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SERIES V: DATA COMMUNICATION OVER THE TELEPHONE NETWORK

Transmission quality and maintenance

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.70

(Previously "CCITT Recommendation")

ITU-T V-SERIES RECOMMENDATIONS

DATA COMMUNICATION OVER THE TELEPHONE NETWORK

1 – General
2 – Interfaces and voiceband modems
3 – Wideband modems
4 – Error control
5 – **Transmission quality and maintenance**
6 – Interworking with other networks

For further details, please refer to ITU-T List of Recommendations.

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation V.70 was prepared by ITU-T Study Group 14 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 16th of August 1996.

NOTE

1. In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

2. The status of annexes and appendices attached to the Series V Recommendations should be interpreted as follows:

- an *annex* to a Recommendation forms an integral part of the Recommendation;
- an *appendix* to a Recommendation does not form part of the Recommendation and only provides some complementary explanation or information specific to that Recommendation.

CONTENTS

Recommendation V.70

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

(Geneva, 1996)

1 Scope

This Recommendation describes the technical requirements for a Digital Simultaneous Voice and Data (DSVD) terminal, for operation over the General Switched Telephone Network (GSTN) or 2-wire telephone type leased circuits.

The major characteristics of a DSVD terminal are:

- the simultaneous transmission of data[1)], e.g. file transfer or T.120 information, and digitally encoded voice signals over a single GSTN connection or over 2-wire leased point-to-point telephone-type circuits;
- the ability to enter the DSVD operating mode either at call set-up, or during an analogue telephone connection;
- multiplexing of bidirectional voice and data channels using a V.42 [8] LAPM-based multiplexing technique described in Recommendation V.76 [11]; and
- transmission of the multiplexed bit stream using the modulation technique defined in Recommendation V.34 [7] or V.32 *bis* [6].

The DSVD terminal may consist of one physical unit, or alternatively, the functional elements of the terminal may be partitioned between a number of physical units.

This Recommendation defines DSVD operation over a point-to-point connection. Multipoint communication may be achieved, for example using a separate multipoint control unit, but the characteristics of this device are not covered by this Recommendation.

2 Normative 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 edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T Recommendation G.729, Annex A[2)], *Reduced complexity 8 kbit/s CS-ACELP speech coder*.

[2] ITU-T Recommendation H.245 (1996), *Control protocol for multimedia communication*.

[3] ITU-T Recommendation V.8 *bis* (1996), *Procedures for the identification and selection of common modes of operation between Data Circuit-Terminating Equipments (DCEs) and between Data Terminating Equipments (DTEs) over the general switched telephone network and on leased point-to-point telephone-type circuits*.

[4] CCITT Recommendation V.25 *bis* (1988), *Automatic calling and/or answering equipment on the General Switched Telephone Network (GSTN) using the 100-series interchange circuits*.

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1) See Recommendation H.324 for the simultaneous transmission of audio and video information.

2) Presently at the stage of draft.

[5] ITU-T Recommendation V.25 *ter* (1995), *Serial asynchronous automatic dialling and control*.

[6] 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.*

[7] ITU-T Recommendation V.34 (1994), *A modem operating at data signalling rates of up to 28 800 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits*.

[8] ITU-T Recommendation V.42 (1993), *Error-correcting procedures for DCEs using asynchronous-to-synchronous conversion*.

[9] CCITT Recommendation V.42 *bis* (1990), *Data compression procedures for Data Circuit-Terminating Equipment (DCE) using error correction procedures*.

[10] ITU-T Recommendation V.75 (1996), *DSVD terminal control procedures*.

[11] ITU-T Recommendation V.76 (1996), *Generic multiplexer using V.42 LAPM-based procedures*.

[12] ITU-T Recommendation V.80 (1996), *In-band DCE control and synchronous data modes for asynchronous DTE*.

3 Definitions

For the purposes of this Recommendation, the following definitions apply.

3.1 audio blocking factor: The number of information blocks, i.e. coded samples, from the speech coder which are combined and transmitted in a single multiplex frame. The default value is "1".

3.2 DSVD terminal: A DCE/DTE combination which together comply with the requirements of this Recommendation and its associated Recommendations. All the functionality of a DSVD terminal may be implemented within the DCE alone.

3.3 initiator: A role taken on by the control entity and multiplex function that determines how it operates for various functions. The role is determined from the V.8 *bis* procedures and is the same as the initiator role for V.8 *bis*.

3.4 responder: A role taken on by the control entity and multiplex function that determines how it operates for various functions. The role is determined from the V.8 *bis* procedures and is the same as the responder role for V.8 *bis*.

4 Abbreviations

For the purposes of this Recommendation, the following abbreviations are used:

ADP	Answerer Detection Pattern
API	Application Programming Interface
CE	Control Entity
DCE	Data Circuit-Terminating Equipment
DLC	Data Link Connection
DLCI	Data Link Connection Identifier
DSVD	Digital Simultaneous Voice and Data
DTE	Data Terminal Equipment
DTMF	Dual Tone Multiple Frequency
ERM	Error Recovery Mode
GSTN	General Switched Telephone Network
IP	Internet Protocol

LAPM	Link Access Procedure for Modems
MF	Multiplex Function
ODP	Originator Detection Pattern
PPP	Point-to-Point Protocol
SAP	Service Access Point
SCF	Supervisory and Control Function
UNERM	Unacknowledged Non-Error Recovery Mode

5 DSVD system

5.1 System overview

A general model of a DSVD terminal is shown in Figure 1. This is an abstract model and is not intended to restrict practical implementations.

