point-to-point telephone-type circuits, for the identification and selection of common modes of operation between Data Circuit-terminating Equipments (DCEs) and Data Terminal Equipments (DTEs). These are used when the modes of operation of DCEs and DTEs communicating over the connection need to be automatically established and selected, but before signals are exchanged which are specific to a particular Recommendation. Considerations are included for the standard analogue telephony mode of operation.

Source

ITU-T Recommendation V.8 *bis* was revised by ITU-T Study Group 16 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 25th of September 1998.

FOREWORD

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PROCEDURES FOR THE IDENTIFICATION AND SELECTION OF COMMON MODES OF OPERATION BETWEEN DATA CIRCUIT-TERMINATING EQUIPMENTS (DCEs) AND BETWEEN DATA TERMINAL EQUIPMENTS (DTEs) OVER THE PUBLIC SWITCHED TELEPHONE NETWORK AND ON LEASED POINT-TO-POINT TELEPHONE-TYPE CIRCUITS

(revised in 1998)

1 Scope

This Recommendation defines signals, messages and procedures for exchanging these over the PSTN and on leased point-to-point telephone-type circuits, when the modes of operation of DCEs and DTEs communicating over the connection need to be automatically established and selected, but before signals are exchanged which are specific to a particular Recommendation. Considerations are included for the standard analogue telephony mode of operation.

The principal characteristics of this Recommendation are as follows:

- a) use over the PSTN or on leased telephone-type circuits;
- b) use at call establishment on the PSTN upon automatic answering;
- c) use after PSTN call establishment when the circuit is in telephony mode;
- d) provisions to exchange capabilities information for identifying common modes of operation between DCEs and between DTEs;
- e) provisions for a DCE to request the remote DCE to initiate a common mode of operation:
 - mode determination by the calling station upon automatic answering at PSTN call establishment;
 - mode determination by the answering station upon automatic answering at PSTN call establishment; and
 - mode determination after circuit establishment by either station;
- f) provisions to prevent inadvertent disconnection of calls or annoying disturbance to users who may not have V.8 bis capability or be aware of V.8 bis procedures.

2 References

The following Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision. All users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent editions of the Recommendations and other references listed below. A list of currently valid ITU-T Recommendations is regularly published.

- ITU-T Recommendation H.324 (1998), *Terminal for low bit-rate multimedia communication*.
- ITU-T Recommendation T.30 (1996), *Procedures for document facsimile transmission in the general switched telephone network*.
- CCITT Recommendation T.35 (1991), *Procedure for the allocation of CCITT defined codes for non-standard facilities*.
- ITU-T Recommendation T.84 (1996) | ISO/IEC 10918-3:1997, *Information technology – Digital compression and coding of continuous-tone still images – Extensions*.
- ITU-T Recommendation T.120 (1996), *Data protocols for multimedia conferencing*.
- CCITT Recommendation T.434 (1992), *Binary file transfer format for the telematic services*.

- ITU-T Recommendation V.8 (1998), *Procedures for starting sessions of data transmission over the public switched telephone network.*
- ITU-T Recommendation V.14 (1993), *Transmission of start-stop characters over synchronous bearer channels.*
- ITU-T Recommendation V.18 (1998), *Operational and interworking requirements for DCEs operating in the text telephone mode.*
- CCITT Recommendation V.21 (1984), *300 bits per second duplex modem standardized for use in the general switched telephone network.*
- CCITT Recommendation V.22 (1988), *1200 bits per second duplex modem standardized for use in the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits.*
- CCITT Recommendation V.22 bis (1988), *2400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits.*
- CCITT Recommendation V.23 (1988), *600/1200-baud modem standardized for use in the general switched telephone network.*
- ITU-T Recommendation V.32 (1993), *A family of 2-wire, duplex modems operating at data signalling rates of up to 9600 bit/s for use on the general switched telephone network and on leased telephone-type circuits.*
- CCITT Recommendation V.32 bis (1991), *A duplex modem operating at data signalling rates of up to 14 400 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits.*
- ITU-T Recommendation V.34 (1998), *A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits.*
- ITU-T Recommendation V.42 (1996), *Error-correcting procedures for DCEs using asynchronous-to-synchronous conversion.*
- CCITT Recommendation V.42 bis (1990), *Data compression procedures for Data Circuit-terminating Equipment (DCE) using error correction procedures.*
- ITU-T Recommendation V.61 (1996), *A simultaneous voice plus data modem, operating at a voice plus data signalling rate of 4800 bit/s, with optional automatic switching to data-only signalling rates of up to 14 400 bit/s, for use on the general switched telephone network and on leased point-to-point 2-wire telephone type circuits.*
- ITU-T Recommendation V.70 (1996), *Procedures for the simultaneous transmission of data and digitally encoded voice signals over the GSTN, or over 2-wire leased point-to-point telephone-type circuits.*
- ITU-T Recommendation V.76 (1996), *Generic multiplexer using V.42 LAPM-based procedures.*
- ITU-T Recommendation V.80 (1996), *In-band DCE control and synchronous data modes for asynchronous DTE.*
- ITU-T Recommendation V.90 (1998), *A digital modem and analogue modem pair for use on the Public Switched Telephone Network (PSTN) at data signalling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream.*
- ITU-T Recommendation V.250 (1998), *Serial asynchronous automatic dialling and control.*
- ITU-T Recommendation V.251 (1998), *Procedure for DTE-controlled call negotiation.*
- ISO/IEC 3309:1993, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures – Frame structure.*

3 Definitions

This Recommendation defines the following terms:

3.1 answering station: The DTE, DCE and other associated terminal equipment which answers a call placed on the PSTN.

3.2 calling station: The DTE, DCE and other associated terminal equipment which originates a call over the PSTN.

3.3 initiating station: The DTE, DCE and other associated terminal equipment which initiates a V.8 *bis* transaction. This may be either the answering or calling station on the PSTN or either station on a leased circuit, and may change from one V.8 *bis* transaction to the next. When a transaction is initiated upon automatic answering of a call placed on the PSTN, the answering station is the initiating station.

3.4 responding station: The station which responds to initiation of a V.8 *bis* transaction from the remote station. This may be either the answering or calling station on the PSTN or either station on a leased circuit, and may change from one V.8 *bis* transaction to the next. When a transaction is initiated upon automatic answering of a call placed on the PSTN, the calling station is the responding station.

3.5 initiating signal: A signal which initiates a V.8 *bis* transaction.

3.6 message: Framed information conveyed via modulated transmission at 300 bit/s using V.21 channels No. 1 and 2 (defined in clause 3/V.21), and referred to herein as V.21 (L) and V.21 (H), respectively.

3.7 responding signal: A signal that is sent in response to an initiating signal.

3.8 signal: Information conveyed via tone based transmission.

3.9 telephony mode: The operational mode in which voice or other audio (rather than modulated information-bearing messages) is the method of communication.

3.10 transaction: A sequence of V.8 *bis* signals and messages, beginning with an initiating signal and terminating with either a positive acknowledgment [ACK(1) (except as noted in 9.7)], a negative acknowledgment (NAK), or a time-out (see 9.8).

4 Abbreviations

This Recommendation uses the following abbreviations:

ACK	Acknowledge Message
ANS	V.25 answer tone
ANSam	V.8 modulated answer tone
CCITT	International Telegraph and Telephone Consultative Committee
CL	Capabilities List
CLR	Capabilities List Request
CR	Capabilities Request
DCME	Digital Circuit Multiplexing Equipment
DIS	Digital Identification Signal
ES	Escape Signal
FCS	Frame Check Sequence
ISO	International Organization for Standardization
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
LSB	Least Significant Bit
MR	Mode Request
MS	Mode Select
MSB	Most Significant Bit
NAK	Negative Acknowledge Message
OGM	Outgoing Message (recorded voice or other audio)
PSTN	Public Switched Telephone Network

5 Overview of this Recommendation

This Recommendation provides means for DCEs and DTEs, having multiple modes of operation over the PSTN and on leased telephone-type circuits, to perform the following functions:

- selection of the desired mode of operation at automatic call establishment on the PSTN, controlled by either the calling or answering station;
- selection of the desired mode of operation while in telephony mode on an already established connection, controlled by either station;
- determination by either station of whether the remote station supports V.8 *bis*, with minimum disturbance to a voice caller;
- exchange of available capabilities between stations on a connection at call establishment or while in telephony mode; and
- graceful recovery in the event of transmission errors or selection of an unavailable mode of operation.

Means for the functions listed above are provided by defining a set of signals, messages and procedures. Signals are intended to be detected in the presence of an interfering voice or other audio, to turn around any echo suppressors in the network prior to the beginning of information transmission and to indicate the initiation of a V.8 *bis* transaction to the receiving station while not appearing to the user and receiver as an indication of a data or facsimile device.

Messages convey significantly more information than signals, but may be used only when they will not cause disruption to a voice caller. They are intended to be used only in the absence of an interfering voice or other audio.

This Recommendation provides for error detection and rejection of corrupted messages, and rejection of mode selections that are unavailable.

6 Description of signals and messages

6.1 Escape Signal (ES)

This signal requests the remote station transition from telephony mode to an information transfer mode. In particular:

- signal ES_i is sent by the initiating station; and
- signal ES_r is sent by the responding station.

6.2 Mode Request (MR)

This signal requests the remote station transition from telephony mode to an information transfer mode and requests the transmission of a mode select message by the remote station. In particular:

- signal MR_e is sent by an automatic answering station at call establishment; and
- signal MR_d is sent by the initiating station during the course of a call, or by the calling station at call establishment in response to an MR_e.

6.3 Capabilities Request (CR)

This signal requests the remote station transition from telephony mode to an information transfer mode and requests the transmission of a capabilities list message by the remote station. In particular:

- signal CR_e is sent by an automatic answering station at call establishment; and
- signal CR_d is sent by the initiating station during the course of a call, or by the calling station at call establishment in response to a CR_e or MR_e.

6.4 Mode Select (MS)

This message requests the initiation of a particular mode of operation in the remote station.

6.5 Capabilities List (CL)

This message conveys a list of possible modes of operation of the transmitting station.

6.6 Capabilities List Request (CLR)

This message conveys a list of possible modes of operation of the transmitting station and also requests the transmission of a capabilities list by the remote station.

6.7 Acknowledge Message (ACK)

- ACK(1): This message acknowledges receipt of an MS message and terminates a V.8 *bis* transaction. It may also be used to acknowledge receipt of part of a CL-MS message combination and to request transmission of the remainder of the message combination.
- ACK(2): This message acknowledges receipt of a CL, CLR or MS message and requests the transmission of additional information by the remote station, providing the remote station has indicated that additional information is available.

6.8 Negative Acknowledge Message (NAK)

This message indicates that the receiving station is unable to interpret a received message or to invoke the mode requested by the transmitting station. Four NAK messages are defined:

- NAK(1) indicates that the receiving station is unable to interpret the received message;
- NAK(2) indicates that the receiving station is temporarily unable to invoke the mode requested by the transmitting station;
- NAK(3) indicates that the receiving station either does not support or has disabled the mode requested by the transmitting station; and
- NAK(4) indicates that the receiving station is unable to interpret a received message and requests a retransmission of the message. The use of this message is for further study.

7 Structure of signals and messages

The structure of the signals and messages is described in this clause.

7.1 Signals

V.8 *bis* signals that initiate a transaction (initiating signals) and signals that are sent in response to initiating signals during automatic call establishment (responding signals) are tone based.

Signals sent at call establishment by an automatic answering station upon answering a call are designated with the subscript "e" and signals sent during the telephony mode are designated with the subscript "d".

Signals (MR_e, MR_d, CR_e, CR_d, ES_i, and ES_r) are made up of two segments. Segment 1 consists of a dual tone pair, which is detectable in the presence of interfering voice or other audio. Segment 2 is a single tone which identifies the signal.

Signals sent by the initiating station use one dual tone pair for segment 1. Signals sent by the responding station use a different tone pair for segment 1.

7.1.1 Frequencies

The frequencies of the dual tone pairs comprising segment 1 of initiating and responding MR, CR and ES signals and the frequencies of the tones comprising segment 2 are defined in Tables 1 and 2 respectively.

Table 1/V.8 bis – Signal tone frequencies – Segment 1

Signal	Segment 1 (dual tone) frequencies (Hz)
Initiating: MR _e , MR _d , CR _e , CR _d and ES _i	1375 + 2002
Responding: MR _d , CR _d and ES _r	1529 + 2225

Table 2/V.8 bis – Signal tone frequencies – Segment 2

Signal	Segment 2 (single tone) frequencies (Hz)
MR _e	650
MR _d	1150
CR _e	400
CR _d	1900
ES _i	980
ES _r	1650

7.1.2 Duration

The duration of segment 1 of each signal shall be 400 ms nominal and the duration of segment 2 shall be 100 ms nominal. However, for signals MR_e and CR_e, the duration of segment 1 may be shortened to 285 ms to ensure compatibility with non-V.8 bis capable modems.

NOTE – It is desirable to maintain the duration of segment 1 as 400 ms on circuits where echo suppressors may be present.

7.1.3 Tolerances

The tolerance of the frequency of all tones shall be ± 250 ppm of the nominal value.

The tolerance of the duration of the tone segments shall be $\pm 2\%$.

7.1.4 Transmitted power levels

The transmit power of all signals shall conform to applicable national regulations, for which Recommendation V.2 is a guide. However, the transmitted power of signals CR_e and MR_e shall be 12 to 15 dB below the nominal permitted transmitted power, i.e. the transmit power of continuous signals. In addition, it is desirable that the transmit power of all signals, except CR_e and MR_e, be the highest permitted level, particularly when it is known that the PSTN connection may include an echo suppressor. Note also that it is desirable to use the highest permitted level at an automatic answering station when telephony mode is available and CR_e and MR_e are retransmitted as specified in 10.2.2 after the detection of CNG, CT or CI.

7.2 Messages

Messages MS, CL, CLR, ACK and NAK shall be transmitted using V.21 modulation. V.21(L) is used for messages from an initiating station and V.21(H) is used for messages from a responding station. Frequencies F_A and F_Z shall have a tolerance of $\pm 0.01\%$.

7.2.1 Transmitted power level

The transmit power of V.21 line signals of messages shall conform to applicable national regulations, for which Recommendation V.2 is a guide.

7.2.2 Format convention

The basic format convention used for messages is illustrated in Figure 1. Bits are grouped into octets. The bits of each octet are shown horizontally and are numbered from 1 to 8. Octets are displayed vertically and are numbered from 1 to N.

The octets are transmitted in ascending numerical order. Within an octet, bit 1 is the first bit to be transmitted.

For fields which are contained within a single octet, the lowest numbered bit of the field represents the least significant bit (2^0). When a field spans multiple octets, the lowest numbered bit of the field in the highest numbered octet containing the field represents the least significant bit (2^0). The order of bit values within each octet increases as the bit number increases. The order of bit values from octet to octet increases as the octet number decreases. Figure 2 illustrates a field which spans two octets.

An exception to this convention is the Frame Check Sequence (FCS) field, which spans two octets. In this case, the order of bit values within the octets is reversed. Bit 1 of the first octet is the MSB and bit 8 of the second octet is the LSB (Figure 3).

