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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Infrastructure of audiovisual services – Communication procedures

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Control protocol for multimedia communication

ITU-T Recommendation H.245

(Previously CCITT Recommendation)

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ITU-T RECOMMENDATION H.245

CONTROL PROTOCOL FOR MULTIMEDIA COMMUNICATION

Summary

This Recommendation specifies syntax and semantics of terminal information messages as well as procedures to use them for in-band negotiation at the start of or during communication. The messages cover receiving and transmitting capabilities as well as mode preference from the receiving end, logical channel signalling, and Control & Indication. Acknowledged signalling procedures are specified to ensure reliable audiovisual and data communication.

Source

ITU-T Recommendation H.245 was revised by ITU-T Study Group 16 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 10th of July 1997.

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.

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Recommendation H.245

CONTROL PROTOCOL FOR MULTIMEDIA COMMUNICATION

(Revised in 1997)

1 Scope

This Recommendation specifies syntax and semantics of terminal information messages as well as procedures to use them for in-band negotiation at the start of or during communication. The messages cover receiving and transmitting capabilities as well as mode preference from the receiving end, logical channel signalling, and Control & Indication. Acknowledged signalling procedures are specified to ensure reliable audiovisual and data communication.

This Recommendation covers a wide range of applications, including storage/retrieval, messaging and distribution services as well as conversational. It applies to, but is not limited to, multimedia systems that use the multiplexes defined in Recommendations H.222.0, H.223 and H.225.0. These different systems share the same syntax and semantics, and are therefore bit-wise compatible. Some of the procedures are applicable to all systems, while the others are more specific to particular systems.

The different systems that make use of this Recommendation may specify the use of different transport protocols. However, it is intended to be used with a reliable transport layer, that is, one that provides guaranteed delivery of correct data.

NOTE – There should be no confusion with the T.120 management system, which is carried within the data stream, and covers different functionalities from those described here – the H.245 stream and the T.120-data stream are complementary.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of the 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] CCITT Recommendation G.711 (1988), *Pulse code modulation (PCM) of voice frequencies.*

[2] CCITT Recommendation G.722 (1988), *7 kHz audio-coding within 64 kbit/s.*

[3] ITU-T Recommendation G.723.1 (1996), *Dual rate speech coder for multimedia communication transmitting at 5.3 and 6.3 kbit/s.*

[4] CCITT Recommendation G.728 (1992), *Coding of speech at 16 kbit/s using low-delay code excited linear prediction.*

[5] ITU-T Recommendation H.221 (1997), *Frame structure for a 64 to 1920 kbit/s channel in audiovisual teleservices.*

[6] ITU-T Recommendation H.222.0 (1995) | ISO/IEC 13818-1:1996, *Information Technology – Generic coding of moving pictures and associated audio information: Systems.*

[7] ITU-T Recommendation H.222.1 (1996), *Multimedia multiplex and synchronization for audiovisual communication in ATM environments.*

[8] ITU-T Recommendation H.223 (1996), *Multiplexing protocol for low bit rate multimedia communication.*

[9] ITU-T Recommendation H.224 (1994), *A real time control protocol for simplex applications using the H.221 LSD/HSD/MLP channels.*

[10] ITU-T Recommendation H.230 (1997), *Frame-synchronous control and indication signals for audiovisual systems.*

[11] ITU-T Recommendation H.233 (1995), *Confidentiality system for audiovisual services.*

[12] ITU-T Recommendation H.234 (1994), *Encryption key management and authentication system for audiovisual services.*

[13] ITU-T Recommendation H.261 (1993), *Video codec for audiovisual services at p × 64 kbit/s.*

[14] ITU-T Recommendation H.262/Amd.1 (1996) | ISO/IEC 13818-2/Amd.1:1997, *Registration of copyright identifier.*

[15] ITU-T Recommendation H.263 (1996), *Video coding for low bit rate communication.*

[16] ITU-T Recommendation H.281 (1994), *A far end camera control protocol for videoconferences using H.224.*

[17] ITU-T Recommendation H.320 (1997), *Narrow-band visual telephone systems and terminal equipment.*

[18] ITU-T Recommendation H.324 (1996), *Terminal for low bit rate multimedia communication.*

[19] ITU-T Recommendation I.363/Add.1 (1993), *B-ISDN ATM Adaptation Layer (AAL) specification.*

[20] ITU-T Recommendation Q.2931 (1995), *Digital Subscriber Signalling System No. 2 – User Network Interface (UNI) layer 3 specification for basic call/connection control.*

[21] ITU-T Recommendation T.30 (1996), *Procedures for document facsimile transmission in the general switched telephone network.*

[22] CCITT Recommendation T.35 (1991), *Procedure for the allocation of CCITT defined codes for non-standard facilities.*

[23] CCITT Recommendation T.51 (1992), *Latin based coded character sets for telematic services.*

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

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

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

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

[28] ITU-T Recommendation V.34 (1996), *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.*

[29] ITU-T Recommendation V.42 (1996), *Error-correcting procedures for DCEs using asynchronous-to-synchronous conversion.*

[30] ITU-T Recommendation X.680 (1994), *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*

[31] ITU-T Recommendation X.691 (1995), *Information technology – ASN.1 encoding rules – Specification of Packed Encoding Rules (PER).*

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

[33] ISO/IEC 11172-2:1993, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s – Part 2: Video.*

[34] ISO/IEC 11172-3:1993, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s – Part 3: Audio.*

[35] ISO/IEC 13818-3:1995, *Information technology – Generic coding of moving pictures and associated audio information – Part 3: Audio.*

[36] ISO/IEC 13818-6[1], *Information technology – Generic coding of moving pictures and associated audio – Part 6: Extensions for DSM-CC.*

[37] ISO/IEC TR 9577:1996, *Information technology – Protocol identification in the network layer.*

[38] ITU-T Recommendation H.225.0 (1996), *Media stream packetization and synchronization on non-guaranteed quality of service LANs.*

[39] ITU-T Recommendation H.323 (1996), *Visual telephone systems and equipment for local area networks which provide a non-guaranteed quality of service.*

[40] ITU-T Recommendation H.243 (1997), *Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 1920 kbit/s.*

[41] ITU-T Recommendation H.230 (1997), *Frame-synchronous control and indication signals for audiovisual systems.*

[42] ITU-T Recommendation T.123 (1996), *Network specific data protocol stacks for multimedia conferencing.*

[43] ITU-T Recommendation E.164 (1997), *The international public telecommunication numbering plan.*

3 Definitions

This Recommendation defines the following terms:

3.1 bi-directional logical channel: A bi-directional logical channel consists of a pair of associated transmission paths between two terminals, one in each direction of transmission.

3.2 capability: A terminal has a particular capability if it is able to encode and transmit or receive and decode that particular signal.

3.3 channel: A channel is a uni-directional link between two-end points.

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[1] Presently at the stage of draft

3.4 command: A command is a message that requires action but no explicit response.

3.5 elementary stream: Elementary Stream is a generic term for a coded video, coded audio or other coded bitstream.

3.6 entry: The word entry is used to refer to elements in sets or tables, such as capability sets and multiplex tables.

3.7 forward: Forward is used to refer to transmission directed from the terminal making the request for a bi-directional logical channel to the other terminal.

3.8 in-band: In-band messages are those that are transported within the channel or logical channel to which they refer.

3.9 incoming: An Incoming Signalling Entity cannot initiate a procedure, but responds to messages from the remote Signalling Entity and its own user's primitives.

3.10 indication: An indication is a message that contains information but does not require action or response.

3.11 logical channel: A logical channel is a uni-directional path or bi-directional path for the transmission of information.

3.12 logical channel number: A logical channel number is a number that identifies a single logical channel.

3.13 logical channel signalling: Logical channel signalling is a set of procedures that are used to open and close logical channels.

3.14 master terminal: A master terminal is the terminal that is determined as being the master terminal by the master-slave determination procedure defined in this Recommendation, or by some other procedure.

3.15 medium type: A medium type is a single form of information that is presented to a user or the data representing that information: video, audio and text are example Medium Types.

3.16 mode: A mode is a set of elementary streams that a terminal is transmitting, intends to transmit, or would like to receive.

3.17 multimedia communication: Multimedia communication refers to the transmission and/or reception of signals of two or more Medium Types simultaneously.

3.18 non-standard: Not conforming to a national or international standard referenced in this Recommendation.

3.19 outgoing: An Outgoing Signalling Entity is one which initiates a procedure.

3.20 multipoint: Multipoint refers to the simultaneous interconnection of three or more terminals to allow communication among several sites through the use of multipoint control units (bridges) that centrally direct the flow of information.

3.21 request: A request is a message that results in action by the remote terminal and requires an immediate response from it.

3.22 response: A response is a message that is the response to a request.

3.23 reverse: Reverse is used to refer to transmission directed from the terminal receiving a request for a bi-directional logical channel to the terminal making the request.

3.24 session: A session is a period of communication between two terminals which may be conversational or non-conversational (for example retrieval from a database).

3.25 slave terminal: A slave terminal is the terminal that is determined as being the slave terminal by the master-slave determination procedure defined in this Recommendation, or by some other procedure.

3.26 support: The ability to operate in a given mode, however a requirement to support a mode does not mean that the mode must actually be used at all times: unless prohibited, other modes may be used by mutual negotiation.

3.27 terminal: A terminal is any endpoint and may be a user's terminal or some other communication system such as an MCU or an information server.

3.28 TSAP identifier: The piece of information used to multiplex several transport connections of the same type on a single H.323 entity with all transport connections sharing the same LAN address, (e. g. the port number in a TCP/UDP/IP environment). TSAP identifiers may be (pre)assigned by some international authority or may be allocated dynamically during set-up of a call. Dynamically assigned TSAP identifiers are of transient nature, i. e. their values are only valid for the duration of a single call.

3.29 uni-directional logical channel: A uni-directional logical channel is a path for the transmission of a single elementary stream from one terminal to another.

4 Abbreviations

This Recommendation uses the following abbreviations:

AAL	ATM Adaptation Layer
AL1, 2, 3	H.223 Adaptation Layers 1, 2 and 3
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
B-LCSE	Bi-directional Logical Channel Signalling Entity
CESE	Capability Exchange Signalling Entity
CIF	Common Intermediate Format (of a video picture: refer to Recommendations H.261 and H.263)
CLCSE	Close Logical Channel Signalling Entity
CPCS	Common Part Convergence Sublayer (of ATM Adaptation Layer 5)
DSM-CC	Digital Storage Media – Command and Control
DTMF	Dual Tone Multi-Frequency
GOB	Group of Blocks (of a video picture: refer to Recommendations H.261 and H.263)
GSTN	General Switched Telephone Network
HDLC	High-level Data Link Control
HRD	Hypothetical Reference Decoder (refer to Recommendations H.261 and H.263)
IV	Initialization Vector (used for encryption: refer to Recommendations H.233 and H.234)
LAPM	Link Access Protocol for Modems
LCSE	Logical Channel Signalling Entity
MC	H.323 Multipoint Control Entity
MCU	Multipoint Control Unit
MLSE	Maintenance Loop Signalling Entity
MPI	Minimum Picture Interval

MRSE	Mode Request Signalling Entity
MSDSE	Master Slave Determination Signalling Entity
MTSE	Multiplex Table Signalling Entity
PCR	Program Clock Reference (refer to ITU-T Rec. H.222.0 | ISO/IEC 13818-1)
PID	Packet Identifier (refer to ITU-T Rec. H.222.0 | ISO/IEC 13818-1)
QCIF	Quarter CIF
RMESE	Request Multiplex Entry Signalling Entity
RTCP	Real-time Transport Control Protocol
RTDSE	Round Trip Delay Signalling Entity
RTP	Real-time Transport Protocol
SDL	Specification and Description Language
SDU	Service Data Unit
SE	Session Exchange message (used for encryption: refer to Recommendations H.233 and H.234)
SQCIF	Sub QCIF
STD	System Target Decoder (refer to ITU-T Rec. H.222.0 | ISO/IEC 13818-1)
VC	ATM Virtual Channel

5 General

This Recommendation provides a number of different services, some of which are expected to be applicable to all terminals that use it and some that are more specific to particular ones. Procedures are defined to allow the exchange of audiovisual and data capabilities; to request the transmission of a particular audiovisual and data mode; to manage the logical channels used to transport the audiovisual and data information; to establish which terminal is the master terminal and which is the slave terminal for the purposes of managing logical channels; to carry various control and indication signals; to control the bit rate of individual logical channels and the whole multiplex; and to measure the round trip delay, from one terminal to the other and back. These procedures are explained in more detail below.

Following this general introduction, there are subclauses detailing the message syntax and semantics and the procedures. The syntax has been defined using ASN.1 notation [30] and the semantics define the meaning of syntax elements as well as providing syntactic constraints that are not specified in the ASN.1 syntax. The procedures subclause defines the protocols that use the messages defined in the other subclauses.

Although not all of the messages and procedures defined in this Recommendation will be applicable to all terminals, no indication of such restrictions is given here. These restrictions are the responsibility of the recommendations that use this Recommendation.

This Recommendation has been defined to be independent of the underlying transport mechanism, but is intended to be used with a reliable transport layer, that is, one that provides guaranteed delivery of correct data.

5.1 Master-slave determination

Conflicts may arise when two terminals involved in a call initiate similar events simultaneously and only one such event is possible or desired, for example, when resources are available for only one

occurrence of the event. To resolve such conflicts, one terminal shall act as a master and the other terminal shall act as a slave terminal. Rules specify how the master and slave terminal shall respond at times of conflict.

The master-slave determination procedure allow terminals in a call to determine which terminal is the master and which terminal is the slave. The terminal status, once determined, remains constant for the call duration.

5.2 Capability exchange

The capability exchange procedures are intended to ensure that the only multimedia signals to be transmitted are those that can be received and treated appropriately by the receive terminal. This requires that the capabilities of each terminal to receive and decode be known to the other terminal. It is not necessary that a terminal understand or store all incoming capabilities; those that are not understood, or can not be used shall be ignored, and no fault shall be considered to have occurred.

The total capability of a terminal to receive and decode various signals is made known to the other terminal by transmission of its capability set.

Receive capabilities describe the terminal's ability to receive and process incoming information streams. Transmitters shall limit the content of their transmitted information to that which the receiver has indicated it is capable of receiving. The absence of a receive capability indicates that the terminal cannot receive (is a transmitter only).

Transmit capabilities describe the terminal's ability to transmit information streams. Transmit capabilities serve to offer receivers a choice of possible modes of operation, so that the receiver may request the mode which it prefers to receive. The absence of a transmit capability indicates that the terminal is not offering a choice of preferred modes to the receiver (but it may still transmit anything within the capability of the receiver).

These capability sets provide for more than one stream of a given medium type to be sent simultaneously. For example, a terminal may declare its ability to receive (or send) two independent H.262 video streams and two independent G.722 audio streams at the same time. Capability messages have been defined to allow a terminal to indicate that it does not have fixed capabilities, but that they depend on which other modes are being used simultaneously. For example, it is possible to indicate that higher resolution video can be decoded when a simpler audio algorithm is used; or that either two low resolution video sequences can be decoded or a single high resolution one. It is also possible to indicate trade-offs between the capability to transmit and the capability to receive.

Non-standard capabilities and control messages may be issued using the NonStandardParameter structure. 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.

5.3 Logical channel signalling procedures

An acknowledged protocol is defined for the opening and closing of logical channels which carry the audiovisual and data information. The aim of these procedures is to ensure that a terminal is capable of receiving and decoding the data that will be transmitted on a logical channel at the time the logical channel is opened rather than at the time the first data is transmitted on it; and to ensure that the receive terminal is ready to receive and decode the data that will be transmitted on the logical channel before that transmission starts. The OpenLogicalChannel message includes a description of the data to be transported, for example, H.262 MP@ML at 6 Mbit/s. Logical channels should only be opened when there is sufficient capability to receive data on all open logical channels simultaneously.

A part of this protocol is concerned with the opening of bi-directional channels. To avoid conflicts which may arise when two terminals initiate similar events simultaneously, one terminal is defined as the master terminal, and the other as the slave terminal. A protocol is defined to establish which terminal is the master and which is the slave. However, systems that use this Recommendation may specify the procedure specified in this Recommendation or another means of determining which terminal is the master and which is the slave.

5.4 Receive terminal close logical channel request

A logical channel is opened and closed from the transmitter side. A mechanism is defined which allows a receive terminal to request the closure of an incoming logical channel. The transmit terminal may accept or reject the logical channel closure request. A terminal may, for example, use these procedures to request the closure of an incoming logical channel which, for whatever reason, cannot be decoded. These procedures may also be used to request the closure of a bi-directional logical channel by the terminal that did not open the channel.

5.5 H.223 multiplex table entry modification

The H.223 multiplex table associates each octet within an H.223 MUX message with a particular logical channel number. The H.223 multiplex table may have up to 15 entries. A mechanism is provided that allows the transmit terminal to specify and inform the receiver of new H.223 multiplex table entries. A receive terminal may also request the retransmission of a multiplex table entry.

5.6 Audiovisual and data mode request

When the capability exchange protocol has been completed, both terminals will be aware of each other's capability to transmit and receive as specified in the capability descriptors that have been exchanged. It is not mandatory for a terminal to declare all its capabilities; it need only declare those that it wishes to be used.

A terminal may indicate its capabilities to transmit. A terminal that receives transmission capabilities from the remote terminal may request a particular mode to be transmitted to it. A terminal indicates that it does not want its transmission mode to be controlled by the remote terminal by sending no transmission capabilities.

5.7 Round trip delay determination

It may be useful in some applications to have knowledge of the round trip delay between a transmit terminal and a receive terminal. A mechanism is provided to measure this round trip delay. This mechanism may also be useful as a means to detect whether the remote terminal is still functioning.

5.8 Maintenance loops

Procedures are specified to establish maintenance loops. It is possible to specify the loop of a single logical channel either as a digital loop or decoded loop, and the loop of the whole multiplex.

5.9 Commands and indications

Commands and indications are provided for various purposes: video/audio active/inactive signals to inform the user; fast update request for source switching in multipoint applications are some examples. Neither commands nor indications elicit response messages from the remote terminal. Commands force an action at the remote terminal whilst indications merely provide information and do not force any action.

A command is defined to allow the bit rate of logical channels and the whole multiplex to be controlled from the remote terminal. This has a number of purposes: interworking with terminals using multiplexes in which only a finite number of bit rates are available; multi-point applications where the rates from different sources should be matched; and flow control in congested networks.