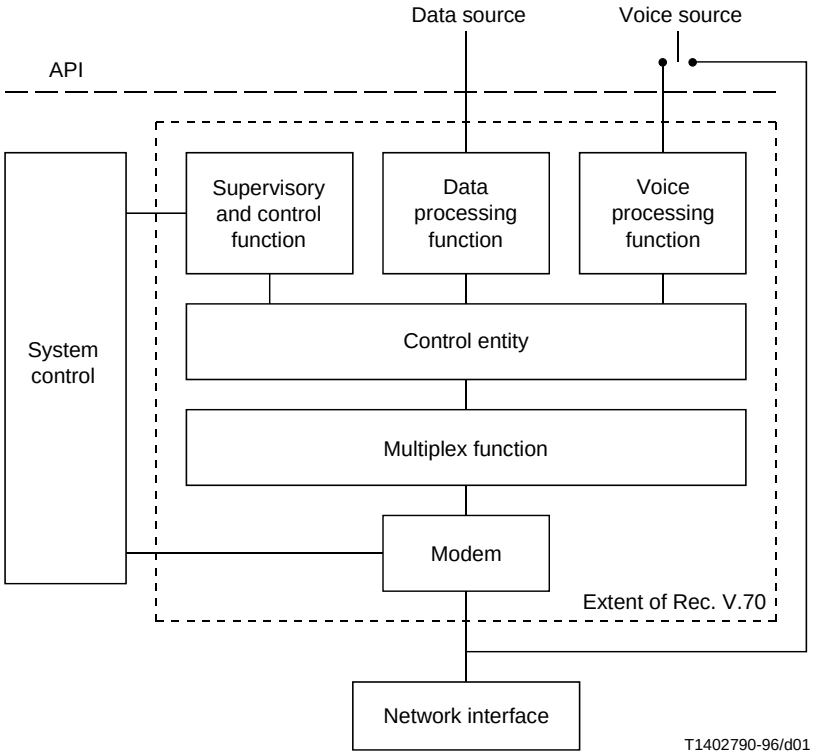


FIGURE 1/V.70

A V.70 system shall include as a minimum the following functional elements, and a compliant V.70 implementation is required to incorporate the functionality of each of these elements:

- *Supervisory and Control Function (SCF)*

  The SCF is responsible for the control of the DSVD system (see 5.2).

- *Data processing function*

  The data processing function is responsible for converting the user data into a format suitable for handling by the multiplex function, e.g. the conversion of start-stop framed data to a format suitable for synchronous transmission. The data channel(s) may be synchronous or asynchronous, and the protocols and applications supported may be indicated and negotiated using the DSVD control entity.

- *Voice processing function*

  The voice processing function includes a codec compliant with Recommendation G.729 Annex A [1] for the conversion of voice signals into a digital bit stream and vice versa. The voice processing function also includes voice activity detection and comfort noise generator, such that periods of silence in voice signals may be used to increase the bit rate available for data communication. The use of alternative speech or audio coders may be negotiated by the SCF using the DSVD control entity.

- *Control Entity (CE)*

  A DSVD control entity is provided to manage the establishment and release of channels, the exchange of capability and parameter information, the conversion of control information into the H.245 message format, and the transfer of data, voice and control information to and from the multiplex function.

- *Multiplex function (MF)*

  A DSVD terminal makes use of a multiplexing capability described in Recommendation V.76 to combine one or more voice channels with one or more data channels, and an optional out-of-band control channel. Each information bit stream (voice, data and control) is assigned a Data Link Connection (DLC) in the multiplexed bit stream. For all channels, transmission is bidirectional. The multiplexer also provides frame delimiting and protection from bit corruption.

- *Modem*

  The multiplexed bit stream is transmitted over the GSTN (or leased circuit) using a V.32 *bis* [6] or V.34 [7] modem, or other future high speed modems to be defined by the ITU. The modem also includes V.8 *bis* functionality for mode negotiation and selection at call set-up and during analogue telephony.

A DSVD terminal may also include a system control entity for functions such as terminal configuration, assignment of channel priority, capability selection decisions, etc. The requirements of this system control entity are outside the scope of this Recommendation.

5.2 Supervisory and control function

The Supervisory and Control Function (SCF) shall be responsible for:

a) requesting a DLC between the DSVD terminal and a remote terminal for the purpose of transferring information as characterized by various parameters; this is achieved using the CE-ESTABLISH primitive; it shall be possible to establish more than one DLC (the maximum number is implementation dependent);

b) orderly release of a DLC using the CE-RELEASE primitive;

c) requesting the exchange of terminal capability information using the CE-SETPARM primitive;

d) handling of potential collisions of open channel requests.

In general these activities are carried out by requesting and receiving services from the control entity using the procedures defined in Recommendation V.75 [10]

NOTE – The SCF may coordinate the changing of parameters of a voice channel. An example of this is changing the speech coder to one using a different rate. This can be done by negotiating and opening a new channel using the new speech coder. This may be done before or after releasing the existing channel. However, the procedure should avoid adverse interaction with the application.

5.3 Data processing function

The data channel provides for end-to-end transmission of user data. A DSVD terminal shall be capable of opening at least one data channel. Initiation of the establishment of a data channel is undertaken by the SCF.

Asynchronous data may be transmitted over either an ERM or a UNERM channel. Synchronous data shall be transmitted over a UNERM channel.