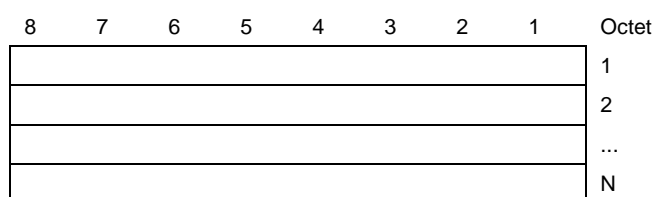


Figure 1/V.8 bis – Format convention

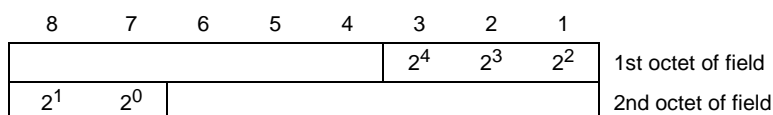


Figure 2/V.8 bis – Field mapping convention

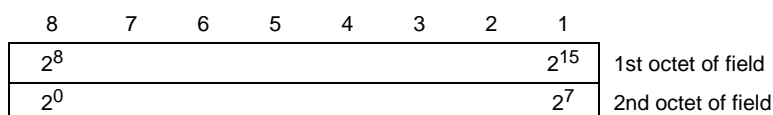


Figure 3/V.8 bis – FCS mapping convention

7.2.3 Frame structure

Messages shall use the frame structure shown in Figure 4.

8	7	6	5	4	3	2	1	Octet
Flag								1
Flag								2
Flag (optional)								
Flag (optional)								
Flag (optional)								
Information field								
FCS (first octet)								N – 2
FCS (second octet)								N – 1
Flag								N
Flag (optional)								
Flag (optional)								

Figure 4/V.8 bis – Message structure

7.2.4 Preamble

Each message shall begin with 100 ms \pm 2% of continuous V.21 marking frequency.

Where the message is preceded by an ES signal, the 100 ms of continuous marking frequency shall be treated as segment 2 of the ES signal.

7.2.5 Flag sequence

Messages shall start and end with the standard HDLC flag octet (01111110) as defined in ISO/IEC 3309. At least two but no more than five flags shall be sent to begin each message. At least one but no more than three flags shall follow the FCS of each message.

7.2.6 Information field

The contents of the information field shall consist of an integer number of octets coded in accordance with clause 8.

7.2.7 Frame check sequence field

The FCS field is 16 bits (2 octets) in length. As defined in ISO/IEC 3309, it shall be the one's complement of the sum (modulo 2) of:

- the remainder of $x^k (x^{15} + x^{14} + x^{13} + x^{12} + x^{11} + x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)$ divided (modulo 2) by the generator polynomial $x^{16} + x^{12} + x^5 + 1$, where k is the number of bits in the frame existing between, but not including, the last bit of the final opening flag and the first bit of the FCS, excluding bits (binary ZEROs) inserted for transparency; and
- the remainder of the division (modulo 2) by the generator polynomial $x^{16} + x^{12} + x^5 + 1$, of the product of x^{16} by the content of the frame existing between, but not including, the last bit of the final opening flag and the first bit of the FCS, excluding bits inserted for transparency.

As a typical implementation at the transmitter, the initial content of the register of the device computing the remainder of the division is preset to all binary ONES and is then modified by division by the generator polynomial (as described above) on the information field. The one's complement of the resulting remainder is transmitted as the 16-bit FCS.

As a typical implementation at the receiver, the initial content of the register of the device computing the remainder of the division is preset to all binary ONES. The final remainder, after multiplication by x^{16} and then division (modulo 2) by the generator polynomial $x^{16} + x^{12} + x^5 + 1$ of the serial incoming protected bits and the FCS, will be 0001110100001111 (x^{15} through x^0 , respectively) in the absence of transmission errors.

7.2.8 Transparency

The transmitting DCE shall examine the contents of the information and FCS fields (everything between the opening and closing flags) and insert a binary ZERO after every sequence of five contiguous binary ONES to ensure that the flag octet is not simulated within the frame. The receiving DCE shall examine the contents of the frame between the opening and closing flags and discard any binary ZERO which directly follows five contiguous binary ONES.

7.2.9 Invalid frames

An invalid frame is one which:

- a) is not properly bounded by flags in accordance with 7.2.5; or
- b) has fewer than three octets between flags; or
- c) does not consist of an integral number of octets before zero-bit insertion or after zero-bit extraction; or
- d) contains a frame check sequence error.

The procedure to be adopted when an invalid frame is received is described in 9.8.

8 Information field coding format

8.1 General

The message information field consists of three components:

- a) an identification field (I), followed by;
- b) a standard information field (S); and
- c) an optional non-standard information field (NS).

This general structure is shown in Figure 5.

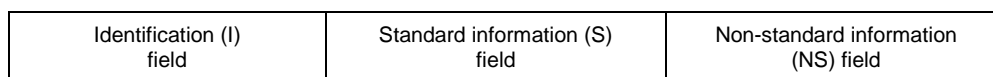


Figure 5/V.8 bis – Information field structure

8.2 Coding format for parameters in the I and S fields

In both the I and S fields most of the information to be conveyed consists of parameters relating to particular modes, features or capabilities associated with the two stations.

In order to:

- a) encode these parameters in accordance with a consistent set of rules; and
- b) allow future extension to the parameter list in a way that permits present and future V.8 bis implementations to correctly parse the information field,

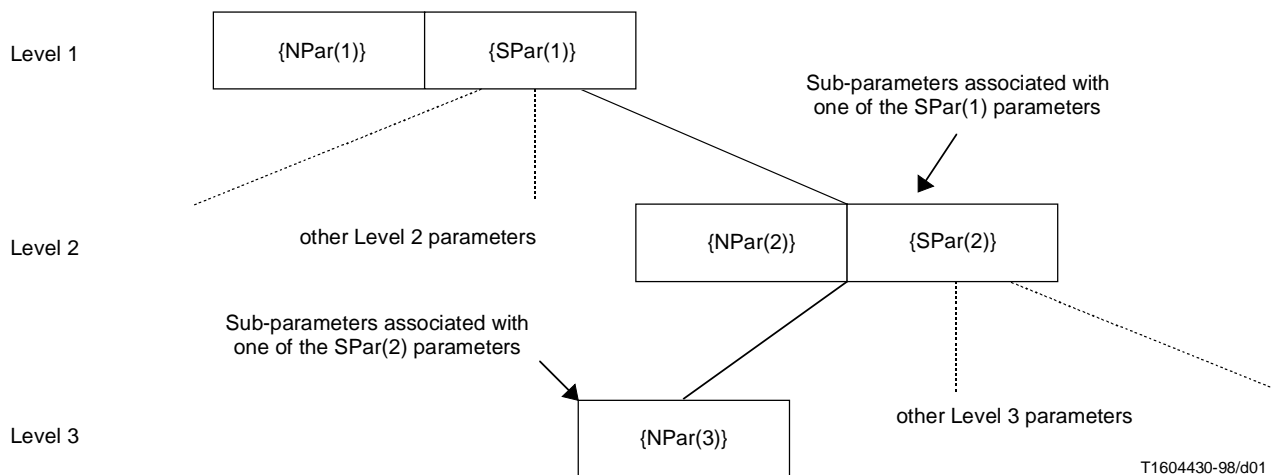
the parameters are linked together in an extensible tree structure. The order in which the parameters in the tree are transmitted and the use of delimiting bits which enable the tree to be reconstructed at the receiver are described in the rules set out below.

8.2.1 Parameter classification

Parameters (Pars) are classified as:

- NPar – Parameter which has no subparameters associated with it; and
- SPar – Parameter which has subparameters associated with it.

The general structure of this tree is as shown in Figure 6.



{NPar(n)} indicates a set of NPar parameters at Level n in the tree

Figure 6/V.8 bis – Tree structure linking parameters in the I and S fields

At level 1, the highest level of the tree, each SPar has associated with it a series of Pars (NPar and possibly SPars) at level 2 in the tree. Similarly, at level 2 in the tree, each SPar has associated with it a series of NPar at level 3 in the tree.

8.2.2 Order of transmission of parameters

Parameters are binary encoded and transmitted serially. Parameters of the same type (i.e. level, classification and association) are transmitted sequentially as a block of data consisting of an integral number of octets.

The order of transmission of NPar and SPars is specified in Figure 7.

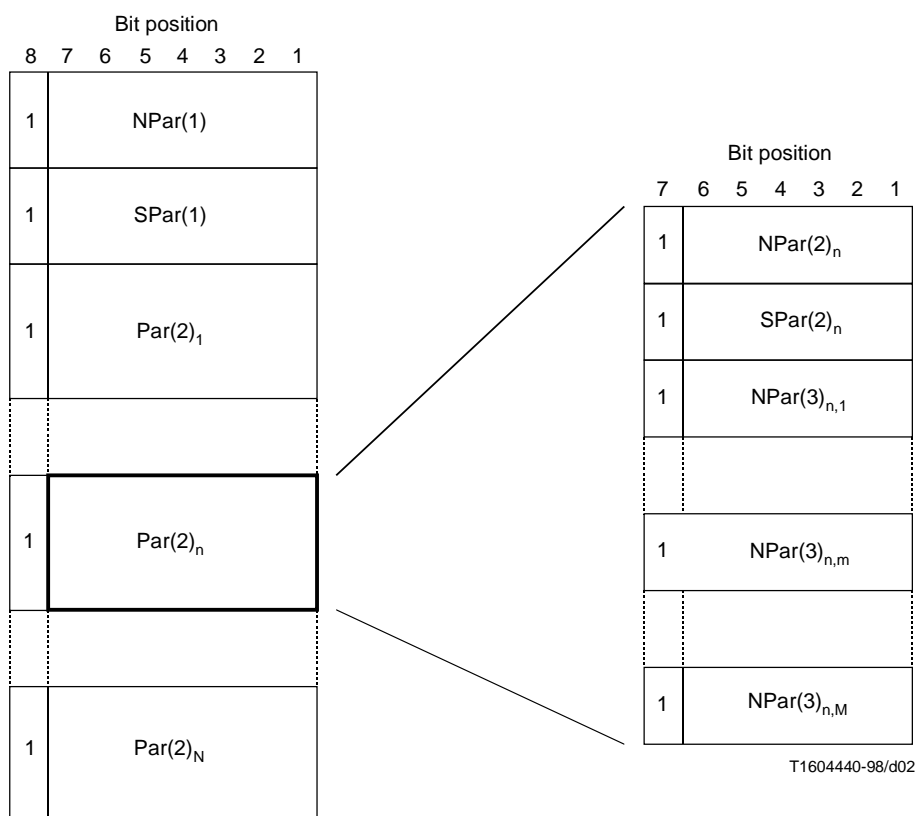


Figure 7/V.8 bis – Order of transmission of NPar and SPars

$\{\text{Par}(2)_n\}$ indicates a set of level 2 parameters associated with the n'th level 1 SPar, and consists of $\text{NPar}(2)_n$ parameters and possibly $\text{SPar}(2)_n$ parameters.

$\{\text{NPar}(3)_{n,m}\}$ indicates a set of level 3 NParS associated with the m'th level 2 SPar which in turn is associated with the n'th level 1 SPar.

Transmission of parameters begins with the first octet of $\text{NPar}(1)$ and ends with the last octet of $\text{Par}(2)_N$.

8.2.3 Delimiting and parsing of data blocks

The use of delimiting bits is illustrated in Figure 7. Within each octet of an information block, at least one bit is defined as a delimiting bit. This is used to define the last octet in the block. A binary ZERO in this bit position indicates that there is at least one additional octet in the block. A binary ONE in this bit position indicates the last octet in the block.

Bit 8 is used to delimit the $\{\text{NPar}(1)\}$ block, the $\{\text{SPar}(1)\}$ block, and each of the $\text{Par}(2)$ blocks. There are N of these $\text{Par}(2)$ blocks, one for each of the capabilities in the $\{\text{SPar}(1)\}$ block that is enabled (set to binary ONE).

Bit 7 is used to delimit each $\{\text{NPar}(2)\}$ block, each $\{\text{SPar}(2)\}$ block, and each of the associated $\{\text{NPar}(3)\}$ blocks. Figure 7 indicates that there are M of these $\text{NPar}(3)$ blocks, one for each of the capabilities in the $\{\text{SPar}(2)_n\}$ block that is enabled (set to binary ONE). M may be different for each of the $\text{Par}(2)$ blocks.

A $\text{Par}(2)$ block may either contain both $\text{NPar}(2)$ and $\text{SPar}(2)$ octets, or $\text{NPar}(2)$ octets alone. To indicate that a $\text{Par}(2)$ block contains only $\text{NPar}(2)$ octets, bits 7 and 8 are both set to binary ONE in the last $\text{NPar}(2)$ octet.

Bits 1 through 7 at level 1 of the tree and bits 1 through 6 at level 2 of the tree may be used to encode parameters.

To allow for compatibility with future revisions of this Recommendation, receivers shall parse all information blocks and ignore information that is not understood.

8.3 Identification field (I)

The identification field consists of three components:

- a) a four-bit message type field; followed by
- b) a four-bit revision number field; and
- c) a bit-encoded parameter field.

This general structure is shown in Figure 8.

Message type field	Revision number field	Bit-encoded parameter field
-----------------------	--------------------------	--------------------------------

Figure 8/V.8 bis – Identification field structure

8.3.1 Message type

The purpose of the message type field is to identify the message type of the frame. The field is four bits in length and occupies the first four bits of the first octet in the identification field. The tree structure encoding rules specified in 8.2 are not applicable to this field. The encoding shall be as shown in Table 3.

NOTE – Codepoints other than those specified in Table 3 are reserved for allocation by the ITU-T. To allow for compatibility with future revisions of this Recommendation, receivers should parse the message type field and ignore information not understood.

Table 3/V.8 bis – Message type field format

Message type	Bit numbers			
	4	3	2	1
MS	0	0	0	1
CL	0	0	1	0
CLR	0	0	1	1
ACK(1)	0	1	0	0
ACK(2)	0	1	0	1
NAK(1)	1	0	0	0
NAK(2)	1	0	0	1
NAK(3)	1	0	1	0
NAK(4)	1	0	1	1

8.3.2 Revision number

The purpose of the revision number field is to identify the revision number of V.8 *bis* to which the equipment conforms. The field is four bits in length and occupies bits 5 to 8 of the first octet in the identification field. The tree structure encoding rules specified in 8.2 are not applicable to this field. The encoding shall be in accordance with Table 4.

Table 4/V.8 bis – Revision number field format

Revision number	Bit numbers			
	8	7	6	5
Revision 1	0	0	0	1

8.3.3 Parameter field

- The parameter field of CL, CLR and MS messages is encoded in accordance with the rules described in 8.2.
- The parameter field of ACK and NAK messages is not used and is therefore of zero length.

The parameter field consists of a set of octets in which each parameter is assigned a unique bit position. A binary ONE in the assigned bit position indicates that the parameter is valid. The validity of multiple parameters may be conveyed by transmitting a binary ONE in each bit position corresponding to a valid parameter.

The level 1 and 2 NParS and SPars are listed in Tables 5-1, 5-2 and 5-3.