6 Messages: syntax

This clause specifies the syntax of messages using the notation defined in ASN.1 [30]. Messages shall be encoded for transmission by applying the packed encoding rules specified in [31] using the basic aligned variant. The first bit in each octet which is transmitted is the most significant bit of the octet as is specified in Recommendation X.691.

```
MULTIMEDIA-SYSTEM-CONTROL DEFINITIONS AUTOMATIC TAGS ::=
BEGIN

-- Export all symbols

-- ================================================================================
-- Top level Messages
-- ================================================================================

MultimediaSystemControlMessage          ::=CHOICE
{
        request                         RequestMessage,
        response                        ResponseMessage,
        command                         CommandMessage,
        indication                      IndicationMessage,
        ...
}

-- A RequestMessage results in action and requires an immediate response

RequestMessage     ::=CHOICE
{
        nonStandard                     NonStandardMessage,

        masterSlaveDetermination        MasterSlaveDetermination,

        terminalCapabilitySet           TerminalCapabilitySet,

        openLogicalChannel              OpenLogicalChannel,
        closeLogicalChannel             CloseLogicalChannel,

        requestChannelClose             RequestChannelClose,
```

```
        multiplexEntrySend              MultiplexEntrySend,

        requestMultiplexEntry           RequestMultiplexEntry,

        requestMode                     RequestMode,

        roundTripDelayRequest           RoundTripDelayRequest,

        maintenanceLoopRequest          MaintenanceLoopRequest,

        ...,
        communicationModeRequest        CommunicationModeRequest,
        conferenceRequest               ConferenceRequest
}

-- A ResponseMessage is the response to a request Message

ResponseMessage   ::=CHOICE
{
        nonStandard                     NonStandardMessage,

        masterSlaveDeterminationAck     MasterSlaveDeterminationAck,
        masterSlaveDeterminationReject  MasterSlaveDeterminationReject,

        terminalCapabilitySetAck        TerminalCapabilitySetAck,
        terminalCapabilitySetReject     TerminalCapabilitySetReject,

        openLogicalChannelAck           OpenLogicalChannelAck,
        openLogicalChannelReject        OpenLogicalChannelReject,
        closeLogicalChannelAck          CloseLogicalChannelAck,

        requestChannelCloseAck          RequestChannelCloseAck,
        requestChannelCloseReject       RequestChannelCloseReject,

        multiplexEntrySendAck           MultiplexEntrySendAck,
        multiplexEntrySendReject        MultiplexEntrySendReject,

        requestMultiplexEntryAck        RequestMultiplexEntryAck,
        requestMultiplexEntryReject     RequestMultiplexEntryReject,

        requestModeAck                  RequestModeAck,
        requestModeReject               RequestModeReject,

        roundTripDelayResponse          RoundTripDelayResponse,

        maintenanceLoopAck              MaintenanceLoopAck,
        maintenanceLoopReject           MaintenanceLoopReject,

        ...,
        communicationModeResponse       CommunicationModeResponse,

        conferenceResponse              ConferenceResponse
}
-- A CommandMessage requires action, but no explicit response

CommandMessage                  ::=CHOICE
{
        nonStandard                     NonStandardMessage,

        maintenanceLoopOffCommand       MaintenanceLoopOffCommand,
```

```
        sendTerminalCapabilitySet       SendTerminalCapabilitySet,
        encryptionCommand               EncryptionCommand,
        flowControlCommand              FlowControlCommand,
        endSessionCommand               EndSessionCommand,
        miscellaneousCommand            MiscellaneousCommand,
        ...,
        communicationModeCommand        CommunicationModeCommand,
        conferenceCommand               ConferenceCommand
}
-- An IndicationMessage is information that does not require action or response

IndicationMessage                       ::=CHOICE
{
        nonStandard                     NonStandardMessage,
        functionNotUnderstood           FunctionNotUnderstood,
        masterSlaveDeterminationRelease MasterSlaveDeterminationRelease,
        terminalCapabilitySetRelease    TerminalCapabilitySetRelease,
        openLogicalChannelConfirm       OpenLogicalChannelConfirm,
        requestChannelCloseRelease      RequestChannelCloseRelease,
        multiplexEntrySendRelease       MultiplexEntrySendRelease,
        requestMultiplexEntryRelease    RequestMultiplexEntryRelease,
        requestModeRelease              RequestModeRelease,
        miscellaneousIndication         MiscellaneousIndication,
        jitterIndication                JitterIndication,
        h223SkewIndication              H223SkewIndication,
        newATMVCIndication              NewATMVCIndication,
        userInput                       UserInputIndication,
        ...,
        h2250MaximumSkewIndication      H2250MaximumSkewIndication,
        mcLocationIndication            MCLocationIndication,
        conferenceIndication            ConferenceIndication,
        vendorIdentification            VendorIdentification,
        functionNotSupported            FunctionNotSupported
}

-- SequenceNumber is defined here as it is used in a number of Messages
```

```
SequenceNumber                  ::=INTEGER (0..255)

-- ================================================================================
-- Non standard Message definitions
-- ================================================================================

NonStandardMessage              ::=SEQUENCE
{
        nonStandardData         NonStandardParameter,
        ...
}

NonStandardParameter            ::=SEQUENCE
{
        nonStandardIdentifier   NonStandardIdentifier,
        data                    OCTET STRING
}

NonStandardIdentifier           ::=CHOICE
{
        object                  OBJECT IDENTIFIER,
        h221NonStandard         SEQUENCE
        {
                t35CountryCode  INTEGER (0..255),       -- country, per T.35
                t35Extension    INTEGER (0..255),       -- assigned nationally
                manufacturerCode INTEGER (0..65535)     -- assigned nationally
        }
}

-- ================================================================================
-- Master-slave determination definitions
-- ================================================================================

MasterSlaveDetermination        ::=SEQUENCE
{
        terminalType            INTEGER (0..255),
        statusDeterminationNumber INTEGER (0..16777215),
        ...
}

MasterSlaveDeterminationAck     ::=SEQUENCE
{
        decision                CHOICE
        {
                master          NULL,
                slave           NULL
        },
        ...
}

MasterSlaveDeterminationReject  ::=SEQUENCE
{
        cause                   CHOICE
        {
                identicalNumbers NULL,
                ...
        },
        ...
}
```

```
MasterSlaveDeterminationRelease          ::=SEQUENCE
{
        ...
}

-- ========================================================================
-- Capability exchange definitions
-- ========================================================================

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,

        ...
}

V75Capability                            ::=SEQUENCE
{
        audioHeader                      BOOLEAN,
        ...
}

CapabilityTableEntry                     ::=SEQUENCE
{
        capabilityTableEntryNumber       CapabilityTableEntryNumber,
        capability                       Capability OPTIONAL
}

CapabilityDescriptor                     ::=SEQUENCE
{
        capabilityDescriptorNumber       CapabilityDescriptorNumber,
        simultaneousCapabilities         SET SIZE (1..256) OF AlternativeCapabilitySet OPTIONAL
}

AlternativeCapabilitySet                 ::=SEQUENCE SIZE (1..256) OF CapabilityTableEntryNumber

CapabilityTableEntryNumber               ::=INTEGER (1..65535)

CapabilityDescriptorNumber               ::=INTEGER (0..255)

TerminalCapabilitySetAck                 ::=SEQUENCE
{
        sequenceNumber                   SequenceNumber,
        ...
}
```

```
TerminalCapabilitySetReject                    ::=SEQUENCE
{
        sequenceNumber                         SequenceNumber,
        cause                                  CHOICE
        {
                unspecified                    NULL,
                undefinedTableEntryUsed        NULL,
                descriptorCapacityExceeded     NULL,
                tableEntryCapacityExceeded     CHOICE
                {
                        highestEntryNumberProcessed   CapabilityTableEntryNumber,
                        noneProcessed                 NULL
                },
                ...
        },
        ...
}

TerminalCapabilitySetRelease                   ::=SEQUENCE
{
        ...
}

-- ================================================================================
-- Capability exchange definitions: top level capability description
-- ================================================================================

Capability                                     ::=CHOICE
{
        nonStandard                            NonStandardParameter,

        receiveVideoCapability                 VideoCapability,
        transmitVideoCapability                VideoCapability,
        receiveAndTransmitVideoCapability      VideoCapability,

        receiveAudioCapability                 AudioCapability,
        transmitAudioCapability                AudioCapability,
        receiveAndTransmitAudioCapability      AudioCapability,

        receiveDataApplicationCapability       DataApplicationCapability,
        transmitDataApplicationCapability      DataApplicationCapability,
        receiveAndTransmitDataApplicationCapability   DataApplicationCapability,

        h233EncryptionTransmitCapability       BOOLEAN,
        h233EncryptionReceiveCapability        SEQUENCE
        {
                h233IVResponseTime             INTEGER (0..255),        -- units milliseconds
                ...
        },
        ...,
        conferenceCapability                   ConferenceCapability

}
```

```
-- ================================================================================
-- Capability exchange definitions: Multiplex capabilities
-- ================================================================================

MultiplexCapability                         ::=CHOICE
{
        nonStandard                         NonStandardParameter,
        h222Capability                      H222Capability,
        h223Capability                      H223Capability,
        v76Capability                       V76Capability,
        ...,
        h2250Capability                     H2250Capability

}

H222Capability                              ::= SEQUENCE
{
        numberOfVCs                         INTEGER (1..256),
        vcCapability                        SET OF VCCapability,
        ...
}

VCCapability                                ::=SEQUENCE
{
        aal1                                SEQUENCE
        {
                nullClockRecovery           BOOLEAN,
                srtsClockRecovery           BOOLEAN,
                adaptiveClockRecovery       BOOLEAN,
                nullErrorCorrection         BOOLEAN,
                longInterleaver             BOOLEAN,
                shortInterleaver            BOOLEAN,
                errorCorrectionOnly         BOOLEAN,
                structuredDataTransfer      BOOLEAN,
                partiallyFilledCells        BOOLEAN,
                ...
        } OPTIONAL,
        aal5                                SEQUENCE
        {
                forwardMaximumSDUSize       INTEGER (0..65535),  -- units octets
                backwardMaximumSDUSize      INTEGER (0..65535),  -- units octets
                ...
        } OPTIONAL,
        transportStream                     BOOLEAN,
        programStream                       BOOLEAN,
        availableBitRates                   SEQUENCE
        {
                type                        CHOICE
                {
                        singleBitRate       INTEGER (1..65535),  -- units 64 kbit/s
                        rangeOfBitRates     SEQUENCE
                        {
                                lowerBitRate    INTEGER (1..65535),     -- units 64 kbit/s
                                higherBitRate   INTEGER (1..65535)      -- units 64 kbit/s
                        }
                },
                ...
        },
        ...
}
```

```
H223Capability                          ::=SEQUENCE
{
    transportWithI-frames               BOOLEAN,        -- I-frame transport of H.245

    videoWithAL1                        BOOLEAN,
    videoWithAL2                        BOOLEAN,
    videoWithAL3                        BOOLEAN,
    audioWithAL1                        BOOLEAN,
    audioWithAL2                        BOOLEAN,
    audioWithAL3                        BOOLEAN,
    dataWithAL1                         BOOLEAN,
    dataWithAL2                         BOOLEAN,
    dataWithAL3                         BOOLEAN,

    maximumAl2SDUSize                   INTEGER (0..65535), -- units octets
    maximumAl3SDUSize                   INTEGER (0..65535), -- units octets

    maximumDelayJitter                  INTEGER (0..1023),  -- units milliseconds

    h223MultiplexTableCapability        CHOICE
    {
        basic                           NULL,
        enhanced                        SEQUENCE
        {
            maximumNestingDepth         INTEGER (1..15),
            maximumElementListSize      INTEGER (2..255),
            maximumSubElementListSize   INTEGER (2..255),
            ...
        }
    },
    ...,
    maxMUXPDUSizeCapability             BOOLEAN
}

V76Capability                           ::=SEQUENCE
{
    suspendResumeCapabilitywAddress     BOOLEAN,
    suspendResumeCapabilitywoAddress    BOOLEAN,
    rejCapability                       BOOLEAN,
    sREJCapability                      BOOLEAN,
    mREJCapability                      BOOLEAN,
    crc8bitCapability                   BOOLEAN,
    crc16bitCapability                  BOOLEAN,
    crc32bitCapability                  BOOLEAN,
    uihCapability                       BOOLEAN,
    numOfDLCS                           INTEGER (2..8191),
    twoOctetAddressFieldCapability      BOOLEAN,
    loopBackTestCapability              BOOLEAN,
    n401Capability                      INTEGER (1..4095),
    maxWindowSizeCapability             INTEGER (1..127),
    v75Capability                       V75Capability,
    ...
}

H2250Capability                         ::=SEQUENCE
{
    maximumAudioDelayJitter             INTEGER(0..1023),   -- units in milliseconds
    receiveMultipointCapability         MultipointCapability,
    transmitMultipointCapability        MultipointCapability,
    receiveAndTransmitMultipointCapability  MultipointCapability,
    mcCapability                        SEQUENCE
```

```
        {
                centralizedConferenceMC         BOOLEAN,
                decentralizedConferenceMC       BOOLEAN,
                ...
        },
        rtcpVideoControlCapability              BOOLEAN,        -- FIR and NACK
        mediaPacketizationCapability            MediaPacketizationCapability,
        ...
}

MediaPacketizationCapability                    ::=SEQUENCE
{
        h261aVideoPacketization                 BOOLEAN,
        ...
}

MultipointCapability                            ::=SEQUENCE
{
        multicastCapability                     BOOLEAN,
        multiUniCastConference                  BOOLEAN,
        mediaDistributionCapability             SEQUENCE OF MediaDistributionCapability,
        ...
}

MediaDistributionCapability                     ::=SEQUENCE
{
        centralizedControl                      BOOLEAN,
        distributedControl                      BOOLEAN,        -- for further study in H.323
        centralizedAudio                        BOOLEAN,
        distributedAudio                        BOOLEAN,
        centralizedVideo                        BOOLEAN,
        distributedVideo                        BOOLEAN,
        centralizedData                         SEQUENCE OF DataApplicationCapability OPTIONAL,
        distributedData                         SEQUENCE OF DataApplicationCapability OPTIONAL,
                                                        -- for further study in H.323
        ...
}

H223AnnexACapability                            ::=SEQUENCE
{
        transferWithI-frames                    BOOLEAN,        -- I-frame transport of H.245

        videoWithAL1M                           BOOLEAN,
        videoWithAL2M                           BOOLEAN,
        videoWithAL3M                           BOOLEAN,
        audioWithAL1M                           BOOLEAN,
        audioWithAL2M                           BOOLEAN,
        audioWithAL3M                           BOOLEAN,
        dataWithAL1M                            BOOLEAN,
        dataWithAL2M                            BOOLEAN,
        dataWithAL3M                            BOOLEAN,

        maximumAL2MSDUSize                      INTEGER (0..65535),  -- units octets
        maximumAL3MSDUSize                      INTEGER (0..65535),  -- units octets

        maximumDelayJitter                      INTEGER (0..1023),   -- units milliseconds

        reconfigurationCapability               BOOLEAN,
```

```
        h223AnnexAMultiplexTableCapability      CHOICE          -- identical to H.223
        {
                basic                           NULL,
                enhanced                        SEQUENCE
                {
                        maximumNestingDepth     INTEGER (1..15),
                        maximumElementListSize  INTEGER (2..255),
                        maximumSubElementListSize INTEGER (2..255),
                        ...
                },
                ...
        },
        ...
}

-- ================================================================================
-- Capability exchange definitions: Video capabilities
-- ================================================================================

VideoCapability                         ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        h261VideoCapability             H261VideoCapability,
        h262VideoCapability             H262VideoCapability,
        h263VideoCapability             H263VideoCapability,
        is11172VideoCapability          IS11172VideoCapability,
        ...
}

H261VideoCapability                     ::=SEQUENCE
{
        qcifMPI                         INTEGER (1..4) OPTIONAL,        -- units 1/29.97 Hz
        cifMPI                          INTEGER (1..4) OPTIONAL,        -- units 1/29.97 Hz
        temporalSpatialTradeOffCapability BOOLEAN,
        maxBitRate                      INTEGER (1..19200),             -- units of 100 bit/s
        stillImageTransmission          BOOLEAN,                        -- Annex D of H.261
        ...
}

H262VideoCapability                     ::=SEQUENCE
{
        profileAndLevel-SPatML          BOOLEAN,
        profileAndLevel-MPatLL          BOOLEAN,
        profileAndLevel-MPatML      BOOLEAN,
        profileAndLevel-MPatH-14        BOOLEAN,
        profileAndLevel-MPatHL          BOOLEAN,
        profileAndLevel-SNRatLL         BOOLEAN,
        profileAndLevel-SNRatML         BOOLEAN,
        profileAndLevel-SpatialatH-14   BOOLEAN,
        profileAndLevel-HPatML          BOOLEAN,
        profileAndLevel-HPatH-14        BOOLEAN,
        profileAndLevel-HPatHL          BOOLEAN,
        videoBitRate                    INTEGER (0.. 1073741823) OPTIONAL,      -- units 400 bit/s
        vbvBufferSize                   INTEGER (0.. 262143) OPTIONAL,          -- units 16384 bits
        samplesPerLine                  INTEGER (0..16383) OPTIONAL,            -- units samples/line
        linesPerFrame                   INTEGER (0..16383) OPTIONAL,            -- units lines/frame
        framesPerSecond                 INTEGER (0..15) OPTIONAL,               -- frame_rate_code
        luminanceSampleRate             INTEGER (0..4294967295) OPTIONAL,       -- units samples/sec
        ...
}
```

```
H263VideoCapability                     ::=SEQUENCE
{
        sqcifMPI                        INTEGER (1..32) OPTIONAL,       -- units 1/29.97 Hz
        qcifMPI                         INTEGER (1..32) OPTIONAL,       -- units 1/29.97 Hz
        cifMPI                          INTEGER (1..32) OPTIONAL,       -- units 1/29.97 Hz
        cif4MPI                         INTEGER (1..32) OPTIONAL,       -- units 1/29.97 Hz
        cif16MPI                        INTEGER (1..32) OPTIONAL,       -- units 1/29.97 Hz
        maxBitRate                      INTEGER (1..192400),            -- units 100 bit/s
        unrestrictedVector              BOOLEAN,
        arithmeticCoding                BOOLEAN,
        advancedPrediction              BOOLEAN,
        pbFrames                        BOOLEAN,
        temporalSpatialTradeOffCapability BOOLEAN,
        hrd-B                           INTEGER (0..524287) OPTIONAL,   -- units 128 bits
        bppMaxKb                        INTEGER (0..65535) OPTIONAL,    -- units 1024 bits
        ...,

        slowSqcifMPI                    INTEGER (1..3600) OPTIONAL,     -- units seconds/frame
        slowQcifMPI                     INTEGER (1..3600) OPTIONAL,     -- units seconds/frame
        slowCifMPI                      INTEGER (1..3600) OPTIONAL,     -- units seconds/frame
        slowCif4MPI                     INTEGER (1..3600) OPTIONAL,     -- units seconds/frame
        slowCif16MPI                    INTEGER (1..3600) OPTIONAL,     -- units seconds/frame
        errorCompensation               BOOLEAN
}

IS11172VideoCapability                  ::=SEQUENCE
{
        constrainedBitstream            BOOLEAN,
        videoBitRate                    INTEGER (0.. 1073741823) OPTIONAL,      -- units 400 bit/s
        vbvBufferSize                   INTEGER (0.. 262143) OPTIONAL,          -- units 16384 bits
        samplesPerLine                  INTEGER (0..16383) OPTIONAL,            -- units samples/line
        linesPerFrame                   INTEGER (0..16383) OPTIONAL,            -- units lines/frame
        pictureRate                     INTEGER (0..15) OPTIONAL,
        luminanceSampleRate             INTEGER (0..4294967295) OPTIONAL,       -- units samples/sec
        ...
}

-- ================================================================================
-- Capability exchange definitions: Audio capabilities
-- ================================================================================

-- For an H.222 multiplex, the integers indicate the size of the STD buffer in units of 256 octets
-- For an H.223 multiplex, the integers indicate the maximum number of audio frames per AL-SDU
-- For an H.225.0 multiplex, the integers indicate the maximum number of audio frames per packet

AudioCapability                         ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        g711Alaw64k                     INTEGER (1..256),
        g711Alaw56k                     INTEGER (1..256),
        g711Ulaw64k                     INTEGER (1..256),
        g711Ulaw56k                     INTEGER (1..256),

        g722-64k                        INTEGER (1..256),
        g722-56k                        INTEGER (1..256),
        g722-48k                        INTEGER (1..256),

        g7231                           SEQUENCE
        {
                maxAl-sduAudioFrames    INTEGER (1..256),
                silenceSuppression      BOOLEAN
```

```
        },

        g728                            INTEGER (1..256),
        g729                            INTEGER (1..256),
        g729AnnexA                      INTEGER (1..256),
        is11172AudioCapability          IS11172AudioCapability,
        is13818AudioCapability          IS13818AudioCapability,
        ...,
        g729wAnnexB                     INTEGER(1..256),
        g729AnnexAwAnnexB               INTEGER(1..256),
        g7231AnnexCCapability           G7231AnnexCCapability
}

G7231AnnexCCapability                   ::= SEQUENCE
{
        maxAl-sduAudioFrames            INTEGER (1..256),
        silenceSuppression              BOOLEAN,
        g723AnnexCAudioMode             SEQUENCE
        {
                highRateMode0           INTEGER (27..78),       -- units octets
                highRateMode1           INTEGER (27..78),       -- units octets
                lowRateMode0            INTEGER (23..66),       -- units octets
                lowRateMode1            INTEGER (23..66),       -- units octets
                sidMode0                INTEGER (6..17),        -- units octets
                sidMode1                INTEGER (6..17),        -- units octets
                ...
        } OPTIONAL,
        ...
}

IS11172AudioCapability                  ::=SEQUENCE
{
        audioLayer1                     BOOLEAN,
        audioLayer2                     BOOLEAN,
        audioLayer3                     BOOLEAN,

        audioSampling32k                BOOLEAN,
        audioSampling44k1               BOOLEAN,
        audioSampling48k                BOOLEAN,

        singleChannel                   BOOLEAN,
        twoChannels                     BOOLEAN,

        bitRate                         INTEGER (1..448),       -- units kbit/s
        ...
}

IS13818AudioCapability                  ::=SEQUENCE
{
        audioLayer1                     BOOLEAN,
        audioLayer2                     BOOLEAN,
        audioLayer3                     BOOLEAN,

        audioSampling16k                BOOLEAN,
        audioSampling22k05              BOOLEAN,
        audioSampling24k                BOOLEAN,
        audioSampling32k                BOOLEAN,
        audioSampling44k1               BOOLEAN,
        audioSampling48k                BOOLEAN,
```

```
        singleChannel                   BOOLEAN,
        twoChannels                     BOOLEAN,
        threeChannels2-1                BOOLEAN,
        threeChannels3-0                BOOLEAN,
        fourChannels2-0-2-0             BOOLEAN,
        fourChannels2-2                 BOOLEAN,
        fourChannels3-1                 BOOLEAN,
        fiveChannels3-0-2-0             BOOLEAN,
        fiveChannels3-2                 BOOLEAN,

        lowFrequencyEnhancement         BOOLEAN,

        multilingual                    BOOLEAN,

        bitRate                         INTEGER (1..1130),      -- units kbit/s
        ...
}

-- ================================================================================
-- Capability exchange definitions: Data capabilities
-- ================================================================================

DataApplicationCapability               ::=SEQUENCE
{
        application                     CHOICE
        {
                nonStandard             NonStandardParameter,
                t120                    DataProtocolCapability,
                dsm-cc                  DataProtocolCapability,
                userData                DataProtocolCapability,
                t84                     SEQUENCE
                {
                        t84Protocol     DataProtocolCapability,
