INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

V.75

Appendix II
(02/98)

SERIES V: DATA COMMUNICATION OVER THE TELEPHONE NETWORK

Simultaneous transmission of data and other signals

DSVD terminal control procedures

Appendix II: Session establishment using V.75/H.245 procedures

ITU-T Recommendation V.75 – Appendix II

(Previously CCITT Recommendation)

ITU-T V-SERIES RECOMMENDATIONS

DATA COMMUNICATION OVER THE TELEPHONE NETWORK

General	V.1–V.9
Interfaces and voiceband modems	V.10–V.34
Wideband modems	V.35–V.39
Error control	V.40–V.49
Transmission quality and maintenance	V.50–V.59
Simultaneous transmission of data and other signals	**V.60–V.99**
Interworking with other networks	V.100–V.199
Interface layer specifications for data communication	V.200–V.249
Control procedures	V.250–V.299

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

ITU-T RECOMMENDATION V.75

DSVD TERMINAL CONTROL PROCEDURES

APPENDIX II

Session establishment using V.75/H.245 procedures

Source

Appendix II to ITU-T Recommendation V.75, was prepared by ITU-T Study Group 16 (1997-2000) on the 6th of February 1998.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the 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.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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

INTELLECTUAL PROPERTY RIGHTS

The ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. The ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

		Page
Appendix II – Session establishment using V.75/H.245 procedures		1
II.1	Introduction	1
II.2	General overview	1
II.3	Opening channels	1
II.4	Capability exchange	2
II.5	H.245 TerminalCapabilitySet structure	2
II.6	Channel establishment	3
II.7	Channel closure	3
II.8	Sample session	4
II.9	Out-of-band control channel	4
II.10	Establishment of suspend/resume channels with the out-of-band control channel	4
II.11	Sample suspend/resume negotiation and activation procedure	5
II.12	Establishment of suspend/resume option in V.76 using V.8 *bis*	6
II.13	Practical considerations TerminalCapabilitySet Tables for V.70	7

Recommendation V.75

DSVD TERMINAL CONTROL PROCEDURES

APPENDIX II

Session establishment using V.75/H.245 procedures

(Geneva, 1998)

II.1 Introduction

The purpose of this Appendix is to describe the establishment of a V.70 session using H.245 messages according to Recommendation V.75. Due to the number of system variables: number of channels, channel parameters, options, user input, etc., the usage of V.75 procedures to establish a V.70 session can be accomplished in a number of ways. This Appendix cannot be therefore a complete review of all V.70 session establishment procedures, but rather a general description of the methods to establish a V.70 session.

This Appendix will describe those control procedures necessary in V.70 session establishment from the point in which a V.34 startup has been completed. It is assumed that the modems have connected at a sufficient bit rate to support DSVD mode and that both ends of the connection have been made aware through the use of V.8*bis* to initiate a V.70 session.

II.2 General overview

V.75 channel establishment procedures follow generally the procedures for establishing a channel in V.42. In other words, an XID exchange on a DLC proceeds a SABME/UA exchange. One significant difference between V.42 and V.70 is that H.245 messages are contained within the XID/SABME/UA/DM/DISC HDLC frames. In V.76, the multiplex for V.70, the SABME/UA/DM/DISC frames have been enhanced to include an information field. In a V.70 session establishment, these information fields contain a single H.245 message. What H.245 message goes into what HDLC frame and the allowed H.245 parameters is essentially what V.75 describes. See Figure II.1

Flag	Control octets	FI	H.245 message	Flag

Figure II.1/V.75 – V.70 XID/SABME/UA/DM/DISC frame format

XID frames in V.70 are a special case. XID frames already included an information field as specified in 12.2/V.42. In V.42 XID frames, the first octet of the I-field is a FI (Format Identifier). This identifier indicates the encoding of the remainder of the I-field which is described in 12.2/V.42. To identify the new I-field encoding of XID frames for V.70 (H.245 messages), a new FI (133_D) has been assigned. For consistency throughout V.70, V.75 specifies that this new FI be present as the first octet in not just XID I-fields but in all HDLC control frames.