Table 5-1/V.8 bis – Identification field – {NPar(1)} coding

8	7	6	5	4	3	2	1	NPar(1)s
x	x	x	x	x	x	x	1	Rec. V.8 (see 9.9)
x	x	x	x	x	x	1	x	Short V.8 (see 9.9)
x	x	x	x	x	1	x	x	Additional information available (see 9.10)
x	x	x	x	1	x	x	x	Transmit ACK(1) (see 9.7)
x	x	x	1	x	x	x	x	Reserved for allocation by the ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by the ITU-T
x	1	x	x	x	x	x	x	Non-standard field
x	0	0	0	0	0	0	0	No parameters set in this octet

Table 5-2/V.8 bis – Identification field – {SPar(1)} coding

8	7	6	5	4	3	2	1	SPar(1)s
x	x	x	x	x	x	x	1	Network type (Note)
x	x	x	x	x	x	1	x	Reserved for allocation by the ITU-T
x	x	x	x	x	1	x	x	Reserved for allocation by the ITU-T
x	x	x	x	1	x	x	x	Reserved for allocation by the ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by the ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by the ITU-T
x	1	x	x	x	x	x	x	Reserved for allocation by the ITU-T
x	0	0	0	0	0	0	0	No parameters set in this octet

NOTE – The absence of a binary ONE in this bit position indicates that the DCE is connected to an analogue PSTN connection.

Table 5-3/V.8 bis – Identification field – Network type {NPar(2)} coding

8	7	6	5	4	3	2	1	Network Type NPar(2)s
x	x	x	x	x	x	x	1	Cellular access
x	x	x	x	x	x	1	x	ISDN access
x	x	x	x	x	1	x	x	Digital PSTN access (Note)
x	x	x	x	1	x	x	x	Reserved for allocation by the ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by the ITU-T
x	x	1	x	x	x	x	x	Non-standard network
x	x	0	0	0	0	0	0	No parameters set in this octet

NOTE – This bit is set to binary ONE to indicate digital PSTN access, other than ISDN, where the DCE delivers digitally encoded analogue content to the network.

8.4 Standard information field (S)

In the standard information field the parameters represent modes of working or capabilities relating to the DTEs or DCEs. The standard information field consists of a set of octets in which each capability is assigned a unique bit position. A binary ONE in the assigned bit position indicates that the capability is valid.

For messages CL and CLR, the validity of multiple capabilities may be conveyed by transmitting a binary ONE in each bit position corresponding to a valid capability. For message MS, multiple capabilities may be selected only if they can all be supported simultaneously within the DTE or DCE concerned.

When the non-standard network bit in Table 5.3, or the non-standard capabilities bits in other octets, are set to binary ONE, related non-standard information is present in the non-standard information field (see 8.5).

8.4.1 ACK and NAK messages

The standard information field for ACK and NAK messages is not used and is therefore of zero length.

8.4.2 MS, CL, and CLR messages

The level 1, 2 and 3 Pars for MS, CL and CLR messages are listed in Tables 6-1 through 6-10.

Table 6-1/V.8 bis – Standard information field – {NPar(1)} coding

8	7	6	5	4	3	2	1	NPar(1)s
x	x	x	x	x	x	x	1	Reserved for allocation by the ITU-T
x	x	x	x	x	x	1	x	Reserved for allocation by the ITU-T
x	x	x	x	x	1	x	x	Reserved for allocation by the ITU-T
x	x	x	x	1	x	x	x	Reserved for allocation by the ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by the ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by the ITU-T
x	1	x	x	x	x	x	x	Non-standard capabilities
x	0	0	0	0	0	0	0	No parameters in this octet

Table 6-2a/V.8 bis – Standard information field – {SPar(1)} coding – Octet 1

8	7	6	5	4	3	2	1	SPar(1)s
x	x	x	x	x	x	x	1	Data
x	x	x	x	x	x	1	x	Simultaneous voice and data
x	x	x	x	x	1	x	x	H.324 multimedia terminal
x	x	x	x	1	x	x	x	V.18 text telephone
x	x	x	1	x	x	x	x	T.30 facsimile (Note)
x	x	1	x	x	x	x	x	Analogue telephony
x	1	x	x	x	x	x	x	T.101 videotex terminal
x	0	0	0	0	0	0	0	No parameters in this octet
NOTE – Level 2 and 3 Pars associated with this SPar(1) are reserved for allocation by ITU-T Study Group 8.								

Table 6-2b/V.8 bis – Standard information field – {SPar(1)} coding – Octet 2

8	7	6	5	4	3	2	1	SPar(1)s
x	x	x	x	x	x	x	1	H.324-Multilink
x	x	x	x	x	x	1	x	Multilink-Additional-Connection
x	x	x	x	x	1	x	x	Reserved for use by ITU-T
x	x	x	x	1	x	x	x	Reserved for use by ITU-T
x	x	x	1	x	x	x	x	Reserved for use by ITU-T
x	x	1	x	x	x	x	x	Reserved for use by ITU-T
x	1	x	x	x	x	x	x	Reserved for use by ITU-T
x	0	0	0	0	0	0	0	No parameters in this octet

Table 6-3a/V.8 bis – Standard information field – Data {NPar(2)} coding – Octet 1

8	7	6	5	4	3	2	1	Data NPar(2)s
x	x	x	x	x	x	x	1	Transparent data
x	x	x	x	x	x	1	x	V.42 error control (Note 1)
x	x	x	x	x	1	x	x	V.42 <i>bis</i> data compression (Note 2)
x	x	x	x	1	x	x	x	V.14 async/sync conversion
x	x	x	1	x	x	x	x	T.120 conferencing
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE 1 – T.84 and T.434 are standardized image and data exchange formats that require the use of a secured data channel such as V.42.

NOTE 2 – Recommendation T.84 is not recommended for use with Recommendation V.42 *bis*.

Table 6-3b/V.8 bis – Standard information field – Data {NPar(2)} coding – Octet 2

8	7	6	5	4	3	2	1	Data NPar(2)s
x	x	x	x	x	x	x	1	T.84 SPIFF (Notes 1, 2 and 3)
x	x	x	x	x	x	1	x	T.434 file transfer (Note 2)
x	x	x	x	x	1	x	x	V.80 synchronous data HDLC
x	x	x	x	1	x	x	x	Reserved for allocation by the ITU-T
x	x	x	1	x	x	x	x	Rec. V.34 (duplex mode)
x	x	1	x	x	x	x	x	Rec. V.32 <i>bis</i>
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE 1 – SPIFF is the Still Picture Interchange File Format defined in Recommendation T.84.

NOTE 2 – T.84 and T.434 are standardized image and data exchange formats that require the use of a secured data channel such as V.42.

NOTE 3 – Recommendation T.84 is not recommended for use with Recommendation V.42 *bis*.

Table 6-3c/V.8 bis – Standard information field – Data {NPar(2)} coding – Octet 3

8	7	6	5	4	3	2	1	Data NPar(2)s
x	x	x	x	x	x	x	1	Rec. V.32
x	x	x	x	x	x	1	x	Rec. V.22 <i>bis</i>
x	x	x	x	x	1	x	x	Rec. V.22
x	x	x	x	1	x	x	x	Rec. V.21
x	x	x	1	x	x	x	x	V.90 analogue modem
x	x	1	x	x	x	x	x	V.90 digital modem (Note)
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE – A digital V.90 modem cannot operate on an analogue PSTN connection. See Note to Table 5.2.

There are no data SPar(2)s or data NPar(3)s presently defined and there are no octets therefore corresponding to these parameters.

Table 6-4a/V.8 bis – Standard information field – Simultaneous voice and data {NPar(2)} coding – Octet 1

8	7	6	5	4	3	2	1	SVD NPar(2)s
x	x	x	x	x	x	x	1	Recommendation V.70
x	x	x	x	x	x	1	x	Recommendation V.61
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	V.34 (full duplex mode)
x	x	x	1	x	x	x	x	V.32 bis
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet

Table 6-4b/V.8 bis – Standard information field – Simultaneous voice and data {NPar(2)} coding – Octet 2

8	7	6	5	4	3	2	1	SVD NPar(2)s
x	x	x	x	x	x	x	1	Transparent data
x	x	x	x	x	x	1	x	V.42 error control (Note 1)
x	x	x	x	x	1	x	x	V.42 bis data compression (Note 2)
x	x	x	x	1	x	x	x	V.14 async/sync conversion
x	x	x	1	x	x	x	x	T.120 conferencing
x	x	1	x	x	x	x	x	Synchronous HDLC
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE 1 – T.84 and T.434 are standardized image and data exchange formats that require the use of a secured data channel such as V.42.

NOTE 2 – Recommendation T.84 is not recommended for use with Recommendation V.42 bis.

Table 6-4c/V.8 bis – Standard information field – Simultaneous voice and data {NPar(2)} coding – Octet 3

8	7	6	5	4	3	2	1	SVD NPar(2)s
x	x	x	x	x	x	x	1	T.84 SPIFF (Notes 1, 2 and 3)
x	x	x	x	x	x	1	x	T.434 file transfer (Note 2)
x	x	x	x	x	1	x	x	V.76 with default Suspend/Resume parameters
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE 1 – SPIFF is the Still Picture Interchange File Format defined in Recommendation T.84.

NOTE 2 – T.84 and T.434 are standardized image and data exchange formats that require the use of a secured data channel such as V.42.

NOTE 3 – Recommendation T.84 is not recommended for use with Recommendation V.42 bis.

There are no simultaneous voice and data SPar(2)s or data NPar(3)s presently defined and there are no octets therefore corresponding to these parameters.

Table 6-5a/V.8 bis – Standard information field – H.324 multimedia terminal and H.324-Multilink {NPar(2)} coding

8	7	6	5	4	3	2	1	H.324 NPar(2)s
x	x	x	x	x	x	x	1	Video
x	x	x	x	x	x	1	x	Audio
x	x	x	x	x	1	x	x	Encryption
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet

Table 6-5b/V.8 bis – Standard information field – H.324 multimedia terminal and H.324-Multilink {SPar(2)} coding

8	7	6	5	4	3	2	1	H.324 SPar(2)s
x	x	x	x	x	x	x	1	Data
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

Table 6-5c/V.8 bis – Standard information field – H.324 multimedia terminal and H.324-Multilink – Data {NPar(3)} coding – Octet 1

8	7	6	5	4	3	2	1	H.324 – Data NPar(3)s
x	x	x	x	x	x	x	1	Rec. V.42
x	x	x	x	x	x	1	x	Rec. V.14
x	x	x	x	x	1	x	x	PPP
x	x	x	x	1	x	x	x	Rec. T.120
x	x	x	1	x	x	x	x	Rec. T.84
x	x	1	x	x	x	x	x	Rec. T.434
x	x	0	0	0	0	0	0	No parameters in this octet

Table 6-5d/V.8 bis – Standard information field – H.324 multimedia terminal and H.324-Multilink – Data {NPar(3)} coding – Octet 2

8	7	6	5	4	3	2	1	H.324 – Data NPar(3)s
x	x	x	x	x	x	x	1	Rec. T.140
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Reserved for allocation by ITU-T
x	x	0	0	0	0	0	0	No parameters in this octet

NOTE – See Recommendation H.324 for a definition of parameters in the H.324 multimedia terminal NPar(2), SPar(2) and NPar(3) octets.

Table 6-6a/V.8 bis – Standard information field – Multilink-Additional-Connection {NPar(2)} coding – Octet 1

8	7	6	5	4	3	2	1	Multilink Additional Connection NPar(2)s
x	x	x	x	x	x	x	1	Reserved for allocation by ITU-T
x	x	x	x	x	x	1	x	Reserved for allocation by ITU-T
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	Call association number present
x	x	x	1	x	x	x	x	MSB of call association number
x	x	1	x	x	x	x	x	Call association number
x	x	0	0	0	0	0	0	No parameters in this octet

Table 6-6b/V.8 bis – Standard information field – Multilink-Additional-Connection {NPar(2)} coding – Octets 2, 3, 4 and 5 (call association number present)

8	7	6	5	4	3	2	1	Multilink Additional Connection NPar(2)s
x	x	x	x	x	x	x	1	Call association number
x	x	x	x	x	x	1	x	Call association number
x	x	x	x	x	1	x	x	Call association number
x	x	x	x	1	x	x	x	Call association number
x	x	x	1	x	x	x	x	Call association number
x	x	1	0	0	0	0	0	Call association number (LSB of call association number in Octet 5)

Table 6-7/V.8 bis – Standard information field – V.18 text telephone {NPar(2)} coding

8	7	6	5	4	3	2	1	V.18 NPar(2)s
x	x	x	x	x	x	x	1	Recommendation V.21
x	x	x	x	x	x	1	x	Recommendation V.61
x	x	x	x	x	1	x	x	Reserved for allocation by ITU-T
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet

There are no V.18 text telephone SPar(2)s or Data NPar(3)s presently defined and there are no octets therefore corresponding to these parameters.

Table 6-8/V.8 bis – Standard information field – Analogue telephony {NPar(2)} coding

8	7	6	5	4	3	2	1	Analogue telephony NPar(2)s
x	x	x	x	x	x	x	1	Voice
x	x	x	x	x	x	1	x	Audio recording device (Note)
x	x	x	x	x	1	x	x	Voice bridging device (Note)
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet
NOTE – Assignment of codepoints for audio recording device and voice bridging device is provisional. The control of these devices via V.8 bis is the subject of further study.								

There are no analogue telephony SPar(2)s or data NPar(3)s presently defined and there are no octets therefore corresponding to these parameters.

Table 6-9/V.8 bis – Standard information field – T.101 videotex {NPar(2)} coding

8	7	6	5	4	3	2	1	T.101 NPar(2)s
x	x	x	x	x	x	x	1	Duplex (Recs. T.101, F.300 and F.301)
x	x	x	x	x	x	1	x	V.29 short train (Rec. T.104)
x	x	x	x	x	1	x	x	Rec. V.27 ter (Rec. T.104)
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet
NOTE – Assignment of bits in this table is the responsibility of ITU-T Study Group 8.								

There are no T.101 videotex SPar(2)s or data NPar(3)s presently defined and there are no octets therefore corresponding to these parameters.

Table 6-10a/V.8 bis – Standard information field – T.30 facsimile {NPar(2)} coding – Octet 1

8	7	6	5	4	3	2	1	T.30 NPar(2)s
x	x	x	x	x	x	x	1	T.30 procedures (without V.8)
x	x	x	x	x	x	1	x	V.34 (half duplex)
x	x	x	x	x	1	x	x	V.34 (duplex)
x	x	x	x	1	x	x	x	V.61 (ASVF)
x	x	x	1	x	x	x	x	V.70 (DSVF)
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet

Table 6-10b/V.8 bis – Standard information field – T.30 facsimile {NPar(2)} coding – Octet 2

8	7	6	5	4	3	2	1	T.30 NPar(2)s
x	x	x	x	x	x	x	1	H.324 (MSVF)
x	x	x	x	x	x	1	x	Extended negotiation method
x	x	x	x	x	1	x	x	M _s initiated session (Note)
x	x	x	x	1	x	x	x	Reserved for allocation by ITU-T
x	x	x	1	x	x	x	x	Reserved for allocation by ITU-T
x	x	1	x	x	x	x	x	Non-standard capabilities
x	x	0	0	0	0	0	0	No parameters in this octet
NOTE – M _s is the terminal which sent M _s in this session								

NOTE – The T.30 procedures code point is applicable in the case where this Recommendation is used with facsimile/telephone switching (OGM) and no V.8 is forthcoming, i.e. T.30 modulation schemes that do not depend on V.8 for initiation. The other code points contain the modulation types which could be indicated with V.8 *bis* in the facsimile environment.