                        t84Profile      T84Profile
                },
                t434                    DataProtocolCapability,
                h224                    DataProtocolCapability,
                nlpid                   SEQUENCE
                {
                        nlpidProtocol   DataProtocolCapability,
                        nlpidData       OCTET STRING
                },
                dsvdControl             NULL,
                h222DataPartitioning    DataProtocolCapability,
                ...,
                t30fax                  DataProtocolCapability
        },
        maxBitRate                      INTEGER (0..4294967295),        -- units 100 bit/s
        ...
}

DataProtocolCapability                  ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        v14buffered                     NULL,
        v42lapm                         NULL,                   -- may negotiate to V.42bis
        hdlcFrameTunnelling             NULL,
        h310SeparateVCStack             NULL,
        h310SingleVCStack               NULL,
        transparent                     NULL,
        ...,
```

```
        segmentationAndReassembly               NULL,
        hdlcFrameTunnelingwSAR                  NULL,
        v120                                    NULL,           -- as in H.230
        separateLANStack                        NULL,

        v76wCompression                         CHOICE
        {
                transmitCompression             CompressionType,
                receiveCompression              CompressionType,
                transmitAndReceiveCompression   CompressionType,
                ...
        }
}

CompressionType                                 ::=CHOICE
{
        v42bis                                  V42bis,
        ...
}

V42bis                                          ::=SEQUENCE
{
        numberOfCodewords                       INTEGER (1..65536),
        maximumStringLength                     INTEGER (1..256),
        ...
}

T84Profile                                      ::=CHOICE
{
        t84Unrestricted                         NULL,
        t84Restricted                           SEQUENCE
        {
                qcif                            BOOLEAN,
                cif                             BOOLEAN,
                ccir601Seq                      BOOLEAN,
                ccir601Prog                     BOOLEAN,
                hdtvSeq                         BOOLEAN,
                hdtvProg                        BOOLEAN,

                g3FacsMH200x100                 BOOLEAN,
                g3FacsMH200x200                 BOOLEAN,
                g4FacsMMR200x100                BOOLEAN,
                g4FacsMMR200x200                BOOLEAN,
                jbig200x200Seq                  BOOLEAN,
                jbig200x200Prog                 BOOLEAN,
                jbig300x300Seq                  BOOLEAN,
                jbig300x300Prog                 BOOLEAN,

                digPhotoLow                     BOOLEAN,
                digPhotoMedSeq                  BOOLEAN,
                digPhotoMedProg                 BOOLEAN,
                digPhotoHighSeq                 BOOLEAN,
                digPhotoHighProg                BOOLEAN,

                ...
        }
}
```

```
-- ================================================================================
-- Capability Exchange Definitions: Conference
-- ================================================================================
ConferenceCapability                    ::=SEQUENCE
{
        nonStandardData                 SEQUENCE OF NonStandardParameter OPTIONAL,
        chairControlCapability          BOOLEAN,
        ...
}

-- ================================================================================
-- Logical channel signalling definitions
-- ================================================================================

-- 'Forward' is used to refer to transmission in the direction from the terminal making the
-- original request for a logical channel to the other terminal, and 'reverse' is used to refer
-- to the opposite direction of transmission, in the case of a bi-directional channel request.

OpenLogicalChannel                      ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,

        forwardLogicalChannelParameters SEQUENCE
        {
                portNumber              INTEGER (0..65535) OPTIONAL,
                dataType                DataType,
                multiplexParameters     CHOICE
                {
                        h222LogicalChannelParameters    H222LogicalChannelParameters,
                        h223LogicalChannelParameters    H223LogicalChannelParameters,
                        v76LogicalChannelParameters     V76LogicalChannelParameters,
                        ...,
                        h2250LogicalChannelParameters   H2250LogicalChannelParameters
                },
                ...
        },

        -- Used to specify the reverse channel for bi-directional open request

        reverseLogicalChannelParameters SEQUENCE
        {
                dataType                DataType,
                multiplexParameters     CHOICE
                {
                        -- H.222 parameters are never present in reverse direction
                        h223LogicalChannelParameters    H223LogicalChannelParameters,
                        v76LogicalChannelParameters     V76LogicalChannelParameters,
                        ...,
                        h2250LogicalChannelParameters   H2250LogicalChannelParameters
                } OPTIONAL,             -- Not present for H.222
                ...
        } OPTIONAL,                     -- Not present for uni-directional channel request
        ...,
        separateStack                   NetworkAccessParameters OPTIONAL
                                        -- for Open responder to establish the stack

}

LogicalChannelNumber                    ::=INTEGER (1..65535)
```

```
NetworkAccessParameters                 ::=SEQUENCE
{
        distribution                    CHOICE
        {
                unicast                 NULL,
                multicast               NULL,           -- For further study in T.120
                ...
        } OPTIONAL,

        networkAddress                  CHOICE
        {
                q2931Address            Q2931Address,
                e164Address             IA5String(SIZE(1..128)) (FROM ("0123456789#*,")),
                localAreaAddress        TransportAddress,
                ...
        },
        associateConference             BOOLEAN,
        externalReference               OCTET STRING(SIZE(1..255)) OPTIONAL,
        ...
}

Q2931Address                            ::=SEQUENCE
{
        address                         CHOICE
        {
                internationalNumber     NumericString(SIZE(1..16)),
                nsapAddress             OCTET STRING (SIZE(1..20)),
                ...
        },
        subaddress                      OCTET STRING (SIZE(1..20)) OPTIONAL,
        ...
}

V75Parameters                           ::= SEQUENCE
{
        audioHeaderPresent              BOOLEAN,
        ...
}

DataType                                ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        nullData                        NULL,
        videoData                       VideoCapability,
        audioData                       AudioCapability,
        data                            DataApplicationCapability,
        encryptionData                  EncryptionMode,
        ...
}

H222LogicalChannelParameters            ::=SEQUENCE
{
        resourceID                      INTEGER (0..65535),
        subChannelID                    INTEGER (0..8191),
        pcr-pid                         INTEGER (0..8191) OPTIONAL,
        programDescriptors              OCTET STRING OPTIONAL,
        streamDescriptors               OCTET STRING OPTIONAL,
        ...
}
```

```
H223LogicalChannelParameters                    ::=SEQUENCE
{
        adaptationLayerType                     CHOICE
        {
                nonStandard                     NonStandardParameter,
                al1Framed                       NULL,
                al1NotFramed                    NULL,
                al2WithoutSequenceNumbers       NULL,
                al2WithSequenceNumbers          NULL,
                al3                             SEQUENCE
                {
                        controlFieldOctets      INTEGER (0..2),
                        sendBufferSize          INTEGER (0..16777215)       -- units octets
                },

                ...
        },
        segmentableFlag                         BOOLEAN,
        ...
}

V76LogicalChannelParameters                     ::=SEQUENCE
{
        hdlcParameters                          V76HDLCParameters,
        suspendResume                           CHOICE
        {
                noSuspendResume                 NULL,
                suspendResumewAddress           NULL,
                suspendResumewoAddress          NULL,
                ...
        },
        uIH                                     BOOLEAN,
        mode                                    CHOICE
        {
                eRM                             SEQUENCE
                {
                        windowSize              INTEGER (1..127),
                        recovery                CHOICE
                        {
                                rej             NULL,
                                Srej            NULL,
                                mSREJ           NULL,
                                ...
                        },
                        ...
                },
                uNERM                           NULL,
                ...
        },
        v75Parameters                           V75Parameters,
        ...
}

V76HDLCParameters                               ::=SEQUENCE
{
        crcLength                               CRCLength,
        n401                                    INTEGER (1..4095),
        loopbackTestProcedure                   BOOLEAN,
                ...
}
```

```
CRCLength                                   ::=CHOICE
{
        crc8bit                             NULL,
        crc16bit                            NULL,
        crc32bit                            NULL,
        ...
}

H2250LogicalChannelParameters               ::=SEQUENCE
{
        nonStandard                         SEQUENCE OF NonStandardParameter OPTIONAL,
        sessionID                           INTEGER(0..255),
        associatedSessionID                 INTEGER(1..255) OPTIONAL,
        mediaChannel                        TransportAddress OPTIONAL,
        mediaGuaranteedDelivery         BOOLEAN OPTIONAL,
        mediaControlChannel                 TransportAddress OPTIONAL, -- reverse RTCP channel
        mediaControlGuaranteedDelivery      BOOLEAN OPTIONAL,
        silenceSuppression                  BOOLEAN OPTIONAL,
        destination                         TerminalLabel OPTIONAL,
        dynamicRTPPayloadType               INTEGER(96..127) OPTIONAL,
        mediaPacketization                  CHOICE
        {
                h261aVideoPacketization     NULL,
                ...
        } OPTIONAL,
        ...
}

TransportAddress                            ::=CHOICE
{
        unicastAddress                      UnicastAddress,
        multicastAddress                    MulticastAddress,
        ...
}

UnicastAddress                              ::=CHOICE
{
        iPAddress                           SEQUENCE
        {
                network                     OCTET STRING (SIZE(4)),
                tsapIdentifier              INTEGER(0..65535),
                ...
        },
        iPXAddress                          SEQUENCE
        {
                node                        OCTET STRING (SIZE(6)),
                netnum                      OCTET STRING (SIZE(4)),
                tsapIdentifier              OCTET STRING (SIZE(2)),
                ...
        },
        iP6Address                          SEQUENCE
        {
                network                     OCTET STRING (SIZE(16)),
                tsapIdentifier              INTEGER(0..65535),
                ...
        },
        netBios                             OCTET STRING (SIZE(16)),
        iPSourceRouteAddress                SEQUENCE
        {
                routing                     CHOICE
                {
```

```
                strict                          NULL,
                loose                           NULL
            },
            network                             OCTET STRING (SIZE(4)),
            tsapIdentifier                      INTEGER(0..65535),
            route                               SEQUENCE OF OCTET STRING (SIZE(4)),
            ...
        },
        ...,
        nsap                                    OCTET STRING (SIZE(1..20)),
        nonStandardAddress                      NonStandardParameter
}

MulticastAddress                                ::=CHOICE
{
        iPAddress                               SEQUENCE
        {
            network                             OCTET STRING (SIZE(4)),
            tsapIdentifier                      INTEGER(0..65535),
            ...
        },
        iP6Address                              SEQUENCE
        {
            network                             OCTET STRING (SIZE(16)),
            tsapIdentifier                      INTEGER(0..65535),
            ...
        },
        ...,
        nsap                                    OCTET STRING (SIZE(1..20)),
        nonStandardAddress                      NonStandardParameter
}

OpenLogicalChannelAck                           ::=SEQUENCE
{
        forwardLogicalChannelNumber             LogicalChannelNumber,

        reverseLogicalChannelParameters         SEQUENCE
        {
            reverseLogicalChannelNumber         LogicalChannelNumber,
            portNumber                          INTEGER (0..65535) OPTIONAL,
            multiplexParameters                 CHOICE
            {
                h222LogicalChannelParameters    H222LogicalChannelParameters,
                -- H.223 parameters are never present in reverse direction
                ...,
                h2250LogicalChannelParameters   H2250LogicalChannelParameters
            } OPTIONAL,                         -- Not present for H.223
            ...
        } OPTIONAL,                             -- Not present for uni-directional channel request
        ...,
        separateStack                           NetworkAccessParameters OPTIONAL,
                                                -- for Open requester to establish the stack
        forwardMultiplexAckParameters           CHOICE
        {
            -- H.222 parameters are never present in the Ack
            -- H.223 parameters are never present in the Ack
            --V.76 parameters are never present in the Ack

            h2250LogicalChannelAckParameters    H2250LogicalChannelAckParameters,
            ...
        } OPTIONAL
```

```
}

OpenLogicalChannelReject                        ::=SEQUENCE
{
        forwardLogicalChannelNumber             LogicalChannelNumber,
        cause           CHOICE
        {
                unspecified                             NULL,
                unsuitableReverseParameters             NULL,
                dataTypeNotSupported                    NULL,
                dataTypeNotAvailable                    NULL,
                unknownDataType                         NULL,
                dataTypeALCombinationNotSupported       NULL,
                ...,
                multicastChannelNotAllowed              NULL,
                insufficientBandwidth                   NULL,
                separateStackEstablishmentFailed        NULL,
                invalidSessionID                        NULL,
                masterSlaveConflict                     NULL
        },
        ...
}

OpenLogicalChannelConfirm               ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,
        ...
}

H2250LogicalChannelAckParameters        ::=SEQUENCE
{
        nonStandard                     SEQUENCE OF NonStandardParameter OPTIONAL,
        sessionID                       INTEGER(1..255) OPTIONAL,
        mediaChannel                    TransportAddress OPTIONAL,
        mediaControlChannel             TransportAddress OPTIONAL,      -- forward RTCP channel
        dynamicRTPPayloadType           INTEGER(96..127) OPTIONAL,      -- used only by the master
                                                                        -- or MC
        ...
}

CloseLogicalChannel                     ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,
        source                          CHOICE
        {
                user                    NULL,
                lcse                    NULL
        },
        ...
}

CloseLogicalChannelAck                  ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,
        ...
}
```

```
RequestChannelClose                     ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,
        ...
}

RequestChannelCloseAck                  ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,
        ...
}

RequestChannelCloseReject               ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,
        cause                           CHOICE
        {
                unspecified             NULL,
                ...
        },
        ...
}

RequestChannelCloseRelease              ::=SEQUENCE
{
        forwardLogicalChannelNumber     LogicalChannelNumber,
        ...
}

-- ================================================================================
-- H.223 multiplex table definitions
-- ================================================================================

MultiplexEntrySend                      ::=SEQUENCE
{
        sequenceNumber                  SequenceNumber,
        multiplexEntryDescriptors       SET SIZE (1..15) OF MultiplexEntryDescriptor,
        ...
}

MultiplexEntryDescriptor                ::=SEQUENCE
{
        multiplexTableEntryNumber       MultiplexTableEntryNumber,
        elementList                     SEQUENCE SIZE (1..256) OF MultiplexElement OPTIONAL
}

MultiplexElement                        ::=SEQUENCE
{
        type                            CHOICE
        {
                logicalChannelNumber    INTEGER(0..65535),
                subElementList          SEQUENCE SIZE (2..255) OF MultiplexElement
        },
        repeatCount                     CHOICE
        {
                finite                  INTEGER (1..65535),     -- repeats of type
                untilClosingFlag        NULL                    -- used for last element
        }
}

MultiplexTableEntryNumber               ::=INTEGER (1..15)
```

```
MultiplexEntrySendAck                   ::=SEQUENCE
{
        sequenceNumber                  SequenceNumber,
        multiplexTableEntryNumber       SET SIZE (1..15) OF MultiplexTableEntryNumber,
        ...
}

MultiplexEntrySendReject                ::=SEQUENCE
{
        sequenceNumber                  SequenceNumber,
        rejectionDescriptions           SET SIZE (1..15) OF MultiplexEntryRejectionDescriptions,
        ...
}

MultiplexEntryRejectionDescriptions     ::=SEQUENCE
{
        multiplexTableEntryNumber       MultiplexTableEntryNumber,
        cause                           CHOICE
        {
                unspecifiedCause        NULL,
                descriptorTooComplex    NULL,
                ...
        },
        ...
}

MultiplexEntrySendRelease               ::=SEQUENCE
{
        multiplexTableEntryNumber       SET SIZE (1..15) OF MultiplexTableEntryNumber,
        ...
}

RequestMultiplexEntry                   ::=SEQUENCE
{
        entryNumbers                    SET SIZE (1..15) OF MultiplexTableEntryNumber,
        ...
}

RequestMultiplexEntryAck                ::=SEQUENCE
{
        entryNumbers                    SET SIZE (1..15) OF MultiplexTableEntryNumber,
        ...
}

RequestMultiplexEntryReject             ::=SEQUENCE
{
        entryNumbers                    SET SIZE (1..15) OF MultiplexTableEntryNumber,
        rejectionDescriptions           SET SIZE (1..15) OF RequestMultiplexEntryRejectionDescriptions,
        ...
}

RequestMultiplexEntryRejectionDescriptions ::=SEQUENCE
{
        multiplexTableEntryNumber       MultiplexTableEntryNumber,
        cause                           CHOICE
        {
                unspecifiedCause        NULL,
                ...
        },
        ...
```

```
}

RequestMultiplexEntryRelease                ::=SEQUENCE
{
        entryNumbers                        SET SIZE (1..15) OF MultiplexTableEntryNumber,
        ...
}

-- ================================================================================
-- Request mode definitions
-- ================================================================================

-- RequestMode is a list, in order or preference, of modes that a terminal would like
-- to have transmitted to it.

RequestMode                                 ::=SEQUENCE
{
        sequenceNumber                      SequenceNumber,
        requestedModes                      SEQUENCE SIZE (1..256) OF ModeDescription,
        ...
}

RequestModeAck                              ::=SEQUENCE
{
        sequenceNumber                      SequenceNumber,
        response                            CHOICE
        {
                willTransmitMostPreferredMode   NULL,
                willTransmitLessPreferredMode   NULL,
                ...
        },
        ...
}

RequestModeReject                           ::=SEQUENCE
{
        sequenceNumber                      SequenceNumber,
        cause                               CHOICE
        {
                modeUnavailable             NULL,
                multipointConstraint        NULL,
                requestDenied               NULL,
                ...
        },
        ...
}

RequestModeRelease                          ::=SEQUENCE
{
        ...
}

-- ================================================================================
-- Request mode definitions: Mode description
-- ================================================================================

ModeDescription                             ::=SET SIZE (1..256) OF ModeElement

ModeElement                                 ::= SEQUENCE
{
        type                                CHOICE
```

```
        {
                nonStandard                     NonStandardParameter,
                videoMode                       VideoMode,
                audioMode                       AudioMode,
                dataMode                        DataMode,
                encryptionMode                  EncryptionMode,
                ...
        },
        h223ModeParameters              H223ModeParameters OPTIONAL,
        ...,
        v76ModeParameters               V76ModeParameters OPTIONAL

}

H223ModeParameters                      ::=SEQUENCE
{
        adaptationLayerType             CHOICE
        {
                nonStandard                     NonStandardParameter,
                al1Framed                       NULL,
                al1NotFramed                    NULL,
                al2WithoutSequenceNumbers       NULL,
                al2WithSequenceNumbers          NULL,
                al3                             SEQUENCE
                {
                        controlFieldOctets      INTEGER(0..2),
                        sendBufferSize          INTEGER(0..16777215)    -- units octets
                },

                ...
        },
        segmentableFlag                 BOOLEAN,
        ...
}

V76ModeParameters                       ::=CHOICE
{
        suspendResumewAddress           NULL,
        suspendResumewoAddress          NULL,
        ...
}

-- ========================================================================
-- Request mode definitions: Video modes
-- ========================================================================

VideoMode                               ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        h261VideoMode                   H261VideoMode,
        h262VideoMode                   H262VideoMode,
        h263VideoMode                   H263VideoMode,
        is11172VideoMode                IS11172VideoMode,
        ...
}

H261VideoMode                           ::=SEQUENCE
{
        resolution                      CHOICE
        {
                qcif                    NULL,
```

```
            cif                         NULL
        },
        bitRate                         INTEGER (1..19200),         -- units 100 bit/s
        stillImageTransmission          BOOLEAN,
        ...
}

H262VideoMode                           ::=SEQUENCE
{
        profileAndLevel                 CHOICE
        {
            profileAndLevel-SPatML      NULL,
            profileAndLevel-MPatLL      NULL,
            profileAndLevel-MPatMLNULL,
            profileAndLevel-MPatH-14    NULL,
            profileAndLevel-MPatHL      NULL,
            profileAndLevel-SNRatLL     NULL,
            profileAndLevel-SNRatML     NULL,
            profileAndLevel-SpatialatH-14 NULL,
            profileAndLevel-HPatML      NULL,
            profileAndLevel-HPatH-14    NULL,
            profileAndLevel-HPatHL      NULL,
            ...
        },
        videoBitRate                    INTEGER(0..1073741823) OPTIONAL,    -- units 400bit/s
        vbvBufferSize                   INTEGER(0..262143) OPTIONAL,        -- units 16384bits
        samplesPerLine                  INTEGER(0..16383) OPTIONAL,         -- units samples/line
        linesPerFrame                   INTEGER(0..16383) OPTIONAL,         -- units lines/frame
        framesPerSecond                 INTEGER(0..15) OPTIONAL,            -- frame_rate_code
        luminanceSampleRate             INTEGER(0..4294967295) OPTIONAL,    -- units samples/sec
        ...
}

H263VideoMode                           ::=SEQUENCE
{
        resolution                      CHOICE
        {
            sqcif                       NULL,
            qcif                        NULL,
            cif                         NULL,
            cif4                        NULL,
            cif16                       NULL,
            ...
        },
        bitRate                         INTEGER (1..19200),                 -- units 100 bit/s
        unrestrictedVector              BOOLEAN,
        arithmeticCoding                BOOLEAN,
        advancedPrediction          BOOLEAN,
        pbFrames                        BOOLEAN,
        ...,

        errorCompensation               BOOLEAN

}

IS11172VideoMode                        ::=SEQUENCE
{
        constrainedBitstream            BOOLEAN,
        videoBitRate                    INTEGER(0..1073741823) OPTIONAL,    -- units 400bit/s
        vbvBufferSize                   INTEGER(0..262143) OPTIONAL,        -- units 16384bits
        samplesPerLine                  INTEGER(0..16383) OPTIONAL,         -- units samples/line
```

```
        linesPerFrame                   INTEGER(0..16383) OPTIONAL,     -- units lines/frame
        pictureRate                     INTEGER(0..15) OPTIONAL,
        luminanceSampleRate             INTEGER(0..4294967295) OPTIONAL,    -- units samples/sec
        ...
}

-- ================================================================================