II.3 Opening channels

Opening a channel consists of an optional capability exchange using XID frames followed by a channel establishment phase using SABME/UA/DM. This procedure is repeated for each channel to be opened. V.70 mandates the support of one data channel and one audio channel. No specific order is required, but it is recommended that the data channel be opened first so that existing data applications are assigned a data channel as soon as possible.

II.4 Capability exchange

Channel capabilities are exchanged in V.70 just like V.42 with XID frames. V.70 terminal that wishes to establish a channel for audio or data should first complete an XID command-response frame exchange to signal to the remote terminal the local capabilities. Here V.70 diverges somewhat from V.42. In V.42, one XID command-response exchanges capabilities of both the remote and local terminal. As described in V.75, a V.70 XID frame exchange contains the H.245 **TerminalCapabilitySet** and **TerminalCapabilitySetAck** message which only transfers capabilities in one direction. In order that both the remote and local terminals have the complete capability set, two XID command-response exchanges are necessary – one initiated from each side. V.70 specifies that the reception of an XID command frame on a particular DLCI should trigger a V.70 terminal to initiate the corresponding XID command-response exchange in the reverse direction in order that both terminals' capabilities on that DLCI are known by both V.70 terminals.

To allow for faster channel establishment, V.70 does allow you to skip the capability exchange completely and go straight to opening a channel. When skipping the capability exchange, the V.70 user must open the channel with a guess of what the remote terminal can support, and therefore risks a rejection from the remote terminal.

The procedure described above is referred in the Recommendations as an *in-band* capability exchange as it is transmitted on a particular DLCI contained in the control octets in Figure II.1. The capabilities described in the exchange pertain only to that DLCI in which the exchange occurred. For that reason, the H.245 **TerminalCapabilitySet** message must only contain a single "**AlternativeCapabilitySet**" within a "**simultaneousCapabilitySet**". (If it contained more than one **AlternativeCapabilitySet**, the H.245 message would be describing capabilities on more than one channel. Refer to the description of these structures in Recommendation H.245.)

II.5 H.245 TerminalCapabilitySet structure

The H.245 **TerminalCapabilitySet** structure uses two separate structures to define the terminal capabilities. The structures are the "**CapabilityTable**" and the "**CapabilityDescriptor**". The **CapabilityTable** is an array of two elements; the first element is a number (**CapabilityTableEntryNumber**) from 1 to 65535 and the second element (**Capability**) is the capability type. The second structure, the CapabilityDescriptor expresses what combination of capabilities from the CapabilityTable the terminal can support simultaneously. See Figure II.2.