When a data channel has been established by the SCF, information is transferred from the data processing function to the CE using the CE-DATA request primitive.

Where an asynchronous channel is established the data rate shall be dependent on the line signalling rate of the modem, the number of logical channels on the link and the activity on the voice channel.

Where multiple asynchronous channels are established, the allocation of priority between these channels is outside the scope of this Recommendation.

Where a synchronous channel is established the data rate shall be a multiple of 2400 bit/s, and the value shall be calculated taking into account the line capacity allocated to other channels and the overhead for each channel associated with the multiplexer. The maximum rate associated with the voice channel, i.e. with continuous full duplex speech, shall be assumed. The bit rate of a synchronous channel will not change during periods of silence on the voice channel. The SCF shall be responsible for ensuring that no new channels are opened which would impact the assigned data rate for a synchronous channel, or for changing the rate on a synchronous channel if an additional channel is required.

The use of a segmentation/reassembly process for the handling of synchronous frames from the DTE which are larger than the V.76 frame size is defined in 6.5/V.75.

The use of a tunnelling process in support of synchronous frames is described in Annex A.

The use of flow control on the synchronous interface is for further study.

The data application for the data channel is outside the scope of this Recommendation. However, if the data conforms to one of the following standardized applications or formats, then this may be signalled using the capability exchange mechanisms of either Recommendation V.8 *bis* or V.75.

- T.120-Series for point-to-point and multipoint audiographic teleconferencing including database access, still image transfer and annotation, application sharing, real-time file transfer, etc. (support of T.120 operation is described in Appendix II).
- ITU-T Rec. T.84 | ISO/IEC 10918-3 (SPIFF) point-to-point still image transfer cutting across application borders.
- T.434 point-to-point telematic file transfer cutting across application borders.
- Network link layer, per ITU-T Rec. X.263 | ISO/IEC TR 9577 (supports IP and PPP network layers, among others).

5.4 Voice processing function

A DSVD terminal shall include a speech codec in accordance with Recommendation G.729, Annex A, and shall be capable of opening at least one voice channel. The G.729 Annexe A coder encodes speech into an 8.0 kbit/s digital bit stream. It is a reduced complexity version of, and interoperable with, the G.729 speech coder.

Information blocks, i.e. coded samples, from the coder may be combined and transmitted in a single multiplex frame. The number of blocks in a multiplex frame is known as the audio blocking factor. The default value is "1". When an audio blocking factor greater than one is negotiated, all voice blocks shall be preceded by the audio header, see clause 9/V.75.

NOTE – The use of a blocking factor greater than "1" increases the delay on the voice channel.

Support of speech or audio codecs other than G.729 Annex A is optional and may be negotiated.

Initiation of the establishment of a voice channel shall be undertaken by the SCF.

When a voice channel has been established, information shall be transferred from the voice processing function to the CE using the CE-DATA primitive.

The voice processing function may also include an optional voice activity detector and may make use of the optional audio header defined in Recommendation V.75 to signal additional information to that contained in the voice frame.

The definition of a voice activity detector and comfort noise generator for use with the G.729 Annex A coder is for further study.

The transfer of DTMF signals detected at the input to the speech coder is for further study.

The microphone and speaker or telephone handset etc. associated with the voice channel, together with any additional audio processing, such as acoustic echo cancellation, are outside the scope of this Recommendation.

5.5 Control Entity (CE)

The control entity in a DSVD terminal shall use the control procedures defined in Recommendation V.75 [10]. That Recommendation defines:

a) procedures for requesting the MF to establish or release a DLC;

b) the use of request, response, control and indication messages as defined in Recommendation H.245 which gives a common encoding and syntax for use in multimedia terminals;

c) procedures for exchanging capability and parameter information within the DLC to which the information applies (in-band procedure);

d) optional procedures for exchanging capability and parameter information in a separate control DLC (out-of-band procedures);

e) the transfer of H.245 messages in HDLC frames;

f) the transfer of user information to the MF; and

g) optionally adding an audio header octet to voice frames such that voice activity detection and silence compression techniques may be used with speech coders which do not incorporate these capabilities.

The presence of optional capabilities in the DSVD terminal shall be signalled using the control procedures of Recommendation V.75.

5.6 Multiplex function

The multiplexing of voice and data information into a single bit stream and corresponding demultiplexing shall be in accordance with the procedures defined in Recommendation V.76 [11]. The functions provided by Recommendation V.76 include:

a) frame delimiting;

b) protection from bit corruption;

c) the multiplexing and demultiplexing of the information streams;

d) procedures for the establishment and release of a DLC;

e) the transfer of information in either Error Recovery Mode (ERM) or Unacknowledged Non-Error Recovery Mode (UNERM); and

f) optional suspend/resume operation as defined in Annex A/V.76.

The multiplex function for DSVD is equivalent to an extension of the procedures of V.42 [8] LAPM. This relationship between the multiplex function and V.42 LAPM is described in Appendix I, together with procedures for interworking between a DSVD terminal and a modem compliant with V.42 LAPM.

Annex C/V.76 provides details of the multiplexor parameters, their default value and their optional values.

5.7 Modem

The synchronous multiplexed bit stream is passed to a modem function for conversion into an analogue signal that can be transmitted over the GSTN, and the received analogue signal is converted into a synchronous bit stream that is sent to the mux/demux function. The modem function shall be in accordance with Recommendation V.32 *bis* [6] or V.34 [7] or other future high speed modems to be defined by the ITU.