8.5 Non-standard information field (NS)

MS, CL and CLR messages may optionally contain a non-standard information field to convey information beyond that defined in this Recommendation. When non-standard information is to be sent, the "Non-standard field" parameter is set to binary ONE in the identification field of the transmitted message (see Table 5-1).

The non-standard information field may optionally be composed of one or more non-standard information blocks (see Figure 9).

Each non-standard information block (see Figure 10) is composed of:

- a length indicator (one octet) specifying the length of the remainder of the block;
- a country code (K octets), as defined in Recommendation T.35;
- a length indicator (one octet), specifying the length of the provider code; the value in octets indicating that L octets follow;
- a provider code as specified by the country identified in Recommendation T.35; and
- non-standard information (M octets).

Non-standard information field (NS)			
Non-standard information block 1	Non-standard information block 2	–	Non-standard information block N

Figure 9/V.8 bis – Non-standard information field (NS) format

8.6 Information field length

The maximum number of octets in any information field shall be 64. If the information exceeds this limit, the remainder of the information may be contained in subsequent messages. The procedures for segmenting the information field and transmitting it in several messages are described in 9.10.

8	7	6	5	4	3	2	1
Non-standard information length = $K + L + M + 1$ (1 octet)							
T.35 country code (K octets, see Note)							
Provider code length = L (1 octet)							
T.35 provider code (L octets)							
Non-standard information (M octets)							

NOTE – The T.35 country code currently defined as one octet in length. A self-delimiting method of extension for the country code is a subject for further study.

Figure 10/V.8 bis – Non-standard information block format

9 V.8 bis transactions

All permitted V.8 bis transactions are described in this clause.

Transactions may be classified in several ways:

- those that are intended to be used only at call establishment upon automatic answering of a call, vs. others that may be used at any point during a call;
- those that are used to determine if the remote end supports V.8 bis, vs. others that assume this knowledge, *a priori*, and minimize the duration of the transaction.

Transactions involving the use of the messages CL and CLR permit a transfer or exchange of capabilities between the two stations.

Transactions involving the use of the message MS allow a specific mode to be requested by either station and permit the other station to accept or decline the transition to the requested mode.

In all cases V.8 bis transactions are designed to cause minimal disruption to voice users.

At call establishment, upon automatic answering of a call, although the first V.8 bis transaction is always initiated by the answering station, the calling station may take control and determine the type of transaction that takes place.

9.1 Permitted V.8 bis transactions

Permitted V.8 bis transactions are summarized in Table 7:

- $MR_{e/d}$ indicates either MR_e or MR_d ;
- $CR_{e/d}$ indicates either CR_e or CR_d ;
- ACK/NAK indicates either ACK(1), NAK(2) or NAK(3); and
- CL-MS indicates message CL followed immediately by message MS.

NOTE 1 – CL and MS are distinct messages (see 7.2.7) and therefore each one begins with a preamble (see 7.2.4). The preamble for MS shall immediately follow the terminating flag(s) of CL, without any silent interval.

NOTE 2 – MS messages shall contain the minimum number of information octets required to select the desired operating mode. This may be less than the number of information octets received in a preceding CL or CLR message.

Table 7/V.8 bis – Permitted V.8 bis transactions

Transaction number	Initiating station	Responding station	Initiating station	Responding station	Initiating station	Responding station
1	$MR_{e/d} \rightarrow$	$MS \longrightarrow$	ACK/NAK			
2	$CR_{e/d} \rightarrow$	$CL \longrightarrow$	$MS \longrightarrow$	ACK/NAK		
3	$CR_{e/d} \rightarrow$	$CLR \longrightarrow$	$CL-MS \rightarrow$	ACK/NAK		
4	$MS \rightarrow$	ACK/NAK				
5	$CL \rightarrow$	$MS \longrightarrow$	ACK/NAK			
6	$CLR \rightarrow$	$CL \longrightarrow$	$MS \longrightarrow$	ACK/NAK		
7	$MR_e \rightarrow$	$MR_d \longrightarrow$	$MS \longrightarrow$	ACK/NAK		
8	$MR_e \rightarrow$	$MR_d \longrightarrow$	$CR_d \longrightarrow$	$CL \longrightarrow$	$MS \longrightarrow$	ACK/NAK
9	$MR_e \rightarrow$	$MR_d \longrightarrow$	$CR_d \longrightarrow$	$CLR \longrightarrow$	$CL-MS \rightarrow$	ACK/NAK
10	$MR_e \rightarrow$	$CR_d \longrightarrow$	$CL \longrightarrow$	$MS \longrightarrow$	ACK/NAK	
11	$MR_e \rightarrow$	$CR_d \longrightarrow$	$CLR \longrightarrow$	$CL-MS \rightarrow$	ACK/NAK	
12	$CR_e \rightarrow$	$CR_d \longrightarrow$	$CL \longrightarrow$	$MS \longrightarrow$	ACK/NAK	
13	$CR_e \rightarrow$	$CR_d \longrightarrow$	$CLR \longrightarrow$	$CL-MS \rightarrow$	ACK/NAK	

9.2 Transactions permitted at any time on the PSTN and on leased point-to-point circuits

At any time during a PSTN call and while in telephony mode, either station may initiate a V.8 bis transaction regardless of whether that station is the calling or answering station. Similarly, on a leased point-to-point circuit either station may initiate a V.8 bis transaction.

The station initiating a V.8 bis transaction is designated as the initiating station and the other station the responding station. These designations remain for the duration of the ensuing transaction.

9.2.1 Transactions with no *a priori* knowledge of V.8 bis support

Transaction numbers 1, 2 and 3 are used to minimize the potential disturbance experienced by a voice caller at a responding station which does not support V.8 bis. They shall be used whenever both of the following conditions are true:

- the initiating station does not know whether V.8 bis is supported by the responding station; and
- telephony mode is available at the initiating station (which may be an automatic answering station).

Transaction number 1 is used to select an operating mode without first establishing common capabilities. This transaction is used when the responding station has prior knowledge of the capabilities of the initiating station.

Transaction numbers 2 and 3 are used to exchange information about each station's capabilities and then select an operating mode. Since the operating mode selected in MS may be telephony mode, these transactions provide a means to exchange capabilities and then to return to telephony mode.

9.2.2 Transactions with *a priori* knowledge of V.8 bis capability

Transaction numbers 4, 5 and 6 minimize the time duration from initiation of a V.8 bis transaction to initiation of the selected mode of operation. They may be used when either of the following conditions is true:

- the initiating station has *a priori* knowledge that V.8 bis capability is supported by the responding station; or
- telephony mode is not available at an automatic answering station.

They perform the same functions as transaction numbers 1, 2 and 3.

9.3 Transactions permitted only upon automatic answering of a PSTN call

When a transaction is initiated upon automatic answering of a call, the answering station shall be the initiating station.

All transactions permitted during a call on the PSTN are also permitted upon automatic answering of a call. However, upon automatic answering of a call, the answering station, when using transaction numbers 1, 2, or 3, shall indicate to the calling station that the call has been automatically answered by the transmission of MR_e or CR_e rather than the normal MR_d or CR_d.

At an automatic answering station, an OGM may be transmitted immediately following the MR_e or CR_e signal.

Transaction numbers 7 through 13 shall only be used at the beginning of a call when the call has been automatically answered. They are intended to allow the calling station to take control of the outcome of the transaction initiated by the automatic answering station.

9.4 Use of escape signals

Escape signal ES_i is used to precede a message which initiates a V.8 bis transaction if the transaction is not initiated by MR or CR. It is intended to allow the responding station to detect the arrival of an initiating signal in the presence of local voice or other audio. Specifically, in transaction numbers 4, 5 and 6, the first message in the transaction shall be preceded by ES_i.

PSTN connections with network echo suppressors may be accommodated by inserting a 1.5 s silent interval between the ES_i signal and the transmission of the MS, CL or CLR message (see Appendix III).

Escape signal ES_r shall be used to precede a message which responds to MR_e or CR_e. It shall be used in the automatic answering situation to enable the initiating station to detect a responding signal in the presence of an OGM enabling the OGM to be turned off before the responding message arrives and the message to be thus detected in the absence of interference.

ES_r shall only be used to precede MS, CL and CLR in transaction numbers 1, 2 and 3 respectively at call establishment.

9.5 Use of the Negative Acknowledge Message (NAK)

When a station receives an MS message requesting a mode that it is unable to invoke, it shall send either a NAK(2) message or a NAK(3) message, depending on whether it is temporarily unable to invoke the mode, or it does not support or has disabled the requested mode (see 9.8 for error recovery procedures).

9.6 State transition diagrams

Figures 14 and 15 show state transition diagrams for the answering/initiating and calling/responding stations for the permitted V.8 *bis* transactions outlined in 9.1.

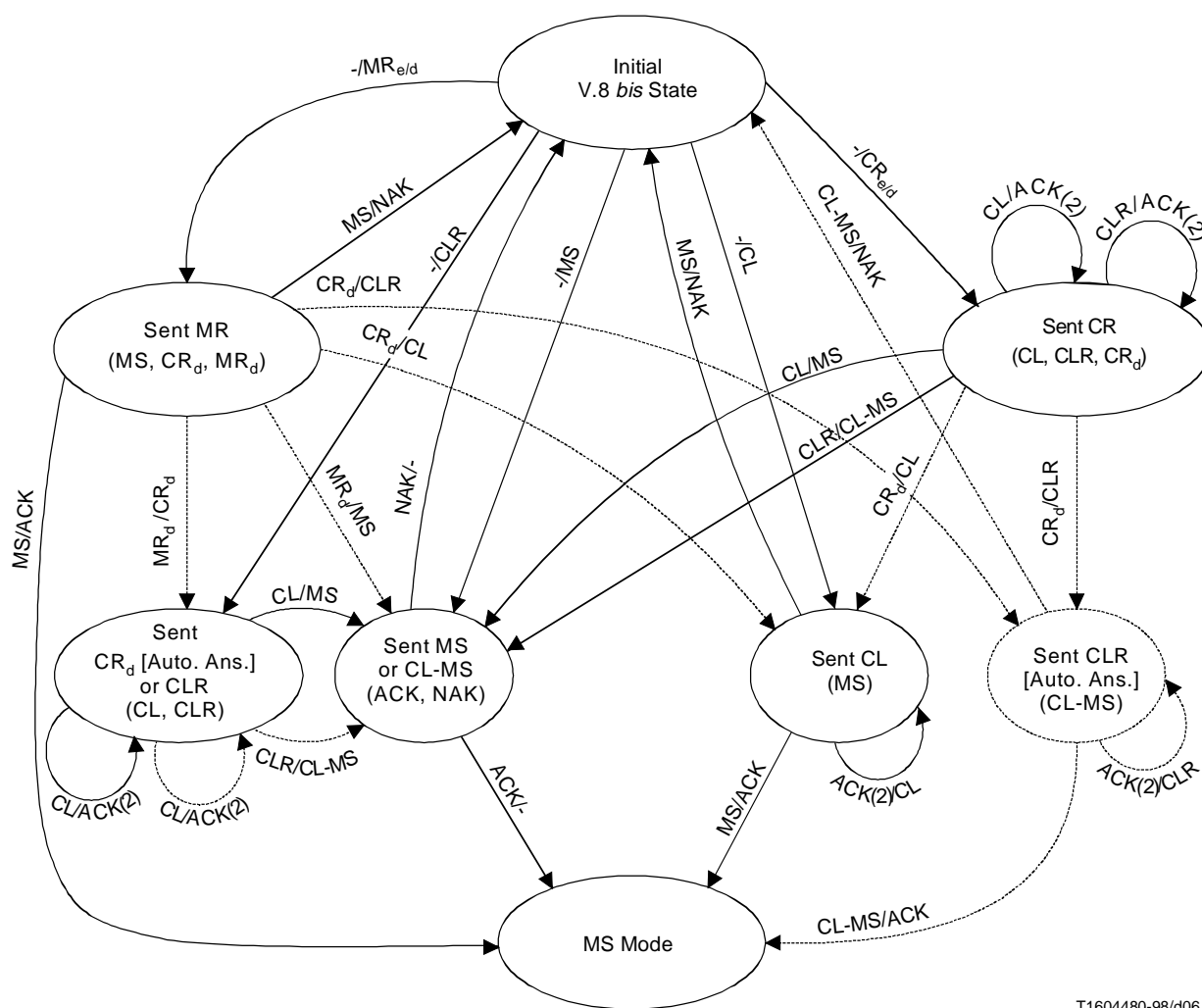


Figure 14/V.8 *bis* – State transition diagram – Answering/initiating station

The state transition diagrams show state information (the last transmitted signal or message, and, in parentheses, the signals and messages that the receiver is next expecting) and transition information (detected signal or received message/transmitted signal or message that caused the state change).

Broken lines in the diagrams indicate states and transitions only permitted upon automatic answering of a PSTN call. Solid lines in the diagrams indicate states and transitions permitted at any time during a call.

When a CL or CLR message is received with the "additional information available" parameter set to binary ONE in the identification field (see Table 5-1), the receiving station may send an ACK(2) message to request further information to be sent (see 9.10). The transition information CL/ACK(2) or CLR/ACK(2) has the effect of returning the transmitting station to the state which it just left.

When an ACK(2) message is received, further information shall be sent. Transition information ACK(2)/CL or ACK(2)/CLR has the effect of returning the transmitting station to the state which it just left.

Transmission of signals associated with a selected mode shall begin immediately after the transmission of ACK(1).