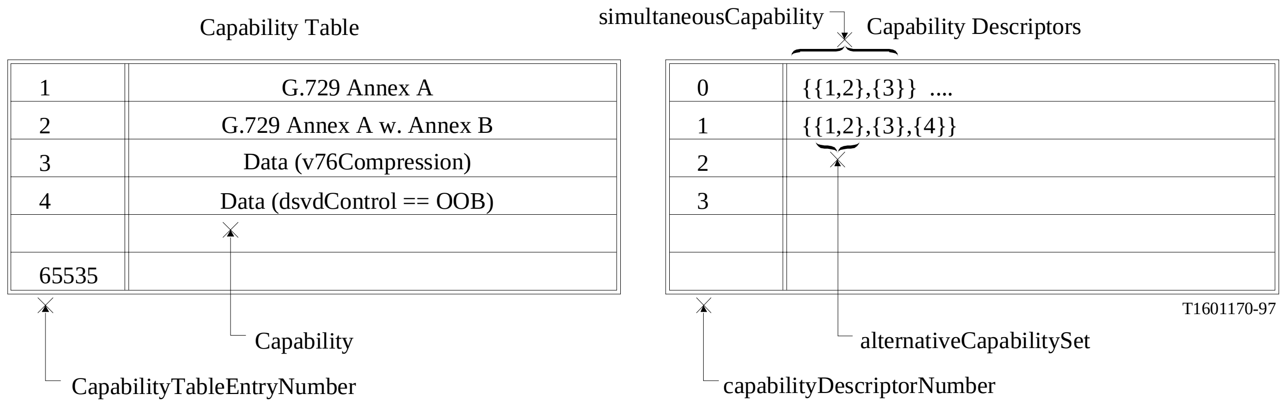

Figure II.2/V.75 – Example of a TerminalCapabilitySet structure

Referring to Figure II.2, the **CapabilityTable** indicates that the V.70 terminal can support 4 separate capabilities: G.729 AnnexA with and without silence suppression, a data channel with compression and an out-of-band control channel. The **CapabilityDescriptor** then describes which of the capabilities in the **CapabilityTable** can be supported simultaneously in the V.70 terminal. This is done using the H.245 structures **alternativeCapabilitySet** and **simultaneousCapabilities**. In the example above the CapabilityDescriptor number 1 indicates two V.70 configurations. The first descriptor says the V.70 can support two channels simultaneously: one with either G.729 Annex A or G.729 Annex A with silence suppression, and the other data with compression. The second descriptor indicates that the V.70 terminal can support three channels: one with either G.729 Annex A or G.729 Annex A with silence suppression, the second just data with compression and a third out-of-band control channel.

Out-of-band capability exchange in which simultaneous capabilities on multiple channels can be described is discussed in Out-of-Band Control Channel subclause below.

II.6 Channel establishment

After the capability exchange, audio or data channels may be established. Following procedures in V.42, channels are established using a SABME-UA (or SABME-DM for rejection) frame exchange. In V.70, both the SABME and UA/DM include I-fields that contain an H.245 message. Which H.245 message is contained in which HDLC frame is specified by V.75. Table II.1 below shows the mapping between HDLC frames and H.245 messages.

Table II.1/V.75 – Mapping of HDLC frame I-fields and H.245 messages

HDLC Frame	H.245 message in I-field
SABME	**OpenLogicalChannel**
UA	**OpenLogicalChannelAck** or **CloseLogicalChannelAck**
DM	**OpenLogicalChannelNack**
DISC	**CloseLogicalChannel**
XID	**TerminalCapabilitySet** or **TerminalCapabilitySetAck** or **TerminalCapabilitySetReject**

The **OpenLogicalChannel** message in the SABME frame contains all of the information needed to establish the correct mode of operation on the DLCI specified in the control octets of the SABME frame. The DLCI value of the SABME frame and the parameters in the **OpenLogicalChannel** message in the I-field should match capabilities exchanged on the DLCI in the previously completed XID command-response exchange.

For V.70 terminals, the value of n401 contained in both the **OpenLogicalChannel** and **TerminalCapabilitySet** message shall be negotiated in octets.

II.7 Channel closure

At the end of a V.70 session, or if a terminal wishes to close a channel in the middle of a session, either terminal may initiate a channel close procedure. Closing a channel in a V.70 session is accomplished by transmitting an H.245 **CloseLogicalChannel** message in the V.76 I-field of a DISC frame. A V.70 terminal receiving such a frame shall then respond with a UA frame containing a **CloseLogicalChannelAck** message.

II.8 Sample session

Figure II.3 is an example of a basic V.70 session depicting the HDLC frames exchanged between V.70 terminals to establish data channel on DLCI 0 and an audio channel on DLCI 1.