The DSVD operating mode may be established automatically at the beginning of a GSTN call or at any time during an analogue telephone connection using the procedures of Recommendation V.8 *bis* [3].

If a physically discrete modem function is used, control of this modem by the rest of the V.70 system shall be in accordance with the procedures of Recommendation V.25 *ter* [5].

5.8 Summary of requirements and options

The following are mandatory features for a V.70 DSVD terminal:

Feature	*Reference*
– The DSVD functional elements defined in 5.1	5.1
– G.729 Annex A speech coder	5.4, G.729 Annex A
– V.8 *bis* procedures for operating mode and capabilities exchange	6.1
– Support roles of both initiator and responder	6.1.4
– At least one voice DLC/channel	5.4
– At least one data DLC/channel	5.3
– Opening and closing of DLCs/channels	6.2
– Both ERM and UNERM for DLCs	5.6
– Audio blocking factor of 1	5.4
– All default parameter values for the V.76 multiplexor	5.6

The following are optional features for a V.70 DSVD terminal defined within Recommendation V.70 and associated Recommendations:

Feature	*Reference*
– More than one voice channel	5.4
– More than one data channel	5.3
– A DLC/channel for out-of-band signalling procedures	6.2.1
– 8-bit or 32-bit FCS	5.4
– Adding an audio header to the voice frames	5.4, 5.5, 9, Rec. V.75
– Audio blocking factor greater than 1	5.4
– Segmentation/reassembly for UNERM data channels	5.3
– Suspend/resume operation	5.6
– Alternative parameter values	Rec. V.76

6 Operating procedures

6.1 DSVD mode initiation

6.1.1 Initiation of GSTN call

A call may be initiated either:

– manually using an associated telephone; or

– automatically using automatic calling procedures in accordance with Recommendation V.25 *bis* [4] or V.25 *ter* [5].

When the GSTN connection has been established, the call shall proceed to either analogue telephony mode or to initiation of DSVD mode.

6.1.2 Analogue telephony mode

In analogue telephony mode users have the opportunity for voice dialogue before proceeding to DSVD mode.

While in this mode the terminals may exchange operating mode capability information using the procedures defined in Recommendation V.8 *bis* [3]. Following this exchange of capabilities, the terminals may proceed directly to DSVD mode, again using V.8 *bis* procedures, or may return to analogue telephony mode. Speech transmission is suspended during this capability exchange.

The use of V.8 *bis* to select other operating modes following the capabilities exchange is outside the scope of this Recommendation.

6.1.3 Switching to DSVD mode

Establishment of DSVD mode shall use the mode selection procedures defined in Recommendation V.8 *bis* and is defined in the following subclauses. In all cases when the successful completion of the modem training is signalled by the modem function, the terminals are in DSVD mode.

6.1.3.1 Procedure at automatic answering terminal

If the answering terminal is conditioned to go directly into DSVD mode, i.e. auto-answer on call set-up without a period of analogue telephony, it shall initiate a V.8 *bis* mode selection transaction, or capability exchange followed by mode selection.

6.1.3.2 Procedure at automatic calling terminal

If the calling terminal is configured to go directly into DSVD mode, it shall condition itself to detect the initiating V.8 *bis* signal, and respond according to the procedures of Recommendation V.8 *bis*. This may include a request for the transmission of the capabilities of the answering terminal.

6.1.3.3 Initiation of DSVD mode after a period of analogue telephony

Either terminal may commence the initiation of DSVD mode at any time during analogue telephony using the procedures of Recommendation V.8 *bis*. This may follow immediately from a capability exchange or may be directly from analogue telephony mode.

6.1.3.4 Error recovery

If the terminal returns to telephony mode as a result of a V.8 *bis* error-recovery process, the terminal may (depending on local configuration):

- disconnect;
- retry the V.8 *bis* procedures; or
- remain in analogue telephony mode.

6.1.4 Relationship between two DSVD terminals

The control entity and multiplex function require knowledge of the relationship between the two terminals, e.g.†initiator/responder determination for the multiplex function. This shall be determined directly from the start-up procedures of Recommendation V.8 *bis* where the same relationship exists.

For leased line operation the relationship shall be determined from the modem-to-modem relationship, i.e. the modem configured to be the “call modem” shall be the “initiator”, and the modem configured to be the “answer modem” shall be the “responder”.

The SCF shall make this information known to the CE and MF (through local means).

6.2 DSVD mode operation

When the modem function indicates that modem training has been successfully completed, the terminal is in DSVD mode and system-to-system communication is initiated by the SCF.

The CE and MF are made aware of initiator/responder identities (see 6.1.4).

The terminal may have an exchange of capability information before opening any DLCs for the exchange of user voice or data information.

6.2.1 Capabilities exchange

The SCF may optionally initiate the establishment of an out-of-band control channel (DLC) for various functions including terminal capability (mux, voice and data) exchange. The support of an out-of-band control channel by a DSVD terminal is optional. If an out-of-band capability exchange is performed, the capabilities so conveyed can be used as a basis for selecting how to subsequently operate a DLC. This capability exchange is additional to any capability exchange which may have taken place using V.8 *bis* procedures, and includes more detailed information.

The SCF may optionally exchange terminal capability (mux, voice and data) information for a single DLC, i.e. in-band. If an out-of-band capability exchange was previously performed, the capability exchange on this DLC overrides the capabilities established on the out-of-band DLC for this DLC only. Capabilities not signalled shall be assumed to be the same as those previously signalled in the out-of-band exchange.