-- Request mode definitions: Audio modes
-- ================================================================================

AudioMode                               ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        g711Alaw64k                     NULL,
        g711Alaw56k                     NULL,
        g711Ulaw64k                     NULL,
        g711Ulaw56k                     NULL,

        g722-64k                        NULL,
        g722-56k                        NULL,
        g722-48k                        NULL,

        g728                            NULL,
        g729                            NULL,
        g729AnnexA                      NULL,

        g7231                           CHOICE
        {
                noSilenceSuppressionLowRate     NULL,
                noSilenceSuppressionHighRate    NULL,
                silenceSuppressionLowRate       NULL,
                silenceSuppressionHighRate      NULL
        },

        is11172AudioMode                IS11172AudioMode,
        is13818AudioMode                IS13818AudioMode,

        ...,

        g729wAnnexB                     INTEGER(1..256),
        g729AnnexAwAnnexB               INTEGER(1..256),
        g7231AnnexCMode                 G7231AnnexCMode}
}

IS11172AudioMode                ::=SEQUENCE
{
        audioLayer                      CHOICE
        {
                audioLayer1             NULL,
                audioLayer2             NULL,
                audioLayer3             NULL
        },

        audioSampling                   CHOICE
        {
                audioSampling32k        NULL,
                audioSampling44k1       NULL,
                audioSampling48k        NULL
        },
```

```
        multichannelType                CHOICE
        {
                singleChannel           NULL,
                twoChannelStereo        NULL,
                twoChannelDual          NULL
        },

        bitRate                         INTEGER (1..448),       --units kbit/s
        ...
}
IS13818AudioMode                ::=SEQUENCE
{
        audioLayer                      CHOICE
        {
                audioLayer1             NULL,
                audioLayer2             NULL,
                audioLayer3             NULL
        },

        audioSampling                   CHOICE
        {
                audioSampling16k        NULL,
                audioSampling22k05      NULL,
                audioSampling24k        NULL,
                audioSampling32k        NULL,
                audioSampling44k1       NULL,
                audioSampling48k        NULL
        },

        multichannelType                CHOICE
        {
                singleChannel           NULL,
                twoChannelStereo        NULL,
                twoChannelDual          NULL,
                threeChannels2-1        NULL,
                threeChannels3-0        NULL,
                fourChannels2-0-2-0     NULL,
                fourChannels2-2         NULL,
                fourChannels3-1         NULL,
                fiveChannels3-0-2-0     NULL,
                fiveChannels3-2         NULL
        },

        lowFrequencyEnhancement         BOOLEAN,

        multilingual                    BOOLEAN,

        bitRate                         INTEGER (1..1130),      --units kbit/s
        ...
}

G7231AnnexCMode                 ::= SEQUENCE
{
        maxAl-sduAudioFrames            INTEGER (1..256),
        silenceSuppression              BOOLEAN,
        g723AnnexCAudioMode             SEQUENCE
        {
                highRateMode0           INTEGER (27..78),       -- units octets
                highRateMode1           INTEGER (27..78),       -- units octets
                lowRateMode0            INTEGER (23..66),       -- units octets
                lowRateMode1            INTEGER (23..66),       -- units octets
```

```
                sidMode0                INTEGER (6..17),        -- units octets
                sidMode1                INTEGER (6..17),        -- units octets
                ...
        },
        ...
}

-- ================================================================================
-- Request mode definitions: Data modes
-- ================================================================================

DataMode                                ::=SEQUENCE
{
        application                     CHOICE
        {
                nonStandard             NonStandardParameter,
                t120                    DataProtocolCapability,
                dsm-cc                  DataProtocolCapability,
                userData                DataProtocolCapability,
                t84                     DataProtocolCapability,
                t434                    DataProtocolCapability,
                h224                    DataProtocolCapability,
                nlpid                   SEQUENCE
                {
                        nlpidProtocol   DataProtocolCapability,
                        nlpidData       OCTET STRING
                },
                dsvdControl             NULL,
                h222DataPartitioning    DataProtocolCapability,
                ...
        },
        bitRate                         INTEGER (0..4294967295),        -- units 100 bit/s
        ...
}

-- ================================================================================
-- Request mode definitions: Encryption modes
-- ================================================================================

EncryptionMode                          ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        h233Encryption                  NULL,
        ...
}

-- ================================================================================
-- Round Trip Delay definitions
-- ================================================================================

RoundTripDelayRequest                   ::=SEQUENCE
{
        sequenceNumber                  SequenceNumber,
        ...
}

RoundTripDelayResponse                  ::=SEQUENCE
{
        sequenceNumber                  SequenceNumber,
        ...
}
```

```
-- ================================================================================
-- Maintenance Loop definitions
-- ================================================================================

MaintenanceLoopRequest                  ::=SEQUENCE
{
        type                            CHOICE
        {
                systemLoop              NULL,
                mediaLoop               LogicalChannelNumber,
                logicalChannelLoop      LogicalChannelNumber,
                ...
        },
        ...
}

MaintenanceLoopAck                      ::=SEQUENCE
{
        type                            CHOICE
        {
                systemLoop              NULL,
                mediaLoop               LogicalChannelNumber,
                logicalChannelLoop      LogicalChannelNumber,
                ...
        },
        ...
}

MaintenanceLoopReject                   ::=SEQUENCE
{
        type                            CHOICE
        {
                systemLoop              NULL,
                mediaLoop               LogicalChannelNumber,
                logicalChannelLoop      LogicalChannelNumber,
                ...
        },
        cause                           CHOICE
        {
                canNotPerformLoop       NULL,
                ...
        },
        ...
}

MaintenanceLoopOffCommand               ::=SEQUENCE
{
        ...
}

-- ================================================================================
-- Communication Mode definitions
-- ================================================================================

CommunicationModeCommand                ::=SEQUENCE
{
        communicationModeTable          SET SIZE(1..256) OF CommunicationModeTableEntry,
        ...
}
```

```
CommunicationModeRequest            ::=SEQUENCE
{
        ...
}

CommunicationModeResponse           ::=CHOICE
{
        communicationModeTable      SET SIZE(1..256) OF CommunicationModeTableEntry,
        ...
}

CommunicationModeTableEntry         ::=SEQUENCE
{
        nonStandard                 SEQUENCE OF NonStandardParameter OPTIONAL,
        sessionID                   INTEGER(1..255),
        associatedSessionID         INTEGER(1..255) OPTIONAL,

        terminalLabel               TerminalLabel OPTIONAL, -- if not present,
                                                            -- it refers to all participants
                                                            -- in the conference
        sessionDescription          BMPString (SIZE(1..128)),  -- Basic ISO/IEC 10646-1 (Unicode)
        dataType                    CHOICE
        {
                videoData           VideoCapability,
                audioData           AudioCapability,
                data                DataApplicationCapability,
                ...
        },
        mediaChannel                TransportAddress OPTIONAL,
        mediaGuaranteedDelivery     BOOLEAN OPTIONAL,
        mediaControlChannel         TransportAddress OPTIONAL, -- reverse RTCP channel
        mediaControlGuaranteedDelivery  BOOLEAN OPTIONAL,
        ...
}

-- ================================================================================
-- Conference Request definitions
-- ================================================================================

ConferenceRequest                   ::=CHOICE
{

        terminalListRequest         NULL,           -- same as H.230 TCU (term->MC)

        makeMeChair                 NULL,           -- same as H.230 CCA (term->MC)
        cancelMakeMeChair           NULL,           -- same as H.230 CIS (term->MC)

        dropTerminal                TerminalLabel,  -- same as H.230 CCD(term->MC)

        requestTerminalID           TerminalLabel,  -- sames as TCP (term->MC)

        enterH243Password           NULL,           -- same as H.230 TCS1(MC->term)
        enterH243TerminalID         NULL,           -- same as H.230 TCS2/TCI
                                                    -- (MC->term)
        enterH243ConferenceID       NULL,           -- same as H.230 TCS3 (MC->term)
        ...,
        enterExtensionAddress       NULL,           -- same as H.230 TCS4 (GW->term)
}
```

```
TerminalLabel                   ::=SEQUENCE
{
        mcuNumber               McuNumber,
        terminalNumber          TerminalNumber,
        ...
}

McuNumber                       ::=INTEGER(0..192)
TerminalNumber                  ::=INTEGER(0..192)

-- ========================================================================
-- Conference Response definitions
-- ========================================================================

ConferenceResponse              ::=CHOICE
{
    mCTerminalIDResponse        SEQUENCE    -- response to TCP(same as TIP)
    {                                       -- sent by MC only
        terminalLabel           TerminalLabel,
        terminalID              TerminalID,
        ...
    },

    terminalIDResponse          SEQUENCE    -- response to TCS2 or TCI
    {                                       -- same as IIS
        terminalLabel           TerminalLabel,  -- (term->MC)
        terminalID              TerminalID,
        ...
    },

    conferenceIDResponse        SEQUENCE    -- response to TCS3
    {                                       -- same as IIS
        terminalLabel           TerminalLabel,  -- (term->MC)
        conferenceID            ConferenceID,
        ...
    },

    passwordResponse            SEQUENCE    -- response to TCS1
    {                                       -- same as IIS
        terminalLabel           TerminalLabel,  -- (term->MC)
        password                Password,
        ...
    },

    terminalListResponse        SET SIZE (1..256) OF TerminalLabel,

    videoCommandReject          NULL,       -- same as H.230 VCR
    terminalDropReject          NULL,       -- same as H.230 CIR

    makeMeChairResponse         CHOICE      -- same as H.230 CCR
    {
        grantedChairToken       NULL,       -- same as H.230 CIT
        deniedChairToken        NULL,       -- same as H.230 CCR
        ...
    },
    ...,
    extensionAddressResponse    SEQUENCE -- response to TCS4
    {
        extensionAddress        TerminalID, -- same as IIS (term->GW)
        ...
    }
```

```
}
TerminalID                          ::=OCTET STRING (SIZE(1..128))    -- as per H.230
ConferenceID                        ::=OCTET STRING (SIZE(1..32))
Password                            ::=OCTET STRING (SIZE(1..32))


-- ================================================================================
-- Command Message definitions
-- ================================================================================

-- ================================================================================
-- Command Message: Send Terminal Capability Set
-- ================================================================================

SendTerminalCapabilitySet           ::=CHOICE
{
        specificRequest             SEQUENCE
        {
          multiplexCapability       BOOLEAN,

          capabilityTableEntryNumbers   SET SIZE (1..65535) OF CapabilityTableEntryNumber
                                        OPTIONAL,

          capabilityDescriptorNumbers   SET SIZE (1..256) OF CapabilityDescriptorNumber OPTIONAL,
                ...
        },
        genericRequest              NULL,
        ...
}

-- ================================================================================
-- Command Message: Encryption
-- ================================================================================

EncryptionCommand                   ::=CHOICE
{
        encryptionSE                OCTET STRING,  -- per H.233, but no error protection
        encryptionIVRequest         NULL,          -- requests new IV
        encryptionAlgorithmID       SEQUENCE
        {
                h233AlgorithmIdentifier     SequenceNumber,
                associatedAlgorithm         NonStandardParameter
        },
        ...
}

-- ================================================================================
-- Command Message: Flow Control
-- ================================================================================

FlowControlCommand                  ::=SEQUENCE
{
        scope                       CHOICE
        {
                logicalChannelNumber    LogicalChannelNumber,
                resourceID              INTEGER (0..65535),
                wholeMultiplex          NULL
        },
        restriction                 CHOICE
        {
                maximumBitRate          INTEGER (0..16777215),      -- units 100 bit/s
```

```
            noRestriction                   NULL
        },
        ...
}

-- ================================================================================
-- Command Message: Change or End Session
-- ================================================================================

EndSessionCommand                   ::=CHOICE
{
        nonStandard                 NonStandardParameter,

        disconnect                  NULL,

        gstnOptions                 CHOICE
        {
            telephonyMode           NULL,
            v8bis                   NULL,
            v34DSVD                 NULL,
            v34DuplexFAX            NULL,
            v34H324                 NULL,
            ...
        },

        ...
}
-- ================================================================================
-- Command Message: Conference Commands
-- ================================================================================

ConferenceCommand                   ::=CHOICE
{
        broadcastMyLogicalChannel       LogicalChannelNumber,   -- similar to H.230 MCV
        cancelBroadcastMyLogicalChannel LogicalChannelNumber,   -- similar to H.230 Cancel-MCV

        makeTerminalBroadcaster         TerminalLabel,          -- same as H.230 VCB
        cancelMakeTerminalBroadcaster   NULL,                   -- same as H.230 Cancel-VCB

        sendThisSource                  TerminalLabel,          -- same as H.230 VCS
        cancelSendThisSource            NULL,                   -- same as H.230 cancel VCS

        dropConference                  NULL,                   -- same as H.230 CCK
        ...
}

-- ================================================================================
-- Command Message: Miscellaneous H.230-like commands
-- ================================================================================

MiscellaneousCommand                ::=SEQUENCE
{
        logicalChannelNumber        LogicalChannelNumber,
        type                        CHOICE
        {
            equalizeDelay           NULL,           -- same as H.230 ACE
            zeroDelay               NULL,           -- same as H.230 ACZ
            multipointModeCommand   NULL,
            cancelMultipointModeCommand NULL,
            videoFreezePicture      NULL,
            videoFastUpdatePicture  NULL,
```

```
            videoFastUpdateGOB              SEQUENCE
            {
                  firstGOB                  INTEGER (0..17),
                  numberOfGOBs              INTEGER (1..18)
            },

            videoTemporalSpatialTradeOff    INTEGER (0..31),      -- commands a trade-off value

            videoSendSyncEveryGOB           NULL,
            videoSendSyncEveryGOBCancelNULL,

            ...,
            videoFastUpdateMB               SEQUENCE
            {
                  firstGOB                  INTEGER (0..255) OPTIONAL,
                  firstMB                   INTEGER (1..8192) OPTIONAL,
                  numberOfMBs               INTEGER (1..8192),
                  ...
            },
            maxH223MUXPDUsize               INTEGER(1..65535)   -- units octets
      },

      ...
}

-- ================================================================================
-- Indication Message definitions
-- ================================================================================

-- ================================================================================
-- Indication Message: Function not understood
-- ================================================================================

-- This is used to return a request, response or command that is not understood

FunctionNotUnderstood               ::=CHOICE
{
      request                       RequestMessage,
      response                      ResponseMessage,
      command                       CommandMessage
}

-- ================================================================================
-- Indication Message: Function not Supported
-- ================================================================================

-- This is used to return a complete request, response or command that is not recognized

FunctionNotSupported                ::=SEQUENCE
{
      cause                         CHOICE
      {
            syntaxError             NULL,
            semanticError           NULL,
            unknownFunction         NULL,
            ...
      },
      returnedFunction              OCTET STRING OPTIONAL,
      ...
}
```

```
-- ========================================================================
-- Indication Message: Conference
-- ========================================================================

ConferenceIndication                    ::=CHOICE
{
        sbeNumber                       INTEGER (0..9),     -- same as H.230 SBE Number

        terminalNumberAssign            TerminalLabel,      -- same as H.230 TIA

        terminalJoinedConference        TerminalLabel,      -- same as H.230 TIN

        terminalLeftConference          TerminalLabel,      -- same as H.230 TID

        seenByAtLeastOneOther           NULL,               -- same as H.230 MIV
        cancelSeenByAtLeastOneOther     NULL,               -- same as H.230 cancel MIV

        seenByAll                       NULL,               -- like H.230 MIV
        cancelSeenByAll                 NULL,               -- like H.230 MIV

        terminalYouAreSeeing            TerminalLabel,      -- same as H.230 TIN

        requestForFloor                 NULL,               -- same as H.230 TIF

        ...
}

-- ========================================================================
-- Indication Message: Miscellaneous H.230-like indication
-- ========================================================================

MiscellaneousIndication                 ::=SEQUENCE
{
        logicalChannelNumber            LogicalChannelNumber,
        type                            CHOICE
        {
                logicalChannelActive            NULL,       -- same as H.230 AIA and VIA
                logicalChannelInactive          NULL,       -- same as H.230 AIM and VIS

                multipointConference            NULL,
                cancelMultipointConference      NULL,

                multipointZeroComm              NULL,       -- same as H.230 MIZ
                cancelMultipointZeroComm        NULL,       -- same as H.230 cancel MIZ

                multipointSecondaryStatus       NULL,       -- same as H.230 MIS
                cancelMultipointSecondaryStatus NULL,       -- same as H.230 cancel MIS

                videoIndicateReadyToActivate    NULL,       -- same as H.230 VIR

                videoTemporalSpatialTradeOff    INTEGER (0..31),    -- indicates current trade-off

                ...,
                videoNotDecodedMBs              SEQUENCE
                {
                        firstMB                 INTEGER (1..8192),
                        numberOfMBs             INTEGER (1..8192),
                        temporalReference       INTEGER (0..255),
                        ...
                }
```

```
        },
        ...
}

-- ================================================================================
-- Indication Message: Jitter Indication
-- ================================================================================

JitterIndication                        ::=SEQUENCE
{
        scope                           CHOICE
        {
                logicalChannelNumber    LogicalChannelNumber,
                resourceID              INTEGER (0..65535),
                wholeMultiplex          NULL
        },
        estimatedReceivedJitterMantissa INTEGER (0..3),
        estimatedReceivedJitterExponent INTEGER (0..7),
        skippedFrameCount               INTEGER (0..15) OPTIONAL,
        additionalDecoderBuffer         INTEGER (0..262143) OPTIONAL,   -- 262143 is 2^18 - 1
        ...
}

-- ================================================================================
-- Indication Message: H.223 logical channel skew
-- ================================================================================

H223SkewIndication                      ::=SEQUENCE
{
        logicalChannelNumber1           LogicalChannelNumber,
        logicalChannelNumber2           LogicalChannelNumber,
        skew                            INTEGER (0..4095),              -- units milliseconds
        ...
}

-- ================================================================================
-- Indication Message: H.225.0 maximum logical channel skew
-- ================================================================================

H2250MaximumSkewIndication              ::=SEQUENCE
{
        logicalChannelNumber1           LogicalChannelNumber,
        logicalChannelNumber2           LogicalChannelNumber,
        maximumSkew                     INTEGER (0..4095),          -- units milliseconds
        ...
}

-- ================================================================================
-- Indication Message: MC Location Indication
-- ================================================================================

MCLocationIndication                    ::=SEQUENCE
{
        signalAddress                   TransportAddress, -- this is the H.323 Call Signalling
                                                          -- address of the entity which
                                                          -- contains the MC
        ...
}
```

```
-- ================================================================================
-- Indication Message: Vendor Identification
-- ================================================================================

        VendorIdentification            ::=SEQUENCE
        {
                vendor                  NonStandardIdentifier,
                productNumber           OCTET STRING (SIZE(1..256)) OPTIONAL, -- per vendor
                versionNumber           OCTET STRING (SIZE(1..256)) OPTIONAL, -- per productNumber
                ...
        }

-- ================================================================================
-- Indication Message: New ATM virtual channel indication
-- ================================================================================

NewATMVCIndication                      ::=SEQUENCE
{
        resourceID                      INTEGER(0..65535),
        bitRate                         INTEGER(1..65535),  -- units 64 kbit/s
        bitRateLockedToPCRClock         BOOLEAN,
        bitRateLockedToNetworkClock     BOOLEAN,
        aal                             CHOICE
        {
                aal1                    SEQUENCE
                {
                        clockRecovery           CHOICE
                        {
                                nullClockRecovery       NULL,
                                srtsClockRecovery       NULL,
                                adaptiveClockRecovery   NULL,
                                ...
                        },
                        errorCorrection         CHOICE
                        {
                                nullErrorCorrection     NULL,
                                longInterleaver         NULL,
                                shortInterleaver        NULL,
                                errorCorrectionOnly     NULL,
                                ...
                        },
                        structuredDataTransfer  BOOLEAN,
                        partiallyFilledCells    BOOLEAN,
                        ...
                },
                aal5                    SEQUENCE
                {
                        forwardMaximumSDUSize   INTEGER (0..65535),  -- units octets
                        backwardMaximumSDUSize  INTEGER (0..65535),  -- units octets
                        ...
                },
                ...
        },
        multiplex                       CHOICE
        {
                noMultiplex             NULL,
                transportStream         NULL,
                programStream           NULL,
                ...
        },
        ...
```

```
}

-- ================================================================================
-- Indication Message: user input
-- ================================================================================

UserInputIndication                     ::=CHOICE
{
        nonStandard                     NonStandardParameter,
        alphanumeric                    GeneralString,
        ...,
        userInputSupportIndication      CHOICE
        {
                nonStandard             NonStandardParameter,
                basicString             NULL,
                iA5String               NULL,
                generalString           NULL,
                ...
        }
}

END
```