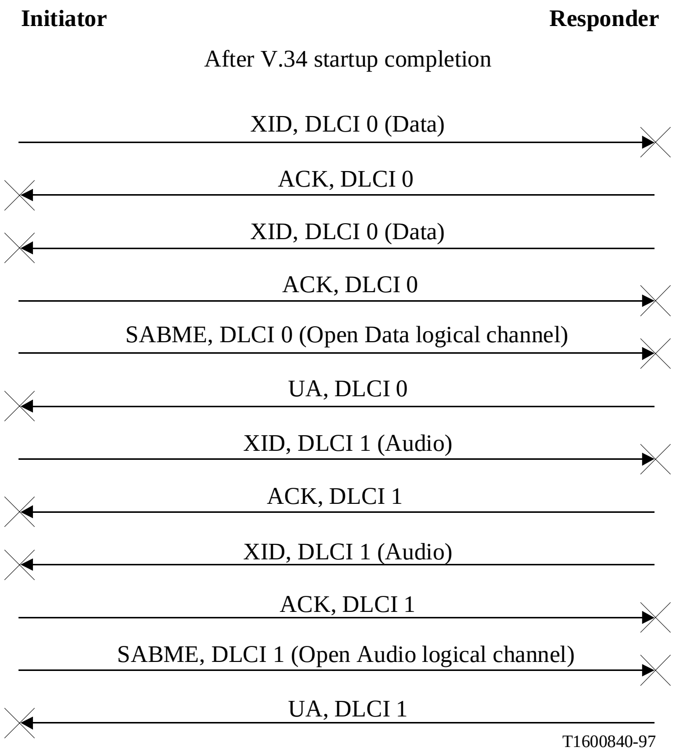

Figure II.3/V.75 – Sample of a basic V.70 session, without Suspend/Resume

II.9 Out-of-band control channel

An out-of-band channel is a third type of channel that a V.70 terminal can open in addition to data and audio. The out-of-band control channel is an option in V.70 terminals. Only H.245 messages are transmitted. Table 6/V.75 lists those H.245 messages that are currently defined as valid in a V.70 out-of-band control channel.

In general, an out-of-band control channel transmits control messages that affect the entire V.70 session and not just a single channel or DLCI. An out-of-band control channel must be opened just like an audio or data channel before it can be used for H.245 message transfer. H.245 messages transmitted in an out-of-band control channel are transferred reliably in I-frames.

II.10 Establishment of suspend/resume channels with the out-of-band control channel

Suspend/resume is a V.76 option in V.70 that allows frames from channels that are real-time in nature to "suspend" transmission of other frames before the HDLC end-flag to lower real-time channel latency. In addition, the suspend/resume option reduces overhead by reducing the number of control octets. The suspend/resume feature is accomplished by redefining the ABORT flag as a "suspend" flag, and is therefore a feature of the multiplex layer in V.70. As the multiplex layer is responsible for transmission of all V.70 channels, the enabling of the suspend/resume feature by the V.76 multiplexer may be signalled via the out-of-band control channel.

Establishment of a suspend/resume channel follows the procedures described above for non-suspend/resume channels, with the one addition that when opening the channel with the SABME/**OpenLogicalChannel** command, the option "**suspendResume**.**wAddress**/**woAddress** must be set. Of course, the suspend/resume option must be available in V.76 to open a suspend/resume channel, and should be signalled in the capability exchange prior to opening channels. The opening of a channel with the suspend/resume option set does not automatically begin suspend/resume operation by the multiplexer. It merely "tags" that particular channel "as one that can suspend/resume others". For the actual suspend/resume operation to begin by the V.76 multiplex layer, an H.245 "**RequestMode** – ModeDescription.ModeElement.V76ModeParameters" message shall be transmitted to the remote terminal.

II.11 Sample suspend/resume negotiation and activation procedure

The following step-by-step procedure may be used to negotiate and activate suspend/resume capability for V.70 terminals.

Step 1)

Signal OOB (Out-of-Band) control channel capability (application = dsvd control) using XID frames containing an H.245 **TerminalCapabiltySet** message. Each endpoint sends a capability set. See 6.4.4.1/V.75.

Step 2)

After both endpoints have exchanged capability sets in which both endpoints have indicated support for the OOB control channel, one end opens the OOB control channel according to 6.2/V.75. (application = **dsvdControl**, **eRM** mode of V.76 shall be invoked.)