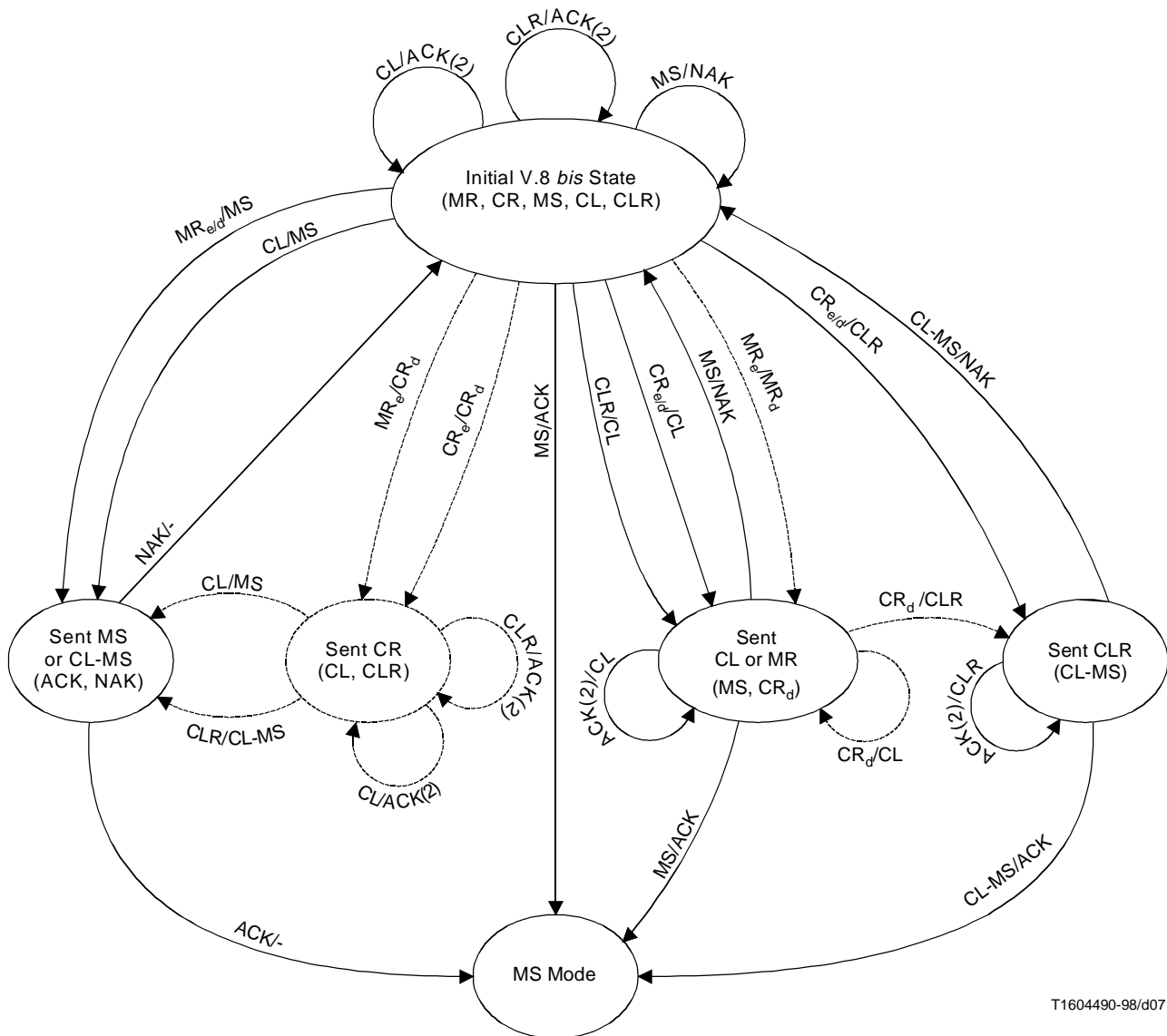


Figure 15/V.8 bis – State transition diagram – Calling/responding station

9.7 Suppression of ACK(1) after an MS message

When an MS message is received with the "transmit ACK(1)" parameter set to binary ONE in the identification field (see Table 5-1) and the MS message is to be positively acknowledged, the responding station shall transmit ACK(1) followed immediately by ANS or ANSam as appropriate (see 9.8). When an MS message is received with the "transmit ACK(1)" parameter set to binary ZERO, and the MS message is to be positively acknowledged, the responding station shall omit ACK(1) and immediately transmit ANS or ANSam.

When an MS message is to be negatively acknowledged, the responding station shall transmit an appropriate NAK, independent of the state of the received "transmit ACK(1)" parameter, before returning to the Initial V.8 bis State.

9.8 Error recovery

If an invalid frame (see 7.2.9) is received in any state, the receiving station shall send a NAK(1) and immediately return to the Initial V.8 bis State.

If a station has been in any state other than the telephony or the MS mode state for a period of more than 5 s, the station shall immediately return to the Initial V.8 bis State.

9.9 Procedures for initiating a modem start-up after a V.8 *bis* transaction

When a V.8 *bis* transaction ends with an MS signal requesting the remote station to enter a modem based communication mode, the station which receives the MS message shall configure its modem as the answer modem irrespective of which station originated the call. Any of the following procedures may be used, at the end of the V.8 *bis* transaction, to initiate the data connection:

- a V.8 start-up;
- a shortened V.8 start-up; or
- a V.25 start-up.

9.9.1 V.8 start-up following a V.8 *bis* transaction

This procedure is illustrated in Figure 11. It may be used where existing modems are permanently configured to start-up using V.8.

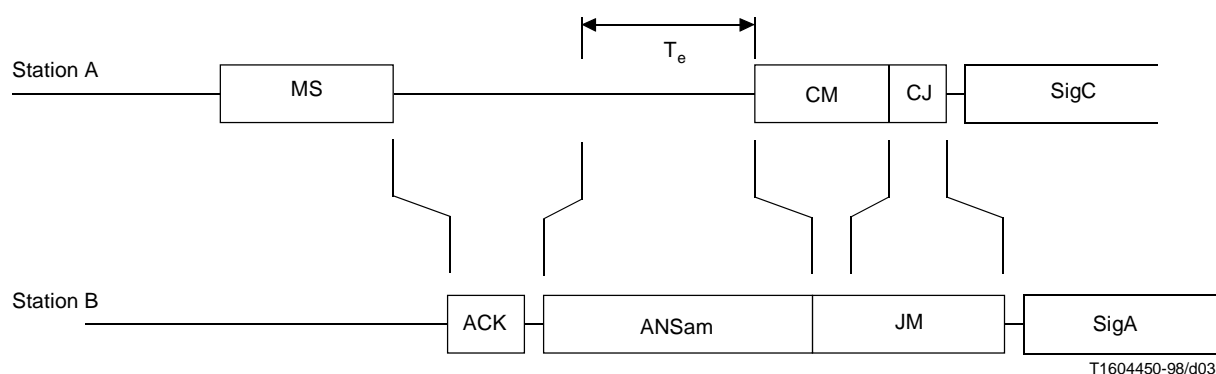


Figure 11/V.8 *bis* – V.8 start-up following a V.8 *bis* transaction

If the V.8 codepoint is set to binary ONE in the NPar(1) information block of the Identification Field (see 8.3.3 and Table 5-1), this indicates:

- in a CL or CLR message, that the transmitting station supports the V.8 start-up procedure; and
- in an MS message, that a V.8 start-up is requested at the end of the V.8 *bis* transaction.

If the V.8 codepoint is set to binary ZERO, this indicates:

- in a CL or CLR message, that the transmitting station does not support the V.8 start-up procedure; and
- in an MS message, that a V.8 start-up should not take place at the end of the V.8 *bis* transaction.

Following receipt of an MS message, the receiving station (Station B) shall respond with ACK, if so configured (see 9.7), or NAK and, provided the indicated modulation mode is available, then transmit ANSam as soon as possible. The two stations shall then continue with the normal V.8 start-up procedure. The station transmitting the MS message (Station A) waiting for a fixed period T_e (T_e is defined in Recommendation V.8), after detecting ANSam before transmitting the V.8 CM message.

When a V.8 start-up follows a V.8 *bis* transaction, parameters set in the V.8 CM and JM message fields shall take priority over those set in the V.8 *bis* MS information field.

9.9.2 Shortened V.8 start-up following a V.8 *bis* transaction

This procedure is illustrated in Figure 12. It is the recommended procedure for the start-up of V.34 and future high-speed modems as it provides a mechanism for signalling the selected modulation format to network based DCME.

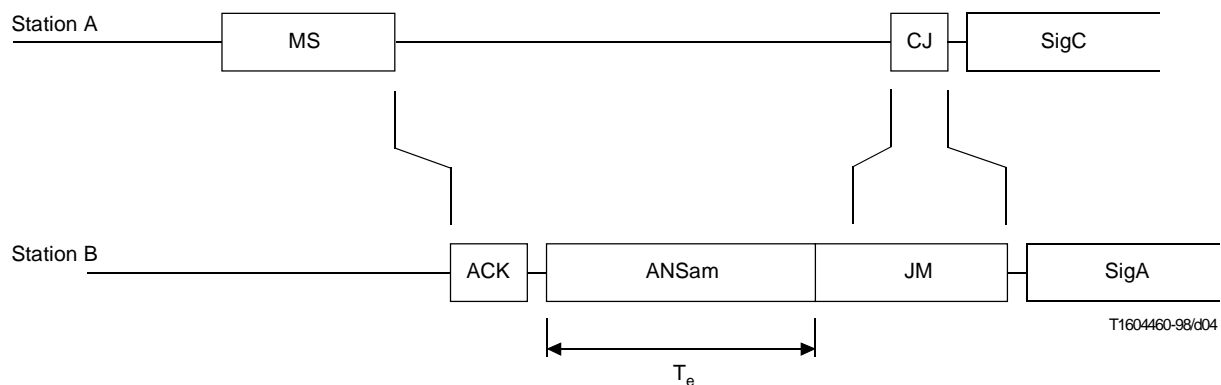


Figure 12/V.8 bis – Shortened V.8 start-up following a V.8 bis transaction

If the short V.8 codepoint is set to binary ONE in the NPar(1) information block of the Identification Field (see 8.3.3 and Table 5-1), this indicates:

- in a CL or CLR message, that the transmitting station supports the short V.8 start-up procedure; and
- in an MS message, that a short V.8 start-up is requested at the end of the V.8 bis transaction.

If the short V.8 codepoint is set to binary ZERO, this indicates:

- in a CL or CLR message, that the transmitting station does not support the short V.8 start-up procedure; and
- in an MS message, that a short V.8 start-up should not take place at the end of the V.8 bis transaction.

Following receipt of an MS message, the receiving station (Station B) shall respond with ACK, if so configured (see 9.7), or NAK and, provided the indicated modulation mode is available, then transmit ANSam as soon as possible. ANSam shall be transmitted for a fixed period T_e (T_e is defined in Recommendation V.8) then begin transmission of a JM signal and continue in accordance with Recommendation V.8. JM shall be coded to indicate the single modulation mode indicated in the MS information field of the preceding V.8 bis transaction.

The station which transmitted MS (Station A) shall not transmit a signal CM, but shall wait to detect a minimum of two identical JM sequences, then transmit signal CJ and continue in accordance with Recommendation V.8.

9.9.3 V.25 start-up following a V.8 bis transaction

This procedure is illustrated in Figure 13. It may be used to shorten start-up time in situations such as low-speed data transmission where the presence of network-based DCME equipment is of no concern.

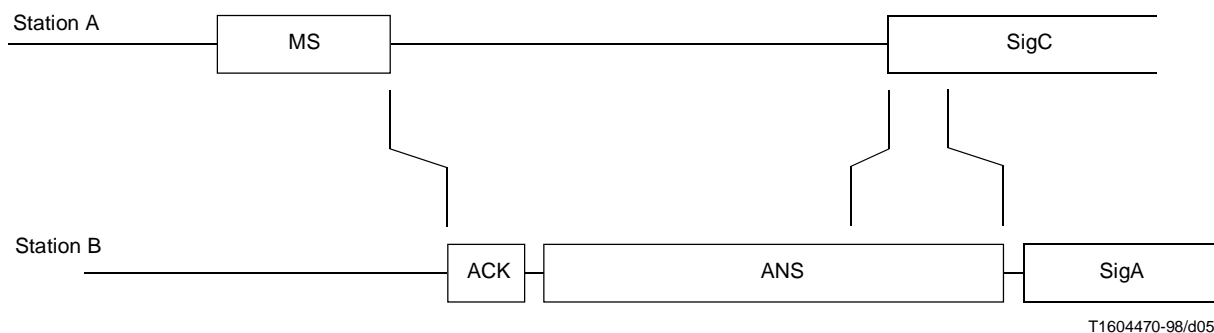


Figure 13/V.8 bis – V.25 start-up following a V.8 bis transaction

If the V.8 and short V.8 codepoints are both set to binary ZERO in the NPar(1) information block of the Identification Field (see 8.3.3 and Table 5-1), the V.25 start-up procedure shall be used to enter a modem-based communication mode at the end of a V.8 *bis* transaction requesting a data connection.

Following receipt of an MS message, the receiving station (Station B) shall respond with ACK, if so configured (see 9.7), or NAK and, provided the indicated modulation mode is available, then transmit ANS, as defined in Recommendation V.25, as soon as possible.

Both stations shall then proceed in accordance with Recommendation V.25 and the start-up procedure specified in the appropriate modem Recommendation. The station transmitting MS (Station A) shall follow the procedure specified for the calling modem and the station receiving MS (Station B) shall follow the procedure specified for the answering modem.

9.10 Message segmentation

The maximum number of octets in any Information Field shall be 64. If the information exceeds this limit, the remainder of the information may be contained in subsequent messages. To indicate that further information is available, the "Additional Information Available" parameter is set to binary ONE in the identification field of the transmitted message (see Table 5-1). This information, however, shall only be sent if, on receiving the message, the remote station sends an ACK(2) message requesting further information.

NOTE – The use of NAK(4) indicating that the receiving station is unable to interpret a received message and requesting a retransmission of the message is for further study.

On some high error rate channels such as cellular radio links, it may be desirable to limit the length of the information field to less than 64 octets. Also, where non-standard information is present in the information field the standard and non-standard information may be conveyed in separate messages.

For transaction numbers 3, 9, 11 and 13 of Table 7, if the information to be conveyed in the CL message cannot be conveyed in a single message, and the "Additional Information Available" parameter is set to binary ONE, a response is required from the receiving station for the transmitting station to complete transmission of the combined CL-MS messages, irrespective of whether the additional information is to be sent. An ACK(1) shall be sent in these circumstances if no further information is required.

10 Operating procedures

If the V.8 *bis* device is activated at either station, as soon as the line goes off-hook, the V.8 *bis* device shall enter the Initial V.8 *bis* State shown in Figures 9 and 10. In the Initial V.8 *bis* State, the V.8 *bis* device shall monitor the line for a V.8 *bis* initiating signal MR_e, MR_d, CR_e, CR_d or ES_i.

On automatically answering a call, if the V.8 *bis* device is activated at the answering station, the V.8 *bis* device shall enter the Initial V.8 *bis* State when the line goes off-hook in response to incoming ringing.

10.1 Operating procedures when not automatically answering on the PSTN and on leased point-to-point circuits

When manually answering a call on the PSTN, or during the course of a voice call on either the PSTN or on point-to-point leased circuits, either station may initiate a V.8 *bis* transaction. The station which initiates the V.8 *bis* transaction is defined as the initiating station and the other station as the responding station.

10.1.1 Initiating station (MR or CR initiation)

To initiate a V.8 *bis* transaction, the initiating station shall transmit either MR_d or CR_d, and condition itself to detect a message preamble and receive a message.

The initiating station shall respond to the received V.8 *bis* signals in accordance with the state transition diagram in Figure 14.

10.1.2 Initiating station (MS, CL or CLR)

To initiate a V.8 *bis* transaction, the initiating station shall transmit ES_i followed by a message MS, CL or CLR, and shall condition itself to receive messages. PSTN connections with network echo suppressors may be accommodated by inserting a 1.5 s silent interval between the ES_i signal and the transmission of the MS, CL or CLR message (see Appendix III).

The initiating station shall respond to the received V.8 *bis* messages in accordance with the state transition diagram in Figure 14.

10.1.3 Responding station

Upon detection of a V.8 *bis* initiating signal MR_d , CR_d or ES_i , the responding station shall determine which signal is being detected based on the segment 2 tone frequency, and, if required, shall then condition itself to receive messages. If the detected signal is MR_d or CR_d , it shall transmit the appropriate message response. If the detected signal is ES_i , it shall decode the message which follows, and shall transmit the appropriate message response.

The responding station shall respond to the received V.8 *bis* signals and messages in accordance with the state transition diagram in Figure 15.