7 Messages: Semantic definitions

This clause provides semantic definitions and constraints on the syntax elements defined in the previous section.

MultimediaSystemControlMessage: A choice of message types. Messages defined in this Recommendation are classified as request, response, command and indication messages.

RequestMessage: A request message results in an action by the remote terminal and requires an immediate response from it. The nonStandard message may be used to send non-standard requests.

ResponseMessage: A response message is the response to a request message. The nonStandard message may be used to send non-standard responses.

CommandMessage: A command message requires action but no explicit response. The nonStandard message may be used to send non-standard commands.

IndicationMessage: An indication contains information that does not require action or response. The nonStandard message may be used to send non-standard indications.

NonStandardParameter: This may be used to indicate a non-standard parameter. It consists of an identity and the actual parameters, which are coded as an octet string.

NonStandardIdentifier: Used to identify the type of non-standard parameter. It is either an object identifier, or an H.221 type of identifier that is an octet string consisting of exactly four octets which are country code (octet 1 as in Recommendation T.35 [22]; octet 2*), manufacturer code (next two octets*), * = assigned nationally. The manufacturer codes are the same as those assigned for use in Recommendation H.320 [17]. H.245 non-standard identifiers may be either "object" type or "h221NonStandard" type at the discretion of the manufacturer defining the non-standard message, as OBJECT IDENTIFIERs and h221NonStandard messages come from non-overlapping spaces and cannot be confused. However, since h221NonStandard messages are also used by Recommendation H.320, such messages come from the same space as Recommendation H.320 messages, and shall have the same meaning.

7.1 Master Slave Determination messages

This set of messages is used by a protocol to determine which terminal is the master terminal and which is the slave terminal.

7.1.1 Master Slave Determination

This is sent from a MSDSE to a peer MSDSE.

terminalType is a number that identifies different types of terminal, such as, terminals, MCUs and gateways. The allocation of values to terminal types is outside the scope of this Recommendation.

statusDeterminationNumber is a random number in the range $0 \ldots 2^{24}-1$.

7.1.2 Master Slave Determination Acknowledge

This is used to confirm whether the terminal is the master terminal or the slave terminal, as indicated by decision. When decision is of type master, the terminal receiving this message is the master terminal and when decision is of type slave, it is the slave terminal.

7.1.3 Master Slave Determination Reject

This is used to reject the MasterSlaveDetermination message. When the cause is of type identicalNumbers, the rejection was due to the random numbers being equivalent and the terminal types being the same.

7.1.4 Master Slave Determination Release

This is sent in the case of a timeout.

7.2 Terminal capability messages

This set of messages is for the secure exchange of capabilities between the two terminals.

7.2.1 Overview

The transmitting terminal assigns each individual mode the terminal is capable of operating in a number in a capabilityTable. For example, G.723.1 audio, G.728 audio, and CIF H.263 video 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.711, G.723.1, G.728} means that the terminal can operate in any one of those audio 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 {H.261, H.263} and {G.711, G.723.1, G.728} means that the terminal can operate either of the video codecs simultaneously with any one of the audio codecs. The simultaneousCapabilities set {{H.261}, {H.261, H.263}, {G.711, G.723.1, G.728}} means the terminal can operate two video channels and one audio channel simultaneously: one video channel per Recommendation H.261, another video channel per either Recommendations H.261 or H.263, and one audio channel per either Recommendations G.711, G.723.1, or G.728.

NOTE – The actual capabilities stored in the capabilityTable are often more complex than presented here. For example, each H.263 capability indicates details including ability to support various picture formats at given minimum picture intervals, and ability to use optional coding modes.

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. For example, a terminal issuing two CapabilityDescriptor structures, one {{H.261, H.263}, {G.711, G.723.1, G.728}} as in the previous example, and the other {{H.262}, {G.711}}, means the terminal can also operate the H.262 video codec, but only with the low-complexity G.711 audio codec.

Terminals may dynamically add capabilities during a communication session by issuing additional CapabilityDescriptor structures, or remove capabilities by sending revised CapabilityDescriptor structures. All terminals shall transmit at least one CapabilityDescriptor structure.

7.2.2 Terminal capability set

This message contains information about the terminal's capability to transmit and receive. It also indicates the version of this Recommendation that is in use. It is sent from an outgoing CESE to a peer incoming CESE.

sequenceNumber is used to label instances of TerminalCapabilitySet so that the corresponding response can be identified.

protocolIdentifier is used to indicate the version of this Recommendation that is in use. Annex A lists the object identifiers defined for use by this Recommendation.

multiplexCapability indicates capabilities relating to multiplexing and network adaptation. A terminal shall include multiplexCapability in the first TerminalCapabilitySet sent.

V75Capability indicates the capabilities of the V.75 control entity. The audioHeader indicates the capability of the V.75 audio header.

7.2.2.1 Capability table

A capability table is a numbered list of capabilities. A terminal shall be capable of everything that it lists in its capability table, but shall not necessarily be capable of simultaneously performing more than one of them.

A TerminalCapabilitySet may contain zero or more CapabilityTableEntrys. At the start, no table entries are defined. When a CapabilityTableEntry is received, it replaces the previously received CapabilityTableEntry with the same CapabilityTableEntryNumber. A CapabilityTableEntry without a Capability may be used to remove the previously received CapabilityTableEntry with the same CapabilityTableEntryNumber.

7.2.2.2 Capability descriptors

CapabilityDescriptors are used to indicate a terminal's capability to transmit and receive. Each CapabilityDescriptor provides an independent statement about the terminal's capabilities.

capabilityDescriptorNumber is used to number CapabilityDescriptors. If a terminal has a preference for the mode it would like to transmit or receive, and wishes to express this when transmitting its capabilities, it may do so by giving CapabilityDescriptors that relate to its preferred mode or modes small values of capabilityDescriptorNumber.

simultaneousCapabilities is a set of AlternativeCapabilitySet. It is used to list the simultaneous capabilities of the terminal.

An AlternativeCapabilitySet is a sequence of CapabilityTableEntryNumbers. Only those CapabilityTableEntrys that have been defined shall be present in an AlternativeCapabilitySet, although it is possible to define CapabilityTableEntrys and refer to them in the same

TerminalCapabilitySet. If a terminal has a preference for the mode it would like to transmit or receive, and wishes to express this when transmitting its capabilities, it may do so by listing elements in AlternativeCapabilitySets in order of decreasing preference.

A terminal shall be capable of simultaneously performing any one capability from each AlternativeCapabilitySet listed in simultaneousCapabilities.

At least one capability descriptor shall have the following structure: there shall be at least one AlternativeCapabilitySet containing only capabilities of a single medium type for each medium type that the terminal can support. This is to ensure that the remote terminal can select a mode of transmission that includes at least one instance of each medium type that the receiver can support.

NOTE 1 – A repetition of a capability in an AlternativeCapabilitySet is redundant and conveys no further information, while the repetition of a capability in different AlternativeCapabilitySets in the same CapabilityDescriptor indicates the possibility of an additional, simultaneous, instance of the particular capability.

NOTE 2 – Terminals that can not vary the allocation of resources can indicate their capability completely by use of a single CapabilityDescriptor.

7.2.2.3 Capability

The choices receiveVideoCapability, receiveAudioCapability and receiveDataApplicationCapability indicate the capability to receive according to the respective VideoCapability, AudioCapability and DataApplicationCapability.

The choices transmitVideoCapability, transmitAudioCapability and transmitDataApplicationCapability indicate the capability to transmit according to the respective VideoCapability, AudioCapability and DataApplicationCapability.

The choices receiveAndTransmitVideoCapability, receiveAndTransmitAudioCapability and receiveAndTransmitDataApplicationCapability indicate the capability to receive and transmit according to the respective VideoCapability, AudioCapability and DataApplicationCapability. These code points may be useful for indicating that the receive and transmit capabilities are not independent.

The boolean h233EncryptionTransmitCapability, when true, indicates that the terminal supports encryption according to H.233 [11] and H.234 [12].

h233IVResponseTime is measured in units of milliseconds, and indicates the minimum time the receiver requires the transmitter to wait after the completion of transmission of an IV message before starting to use the new IV. The means of transmitting the IV is not defined in this Recommendation.

ConferenceCapability indicates conference capabilities such as the ability to support Chair Control as described in Recommendation H.243.

7.2.2.4 Multiplex capabilities

MultiplexCapability indicates capabilities relating to multiplexing and network adaptation. A terminal shall send MultiplexCapability in the first TerminalCapabilitySet sent. Unless stated otherwise, these are capabilities to receive.

H222Capability: Indicates multiplexing and network adaptation capabilities that are specific to the multiplex defined in Recommendation H.222.1 [7].

numberOfVCs indicates how many simultaneous ATM Virtual Channels (VCs) can be supported by the terminal. This includes any VCs that transport H.245, T.120, DSM-CC or any other data, and all VCs that carry audiovisual information. It does not include the VC used for Q.2931 signalling [20].

vcCapability is a set, of size equal to the value of numberOfVCs, that indicates the capabilities present for each available VC.

The sequence aal1, when present, indicates the capability for ATM adaptation layer 1, and which of its options, as specified in Recommendation I.363 [19], are supported. The codepoints are defined in Table 1.

Table 1/H.245 – ATM Adaptation Layer 1 codepoints

ASN.1 codepoint	Semantic meaning of codepoint
nullClockRecovery	Null source clock frequency recovery method: synchronous circuit transport
srtsClockRecovery	Synchronous residual timestamp source clock frequency recovery method
adaptiveClockRecovery	Adaptive clock source clock frequency recovery method
nullErrorCorrection	No error correction is supported
longInterleaver	The forward error correction method for loss sensitive signal transport is supported
shortInterleaver	The forward error correction method for delay sensitive signal transport is supported
errorCorrectionOnly	The forward error correction method without cell interleaving is supported
structuredDataTransfer	Structured data transfer is supported
partiallyFilledCells	Partially filled cells is supported

The sequence aal5, when present, indicates the capability for ATM adaptation layer 5, and which of its options, as specified in Recommendation I.363 [19], are supported. forwardMaximumSDUSize and backwardMaximumSDUSize indicate the maximum CPCS-SDU size in the forward and reverse directions, measured in octets. Either aal1 or aal5 or both shall be present.

The booleans transportStream and programStream, when equal to true, indicate the capability to support the Transport Stream and Program Stream multiplexes respectively [6].

availableBitRates indicates the bit rate capabilities for the VC. It is a sequence of different bit rates that can be supported, measured in units of 64 kbit/s. Bit rates are listed in decreasing order, that is, the highest bit rate supported is listed first. Supported bit rates can be listed as individual values using the field singleBitRate, or as a rangeOfBitRates between lowerBitRate and higherBitRate, indicating that all values between this lower limit and higher limit, including these limits, are supported. The bit rates indicated are measured at the AAL-SAP.

H223Capability: Indicates capabilities specific to the H.223 multiplex [8].

The boolean transportWithI-frames, when true, indicates that the terminal is capable of sending and receiving control channel messages using LAPM I-frames as defined in Recommendation V.42 [29].

The booleans videoWithAL1, videoWithAL2, videoWithAL3, audioWithAL1, audioWithAL2, audioWithAL3, dataWithAL1, dataWithAL2 and dataWithAL3, when true, indicate the capability to receive the stated medium type (video, audio, or data) using the stated adaptation layer (AL1, AL2, or AL3).

The integers maximumAl2SDUSize and maximumAl3SDUSize indicate the maximum number of octets in each SDU that the terminal can receive when using adaptation layer types 2 and 3 respectively.

maximumDelayJitter indicates the maximum peak-to-peak multiplexing jitter that the transmitter shall cause. It is measured in milliseconds. Multiplexing jitter is defined as the difference in time of delivery of the first octet of an audio frame when delivered in the multiplexed stream and when it would be delivered at constant bit rate without a multiplex.

h223MultiplexTableCapability: Indicates the terminal's ability to receive and process multiplex table entries.

basic indicates that the multiplex can only receive basic MultiplexEntryDescriptors as defined in Recommendation H.223 [8].

enhanced indicates that the multiplex can receive enhanced MultiplexEntryDescriptors with the additional parameters defined below.

maximumNestingDepth depth indicates the maximum nesting depth of recursively invoked subElementList fields. MultiplexEntryDescriptors which do not use the subElementList field shall be considered to have a nesting depth of zero.

maximumElementListSize indicates the maximum number of fields in the ASN.1 SEQUENCE.

maximumSubElementListSize indicates the maximum number of subelements in the subElementList.

The boolean maxMUXPDUSizeCapability, when true, indicates that the transmitter is able to restrict the size of the H.223 MUX-PDUs that it transmits. It has no meaning when part of a receive capability.

V76Capability: Indicates capabilities specific to the V.76 multiplex.

The suspendResumeCapabilitywAddress indicates the capability of supporting V.76 suspend/resume with an address field. The suspendResumeCapabilitywoAddress indicates the capability of supporting V.76 suspend/resume without an address field.

rejCapability indicates the capability of the V.76 multiplex error control function to perform reject.

sREJCapability indicates the capability of the multiplex error control function to perform selective reject.

mREJCapability indicates the capability of the multiplex error control function to perform multiple selective reject.

crc8bitCapability is the capability of the multiplex to use 8-bit CRC.

crc16bitCapability is the capability of multiplex to use 16-bit CRC.

crc32bitCapability is the capability of the multiplex to use 32-bit CRC.

uihCapability indicates support of V.76 UIH frames.

numOfDLCs indicates the number of DLCs which the V.76 multiplex can support.

twoOctetAddressFieldCapability indicates the ability of the V.76 multiplex to support an address field of two octets.

loopBackTestCapability indicates the support of loop back per Recommendation V.76. n401Capability indicates the maximum value of N401 described in Recommendation V.76. maxWindowSizeCapability indicates the maximum window size the V.76 multiplex can support.