A capability exchange is not required to announce default values for parameters.

An out-of-band control channel shall be used for the negotiation of the optional suspend/resume mode of operation.

The SCF transfers capability information to and from the CE using the CE-SETPARM primitive defined in Recommendation V.75 [10]. All DSVD capabilities apply to both transmit and receive directions of transmission.

A capabilities exchange shall follow the procedures of Recommendation H.245, which provides a system by which the terminal may describe its ability to operate in various combinations of modes simultaneously.

The transmitting terminal assigns a number in a **capabilityTable** to each individual mode in which the terminal is capable of operating. For example, G.729 Annex A speech, G.728 speech and T.434 binary file transfer would each be assigned separate numbers.

These capability numbers are grouped into **AlternativeCapabilitySet** structures. Each **AlternativeCapabilitySet** indicates that the terminal is capable of operating in exactly one mode listed in the set. For example, an **AlternativeCapabilitySet** listing {G.729 Annex A, G.723 and G.728} means that the terminal can operate in any one of those speech modes, but not more than one.

These **AlternativeCapabilitySet** structures are grouped into **simultaneousCapabilities** structures. Each **simultaneousCapabilities** structure indicates a set of modes the terminal is capable of using simultaneously. For example, a **simultaneousCapabilities** structure containing the two **AlternativeCapabilitySet** structures {T.120 and T.434} and {G.723, G.728 and G.729 Annex A} means that the terminal can operate in either of the data modes simultaneously with any one of the speech codecs. The **simultaneousCapabilities** set {{G.729 Annex A}, {G.729 Annex A and G.723}, {T.84, T.120 and T.434}} means the terminal can operate two voice channels and one data channel simultaneously: one voice channel per G.729 Annex A, another voice channel per either G.729 Annex A or G.723, and one data channel per either T.84, T.120 or T.434.

The terminal shall only exchange **simultaneousCapabilities** structures using the optional out-of-band channel.

NOTE – The actual capabilities stored in the **capabilityTable** are often more complex than presented here. For a complete description, see Recommendation H.245.

The terminal's total capabilities are described by a set of **CapabilityDescriptor** structures, each of which is a single **simultaneousCapabilities** structure and a **capabilityDescriptorNumber**. By sending more than one **CapabilityDescriptor**, the terminal may signal dependencies between operating modes by describing different sets of modes which it can simultaneously use.

Terminals may dynamically add capabilities during a connection by issuing additional **CapabilityDescriptor** structures, or remove capabilities by sending revised **CapabilityDescriptor** structures.

Non-standard capabilities and control messages may be issued using the **NonStandardParameter** structure defined in Recommendation H.245. Note that while the meaning of non-standard messages is defined by individual organizations, equipment built by any manufacturer may signal any non-standard message, if the meaning is known.

Terminals may reissue capability sets at any time.

6.2.2 Data Link Connection (DLC) control

The SCF requests the establishment of a DLC by issuing a CE-ESTABLISH request primitive to the CE, with the selected operating parameters;

- in the case where an out-of-band or DLC specific capability exchange was performed, establishment of the DLC shall select applicable parameters explicitly (where more than one value for a parameter is available) or implicitly (the default applies); or

- in the case where no capability exchange occurred by either method, the DLC establishment may select a full set of applicable parameters, including attempting the use of non-default values; if the establishment attempt of non-default values is not successful, the SCF may re-attempt establishment using default values.

NOTE – Default parameter values may be transferred even if this is not specifically required.

The actions of the CE are detailed in Recommendation V.75 [10].

Confirmation that a DLC has been opened is indicated by the receipt of a CE-ESTABLISH confirm primitive.

Receipt of a CE-ESTABLISH indication primitive indicates a request from the remote terminal to open a DLC, and is acknowledged by the CE-ESTABLISH response primitive.

A SCF which receives a CE-ESTABLISH indication primitive having sent a CE-ESTABLISH request primitive with the same H.245 data type, but before receiving a CE-ESTABLISH confirm primitive, may regard this as a potential coincidence of equivalent open DLC requests. If the SCF is the initiator, it shall respond to the CE-ESTABLISH indication primitive, with a CE-RELEASE response primitive.

The SCF requests the release of a DLC by the transmission of a CE-RELEASE request primitive to the CE.

The use of an H.245 PortNumber parameter to associate a DLC with a physical port on the DSVD terminal or equivalent is for further study.

If the suspend/resume mode is selected using the out-of-band channel, the MF shall redefine the abort sequence at the time the mode is selected. Suspend/resume DLCs may then be opened. If omission of the address field is negotiated, only one suspend/resume channel shall be opened. If the address field is maintained, one or more suspend resume channels may be opened.

The H.245 **AudioCapability** message shall be used to indicate the audio blocking factor, i.e. the number of voice blocks which are contained in a single multiplex frame on a voice DLC. The default value is “1”. When the value is greater than one, the audio header is mandatory for all types of voice block, i.e. including “silence” frames or other frame types associated with silence compression.

The renegotiation of channel parameters once the channel has been established is for further study.

6.2.3 Information transfer

Once a DLC has been established, the transfer of user information may commence. The mechanism for signalling this by the SCF to the information source is implementation dependent.

When user information channels have been opened, it is the responsibility of the CE to transfer voice or data information using the CE-DATA primitive defined in Recommendation V.75 [10] from the voice processing function and data processing function respectively to the multiplex function.