10.2 Operating procedures upon automatic answering of a call on the PSTN

10.2.1 Calling station

When the calling station goes off-hook, it shall enter the Initial V.8 *bis* State and shall condition itself to detect the V.8 *bis* initiating signals, MR_e , MR_d , CR_e , CR_d or ES_i also ANS or ANSam (as defined in Recommendations V.25 and V.8 respectively).

To accommodate situations in which the answering station does not support V.8 *bis*, it may be advisable to transmit a calling signal or message appropriate to a predetermined default mode of operation (CNG, CT signals or CI as defined in Recommendations T.30, V.25 and V.8 respectively). In such cases, the calling station shall not malfunction if it receives two initiating signals separated by an interval likely to be less than 0.5 s.

If ANS or ANSam is detected before any V.8 *bis* initiating signal, the calling station shall exit from the Initial V.8 *bis* State and proceed in accordance with Recommendations V.25 or V.8 respectively.

The calling station shall distinguish between received V.8 *bis* initiating signals by detecting the tone frequency in segment 2 of the signal.

If the detected signal is MR_e or CR_e , the station shall transmit either signal MR_d or CR_d , or an appropriate message response preceded by ES_r . If the detected signal is MR_d or CR_d , the calling station shall transmit the appropriate message response preceded by ES_r . If the detected signal is ES_i , the calling station shall decode the message which follows, and shall then transmit the appropriate message response, if any.

The calling station shall respond to the received V.8 *bis* signals and messages in accordance with the state transition diagram in Figure 15.

10.2.2 Answering station (MR_e or CR_e initiation)

Upon answering a call, the answering station shall immediately enter the Initial V.8 *bis* State, remain silent for a minimum of 400 ms, transmit MR_e or CR_e and condition itself to detect MR_d , CR_d or ES_r .

If telephony mode is available in the answering station, the MR_e or CR_e signal may be followed by an OGM. PSTN connections with network echo suppressors may be accommodated by inserting a 1.5 s silent interval between OGM and the transmission of the MS, CL or CLR message (see Appendix III).

Upon detection of ES_r by the answering station, transmission of the OGM shall be terminated and the answering station shall condition itself to receive V.8 *bis* messages.

The answering station shall respond to the received V.8 *bis* signals and messages in accordance with the state transition diagram in Figure 14.

If a V.8 *bis* signal has not been detected by the end of the OGM, MR_e or CR_e may be retransmitted as soon as the OGM finishes.

If no V.8 *bis* signals have been detected within 3 s following the transmission of MR_e or CR_e and the station is not configured to transmit an OGM, the answering station may retransmit MR_e or CR_e or clear down the line.

The answering station may also be configured to detect the calling signals, CNG, CT or CI (as defined in Recommendations T.30, V.25 or V.8 respectively). If so configured, and a calling signal is detected before the transmission of a V.8 *bis* initiating signal, the answering station may transmit ANS or ANSam and proceed in accordance with the appropriate start-up procedure.

If energy that may be an ON burst of calling signal is detected during or within an interval of 1.5 s after the transmission of a V.8 *bis* initiating signal, the MR_e or CR_e V.8 *bis* signal may be retransmitted at the higher transmit powers specified in 7.1.4. If no V.8 *bis* response is received by the time a subsequent ON burst of calling signal is detected, the answering station may transmit ANS or ANSam and proceed in accordance with the appropriate start-up procedure.

10.2.3 Answering station (MS, CL or CLR initiation)

Upon answering a call, the answering station shall immediately enter the Initial V.8 *bis* State and transmit ES_i.

After transmitting ES_i, the answering station shall transmit message MS, CL or CLR, and then condition itself to receive V.8 *bis* messages. PSTN connections with network echo suppressors may be accommodated by inserting a 1.5 s silent interval between the ES_i signal and the transmission of the MS, CL or CLR message (see Appendix III). When, however, telephony mode is not available at the answering station (see 9.2.2) this silent interval is not required.

The answering station shall respond to the received V.8 *bis* messages in accordance with the state transition diagram in Figure 14.

11 DTE-DCE interface

The DTE-DCE communication protocol to support V.8 *bis* transactions is specified in Recommendation V.251.

Appendix I

Recommendation V.8 *bis* features

I.1 Introduction

With the growth in availability of multifunction terminals and multimedia applications, it is anticipated that users will increasingly require:

- the appropriate type of PSTN communication link to suit their chosen application to be automatically established at call set-up;
- a more precise way than verbal interaction to determine which applications they have in common and whether interworking in a particular mode is possible; and
- a convenient way of switching between normal voice telephony and modem-based communications.

This Recommendation addresses these user needs for communications over the PSTN.

I.2 Basic features of this Recommendation

This Recommendation provides PSTN users for the first time a standard start-up protocol which:

- allows a desired communication mode to be selected by either the calling or answering station;
- allows terminals to automatically identify common operating modes (applications);

- enables automatic selection between multiple terminals that share a common telephone circuit; and
- provides user-friendly switching from normal voice telephony to a modem-based communication mode.

NOTE – Switching back to telephony mode will normally be under the control of the user.

V.8 *bis* may be used:

- at the beginning of a call when the call is automatically or manually answered; and
- during a voice call.

I.3 Selection of a desired communication mode

Because V.8 *bis* signalling precedes the establishment of a modem connection across the PSTN, the type of modem used by the desired communication mode, together with details of the communication mode, may be established via V.8 *bis* and then automatically selected.

V.8 *bis* supports non-standard modes of operation as well as those defined by standards bodies.

The ability of V.8 *bis* to request a desired application in a terminal before modem training also has the potential to enable much faster initiation of application software and hence shorten the time taken to establish communications.

The selection and initiation of an operating mode may be instigated by either the calling or answering station on a connection and may take place during voice telephony or, automatically at call set-up when one station has been configured to automatically answer.

I.4 Identification of common operating modes

The capabilities exchange feature of V.8 *bis* permits a list of communication modes, as well as software applications, to be exchanged between terminals. Each terminal is therefore able to establish the modes of operation it shares with the remote station. A capability exchange between stations thus ensures, *a priori*, that a selected communication mode is possible. Attempts to establish incompatible modes of operation are thus avoided.

As with the mode selection procedure, a capabilities exchange may be performed either at call set-up, automatically under the control of either the calling or answering station, or during the course of telephony. In the latter case, on completion of the information exchange, the communication link may either be configured to return to voice telephony mode or to adopt immediately one of the common modes of communication.

The V.8 *bis* has been designed so that, when a capabilities exchange takes place in telephony mode, and the capabilities exchanged are limited to standard features, the interruption in voice communications is short (less than approximately 2 s) and is as unobtrusive as possible.

I.5 Automatic selection between terminals

Where a number of physically separate terminals share a common PSTN line, in an unattended or automatic answering situation, V.8 *bis* permits a calling station to select the appropriate terminal. This is possible because V.8 *bis* signalling occurs before entering a desired modem-based communication mode (i.e. before initiating modem start-up). The fact that the start-up procedure is different for facsimile and data modems therefore does not prevent the desired communication mode from being automatically selected.

This feature permits a telephone answering device to share a line with a facsimile machine or one or more automatically answering data terminals and ensures that a voice or data caller receives the appropriate response with minimum delay and that the call is correctly established.

I.6 User-friendly switching from telephony to data

The ability of V.8 *bis* to permit automatic switching from voice telephony to data avoids users at both ends of a link having to coordinate their actions in transferring between voice and data. This feature is important in applications such as simultaneous voice and data or videotelephone (Recommendation H.324), where the call may first be established in normal voice telephony before switching into the multimedia mode.

V.8 *bis* is designed so as not to subject users to signals or noise which are unduly disturbing. This particularly applies when a telephone answering device shares the line with one or more data terminals or when switching, either temporarily or permanently, out of the telephony mode. In addition, voice callers, calling an automatic answering station, will not be subjected to signals uncharacteristic of telephony.

I.7 Conferencing applications

In audiographic and other conferencing applications, where a number of users are bridged together, the capabilities exchange and mode selection features of V.8 *bis* provide a means for the bridging device to ensure automatically that compatible communication modes are adopted by all participants in the conference.

I.8 Interworking considerations

A multifunction calling terminal with V.8 *bis* capability will interwork with:

- a pre-V.34 modem through the detection of ANS;
- a V.8 terminal through the detection of ANSam;
- a T.30 facsimile terminal through the optional transmission of CNG.

A multifunction answering terminal with V.8 *bis* capability will interwork with:

- a pre-V.34 modem through transmission of ANS after time-out;
- a V.8 terminal through the transmission of ANSam after time-out;
- a T.30 facsimile terminal through the detection of CNG or, where this is not present, through the transmission of ANSam or DIS.

Determination of the order and priority of time-out conditions is implementation and/or user configuration dependent.

I.9 Relationship between Recommendations V.8 and V.8 *bis*

Recommendation V.8 provides the following features:

- terminal selection by the calling station;
- V.42 error control to be selected by the calling station;
- the highest speed common modulation format to be automatically selected between DCEs;
- the presence of a cellular radio component in the PSTN channel to be identified by both DCEs; and
- DCME equipment may configure itself appropriately.

This Recommendation provides the following additional features:

- terminal selection by the calling or answering stations;
- V.42 error control and other modes of operation to be selected by the calling or answering stations;
- a capabilities exchange to establish common operating modes prior to mode selection (successful terminal selection therefore need not depend on *a priori* knowledge on the part of the calling station that the requested mode of operation is available in the answering station);

- identification of common modulation formats and their dependency on operating modes via the capabilities exchange and selection of a desired modulation format by either station;
- telephone answering devices to share a common PSTN line with automatic answering data terminals;
- a mechanism for switching between voice telephony and data; and
- the facility to exchange and select non-standard modes of operation.

As indicated in I.8, this Recommendation allows for interworking between V.8 and V.8 *bis* devices.

Appendix II

Examples of V.8 *bis* transactions

This appendix provides examples of the transactions that may be used in this Recommendation. The transactions presented are examples only and do not represent a comprehensive listing of the transactions possible.

Figure II.1 shows the MR_e/MS transaction, which is used when an automatic answering station is configured to request mode selection control by the calling station. Figure II.1 a) is an example of the situation where echo suppressors are not expected to be encountered and an OGM may be transmitted immediately following the MR_e signal. Upon detection of ES_r at the answering station, transmission of the OGM is terminated. Figure II.1 b) is an example of the situation where echo suppressors may be encountered and an OGM may be transmitted only after a delay of 1.5 s during which an ES_r is not received.

Figure II.2 shows the CR_e/CL/MS transaction, which is used when the answering station is configured to control mode selection. An OGM may be transmitted immediately following the CR_e signal. Upon detection of the responding escape signal at the answering station, transmission of the OGM is terminated.

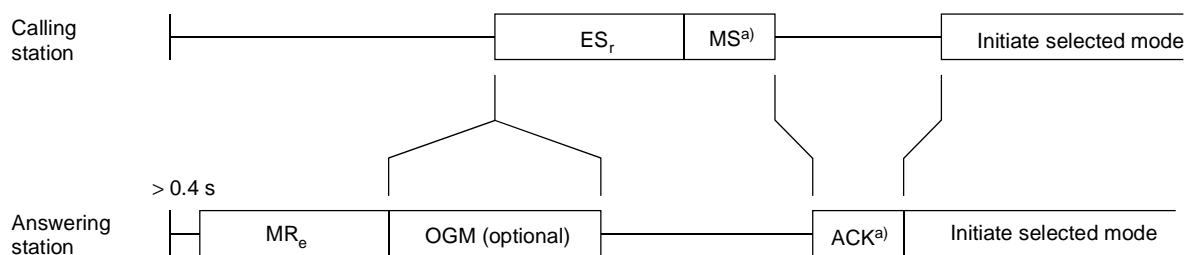
Figure II.3 shows the MR_d/MS transaction, which is used when the initiating station is configured to request mode selection control by the responding station.

Figure II.4 shows the CR_d/CL/MS transaction, which is used when the initiating station is configured to control mode selection.

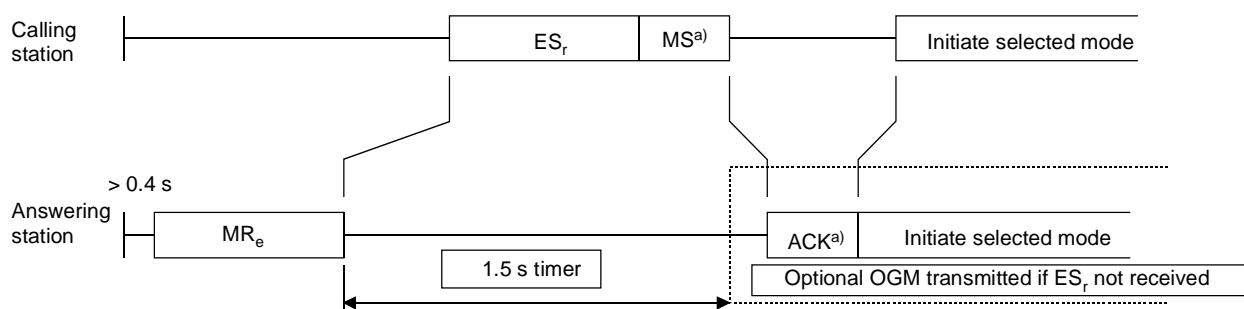
Figure II.5 shows the MS transaction, which is used to select an operating mode without first establishing common capabilities. This transaction is used when the initiating station has prior knowledge of the capabilities of the responding station.

Figure II.5 a) is an example of the situation where echo suppressors are not expected to be encountered and MS may be initiated immediately following ES_i. Figure II.5 b) is an example of a situation where echo suppressors may be encountered and the initiation of MS is delayed 1.5 s after the transmission of ES_i. This transaction is used when the initiating station has prior knowledge of the capabilities of the responding station.

Figure II.6 shows the CLR/CL/MS transaction, which is used by the initiating station to exchange information on each station's capabilities and then select an operating mode. Since the operating mode selected in MS may be telephony mode, this transaction provides a means to exchange capabilities and return to telephony mode.



a) No echo suppressors

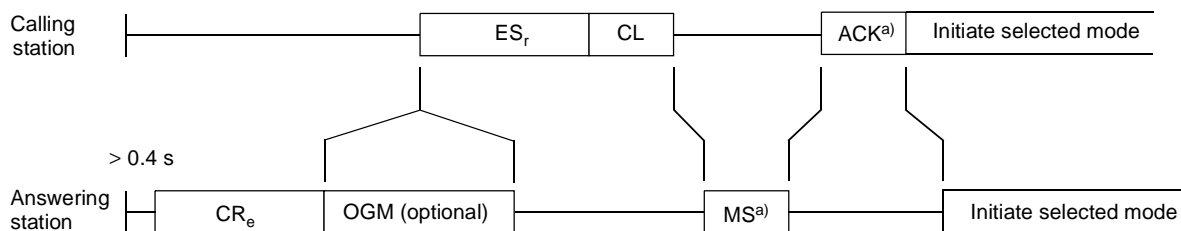


^{a)} ACK is only transmitted if requested in MS.