H2250Capability: Indicates capabilities specific to the H.225.0 media packetization layer.

maximumAudioDelayJitter indicates the maximum peak-to-peak delivery of audio packets to the transport layer that the transmitter shall cause. It is measured in milliseconds.

receiveMultipointCapability indicates the receive capabilities of a terminal in a multipoint conference.

transmitMultipointCapability indicates the transmit capabilities of a terminal in a multipoint conference.

receiveAndTransmitMultipointCapability indicates the receive and transmit capabilities of a terminal in a multipoint conference.

mcCapability indicates the ability of a terminal to act as an MC in a centralized or distributed conference.

rtcpVideoControlCapability indicates a terminal's ability to process both RTCP Full Intra Request (FIR) and Negative Acknowledgement (NACK) messages.

MediaPacketizationCapability indicates which optional media packetization scheme is in use, if any.

h261aVideoPacketization indicates that the H261 alternative RTP payload format described in Recommendation H.225.0 is in use.

MultipointCapability indicates a terminal's capabilities specific to multipoint.

multicastCapability indicates the ability of a terminal to multicast audio or video traffic.

multiUniCastConference indicates the ability of a terminal to participate in a multiUniCast conference.

MediaDistributionCapability indicates a terminal's capabilities for transmission and reception of media in a multipoint conference. Centralized Control and Audio shall be TRUE for H.323 terminals. If Video is supported, the Centralized Video shall be set TRUE. If T.120 is supported, the Centralized Data T.120 Data Application Capability shall be present.

Centralized and distributed control, audio, and video, indicate the ability of a terminal to participate in a conference with those media distribution types. Centralized and distributed data indicate the ability of a terminal to participate in conference with those media distribution types for the specific Data Application Protocol. MediaDistributionCapability is a sequence to allow for the definition of simultaneous capabilities (e.g. centralized audio with distributed video or centralized video with distributed audio, or specific data capabilities per a Data Application Protocol).

7.2.2.5 Video capabilities

This indicates video capabilities. The indication of more than a single capability within a single VideoCapability does not indicate simultaneous processing capability. Simultaneous processing capability can be indicated by instances of VideoCapability in different AlternativeCapabilitySets in a single CapabilityDescriptor.

H261VideoCapability: Indicates H.261 [13] capabilities.

If present, qcifMPI indicates the minimum picture interval in units of 1/29.97 for the encoding and/or decoding of QCIF pictures, and if not present, no capability for QCIF pictures is indicated.

If present, cifMPI indicates the minimum picture interval in units of 1/29.97 for the encoding and/or decoding of CIF pictures, and if not present, no capability for CIF pictures is indicated.

The boolean temporalSpatialTradeOffCapability, when true, indicates that the encoder is able to vary its trade-off between temporal and spatial resolution as commanded by the remote terminal. It has no meaning when part of a receive capability.

maxBitRate indicates the maximum bit rate in units of 100 bit/s at which a transmitter can transmit video or a receiver can receive video.

stillImageTransmission indicates the capability for still images as specified in Annex D of Recommendation H.261.

H262VideoCapability: Indicates H.262 [14] capabilities.

The list of booleans indicate the capability of processing the particular profiles and levels: a value of true indicates that such operation is possible, while a value of false indicates that such operation is not possible. An encoder shall produce bitstreams compliant to the specifications of a profile and level for which it has indicated capability, but also within the limitations imposed by the optional fields (see below). A decoder shall be able to accept all bit streams conforming to a profile and level for which it has indicated capability, provided it is within the limitations indicated by the optional fields. The optional fields are integers with units defined in Table 2.

Table 2/H.245 – Units for H.262 codepoints

ASN.1 codepoint	Units for referenced parameter
videoBitRate	400 bit/s
vbvBufferSize	16 384 bits
samplesPerLine	samples per line
linesPerFrame	lines per frame
framesPerSecond	The index, frame_rate_code, into Table 6-4/H.262
luminanceSampleRate	samples per second

H263VideoCapability: Indicates H.263 [15] capabilities.

If present, sqcifMPI indicates the minimum picture interval in units of 1/29.97 for the encoding and/or decoding of SQCIF pictures, and if not present, no capability for SQCIF pictures is indicated.

If present, qcifMPI indicates the minimum picture interval in units of 1/29.97 for the encoding and/or decoding of QCIF pictures, and if not present, no capability for QCIF pictures is indicated.

If present, cifMPI indicates the minimum picture interval in units of 1/29.97 for the encoding and/or decoding of CIF pictures, and if not present, no capability for CIF pictures is indicated.

If present, cif4MPI indicates the minimum picture interval in units of 1/29.97 for the encoding and/or decoding of 4CIF pictures, and if not present, no capability for 4CIF pictures is indicated.

If present, cif16MPI indicates the minimum picture interval in units of 1/29.97 for the encoding and/or decoding of 16CIF pictures, and if not present, no capability for 16CIF pictures is indicated.

maxBitRate indicates the maximum bit rate in units of 100 bit/s at which a transmitter can transmit video or a receiver can receive video.

The booleans unrestrictedVector, arithmeticCoding, advancedPrediction, and pbFrames, when true, indicate the capability to transmit and/or receive these optional modes defined in the annexes of Recommendation H.263.

The boolean temporalSpatialTradeOffCapability, when true, indicates that the encoder is able to vary its trade-off between temporal and spatial resolution as commanded by the remote terminal. It has no meaning when part of a receive capability.

The integer hrd-B, when present, indicates the HRD parameter B, and is measured in units of 128 bits. When not present, the default value defined in Recommendation H.263 applies. It is a receiver capability and has no meaning in transmission capability sets.

The integer bppMaxKb, when present, indicates the maximum number of bits for one coded picture that the receiver can receive and decode correctly, and is measured in units of 1024 bits. When not present, the default value defined in Recommendation H.263 applies. It is a receiver capability and has no meaning in transmission capability sets.

The following capabilities are intended for use in certain very low frame rate applications such as surveillance applications:

If present, slowSqcifMPI indicates the minimum picture interval in units of seconds per frame for the encoding and/or decoding of SQCIF pictures. If not present and sqcifMPI is not present, no capability for SQCIF pictures is indicated. If sqcifMPI is present, slowSqcifMPI shall not be present.

If present, slowQcifMPI indicates the minimum picture interval in units of seconds per frame for the encoding and/or decoding of QCIF pictures. If not present and qcifMPI is not present, no capability for QCIF pictures is indicated. If qcifMPI is present, slowQcifMPI shall not be present.

If present, slowCifMPI indicates the minimum picture interval in units of seconds per frame for the encoding and/or decoding of CIF pictures. If not present and cifMPI is not present, no capability for CIF pictures is indicated. If cifMPI is present, slowCifMPI shall not be present.

If present, slowCif4MPI indicates the minimum picture interval in units of seconds per frame for the encoding and/or decoding of 4CIF pictures. If not present and cif4MPI is not present, no capability for 4CIF pictures is indicated. If cif4MPI is present, slowCif4MPI shall not be present.

If present, slowCif16MPI indicates the minimum picture interval in units of seconds per frame for the encoding and/or decoding of 16CIF pictures. If not present and cif16MPI is not present, no capability for 16CIF pictures is indicated. If cif16MPI is present, slowCif16MPI shall not be present.

The boolean errorCompensation, when true, indicates the capability to transmit and/or receive feedback information for error compensation as illustrated in Appendix I/H.263. When part of a transmit capability, it indicates the ability of the encoder to process videoNotDecodedMBs indications and compensate errors. When part of a receive capability, it indicates the ability of the decoder to identify erroneous MBs, treat them as not coded, and send appropriate videoNotDecodedMBs indications.

The values of MPI are applicable when all of the optional modes, for which capability is indicated, are being used, as well as when any combination of them is used. A terminal may signal the capability for a smaller MPI when some options are not used by transmitting another VideoCapability including this smaller MPI and indicating the reduced set of options.

IS11172 VideoCapability: Indicates IS11172 [33] capabilities.

constrainedBitstream indicates the capability for bitstreams in which constrained_parameters flag is set to "1": a value of true indicates that such operation is possible, while a value of false indicates that such operation is not possible. An encoder shall produce bitstreams within the limitations imposed by the optional fields (see below). A decoder shall be able to accept all bit streams within the limitations indicated by the optional fields. The optional fields are integers with units defined in Table 3.

Table 3/H.245 – Units for IS11172-2 codepoints

ASN.1 codepoint	Units for referenced parameter
videoBitRate	400 bit/s
vbvBufferSize	16 384 bits
samplesPerLine	samples per line
linesPerFrame	lines per frame
pictureRate	refer to ISO/IEC 11172-2, 2.4.3.2
luminanceSampleRate	samples per second

7.2.2.6 Audio capabilities

This indicates audio capabilities. The indication of more than a single capability within a single AudioCapability does not indicate simultaneous processing capability. Simultaneous processing capability can be indicated by instances of AudioCapability in different AlternativeCapabilitySets in a single CapabilityDescriptor.

The capability to transmit and/or receive G-series audio is indicated by a choice of integers. When an H.222.1 multiplex is used, these numbers refer to the available STD buffer size in units of 256 octets. When an H.223 multiplex is used, these numbers refer to the maximum number of audio frames per AL-SDU. When an H.225.0 multiplex is used, these numbers indicate the maximum number of audio frames per packet. The exact meaning of the codepoints is given in Table 4.

Table 4/H.245 – G-series audio codepoints

ASN.1 codepoint	Semantic meaning of codepoint
g711Alaw64k	G.711 audio at 64 kbit/s, A-law
g711Alaw56k	G.711 audio at 56 kbit/s, A-law, truncated to 7 bits
g711Ulaw64k	G.711 audio at 64 kbit/s, μ-law
g711Ulaw56k	G.711 audio at 56 kbit/s, μ-law, truncated to 7 bits
g722-64k	G.722 7 kHz audio at 64 kbit/s
g722-56k	G.722 7 kHz audio at 56 kbit/s
g722-48k	G.722 7 kHz audio at 48 kbit/s
g7231	G.723.1 at either 5.3 or 6.3 kbit/s
g728	G.728 audio at 16 kbit/s
g729	G.729 audio at 8 kbit/s
g729AnnexA	G.729 Annex A audio at 8 kbit/s
g729wAnnexB	G.729 audio at 8 kbit/s with silence suppression as in Annex B
g729AnnexAwAnnexB	G.729 Annex A audio at 8 kbit/s with silence suppression as in Annex B
g7231AnnexCCapability	G.723.1 with Annex C

G7231: Indicates the ability to process audio codec G723.1. maxAl-sduAudioFrames indicates the maximum number of audio frames per AL-SDU. The boolean silenceSupression, when true, indicates the capability to use silence compression defined in Annex A/G.723.1.

G7231AnnexCCapability: Indicates the ability to process audio codec G723.1 with its Annex C. maxAl-sduAudioFrames indicates the maximum number of audio frames per AL-SDU. The boolean silenceSupression, when true, indicates the capability to use silence compression defined in G.723.1 Annex A. g723AnnexCAudioMode shall not be present when G7231AnnexCCapability is included in a TerminalCapabilitySet message, but shall be present when G7231AnnexCCapability is included in an OpenLogicalChannel message. The fields highRateMode0, highRateMode1, lowRateMode0, lowRateMode1, sidMode0, and sidMode1 indicate the number of octets per frame for each of the audio and error protection modes of Recommendation G.723.1 and Annex C/G.723.1 that will be used on the logical channel.

IS11172AudioCapability: Indicates the ability to process audio coded according to ISO/IEC 11172-3 [34].

Booleans that have the value of true indicate that the particular mode of operation is possible, while a value of false indicates that it is not. The booleans audioLayer1, audioLayer2 and audioLayer3 indicate which audio coding layers can be processed. The booleans audioSampling32k, audioSampling44k1 and audioSampling48k indicate which of the audio sample rates, 32 kHz, 44.1 kHz and 48 kHz respectively, can be processed. The booleans singleChannel and twoChannels indicate capability for single channel and stereo/dual channel operation respectively. The integer bitRate indicates the maximum audio bit rate capability, and is measured in units of kbit/s.

IS13818AudioCapability: Indicates the ability to process audio coded according to ISO/IEC 13818-3 [35].

Booleans that have the value of true indicate that the particular mode of operation is possible, while a value of false indicates that it is not. The booleans audioLayer1, audioLayer2 and audioLayer3 indicate which audio coding layers can be processed. The booleans audioSampling16k, audioSampling22k05, audioSampling24k, audioSampling32k, audioSampling44k1 and audioSampling48k indicate which of the audio sample rates, 16 kHz, 22.05 kHz, 24 kHz, 32 kHz, 44.1 kHz and 48 kHz respectively, can be processed.

The booleans concerned with multi-channel operation indicate capability to operate in the particular modes, as specified in Table 5.

Table 5/H.245 – ISO/IEC 13818-3 multi-channel codepoints

ASN.1 codepoint	Semantic meaning of codepoint
singleChannel	One channel, using the 1/0 configuration. Single channel mode (as in ISO/IEC 11172-3)
twoChannels	Two channels, using the 2/0 configuration. Stereo or dual channel mode (as in ISO/IEC 11172-3)
threeChannels2-1	Three channels, using the 2/1 configuration. Left, Right and single surround channel
threeChannels3-0	Three channels, using the 3/0 configuration. Left, Centre and Right, without surround channel
fourChannels2-0-2-0	Four channels, using the 2/0 + 2/0 configuration. Left and Right of the first programme and Left and Right of the second programme

Table 5/H.245 – ISO/IEC 13818-3 multi-channel codepoints (*concluded*)

ASN.1 codepoint	Semantic meaning of codepoint
fourChannels2-2	Four channels, using the 2/2 configuration. Left, Right, Left surround and Right surround
fourChannels3-1	Four channels, using the 3/1 configuration. Left, Centre, Right, and a single surround channel
fiveChannels3-0-2-0	Five channels, using the 3/0 + 2/0 configuration. Left, Centre and Right of the first programme and Left and Right of the second programme
fiveChannels3-2	Five channels, using the 3/2 configuration. Left, Centre, Right, Left surround and Right surround

The boolean lowFrequencyEnhancement indicates the capability for a low frequency enhancement channel.

The boolean multilingual, when true, indicates the capability to support up to seven multilingual channels, and when false that no multilingual channel is supported.

The integer bitRate indicates the maximum audio bit rate capability, and is measured in units of kbit/s.

7.2.2.7 Data application capabilities

This indicates data capabilities. The indication of more than a single capability within a single DataApplicationCapability does not indicate simultaneous processing capability. Simultaneous processing capability can be indicated by instances of DataApplicationCapability in different AlternativeCapabilitySets in a single CapabilityDescriptor.

Recommendations that use this Recommendation may place restrictions on which of these modes may be signalled.

Some of the data capabilities require bi-directional logical channels, for example, to run a retransmission protocol. This requirement is implicitly included in the appropriate capability codepoints.

DataApplicationCapability: A list of data applications and bit rates. Each data application indicated shall be supported by one or more DataProtocolCapability.

maxBitRate indicates the maximum bit rate in units of 100 bit/s at which a transmitter can transmit video or a receiver can receive the given data application.

t120 indicates the capability to support the T.120 [25] protocol.

dsm-cc indicates the capability to support the DSM-CC [36] protocol.

userData indicates the capability to support unspecified user data from external data ports.

t84 indicates the capability to support the transfer of T.84 [24] type images (JPEG, JBIG, Facsimile Gr.3/4).

t434 indicates the capability to support the transfer of T.434 [26] telematic binary files.

h224 indicates the capability to support the real-time simplex device control protocol H.224 [9].

nlpid indicates the capability to support the network layer protocol as specified by nlpidData as defined in ISO/IEC TR 9577 [37]. These protocols include Internet Protocol (IP) and IETF Point-to-Point protocol (PPP), among others.

NOTE – The use of the NLPID is extensively described in IETC RFC1490, "Multiprotocol Interconnect over Frame Relay".

dsvdControl indicates the capability of the DSVD terminal to support an out-of-band control channel.

h222DataPartitioning indicates the capability to support the modified and restricted usage of data partitioning of H.262, as specified in Recommendation H.222.1, in which the enhancement data is transmitted as a data channel supported by the listed DataProtocolCapability.

t30 fax: This codepoint indicates the use of Annex C/T.30 analog mode (G3V), as specified in Recommendation T.39 for the DSVF/MSVF modes.

DataProtocolCapability: Contains a list of data protocols.

v14buffered indicates the capability to support a specified data application using buffered V.14 [27].

v42lapm indicates the capability to support a specified data application using the LAPM protocol defined in Recommendation V.42 [29].

hdlcFrameTunnelling indicates the capability to support a specified data application using HDLC Frame Tunnelling. Refer to ISO/IEC 3309, 4.5.2 [32].

h310SeparateVCStack indicates the capability to support a specified data application using the protocol stack defined in Recommendation H.310 for the transport of H.245 messages over a separate ATM VC to that used for audiovisual communication.

h310SingleVCStack indicates the capability to support a specified data application using the protocol stack defined in Recommendation H.310 for the transport of H.245 messages in the same ATM VC as that used for audiovisual communication.

transparent indicates the capability to support a specified data application using transparent data transfer.

v120: Use of v120 is for further study in Recommendation H.323.

separateLANStack indicates that a separate transport stack will be used to transport the data. The intent of a separate network connection for data is indicated by dataType in OpenLogicalChannel resolving to values h310SeparateVCStack or separateLANStack of DataProtocolCapability. When the selected DataApplicationCapability is t120, these choices imply use of the T.123 basic profile for B-ISDN and LAN, respectively. Alternative LAN profiles may be selected by a nonStandard DataProtocolCapability.

If separateLANStack is selected and separateStack is present in the OpenLogicalChannel request, the receiver should attempt to establish the stack indicated. It will respond OpenLogicalChannelAck if successful, otherwise OpenLogicalChannelReject with a suitable cause.

If separateLANStack is selected and separateStack is absent in the OpenLogicalChannel request, the receiver should supply an appropriate separateStack in its OpenLogicalChannelAck response. The receiver of this (the original requester) should then attempt to establish the stack indicated. It will issue CloseLogicalChannel if unsuccessful.

If separateLANStack is selected and separateStack is present in the OpenLogicalChannel request, it can be overridden by separateStack in the OpenLogicalChannelAck response. If the original requester does not tolerate an override, it will issue CloseLogicalChannel.

If separateLANStack is selected and separateStack is absent in the OpenLogicalChannel request and also absent in the OpenLogicalChannelAck response, the original requester can infer that the responder does not understand these ASN.1 extensions and should issue CloseLogicalChannel to clean up.

v76wCompression indicates the capability to support data compression on a V.76 data channel.