6.3 End of DSVD mode

DSVD mode may be terminated by closing all DLCs and invoking the modem cleardown procedure.

If either terminal wishes to return to analogue telephony mode, or wishes to switch to an alternative non-voice mode, this may be indicated using the H.245 **EndSessionCommand** message in the out-of-band channel. A terminal receiving an H.245 **EndSessionCommand** message should assume that all DLCs are closed.

When it is required to return to analogue telephony or to cleardown the GSTN connection, the modem cleardown procedures from the appropriate modem Recommendation shall be used.

7 Interfaces

7.1 DTE-DCE data interface

Where a discrete physical DCE-DTE interface is required, it shall be in accordance with the interface specified in the appropriate modem Recommendation for the modem function of the DSVD terminal.

7.2 DTE-DCE control

Control of a DSVD terminal from a DTE shall be in accordance with the procedures of Recommendation V.25 *ter* [5], including Annex A for the control of the procedures of Recommendations V.8 *bis* and V.80 [12].

7.3 Voice interface

Definition of the characteristics of the voice interface is outside the scope of this Recommendation.

7.4 Combined data/voice interface

The requirements for a combined voice and data interface to a DTE are for further study.

8 System implementation requirements

The specification of system implementation requirements, such as the maximum value of the delay for the transfer of voice or data information through a DSVD terminal, is for further study.

A protocol implementation conformance statement (PICS) for a V.70 terminal is for further study.

9 Interworking

Procedures for interworking with a modem supporting V.42 operation are described in Appendix I.

Interworking between the V.70 operating mode and other multimedia operating modes, e.g. Recommendations V.61 and H.324, is currently not accommodated, and is for further study.

Annex A

UNERM tunnelling procedures

Introduction

For the case of synchronous protocols running in the DTE, an efficient method of transporting the synchronous protocol's frames within a single V.76 channel can be found. This annex describes a method called UNERM tunnelling.

The procedures here are given in terms of the synchronous frames as defined in Recommendation Q.922, although the procedures are applicable to many of the other synchronous protocols having similar characteristics to Recommendation Q.922. In this method, Q.922 frames have their ISO/IEC 3309 transparency and flags removed. The resulting frames are placed into a V.76 UI/UIH frame. It is also possible to remove the FCS of the synchronous protocol, although that is not shown in the procedures below.

V.70 UNERM tunnelling

When operating in the UNERM tunnelling mode, the V.70 terminal shall implement at the asynchronous V.24 interface the following procedures taken from 4.5.2 of ISO/IEC 3309.

The control escape octet is a transparency identifier that identifies an octet occurring within a frame to which the following transparency procedure is applied. The encoding of the escape octet is given in Figure A.1.

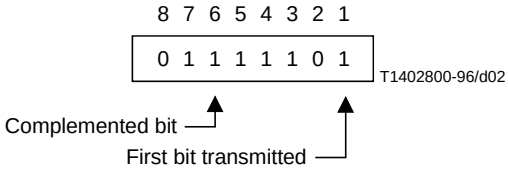


FIGURE A.1/V.70

Control escape octet for UNERM tunnelling procedure

The transmitter shall examine the frame content between the opening and closing flag sequences (01111110) including the address, control and FCS fields and, following completion of the FCS calculation, shall:

a) upon the occurrence of the flag or a control escape octet, complement the 6 bit of the octet; and

b) insert a control escape octet immediately preceding the octet resulting from the above prior to transmission.

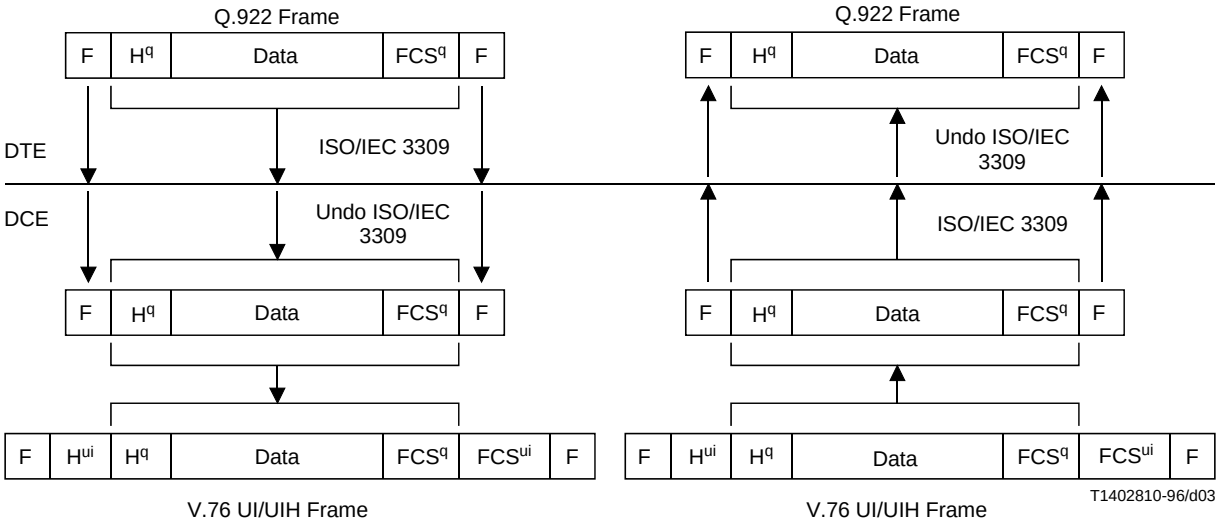
The receiver shall examine the frame content between the two flag octets and shall, upon receipt of a control escape octet and prior to FCS calculation:

a) discard the control escape octet; and

b) restore the immediately following octet by complementing its 6 bit.