T1605680-98/d08

b) Echo suppressors option

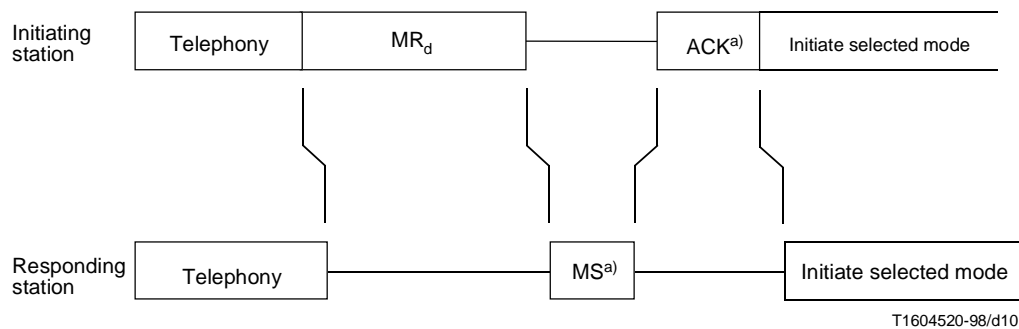
Figure II.1/V.8 bis – MR_e/MS transaction upon automatic answering of a call



^{a)} ACK is only transmitted if requested in MS.

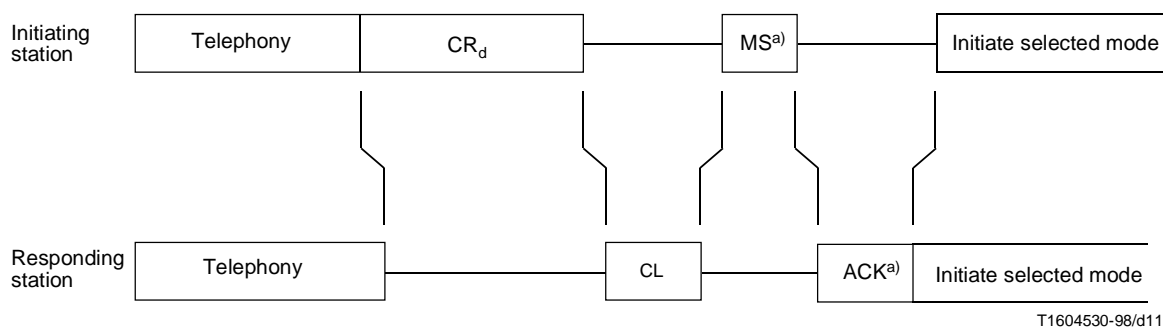
T1604510-98/d09

Figure II.2/V.8 bis – CR_e/CL/MS transaction upon automatic answering of a call



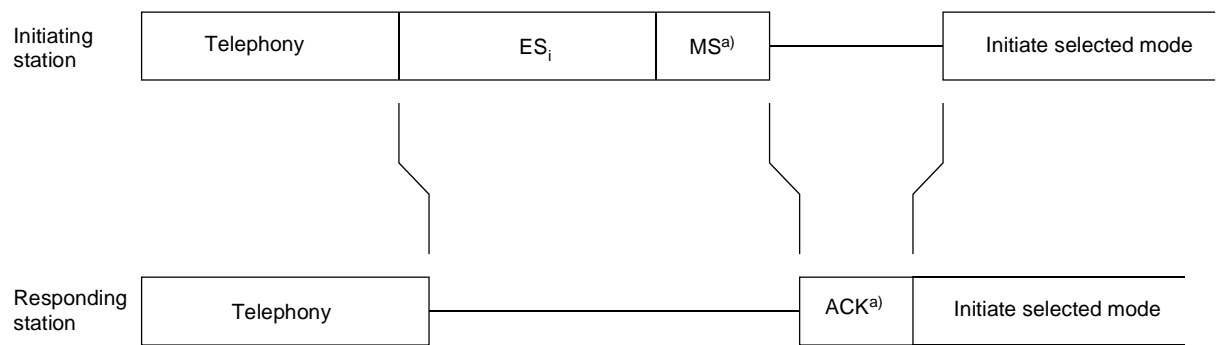
^{a)} ACK is only transmitted if requested in MS.

Figure II.3/V.8 bis – MR_d/MS transaction during established connection

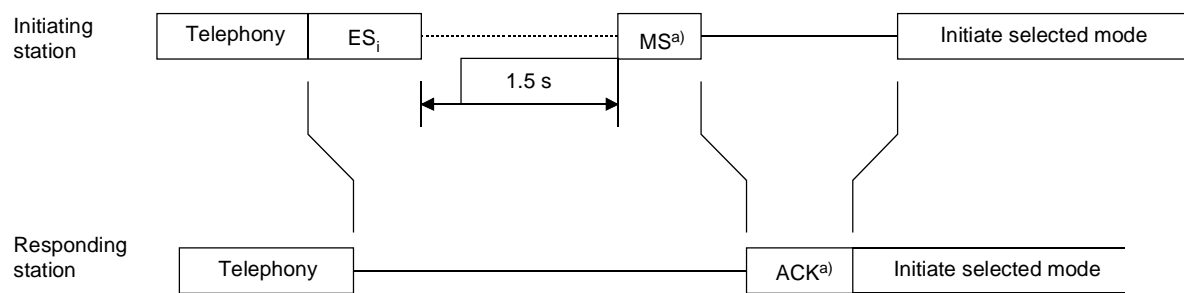


^{a)} ACK is only transmitted if requested in MS.

Figure II.4/V.8 bis – CR_d/CL/MS transaction during established connection



a) No echo suppressors

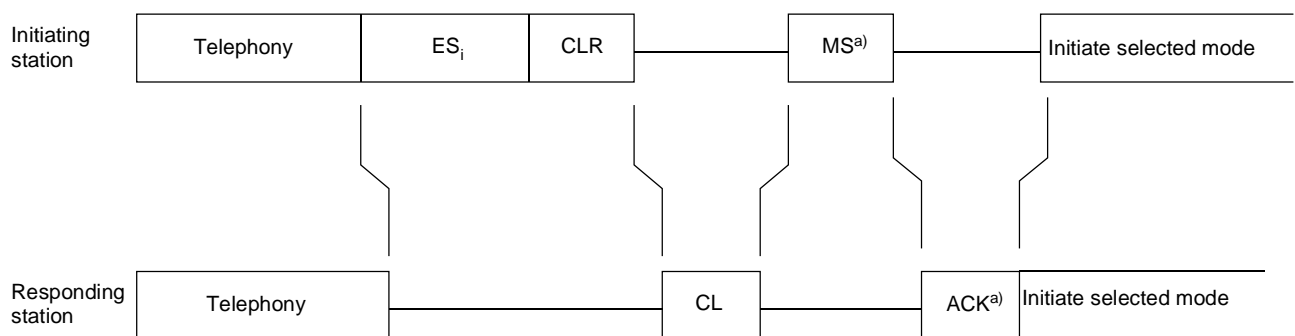


T1604540-98/d12

a) ACK is only transmitted if requested in MS.

b) Echo suppressors option

Figure II.5/V.8 bis – MS transaction during established connection



T1605690-98/d13

a) ACK is only transmitted if requested in MS.

Figure II.6/V.8 bis – CLR/CL/MS transaction during established connection

Appendix III

Effect of echo suppressors

III.1 Introduction

This Recommendation contains provisions to ensure correct operation over connections in which echo suppressors are present. These special provisions are discussed in this appendix. Although not exhaustive, the discussions cover the dominant echo suppressor configurations encountered in the PSTN. Recommendations G.164 and G.165 specify echo suppressors and echo cancellers, respectively. Most echo control devices are of the canceller variety but echo suppressors continue in use on many connections, frequently at one end only.

III.2 Operation of echo suppressors

The inclusion of echo suppressors in a PSTN connection is illustrated in Figure III.1.

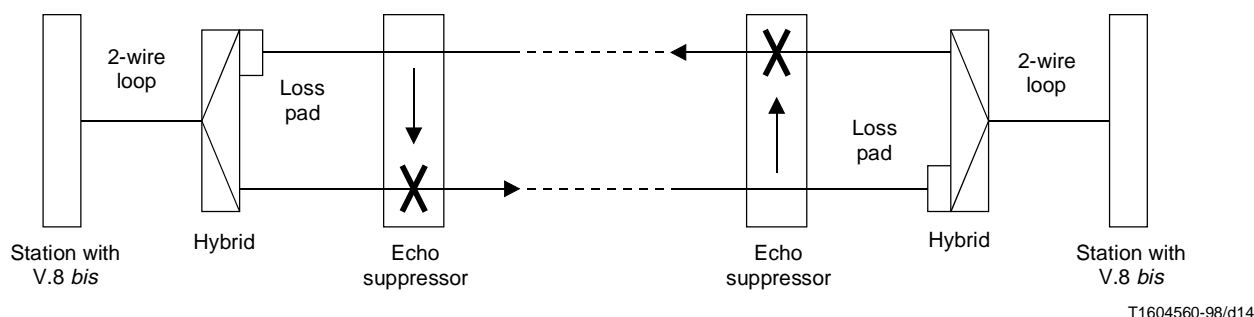


Figure III.1/V.8 bis – Echo path illustration

The echo suppressor at one end of a connection is intended to suppress the echo of a signal received at that end. Thus, the echo control device on the left in Figure III.1 suppresses the echo of the signal received from the station on the right. The source of echo is the four-to-two wire conversion (hybrid) that provides for the connection of two-wire loop to the four-wire transmission path provided through the PSTN. In this appendix, the two directions of transmission through an echo control device are referred to as the "forward" direction and "echo" direction. The forward direction through the device on the left in Figure III.1 is from right to left. Suppressors function by essentially blocking transmission in the echo direction when a signal is present in the forward direction.

A suppressor will introduce a large loss in its echo direction path when a signal is present in its forward direction and it will maintain this high echo path loss condition as long as the signal is present. However, if a strong signal is transmitted from the near station in the echo direction and this signal is large enough (generally a power greater than in forward direction), the suppressor will enter "double talk mode" (or the "break in state") in which it introduces nominally 6 dB of loss in the forward direction and removes the loss in the echo direction. However, if the signal in the forward direction increases in power such that its power exceeds that of the signal in the echo direction by an amount greater than the loss introduced by the suppressor in the forward direction, it will revert to the suppression state and block the signal in the echo direction.

It can therefore be assumed that a signal will experience nominally 6 dB loss in the forward direction path when the local station is transmitting unless the received signal is dominant.

The impact of these echo suppressor characteristics on the operation of V.8 bis are discussed in the following subclauses.

III.3 Dual tone signal breakthrough of echo suppressors

When a V.8 bis exchange is initiated during telephony mode, one of the signals MR_d , CR_d or ES_i is transmitted by the initiating station and while this takes place the user of the receiving station may be continuing to speak or send audio. The situation when a local echo suppressor is present in the connection is illustrated in Figure III.2.

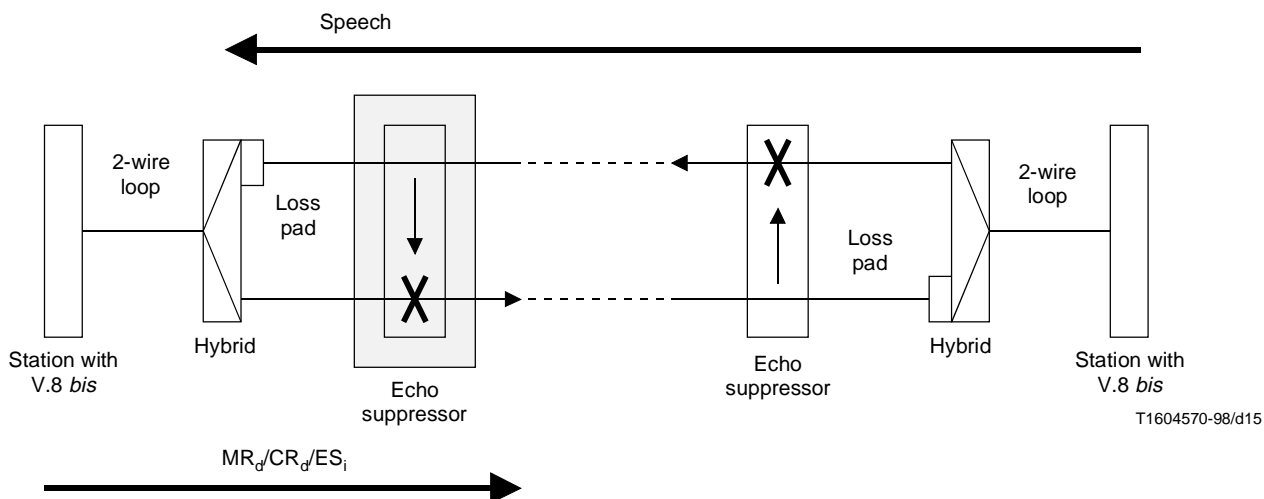


Figure III.2/V.8 bis – Near-end suppressor blocking of MR_d , CR_d and ES_i

The station on the left is the initiating station. The speech or audio signal from the station on the right could have placed the suppressor in the suppression state so that the initiating signal might then be blocked. The power of the speech or audio signal is a function of the user/station on the right and the loss of the associated loop. Note that except for loop losses, the loss in the paths to the left suppressor is the same for signals from the stations at either end, even though the distance to the station on the right may be many times as large. To avoid being blocked, the power of the signals MR_d , CR_d or ES_i is specified to be large enough to drive the suppressor into the double talk mode, taking into account the distributions of talker volume and loop loss, for all except unusually loud talkers.

If a far-end echo suppressor is also present in the connection, for correct operation, the signals must also break through the far-end echo suppressor. This scenario is illustrated in Figure III.3. The presence of speech or audio in the echo direction of the far-end suppressor will now result in a nominal 6 dB loss being introduced into the forward direction and a consequent attenuation of the MR_d , CR_d or ES_i signals. The transmit power of these signals must therefore allow for this attenuation effect.

Another scenario in which a V.8 bis is intended to be detected in the presence of speech/audio, in the reverse direction is the case of ES_r sent in response to a received MR_d , CR_d or ES_i signal. In this case the speech/audio is a recorded OGM, the peak level of which will not be as high as live speech, and will be unlikely therefore to present a problem. Higher transmit power or delay in the transmission of an associated message is therefore not justified for ES_r .

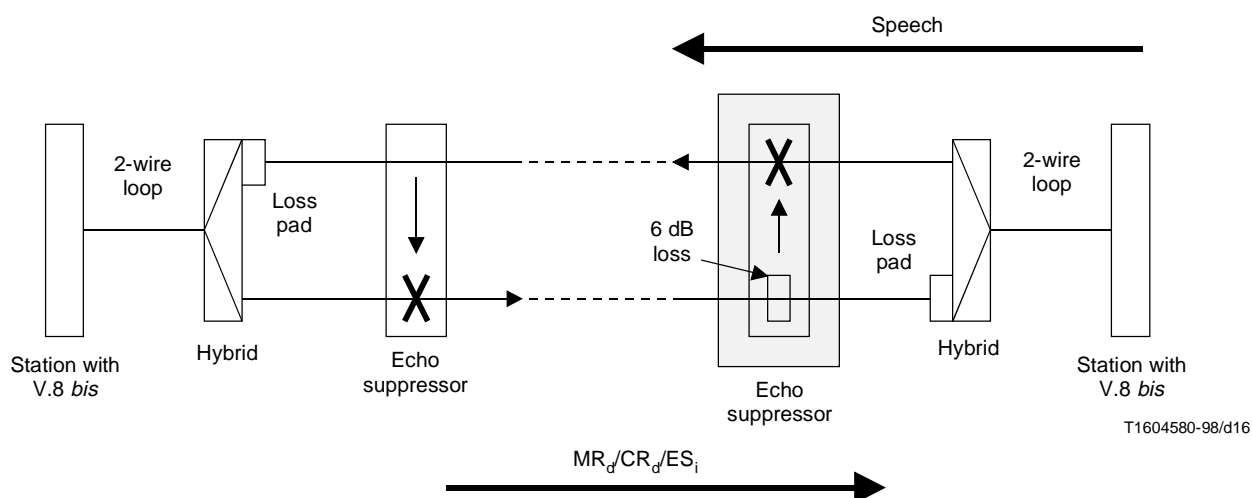


Figure III.3/V.8 bis – Far-end suppressor blocking of MR_d , CR_d and ES_i

III.4 V.8 bis transactions 4, 5 and 6

Transactions 4, 5 and 6, defined in Table 7 involve the transmission of signal ES_i followed by a message. It was shown in III.3 above that signal ES_i is capable of successfully breaking through echo suppressors. However, the effects of a near-end suppressor on the transmission of an associated message must also be considered.