T84Profile: Indicates the types of still image profile that the terminal is able to support.

t84Unrestricted provides no indication of the type of T.84 still image that the terminal is able to support: information in the T.84 layer should be used to determine whether a particular image can be received.

t84Restricted indicates the type of T.84 still image that the terminal is able to support.

qcif indicates the support of a sequential colour YCrCb type image with QCIF resolution.

cif indicates the support of a sequential colour YCrCb type image with CIF resolution.

ccir601Seq indicates the support of a sequential colour YCrCb type image with CCIR601 resolution.

ccir601Prog indicates the support of a progressive colour YCrCb type image with CCIR601 resolution.

hdtvSeq indicates the support of a sequential colour YCrCb type image with HDTV resolution.

hdtvProg indicates the support of a progressive colour YCrCb type image with HDTV resolution.

g3FacsMH200x100 indicates the support of a sequential Facsimile Gr. 3 MH (Modified Huffman) coded bi-level image at the normal (200 × 100 ppi) resolution.

g3FacsMH200x200 indicates the support of a sequential Facsimile Gr. 3 MH (Modified Huffman) coded bi-level image at the high (200 × 200 ppi) resolution.

g4FacsMMR200x100 indicates the support of a sequential Facsimile Gr. 4 MMR (Modified Modified Reed) coded bi-level image at the normal (200 × 100 ppi) resolution.

g4FacsMMR200x200 indicates the support of a sequential Facsimile Gr. 4 MMR (Modified Modified Reed) coded bi-level image at the high (200 × 200 ppi) resolution.

jbig200x200Seq indicates the support of a sequential bi-level JBIG coded bi-level image at the 200 × 200 ppi resolution.

jbig200x200Prog indicates the support of a progressive bi-level JBIG coded bi-level image at the 200 × 200 ppi resolution.

jbig300x300Seq indicates the support of a sequential bi-level JBIG coded bi-level image at the 300 × 300 ppi resolution.

jbig300x300Prog indicates the support of a progressive bi-level JBIG coded bi-level image at the 300 × 300 ppi resolution.

digPhotoLow indicates the support of a sequential JPEG coded colour image of up to 720 × 576 image size.

digPhotoMedSeq indicates the support of a sequential JPEG coded colour image of up to 1440 × 1152 image size.

digPhotoMedProg indicates the support of a progressive JPEG coded colour image of up to 1440 × 1152 image size.

digPhotoHighSeq indicates the support of a sequential JPEG coded colour image of up to 2880 × 2304 image size.

digPhotoHighProg indicates the support of a progressive JPEG coded colour image of up to 2880 × 2304 image size.

7.2.3 Terminal Capability Set Acknowledge

This is used to confirm receipt of a TerminalCapabilitySet from the peer CESE.

The sequenceNumber shall be the same as the sequenceNumber in the TerminalCapabilitySet for which this is the confirmation.

7.2.4 Terminal Capability Set Reject

This is used to reject a TerminalCapabilitySet from the peer CESE.

The sequenceNumber shall be the same as the sequenceNumber in the TerminalCapabilitySet for which this is the negative acknowledgement.

The reasons for sending this message are given in Table 6.

Table 6/H.245 – Reasons for rejecting a TerminalCapabilitySet

ASN.1 codepoint	Cause
unspecified	No cause for rejection specified
undefinedTableEntryUsed	A capability descriptor made reference to a capabilityTable entry that is not defined
descriptorCapacityExceeded	The terminal was incapable of storing all of the information in the TerminalCapabilitySet
tableEntryCapacityExceeded	The terminal was incapable of storing more entries than that indicated in highestEntryNumberProcessed or else could not store any

7.2.5 Terminal Capability Set Release

This is sent in the case of a timeout.

7.3 Logical channel signalling messages

This set of messages is for logical channel signalling. The same set of messages is used for uni-directional and bi-directional logical channel signalling; however, some parameters are only present in the case of bi-directional logical channel signalling.

"Forward" is used to refer to transmission in the direction from the terminal making the original request for a logical channel to the other terminal, and "reverse" is used to refer to the opposite direction of transmission, in the case of a bi-directional channel request.

7.3.1 Open Logical Channel

This is used to attempt to open a uni-directional logical channel connection between an outgoing LCSE and a peer incoming LCSE and to open a bi-directional logical channel connection between an outgoing B-LCSE and a peer incoming B-LCSE.

forwardLogicalChannelNumber: Indicates the logical channel number of the forward logical channel that is to be opened.

forwardLogicalChannelParameters: Include parameters associated with the logical channel in the case of attempting to open a uni-directional channel and parameters associated with the forward logical channel in the case of attempting to open a bi-directional channel.

reverseLogicalChannelParameters: Include parameters associated with the reverse logical channel in the case of attempting to open a bi-directional channel. Its presence indicates that the request is for a bi-directional logical channel with the stated parameters, and its absence indicates that the request is for a uni-directional logical channel.

NOTE – H.222 parameters are not included in reverseLogicalChannelParameters as their values are not known to the terminal initiating the request.

portNumber is a user to user parameter that may be used by a user for such purposes as associating an input or output port, or higher layer channel number, with the logical channel.

dataType indicates the data that is to be carried on the logical channel.

If it is nullData, the logical channel will not be used for the transport of elementary stream data, but only for adaptation layer information – if video is to be transmitted in one direction only, but a retransmission protocol is to be used, such as AL3 defined in Recommendation H.223, a return channel is needed to transport the retransmission requests – it may also be used to describe a logical channel that only contains PCR values in the case of H.222.1 Transport Streams [7].

Terminals capable only of uni-directional (transmit or receive) operation on media types which make use of bi-directional channels shall send capabilities only for the supported direction of operation. The reverse direction shall use the nullData type, for which no capability is necessary. Transmit-only terminals should send transmit capabilities, but terminals should not assume that the absence of transmit capabilities implies that transmit-only operation is not possible.

separateStack indicates that a separate transport stack will be used to transport the data and provides an address to use to establish the stack which is either a Q.2931, E.164, or local area network transport address.

networkAccessParameters define the distribution, network address, and creation and association information to be used for the separateStack.

distribution shall be present when networkAddress is set to localAreaNetwork and shall indicate whether the networkAddress is a uni or multicast transport address.

networkAddress indicates the address of the actual stack in use: Q.2931, E.164, or local area network transport address.

associateConference indicates whether or not the data conference is new (associateConference = FALSE) or is an existing data conference which should be associated with the audio/video call (associateConference = TRUE).

externalReference indicates information which may be used to further provide association or information concerning the separateStack.

If it is of type VideoCapability, AudioCapability, the logical channel may be used for any of the variations indicated by each individual capability; and it shall be possible to switch between these variations using only signalling that is in-band to the logical channel – for example, in the case of H.261 video, if both QCIF and CIF are indicated, it shall be possible to switch between these on a picture by picture basis. In the case of DataApplicationCapability, only one instance of a capability can be indicated since there is no in-band signalling allowing a switch between variations.

If it is encryptionData, the logical channel will be used for the transport of encryption information as specified.

H222LogicalChannelParameters: Used to indicate parameters specific to using Recommendation H.222.1 [7]. It shall be present in forwardLogicalChannelParameters and shall not be present in reverseLogicalChannelParameters.

resourceID indicates in which ATM Virtual Channel the logical channel is to be transported. The means by which this parameter is associated with an ATM Virtual Channel is not specified in this Recommendation.

subChannelID indicates which H.222.1 sub-channel is used for the logical channel. It shall be equal to the PID in a Transport Stream and the stream_id in a Program Stream.

pcr-pid indicates the PID used for the transport of Program Clock References when the Transport Stream is used. It shall be present when the ATM virtual channel carries a Transport Stream and shall not be present when the ATM virtual channel carries a Program Stream.

programDescriptors is an optional octet string, which, if present, contains one or more descriptors, as specified in Recommendations H.222.0 and H.222.1, that describe the program that the information to be carried in the logical channel is a part of.

streamDescriptors is an optional octet string, which, if present, contains one or more descriptors, as specified in Recommendations H.222.0 and H.222.1, that describe the information that is to be carried in the logical channel.

H223LogicalChannelParameters: Used to indicate parameters specific to using Recommendation H.223 [8]. It shall be present in forwardLogicalChannelParameters and reverseLogicalChannelParameters.

adaptationLayerType indicates which adaptation layer and options will be used on the logical channel. The codepoints are as follows: nonStandard, al1Framed (AL1 framed mode), al1NotFramed (AL1 unframed mode), al2WithoutSequenceNumbers (AL2 with no sequence numbers present), al2WithSequenceNumbers (AL2 with sequence numbers present), and al3 (AL3, indicating the number of control field octets that will be present and the size of the send buffer, B_S, that will be used, the size being measured in octets).

segmentableFlag, when equal to true indicates that the channel is designated to be segmentable, and when equal to false indicates that the channel is designated to be non-segmentable.

V76LogicalChannelParameters: Used to indicate parameters specific to using Recommendation V.76.

audioHeader is used to indicate the use of an audio header on the logical channel. This is a valid parameter for channels of the DataType audio.

suspendResume is used to indicate that the channel may use the suspend/resume procedures to suspend other logical channels. Three channel options may be selected; no suspend resume on the channel, suspend resume using an address or suspend resume without an address as defined in Recommendation V.76. suspendResumewAddress indicates that the suspend/resume channel shall use the address field as defined in Recommendation V.76. suspendResumewoAddress indicates that the suspend/resume channel shall not use the address field.

eRM indicates that the logical channel shall perform error recovery procedures as defined in Recommendation V.76.

uNERM indicates that the logical channel shall operate in non error recovery mode as defined in Recommendation V.76.

For description of n401, windowSize and loopbackTestProcedure see Recommendation V.42, 12.2.1 and its subsections. For the purposes of Recommendation V.70, n401 shall be encoded in octets.

crcLength is an optional parameter that indicates the CRC length used in error recovery mode. If this parameter is not present, the default CRC length shall be used. crc8bit indicates to use an 8-bit CRC, crc16bit indicates use of the 16-bit CRC and crc32bit indicates to use a 32-bit CRC as defined in Recommendation V.76.

recovery is an optional parameter that indicates the error recover procedures defined in Recommendation V.76. If this parameter is not present, the default error recovery procedure shall be used. sREJ indicates to use the selective frame reject procedure and mSREJ indicates to use the multiple selective reject procedure as defined in Recommendation V.76.

uIH indicates the use of V.76 UIH frames.

rej indicates the use of the reject procedure in Recommendation V.76.

V75Parameters is used to indicate parameter specific to using V.75. audioHeaderPresent indicates the presence of the V.75 audio header.

H2250LogicalChannelParameters: Used to indicate parameters specific to using Recommendation H.225.0. It shall be present in forwardLogicalChannelParameters and reverseLogicalChannelParameters.

The sessionID is a unique RTP Session Identifier in the conference. It is used by the transmitter to refer to the session to which the logical channel applies. Only the master can create the session identification. By convention, there are two primary sessions. The first primary session with a session identification of 1 is the audio session and the second primary session with a session identification of 2 is the video session. A slave entity can open an additional session by providing a session identification of 0 in the openLogicalChannel message. The master will create a unique session identification and provide it in the openLogicalChannelAck message.

The associatedSessionID is used to associate one session with another. Typical use will be to associate an audio session with a video session to indicate which sessions to process for lip synchronization.

The mediaChannel indicates a transportAddress to be used for the logical channel. It is not present in the OpenLogicalChannel message when the transport is unicast. If the transportAddress is multicast, the master is responsible for creating the multicast transport address and shall include the address in the OpenLogicalChannel message. A slave entity that wishes to open a new multicast channel will provide zeroes in the multicast transportAddress field. The master will create and provide the multicast transportAddress in the OpenLogicalChannelAck message for the slave entity. Note that the MC will use the communicationModeCommand to specify the details about all the RTP Sessions in the conference.

The mediaChannel is used to describe the transport address for the logical channel. IPv4 and IPv6 addresses shall be encoded with the most significant octet of the address being the first octet in the respective OCTET STRING, e.g. the class B IPv4 address 130.1.2.97 shall have the "130" being encoded in the first octet of the OCTET STRING, followed by the "1" and so forth. The IPv6 address a148:2:3:4:a:b:c:d shall have the "a1" encoded in the first octet, "48" in the second, "00" in the third, "02" in the fourth and so forth. IPX addresses, node, netnum, and port shall be encoded with the most significant octet of each field being the first octet in the respective OCTET STRING.

mediaGuaranteedDelivery indicates whether or not the underlying media transport should be selected to provide or not provide guaranteed delivery of data.

mediaControlChannel indicates the media control channel in which the sender of the open logical channel will be listening for media control messages for this session. This field is present only when a media control channel is required.

mediaControlGuaranteedDelivery indicates whether or not the underlying media control transport should be selected to provide or not provide guaranteed delivery of data. This field is present only when a media control channel is required.

The silenceSuppression is used to indicate whether the transmitter stops sending packets during times of silence. It shall be included in the openLogicalChannel message for an audio channel and omitted for any other type of channel.

destination indicates the terminalLabel of the destination if one has been assigned.

dynamicRTPPayloadType indicates a dynamic payload value which is used in Recommendation H.323 for the H.225.0 alternative H.261 video packetization scheme. This field is present only when a dynamic RTP payload is in use.

mediaPacketization indicates which optional media packetization scheme is in use.

7.3.2 Open Logical Channel Acknowledge

This is used to confirm acceptance of the logical channel connection request from the peer LCSE or B-LCSE. In the case of a request for a uni-directional logical channel, it indicates acceptance of that uni-directional logical channel. In the case of a request for a bi-directional logical channel, it indicates acceptance of that bi-directional logical channel, and indicates the appropriate parameters of the reverse channel.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel that is being opened.

reverseLogicalChannelParameters is present if and only if responding to a bi-directional channel request.

reverseLogicalChannelNumber indicates the logical channel number of the reverse channel.

portNumber is a user to user parameter that may be used by a user for such purposes as associating an input or output port, or higher layer channel number, with the reverse logical channel.

multiplexParameters indicate parameters specific to the multiplex, H.222, H.223, or H.225.0, that is used to transport the reverse logical channel.

separateStack indicates that a separate transport stack will be used to transport the data and provides an address, to use to establish the stack, which is either a Q.2931, E.164, or local area network transport address.

forwardMultiplexAckParameters indicate parameters specific to the multiplex, H.222, H.223, or H.225.0 that is used to transport the forward logical channel.

H2250LogicalChannelAckParameters are used to indicate parameters specific to using Recommendation H.225.0.

sessionID is a unique RTP Session Identifier in the conference that can only be created by the master. It is created and provided by the master if the slave wishes to create a new session by specifying an invalid session identification of 0 in the openLogicalChannelAck message.

The mediaChannel indicates a transportAddress to be used for the logical channel. It shall be present in the OpenLogicalChannelAck message when the transport is unicast. If the transportAddress is multicast, the master is responsible for creating the multicast transport address and shall include the address in the OpenLogicalChannel message. A slave entity that wishes to open a new multicast channel will provide zeroes in the multicast transportAddress field. The master will create and provide the multicast transportAddress in the OpenLogicalChannelAck message for the slave entity.

Note that the MC will use the communicationModeCommand to specify the details about all the RTP Sessions in the conference.

The mediaChannel is used to describe the transport address for the logical channel. IPv4 and IPv6 addresses shall be encoded with the most significant octet of the address being the first octet in the respective OCTET STRING, e.g. the class B IPv4 address 130.1.2.97 shall have the "130" being encoded in the first octet of the OCTET STRING, followed by the "1" and so forth. The IPv6 address a148:2:3:4:a:b:c:d shall have the "a1" encoded in the first octet, "48" in the second, "00" in the third, "02" in the fourth and so forth. IPX addresses, node, netnum, and port shall be encoded with the most significant octet of each field being the first octet in the respective OCTET STRING.

mediaControlChannel indicates the media control channel in which the sender of the openLogicalChannelAck will be listening for media control messages for this session. This field is present only when a media control channel is required.

dynamicRTPPayloadType indicates a dynamic payload value which is used in H.323 for the H.225.0 alternative H.261 video packetization scheme. This field is present only when a dynamic RTP payload is in use.

NOTE – H.223 parameters are not included in reverseLogicalChannelParameters as their values were specified in the OpenLogicalChannel request message.

7.3.3 Open Logical Channel Reject

This is used to reject the logical channel connection request from the peer LCSE or B-LCSE.

NOTE – In the case of a bi-directional channel request, rejection applies to both forward and reverse channels. It is not possible to accept one and reject the other.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel specified in the request that is being rejected.

The cause field indicates the reason for rejection of the logical channel establishment. The cause values are given in Table 7.

Table 7/H.245 – Reasons for rejecting a OpenLogicalChannel

ASN.1 codepoint	Cause
unspecified	No cause for rejection specified
unsuitableReverseParameters	This shall only be used to reject a bi-directional logical channel request when the only reason for rejection is that the requested reverseLogicalChannelParameters are inappropriate. Such a rejection shall immediately be followed by initiating procedures to open a similar but acceptable bi-directional logical channel
dataTypeNotSupported	The terminal was not capable of supporting the dataType indicated in OpenLogicalChannel
dataTypeNotAvailable	The terminal was not capable of supporting the dataType indicated in OpenLogicalChannel simultaneously with the dataTypes of logical channels that are already open
unknownDataType	The terminal did not understand the dataType indicated in OpenLogicalChannel

Table 7/H.245 – Reasons for rejecting a OpenLogicalChannel (*concluded*)

ASN.1 codepoint	Cause
dataTypeALCombinationNotSupported	The terminal was not capable of supporting the dataType indicated in OpenLogicalChannel simultaneously with the Adaptation Layer type indicated in H223LogicalChannelParameters
multicastChannelNotAllowed	Multicast Channel could not be opened
insufficientBandwidth	The channel could not be opened because permission to use the requested bandwidth for the logical channel was denied
separateStackEstablishmentFailed	A request to run the data portion of a call on a separate stack failed
invalidSessionID	Attempt by slave to set SessionID when opening a logical channel to the master
masterSlaveConflict	Attempt by slave to open logical channel in which the master has determined a conflict may occur. (See 8.4.1.3 and 8.5.1.3)

7.3.4 Open Logical Channel Confirm

This is used in bi-directional signalling to indicate to the incoming B-LCSE that the reverse channel is open and can be used for transmission.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel which was opened.

7.3.5 Close Logical Channel

This is used by the outgoing LCSE or B-LCSE to close a logical channel connection between two peer LCSEs or B-LCSEs.

NOTE – In the case of a bi-directional logical channel, this closes both forward and reverse channels. It is not possible to close one and not the other.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel of the logical channel that is to be closed.

The source of the logical channel release is given in Table 8.

Table 8/H.245 – Sources of logical channel release

ASN.1 codepoint	Cause
user	The LCSE or B-LCSE user is the source of the release
lcse	The LCSE or B-LCSE is the source of the release. This may occur as a result of a protocol error

7.3.6 Close Logical Channel Acknowledge

This is used to confirm the closing of a logical channel connection.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel of the logical channel that is being closed.

7.3.7 Request Channel Close

This is used to by the outgoing CLCSE to request the closing of a logical channel connection between two peer LCSEs.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel of the logical channel that is requested to close.

7.3.8 Request Channel Close Acknowledge

This is used by the incoming CLCSE to indicate that the logical channel connection will be closed.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel of the logical channel that it has been requested to close.

7.3.9 Request Channel Close Reject

This is used by the incoming CLCSE to indicate that the logical channel connection will not be closed.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel of the logical channel that it has been requested to close.

The cause field indicates the reason for rejection of the request to close the logical channel. The only valid cause value is unspecified.

7.3.10 Request Channel Close Release

This is sent by the outgoing CLCSE in the case of a timeout.

forwardLogicalChannelNumber indicates the logical channel number of the forward channel of the logical channel that it has requested to close.

7.4 Multiplex Table signalling messages

This set of messages is for the secure transmission of H.223 multiplex table entries from the transmitter to the receiver.

7.4.1 Multiplex Entry Send

This is used to send H.223 multiplex table entries from the transmitter to the receiver. It is sent from an outgoing MTSE and a peer incoming MTSE.

sequenceNumber is used to label instances of MultiplexEntrySend so that the corresponding response can be identified.

MultiplexEntryDescriptors is a set of 1 to 15 MultiplexEntryDescriptors.

MultiplexEntryDescriptor: Describes a single multiplex table entry. It includes the MultiplexTableEntryNumber and a list of MultiplexElements. A missing element list indicates that the entry is deactivated.

MultiplexElement: A recursive structure that describes a single element and a repeat count. If of type logicalChannelNumber, the element indicates a single slot from the given logical channel, and the repeat count indicates the length of the slot in octets. If of type subElementList, the element

indicates a sequence of nested MultiplexElements, and the repeat count indicates the number of times to repeat the sequence. In either case, if the repeatCount field is untilClosingFlag, this means to repeat the element indefinitely until the closing flag of the MUX-PDU.