The DCE shall place frames into UI or UIH frames within Recommendation V.76.

Figures A.2 illustrates this procedure:



H^q Header of Q.922 frame
H^{ui} Header of V.76 UI/UIH frame
FCS^q FCS of Q.922 frame
FCS^{ui} FCS of V.76 UI/UIH frame

FIGURE A.2/V.70

UNERM tunnelling process

Appendix I

Relationship with V.42 LAPM operation

I.1 Differences between V.76 and V.42 LAPM

The multiplexer for DSVD as defined in Recommendation V.76 [11] is equivalent to, and an extension of, the procedures of V.42 LAPM in the following ways:

- both use the same basic HDLC framing technique of ISO/IEC 3309 (or ISO/IEC 13239); optionally the DSVD multiplexer provides a low overhead framing technique known as "suspend/resume" framing which is described in Recommendation V.76;
- in addition to the 16-bit and 32-bit CRCs shared by both LAPM and the DSVD multiplexer, the latter also offers an optional 8-bit CRC particularly useful for voice applications;
- both LAPM and DSVD convey information bit streams in a DLC identified by a DLCI, but while LAPM uses only DLCI = 0 for data, the DSVD multiplexer uses multiple DLCIs for voice plus data;
- both LAPM and the DSVD multiplexer provide an Error Recovery Mode (ERM); the DSVD multiplexer also provides an Unacknowledged Non-Error Recovery Mode (UNERM) to cater for voice and those applications not needing error control;

– when operating in ERM, both LAPM and the DSVD multiplexer use the same frame types and procedures and, therefore, can operate with the same state machine;

– whereas LAPM made provision for an SCF-SCF control channel but no specification of this was developed, the DSVD multiplexer provides an optional out-of-band (OOB) control channel for additional functions such as capabilities exchanges; and

– DLCI set-up and release for both LAPM and the DSVD multiplexer use the same frame types and procedures; however, the DSVD multiplexer also incorporates an optional set-up procedure that may reduce set-up time.

I.2 Interworking procedures

The major differences between the LAPM procedures in Recommendation V.42 and the procedures defined in Recommendation V.76 are the support of multiple DLCIs and UNERM operation in Recommendation V.76. Therefore, communication between two implementations, i.e. one conforming to V.42 LAPM and the other, a DSVD terminal conforming to this incorporating V.76, is to default to communication with one DLCI (0) and ERM. If this is not satisfactory to an implementation of this Recommendation, it can choose not to communicate with a LAPM implementation.

The first opportunity for detection of a LAPM implementation may occur during some external exchange of capabilities (e.g. such as in Recommendation V.8 *bis*). If communication in the LAPM mode is negotiated as a result of this exchange, the ODP/ADP detection of Recommendation V.42 is not necessary.

If the external capability exchange does not identify the capability of the remote DCE as either DSVD or LAPM compliant, then a DSVD terminal wishing to communicate with a LAPM modem should complete the ODP/ADP handshake. This is necessary so that a LAPM implementation does not return to non-error correcting mode (see Appendix I/V.42).

Appendix II

Alternatives for support of T.120-based audiographic conferencing using Recommendation V.70

Introduction

Recommendation T.123 defines various stacks which the T.120 suite uses for communication over various technologies. It assumes some mix of voice, video and data capabilities.

For the voice aspects of audiographic conferencing, the audio functions of Recommendation V.70 are used.

For the data aspects of Recommendation T.120, this appendix provides a recognition of Recommendation V.70 as it might relate to Recommendation T.123 in terms of the T.123 defined basic protocol profile and three alternative methods for transporting the T.125 information. Each of these methods has a different level of efficiency. Further study is needed to refine and converge these alternatives.

II.1 PSTN basic profile

II.1.1 Profile description

The PSTN basic profile as defined in 7.4/T.123 may be used over a single V.76 UNERM or ERM channel without modification. Figure II.1 shows this configuration as it is shown in Figure 8/T.123. The UNERM case would be preferred, as the basic profile provides for error correction using Recommendation Q.922.

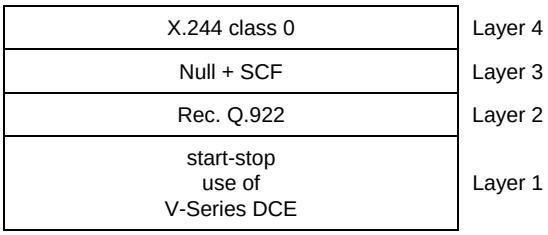


FIGURE II.1/V.70

It is noted that when Recommendation V.70 is in use, an UNERM channel is preferred. If an ERM channel is being used, system parameters should be set to avoid adverse interaction with the error correcting operation of Q.922. Important elements are the acknowledgment timer, the maximum number of octets in an information field, and the data forwarding conditions.

II.2 Alternative A: PSTN profile-based on Recommendation V.70 with UNERM tunnelling

II.2.1 Profile description

Figure II.2 shows an alternative method of placing Q.922 frames into a single UNERM V.70 channel with removal of the ISO/IEC 3309 frame transparency and FCS. This forces a one-to-one mapping of V.70 frames to Q.922 frames. This method is also more efficient than the basic profile due to the removal of the "byte-stuffing" added by Recommendation Q.922.