Assuming the signal and message are to be transmitted from the station on the left in Figure III.4 and the user of the station on the right is speaking, the near-end echo suppressor on the left will initially be in suppression mode. As previously discussed, transmission of the ES_i signal will force this suppressor into the "double talk mode" (see III.3). However, if the speech is still present after the ES_i has passed, the near-end suppressor could revert back into the suppression state because the message is lower in power than ES_i . The "double talk mode" will be maintained only if the message line signal power is no more than nominally 6 dB below the speech power. Upon detection of ES_i at the station on the right, the user's speech will be squelched by the station's V.8 bis capability and the near-end echo canceller will then permit unattenuated transmission of the message. However, the transmission delay from the time the ES_i signal passes the suppressor to the time it is detected at the station on the right may be considerable and the suppression of the speech will be similarly delayed at the near-end echo suppressor resulting in a loss of message. To assure that this does not occur, where it is known that the connection may include a near-end echo suppressor it is recommended that the initiation of a message following an ES_i is delayed by 1.5 s. This allows for one round trip delay plus time for the detection of ES_i and the squelching of speech at the receiving station.

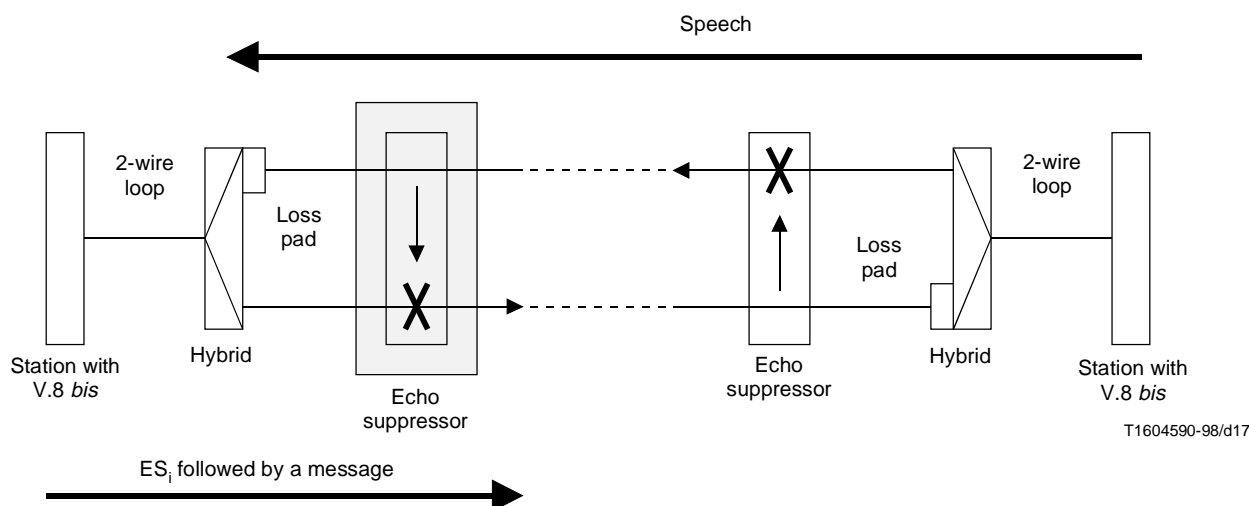


Figure III.4/V.8 bis – Effect of near-end suppressor on ES_i followed by a message

III.5 Automatic answering together with a voice recording device

III.5.1 Blocking of V.8 bis initiating signals

Where an automatic answer station includes a voice recording device, the initiating signals, MR_e or CR_e are transmitted at a low power to avoid disturbing voice callers (expected to be dominant in most situations).

This Recommendation allows the calling station to transmit CNG, CT or CI, as appropriate, when a non-telephony mode is required. CNG and CT are intermittent tones and CI is repetitive bursts of a V.21(H) modulated sequence. These signals may be present at the answering end echo suppressor and cause it to be in the suppression mode, thereby blocking the transmission of the low level MR_e or CR_e signal from the answering station. This is illustrated in Figure III.5. Here, the calling station is on the right and the answering end echo suppressor on the left.

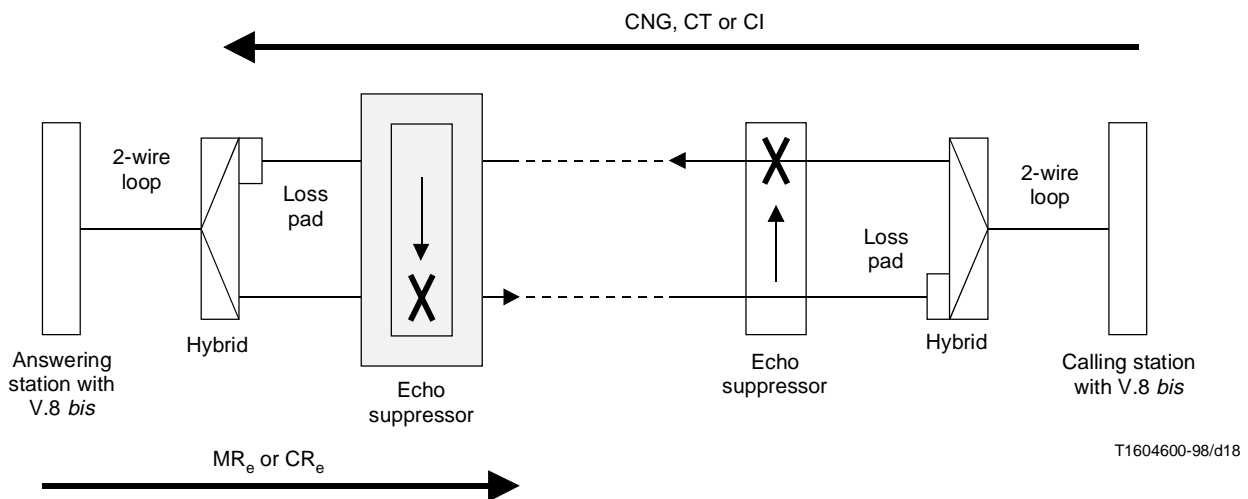


Figure III.5/V.8 bis – Effect of CNG, CT or CI on answering end echo suppressor

To overcome this potential failure, the transmission of OGM is delayed in such situations until it is determined that no call signals are present. This also ensures that the call signals, if present, can be reliably detected. If tonal signals, indicative of either CNG, CT or CI, are detected during a period immediately after the called station answer, it will be clear that the calling station is a non-telephony terminal calling to establish a non-telephony-mode connection. Signals MR_e and CR_e may then be retransmitted at the higher power level of MR_d or CR_d without concern for the disturbance of voice callers. This should ensure that the answering end echo suppressor switches to "double talk mode" and that the V.8 bis signals are correctly received by the calling party.

While the blocking of MR_e and CR_e by an echo suppressor at the answering end is of primary concern, call signals CNG, CT or CI present at the calling end echo suppressor can also cause signals MR_e and CR_e to be attenuated by an additional 6 dB. This scenario is illustrated in Figure III.6.

To avoid any failure resulting from this loss, it is important to ensure correct detection of any received CNG, CT or CI signal. To ensure this, the transmission of OGM must be delayed for about 1.5 s (this is consistent with the delay required to deal with the effect described in III.5.2 below). As explained above, the detection of CNG, CT or CI indicates that the calling station is a non-telephony terminal calling to establish a non-telephony mode connection. Once this is established, MR_e and CR_e can be retransmitted at the higher levels of MR_d and CR_d .

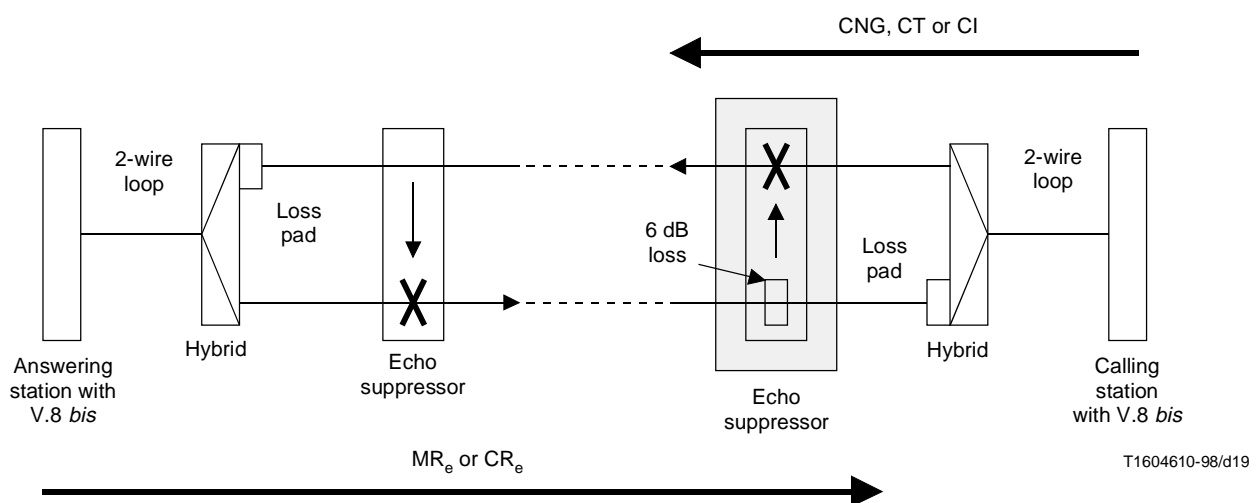


Figure III.6/V.8 bis – Effect of CNG, CT or CI on calling end echo suppressor

III.5.2 Blocking of response to MR_e and CR_e by OGM

In the absence of signals CNG, CT or CI, the MR_e or CR_e signals should have been received accurately by the calling station and a response generated in accordance with this Recommendation. The absence of a response within a period of time longer than that required for the calling station to respond and the absence of any detection of CNG, CT or CI indicates that the calling station is probably a telephone caller and transmission of an OGM is therefore appropriate. The delay of 1.5 s indicated above for the transmission of OGM after the transmission of MR_e or CR_e will ensure that the response to MR_e or CR_e is not blocked by the OGM. This delay also ensures that with a calling end echo suppressor in the connection, the OGM will not cause it to assume the suppression mode and block a response to MR_e or CR_e from the calling station. This scenario is illustrated in Figure III.7.

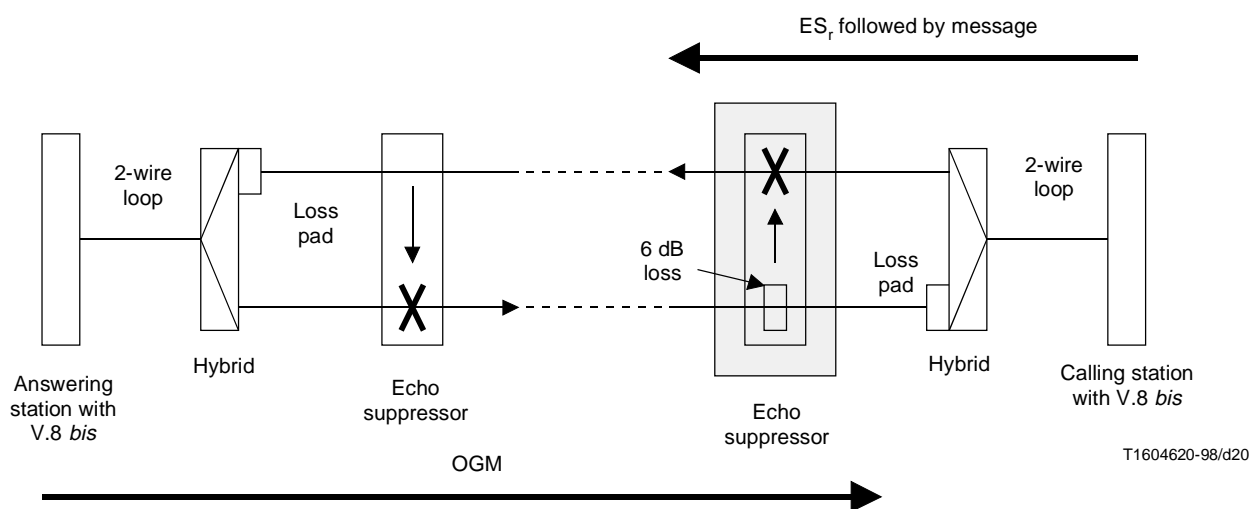


Figure III.7/V.8 bis – Effect of OGM on calling end echo suppressor

III.6 Optional status of provisions

Most of the provisions discussed in this appendix are optional and they are only required when the station is configured for operation over PSTN connections that may include an echo suppressor. It is assumed that, during the lifetime of most products that implement this Recommendation, echo suppressors presently in the PSTN will be replaced by echo cancellers. It is also recognized that echo suppressors will not be encountered in major parts of the world. While it is left to implementors to determine how to handle this optional status, it is recommended that users are not given the responsibility for determining the use of the option on a call-by-call basis. Implementors may take advantage of the fact that in many areas, such as North America, echo suppressors will never be encountered and there will never be a near-end echo suppressor on international connections. In most countries in fact, echo suppressors will only be encountered on international connections. This means that signals MR_e or CR_e will never be blocked by calling tones from a calling station. It also means that the optional delay in the transmission of the message in transactions 4, 5 and 6 will never be required.

It should be noted that the transmit signal power of MR_d , CR_d and ES_i should be set to the maximum level permitted by national regulations. This signal power is important to facilitate reliable detection of these signals in the absence of echo suppressors but in the presence of a high level of speech, a loud talker. It should also be noted that the 1.5 s delay in the transmission of a message following ES_i in transactions 4, 5 and 6 may be required in some countries for compliance with signal power limitations.

Although international calls can be distinguished from national calls by examining the called number and a calling station might therefore be automatically configured for operation on connections with echo suppressors, at the present time there is no universal way of distinguishing international connections from national connections at the answering station.

To avoid options and to assure reliable operation, therefore, implementors may choose to provide for the highest possible transmit power for signals MR_d , CR_d and ES_i on all international connections and to use the minimum transmit power for messages and implement all silent intervals to assure compliance with national regulations on maximum average transmit power.

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