Step 3)

Exchange of complete simultaneous Terminal Capabilities in the OOB channel, including suspend/resume for audio. The H.245 **TerminalCapabilitySet** messages are transmitted in I frames. (In the OOB case, the simultaneous structure in H.245 may contain more than one **AlternativeCapabilitySet**, as capabilities signalled in the OOB channel pertain to multiple channels. See 6.4.4.2/V.75.)

Step 4)

If both terminals support suspend/resume for audio, one end may then send a **RequestMode** message in the I frame, enabling the suspend/resume feature on the V.76 multiplexer. The **RequestMode** parameters should be as follows:

sequenceNumber =0
SEQUENCE SIZE OF ModeDescription =1
SET SIZE OF ModeElement =1
type= audioMode
v76ModeParameters = suspendResumewAddress or suspendResumewoaddress

If the Suspend/Resume mode is available, the receiver shall change the definition of the abort sequence to be at least nine consecutive 1-bits and send the following **RequestModeAck** message:

sequenceNumber =0
response = willTransmitMostPreferredMode

Upon the receipt of the **RequestModeAck** message, the transmitter shall change the definition of the abort sequence to be at least nine consecutive 1-bits. At this point, the Suspend/Resume mode can be invoked by an **OpenLogicalChannel** command.

If the Suspend/Resume mode is unavailable in the receiver, it shall send the following **RequestModeReject** message:

> **sequenceNumber =0**
> **cause = modeUnavailable**

Step 5)

Either terminal can proceed with opening of the data logical channel according to 6.2/V.75.

Step 6)

Either terminal can proceed with opening of the audio logical channel, with or without Suspend/Resume mode. The first transfer using Suspend/Resume flags shall start when an audio frame is ready for transmission. See Figure II.4.

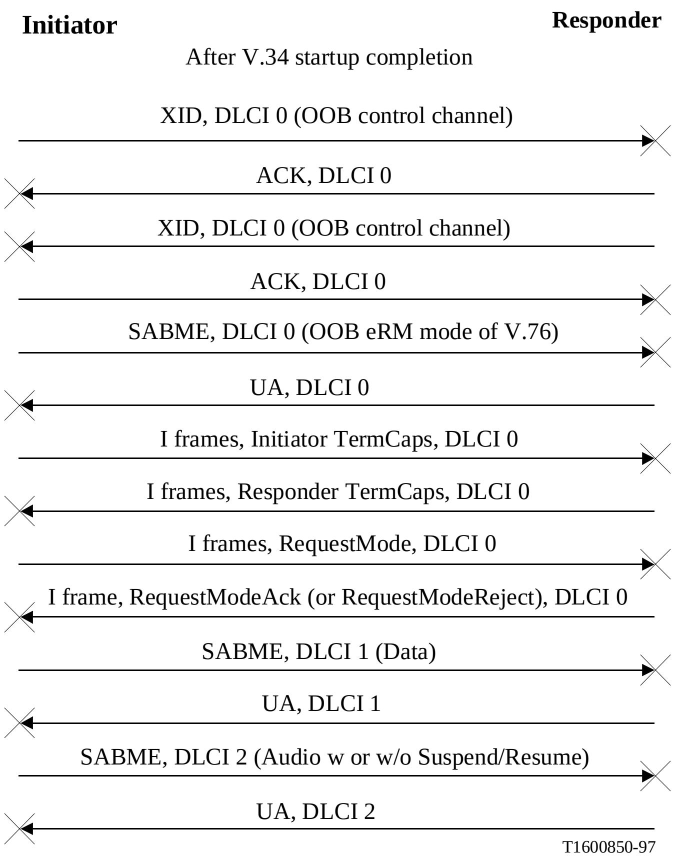

Figure II.4/V.75 – Sample Suspend/resume procedure

II.12 Establishment of suspend/resume option in V.76 using V.8 *bis*

If both the V.8 *bis* capability exchange and mode selection have indicated that both terminals support and request the V.76 suspend/resume option, the V.70 terminals shall initiate the V.70 connection, after modem training, using the V.76 suspend/resume option with default parameters as defined in Recommendation V.76 as the multiplexer configuration.