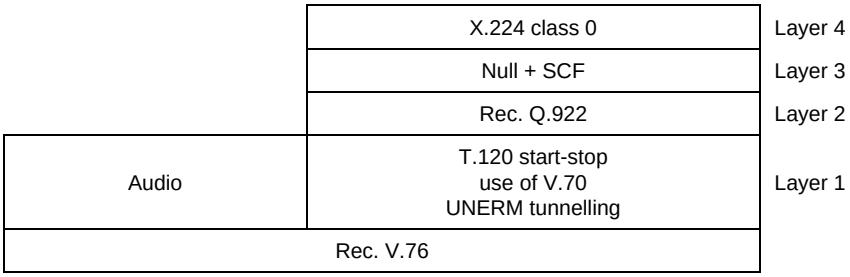


FIGURE II.2/V70

It should be noted here that:

Layer 4

- No modifications.

Layer 3

- No modifications.

Layer 2

- No modifications.

Layer 1

- Start-stop transmission by DTE.
- DCE as specified in V.70 UNERM tunnelling for Recommendation T.120.
- The DTE and DCE may be logical functions that are not physically separated, if integrated equipment can produce the same transmitted signals.

NOTE – The net effect is that the content of a Q.922 frame – without FCS, flags, or transparency – is conveyed as one UI frame over the channel opened for the T.120 data application.

II.3 Alternative B: PSTN profile-based on Recommendation V.70 using V.76 channels

II.3.1 Profile description

Figure II.3 shows an alternative method of using one V.76 channel per X.224 class 0 transport connection. This effectively removes the Q.922 layer used in the normal PSTN stack.

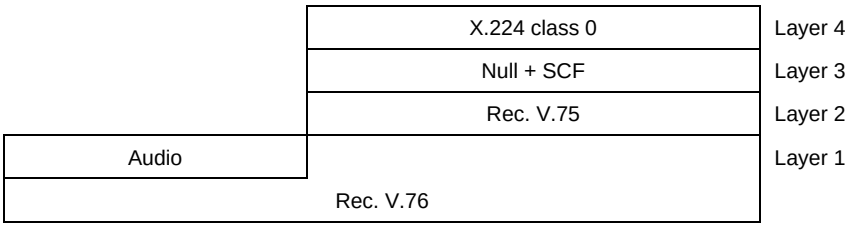


FIGURE II.3/V.70

It should be noted here that:

Layer 4

- X.224 class 0 preferred, no alternative class.
- Maximum TPDU size shall not exceed V.76 parameter N401.

Layer 3

- No modifications.

Layer 2

- V.75 control entity.

Layer 1

- V.76 multiplex function.

II.4 Alternative C: PSTN profile-based on Recommendation V.70 using V.75 CE primitives

II.4.1 Profile description

Figure II.4 shows a method of mapping X.214 transport service primitives into V.75 control entity primitives. Recommendation V.70 contains the whole stack which Recommendation T.125 uses for transport.

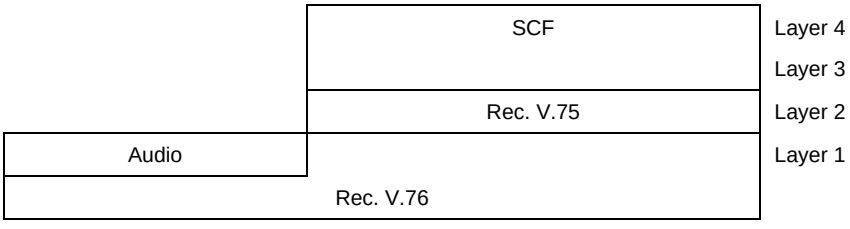


FIGURE II.4/V.70

It should be noted here that:

Layer 4

- Maps X.214 transport service primitives to V.75 control entity primitives as follows:

X.214/T.123		Rec. V.76	Purpose
T-CONEXIÓN	⇔	L-SETPARM and L-ESTABLISH	Connection establishment
T-DATA	⇔	L-DATA	Data transfer
T-DISCONNECT	⇔	L-RELEASE	Connection release

Layer 3

- SCF (for further study).

Layer 2

- V.75 control entity.

Layer 1

- V.76 multiplex function.

Bibliography

– ITU-T Recommendation T.84 (1996) | ISO/IEC 10918-3:1996, *Informating technology – Digital compression and coding of continuous-tone still images: Extensions*.

– ITU-T Recommendation T.120 (1996), *Data protocols for multimedia conferencing*.

– ITU-T Recommendation T.123 (1994), *Protocol stacks for audiographic and audiovisual teleconference applications*.

– ITU-T Recommendation T.125 (1994), *Multipoint communication service protocol specification*.

– ITU-T Recommendation T.434 (1996), *Binary file transfer format for the telematic services.*

– ITU-T Recommendation V.14 (1993), *Transmission of start-stop characters over synchronous bearer channels*.

– ITU-T Recommendation X.214 (1995), *Information technology – Open Systems Interconnection – Transport service definition*.

– ITU-T Recommendation X.290 (1995) | ISO/IEC 9646-1:1994, *OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – General concepts*.

– ITU-T Recommendation X.296 (1995) | ISO/IEC 9646-7:1995, *OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications – Implementation conformance statements*.

– ISO/IEC 3309:1993, *Information technology – Telecommunications and information exchange between systems – High-level data link control (HDLC) procedures – Frame structure*.

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