II.13 Practical considerations TerminalCapabilitySet Tables for V.70

There are five elements (members) in an H.245 TerminalCapabilitySet SEQUENCE (as illustrated below):

```
TerminalCapabilitySet          ::=SEQUENCE
{
    sequenceNumber             SequenceNumber,
    protocolIdentifier         OBJECT IDENTIFIER,
                               -- shall be set to the value
                               -- {itu-t (0) recommendation (0) h (8) 245 version (0) 2}

    multiplexCapability        MultiplexCapability OPTIONAL,
    capabilityTable            SET SIZE (1..256) OF CapabilityTableEntry OPTIONAL,
    capabilityDescriptors      SET SIZE (1..256) OF CapabilityDescriptor OPTIONAL,
    ...
}
```

For V.70 purposes, **SequenceNumber** is defined to be zero, **protocolIdentifier** is a predefined constant array and **MultiplexCapability** points to v76Capability which in turn is a simple SEQUENCE. The last two members namely, **capabilityTable** and **capabilityDescriptors**, are in effect arrays of tables and table numbers. To clarify the encoding of **TerminalCapabilitySet** for V.70, the pages that follow provide examples for **capabilityTable** and **capabilityDescriptors**.

Examples #1a, b, c and #2 are all practical cases that are applicable to V.70 implementations. In Examples #1a, b and c, tables for in-band **TerminalCapabilitySet** messages are described. These messages are used to signal data, audio and out-of-band control channel capabilities.

Example #1a

Tables for an in-band **TerminalCapabilitySet** to signal a data channel with V76wCompression capability.

CapabilityTable size=1, capabilityDescriptors size=1, simultaneousCapability size=1, AlternativeCapabilitySet size=1 {1}
CapabilityTable = { {1,V76wCompression} }
CapabilityDescriptors = { { 0 , { {1} } } }

Example #1 b

Tables for an in-band **TerminalCapabilitySet** to signal an audio channel with G729 Annex A w. Annex B capability.

capabilityTable size=1, capabilityDescriptors size=1, simultaneousCapability size=1, AlternativeCapabilitySet size=1 {1}
CapabilityTable = { {1,G729AnnexAwAnnexB} }
CapabilityDescriptors = { { 0 , { {1} } } }

Example #1c

Tables for an in-band **TerminalCapabilitySet** to signal out-of-band control capability.

capabilityTable size=1, capabilityDescriptors size=1, simultaneousCapability size=1, AlternativeCapabilitySet size=1 {1}
CapabilityTable = { {1,OOB} }
CapabilityDescriptors = { { 0 , { {1} } } }

Example#2

Tables for an out-of-band **TerminalCapabilitySet** with one audio, one data and one out-of-band control channel.

capabilityTable size=3, capabilityDescriptors size=1:
for capabilityDescriptorNumber=0: simultaneousCapabilities size =3:
for simultaneousCapabilities(1), AlternativeCapabilitySet size =1 {1}
for simultaneousCapabilities(2), AlternativeCapabilitySet size =1 {2}
for simultaneousCapabilities(3), AlternativeCapabilitySet size =1 {3}

CapabilityTable = { {1,v76wCompression} , {2,G729AnnexAwAnnexB} , {3,OOB} }
CapabilityDescriptors = { { 0 , { {1} , {2} , {3} } } }

This typical V.70 **CapabilityDescriptors** describes a V.70 terminal that has the capability of opening one v76wCompression data channel, one G729 Annex A w. Annex B audio channel, and one out-of-band control channel simultaneously.

ITU-T RECOMMENDATIONS SERIES

Series A	Organization of the work of the ITU-T
Series B	Means of expression: definitions, symbols, classification
Series C	General telecommunication statistics
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	TMN and network maintenance: international transmission systems, telephone circuits, telegraphy, facsimile and leased circuits
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	**Data communication over the telephone network**
Series X	Data networks and open system communications
Series Y	Global information infrastructure
Series Z	Programming languages