In each MultiplexEntryDescriptor, the repeatCount of the final MultiplexElement in the elementList shall be set to "untilClosingFlag", and the repeatCount of all other MultiplexElements in the elementList shall be set to "finite". This ensures that all multiplex table entries define a multiplex sequence pattern of indefinite length, repeating until the closing flag of the MUX-PDU. A MultiplexEntryDescriptor with a missing elementList field shall indicate a deactivated entry.

Each MultiplexEntrySend request may contain up to 15 MultiplexEntryDescriptors, each describing a single multiplex table entry. Multiplex entries may be sent in any order.

7.4.2 Multiplex Entry Send Acknowledge

This is used to confirm receipt of one or more multiplexEntryDescriptors from a MultiplexEntrySend from the peer MTSE.

The sequenceNumber shall be the same as the sequenceNumber in the MultiplexEntrySend for which this is the confirmation.

multiplexTableEntryNumber indicates which multiplex table entries are being confirmed.

7.4.3 Multiplex Entry Send Reject

This is used to reject one or more multiplexEntryDescriptors from a MultiplexEntrySend from the peer MTSE.

The sequenceNumber shall be the same as the sequenceNumber in the MultiplexEntrySend for which this is the rejection.

MultiplexEntryRejectionDescriptions specifies which table entries are being rejected, and why. The causes of rejection are given in Table 9.

Table 9/H.245 – Reasons for rejecting a MultiplexEntrySend

ASN.1 codepoint	Cause
unspecified	No cause for rejection specified
descriptorTooComplex	The MultiplexEntryDescriptor exceeded the capability of the receive terminal

7.4.4 Multiplex Entry Send Release

This is sent by the outgoing MTSE in the case of a time-out.

multiplexTableEntryNumber indicates which multiplex table entries have timed-out.

7.5 Request Multiplex Table signalling messages

This set of messages is for the secure request of retransmission of one or more MultiplexEntryDescriptors from the transmitter to the receiver.

7.5.1 Request Multiplex Entry

This is used to request the retransmission of one or more MultiplexEntryDescriptors.

entryNumbers is a list of the MultiplexTableEntryNumbers of the MultiplexEntryDescriptors for which retransmission is requested.

7.5.2 Request Multiplex Entry Acknowledge

This is used by the incoming RMESE to indicate that the multiplex entry will be transmitted.

entryNumbers is a list of the MultiplexTableEntryNumbers of the MultiplexEntryDescriptors will be transmitted.

7.5.3 Request Multiplex Entry Reject

This is used by the incoming RMESE to indicate that the multiplex entry will not be transmitted.

entryNumbers is a list of the MultiplexTableEntryNumbers of the MultiplexEntryDescriptors will not be transmitted. The values of MultiplexTableEntryNumber in entryNumbers should match the values of MultiplexTableEntryNumber in rejectionDescriptions otherwise errors may occur during operation.

RequestMultiplexEntryRejectionDescriptions specifies which table entries are being rejected, and why. The causes of rejection are given in Table 10.

Table 10/H.245 – Reasons for rejecting a MultiplexEntrySend

ASN.1 codepoint	Cause
unspecified	No cause for rejection specified

7.5.4 Request Multiplex Entry Release

This is sent by the outgoing RMESE in the case of a time-out.

entryNumbers is a list of the MultiplexTableEntryNumbers of the MultiplexEntryDescriptors for which time-out has occurred.

7.6 Request Mode messages

This set of messages is used by a receive terminal to request particular modes of transmission from the transmit terminal.

7.6.1 Request Mode

This is used to request particular modes of transmission from the transmit terminal. It is a list, in order or preference (most preferable first), of modes that the terminal would like to receive. Each mode is described using a ModeDescription.

sequenceNumber is used to label instances of RequestMode so that the corresponding response can be identified.

ModeDescription: A set of one or more ModeElements.

ModeElement: Used to describe a mode element, that is, one of the constituent parts of a complete mode description. It indicates the type of elementary stream that is requested and optionally how it is requested to be multiplexed.

type is used to indicate the type of elementary stream that is requested. It is a choice of VideoMode, AudioMode, DataMode, and EncryptionMode.

h223ModeParameters: Used to indicate parameters specific to using Recommendation H.223 [8].

adaptationLayerType indicates which adaptation layer and options are requested for the requested type. The codepoints are as follows: nonStandard, al1Framed (AL1 framed mode), al1NotFramed (AL1 unframed mode), al2WithoutSequenceNumbers (AL2 with no sequence numbers present),

al2WithSequenceNumbers (AL2 with sequence numbers present), and al3 (AL3, indicating the number of control field octets that will be present and the size of the send buffer, B_S, that will be used, the size being measured in octets).

segmentableFlag, when equal to true indicates that segmentable multiplexing is requested, and when equal to false indicates that non-segmentable multiplexing is requested.

7.6.1.1 Video Mode

This is a choice of VideoModes.

H261VideoMode: Indicates the requested picture resolution (either QCIF or CIF), bit rate, in units of 100 bit/s, and still picture transmission.

H262VideoMode: Indicates the requested profile and level, and the optional fields, if present, indicate the requested values of the parameters given. The optional fields are integers with units defined in Table 2.

H263VideoMode: Indicates the requested picture resolution (SQCIF, QCIF, CIF, 4CIF and 16CIF) and bit rate, in units of 100 bit/s.

The booleans unrestrictedVector, arithmeticCoding, advancedPrediction, and pbFrames, when true, indicate that is it requested to use these optional modes that are defined in the annexes of Recommendation H.263.

The boolean errorCompensation, when true, indicates that the encoder is capable of processing videoNotDecodedMBs indications and compensating errors as illustrated in Appendix I/H.263. The encoder is not required to respond to videoNotDecoded indications. In a multipoint control unit (MCU), it may not be practical for the MCU to respond to all indications.

IS11172VideoMode: Indicates request for constrainedBitstream and the optional fields, if present, indicate the requested values of the parameters given. The optional fields are integers with units defined in Table 3.

7.6.1.2 Audio Mode

This is a choice of AudioModes.

The exact meaning of the G-series audio codepoints is given in Table 4. There are four options for G.723.1 audio, to allow either of the bit rates (the low bit rate of 5.3 kbit/s or the high bit rate of 6.3 kbit/s) to be requested with or without the use of silence suppression.

G7231AnnexCMode: Used to request audio coded according to Annex C/G.723.1. maxAl-sduAudioFrames indicates the requested maximum number of audio frames per AL-SDU. The boolean silenceSupression, when true, requests the use of silence compression defined in Annex A/G.723.1. The fields of g723AnnexCAudioMode, highRateMode0, highRateMode1, lowRateMode0, lowRateMode1, sidMode0, and sidMode1 indicates the requested number of octets per frame for each of the audio and error protection modes of Recommendation G.723.1 and Annex C/G.723.1.

IS11172AudioMode: Used to request audio coded according to ISO/IEC 11172-3 [34].

audioLayer indicates which coding layer is requested: either audioLayer1, audioLayer2 or audioLayer3.

audioSampling indicates which sample rate is requested: audioSampling32k, audioSampling44k1 and audioSampling48k indicate the audio sample rates 32 kHz, 44.1 kHz and 48 kHz respectively.

multi-channelType indicates which multi-channel mode is requested: singleChannel, twoChannelStereo and twoChannelDual request single channel, stereo and dual channel operation respectively.

bitRate indicates the requested audio bit rate, and is measured in units of kbit/s.

IS13818AudioMode: Used to request audio coded according to ISO/IEC 13818-3 [35].

audioLayer indicates which coding layer is requested: either audioLayer1, audioLayer2 or audioLayer3.

audioSampling indicates which sample rate is requested: audioSampling16k, audioSampling22k05, audioSampling24k, audioSampling32k, audioSampling44k1 and audioSampling48k indicate the audio sample rates 16 kHz, 22.05 kHz, 24 kHz, 32 kHz, 44.1 kHz and 48 kHz respectively.

multi-channelType indicates which multi-channel mode is requested as specified in Table 11.

Table 11/H.245 – ISO/IEC 13818-3 multi-channel codepoints

ASN.1 codepoint	Semantic meaning of codepoint
singleChannel	One channel, using the 1/0 configuration. Single channel mode (as in ISO/IEC 11172-3)
twoChannelStereo	Two channels, using the 2/0 configuration, stereo channel mode (as in ISO/IEC 11172-3)
twoChannelDual	Two channels, using the 2/0 configuration, dual channel mode (as in ISO/IEC 11172-3)
threeChannels2-1	Three channels, using the 2/1 configuration. Left, Right and single surround channel
threeChannels3-0	Three channels, using the 3/0 configuration. Left, Centre and Right, without surround channel
fourChannels2-0-2-0	Four channels, using the 2/0 + 2/0 configuration. Left and Right of the first programme and Left and Right of the second programme
fourChannels2-2	Four channels, using the 2/2 configuration. Left, Right, Left surround and Right surround
fourChannels3-1	Four channels, using the 3/1 configuration. Left, Centre, Right, and a single surround channel
fiveChannels3-0-2-0	Five channels, using the 3/0 + 2/0 configuration. Left, Centre and Right of the first programme and Left and Right of the second programme
fiveChannels3-2	Five channels, using the 3/2 configuration. Left, Centre, Right, Left surround and Right surround

The boolean lowFrequencyEnhancement, when true, requests a low frequency enhancement channel.

The boolean multilingual, when true, requests up to seven multilingual channels.

bitRate indicates the requested audio bit rate, and is measured in units of kbit/s.

7.6.1.3 Data Mode

This is a choice of data applications and bit rates.

bitRate indicates the requested bit rate in units of 100 bit/s.

t120 requests the use of the T.120 [25] protocol.

dsm-cc requests the use of the DSM-CC [36] protocol.

userData requests the use of unspecified user data from external data ports.

t84 requests the use of T.84 [24] for the transfer of such images (JPEG, JBIG, Facsimile Gr.3/4).

t434 requests the use of T.434 [26] for the transfer of telematic binary files.

h224 requests the use of the real-time simplex device control protocol H.224 [9].

nlpid requests the use of the specified network link layer data application.

v76Control requests the use of the v76 terminal to support an out-of-band control channel.

h222DataPartitioning requests the use of the modified and restricted usage of data partitioning of H.262, as specified in Recommendation H.222.1, in which the enhancement data is transmitted as a data channel supported by the listed DataProtocolCapability.

7.6.1.4 Encryption Mode

This is a choice of encryption modes.

h233Encryption requests the use of encryption according to Recommendations H.233 [11] and H.234 [12].

7.6.2 Request Mode Acknowledge

This is sent to confirm that the transmit terminal intends to transmit in one of the modes requested by the receive terminal.

The sequenceNumber shall be the same as the sequenceNumber in the RequestMode for which this is the confirmation.

The response field indicates the action from the remote terminal. The possible values of response are given in Table 12.

Table 12/H.245 – Confirmation responses to Request Mode

ASN.1 codepoint	Response
willTransmitMostPreferredMode	The transmit terminal will change to the receiver's most preferred mode
willTransmitLessPreferredMode	The transmit terminal will change to one of the receiver's preferred mode, but not the most preferred mode

7.6.3 Request Mode Reject

This is sent to reject the request by the receive terminal.

The sequenceNumber shall be the same as the sequenceNumber in the RequestMode for which this is the response.

The cause field indicates the reason for rejection of the requested mode. The cause values are given in Table 13.

Table 13/H.245 – Rejection responses to Request Mode

ASN.1 codepoint	Response
modeUnavailable	The transmit terminal will not change its mode of transmission as the requested modes are not available
multipointConstraint	The transmit terminal will not change its mode of transmission due to a multipoint constraint
requestDenied	The transmit terminal will not change its mode of transmission

7.6.4 Request Mode Release

This is used by the outgoing MRSE in the case of a time-out.

7.7 Round Trip Delay messages

This set of messages is used by a terminal to determine the round trip delay between two communicating terminals. It also enables an H.245 user to determine whether the peer H.245 protocol entity is alive.

7.7.1 Round Trip Delay Request

This is sent from the outgoing RTDSE to the incoming RTDSE.

sequenceNumber is used to label instances of RoundTripDelayRequest so that the corresponding response can be identified.

7.7.2 Round Trip Delay Response

This is sent from the incoming RTDSE to the outgoing RTDSE.

The sequenceNumber shall be the same as the sequenceNumber in the RoundTripDelayRequest for which this is the response.

7.8 Maintenance Loop messages

This set of messages is used by a terminal to perform maintenance loop functions.

7.8.1 Maintenance Loop Request

This is sent to request a particular type of loopback. The types mediaLoop and logicalChannelLoop request the loopback of only one logical channel as indicated by LogicalChannelNumber, while the type systemLoop refers to all logical channels. The exact definition of these types is system specific and outside the scope of this Recommendation.

7.8.2 Maintenance Loop Acknowledge

This is used confirm that the terminal will perform the loop as requested.

7.8.3 Maintenance Loop Reject

This is used indicate that the terminal will not perform the loop as requested.

A terminal may use the cause canNotPerformLoop to indicate that it does not have the capability to perform the requested loop.

7.8.4 Maintenance Loop Command Off

On receipt of this command, the terminal shall disconnect all loops and restore audio, video and data paths to their normal condition.

7.9 Communication Mode messages

This set of messages are used by an H.323 MC to convey the communication mode of an H.323 conference.

7.9.1 Communication Mode Command

This command is sent by the H.323 MC to specify the communication mode for each data type: unicast or multicast. This command may cause a switch between a centralized and decentralized conference. A switch may involve closing all existing logical channels and opening new ones.

The CommunicationModeTable specifies all the sessions in the conference. For each session, the RTP session identifier, an associated RTP session ID, a terminal number, a description of the session, a mode for each data type, a unicast or multicast address for the media channel and an associated guaranteed delivery request, a media control address for the reverse RTCP channel and an associated guaranteed delivery request.

7.9.2 Communication Mode Request

This is sent to the MC to request the communication mode of the current conference.

7.9.3 Communication Mode Response

This is sent by the MC, in response to a CommunicationModeRequest to specify the communication mode of a conference.

7.10 Conference Request and Response Messages

TerminalID, which is used in the Conference Request and Response Messages, has a length of 128 octets. When communicating between an H.323 terminal and an H.320 terminal via an H.323 Gateway, this field will be truncated to 32 octets.

7.10.1 Terminal List Request

This request equates to H.230 TCU as described in Recommendation H.243.

7.10.2 Terminal List Response

This request equates to a sequence of terminalNumbers as described in Recommendation H.230.

7.10.3 Make Me Chair

This request equates to CCA as described in Recommendation H.230.

7.10.4 Cancel Make Me Chair

This request equates to CIS as described in Recommendation H.230.

7.10.5 Make Me Chair Response

This request equates to either H.230 CIT if the chair control token is granted or H.230 CCR if the chair control token is denied.

7.10.6 Drop Terminal

This request equates to CCD as described in Recommendation H.230.

7.10.7 Terminal Drop Reject

This response equates to CIR as described in Recommendation H.230.

7.10.8 RequestTerminal ID

This request equates to TCP as described in Recommendation H.230.

7.10.9 MC Terminal ID Response

This response equates to TIP as described in Recommendation H.230.

7.10.10 Enter H.243 Password Request

This request equates to TCS1 as described in Recommendation H.230.

7.10.11 Password Response

This response equates to IIS as described in Recommendation H.230.

7.10.12 Enter H.243 Terminal ID Request

This request equates to TCS2/TCI as described in Recommendation H.230.

7.10.13 Terminal ID Response

This response equates to IIS as described in Recommendation H.230.

7.10.14 Enter H.243 Conference ID Request

This request equates to TCS3 as described in Recommendation H.230.

7.10.15 Conference ID Response

This response equates to IIS as described in Recommendation H.230.

7.10.16 Video Command Reject

This request equates to VCR as described in Recommendation H.230.

7.10.17 Enter Extension Address Request

This request equates to TCS4 as described in Recommendation H.230.

7.10.18 Extension Address Response

This response equates to IIS as described in Recommendation H.230.

7.11 Commands

A command message requires action but no explicit response.

7.11.1 Send Terminal Capability Set

specificRequest commands the far end terminal to indicate its transmit and receive capabilities by sending one or more TerminalCapabilitySets that contain the information requested, as specified below. This command may be sent at any time to elicit the capabilities of the remote terminal, for example, following an interruption or other cause for uncertainty; however, such messages should not be sent repetitively without strong cause.

A terminal shall only request the transmission of capabilityTableEntryNumbers and capabilityDescriptorNumbers that it has previously received. A terminal shall ignore any requests to transmit capabilityTableEntryNumbers and capabilityDescriptorNumbers that it has not previously transmitted and no fault shall be considered to have occurred.

The boolean multiplexCapability, when true, requests the transmission of the MultiplexCapability.

capabilityTableEntryNumbers is a set of the CapabilityTableEntryNumbers that indicate the CapabilityTableEntrys that the terminal requests to be transmitted.

capabilityDescriptorNumbers is a set of the capabilityDescriptorNumbers that indicate the CapabilityDescriptors that the terminal requests to be transmitted.

genericRequest commands the far end terminal to send its entire terminal capability set.

7.11.2 Encryption

This command is used to exchange encryption capabilities and to command the transmission of an initialization vector (IV), refer to Recommendations H.233 [11] and H.234 [12].

encryptionSE is an H.233 Session Exchange (SE) message, except that the error protection bits described in Recommendation H.233 shall not be applied.

encryptionIVRequest commands the far-end encryptor to transmit a new IV in a logical channel opened for encryptionData.

encryptionAlgorithmID indicates to the receiver that the sending terminal will associate the given h233AlgorithmIdentifier value with the non-standard encryption algorithm associatedAlgorithm.

7.11.3 Flow Control

This command is used to specify the upper limit of bit rate of either a single logical channel or the whole multiplex. A terminal may send this command to restrict the bit rate that the far-end terminal sends. A terminal that receives this command shall comply with it.

When scope is of type logicalChannelNumber the limit applies to the given logical channel, when scope is of type resourceID the limit applies to the given ATM virtual channel, and when scope is of type wholeMultiplex the limit applies to the whole multiplex.

maximumBitRate is measured in units of 100 bit/s averaged over non-overlapping consecutive periods of one second. When this is present, the specified limit supersedes any previous limit, whether higher or lower. When it is not present, any previous restriction on the bit rate for the channel is no longer applicable.

The point at which the bit rate limit is applied, and the specification of which bits are included in the calculation of bit rate is not specified in this Recommendation, but should be specified by Recommendations that use this Recommendation.

Each transmission of this command affects a specific logical channel or the entire multiplex. More than one such command may be in effect at the same time, up to the number of open logical channels plus one, for the overall multiplex limitation.

NOTE – When the bit rate that can be transmitted on a logical channel is constrained to particular values, for example G.723.1 audio, and the request is to transmit at a rate lower than the lowest rate at which it would normally operate, it shall respond by stopping transmission on the logical channel.

7.11.4 End session

This command indicates the end of the H.245 session. After transmitting EndSessionCommand, the terminal shall not send any more of the messages defined in this Recommendation.

disconnect indicates that the connection will be dropped.

gstnOptions: A choice of alternatives that will occur after ending the H.245 session when a V-series modem is used over the GSTN.

The possible options are given in Table 14.

Table 14/H.245 – Options after EndSessionCommand when using an V-Series modem over the GSTN

ASN.1 codepoint	Option
telephonyMode	The terminal shall initiate the cleardown procedures defined in the V-Series modem Recommendation, except that it shall not physically disconnect the GSTN connection
v8bis	The terminal shall initiate the cleardown procedures defined in the V-Series modem Recommendation and enter a V.8 *bis* session
v34v76	The terminal shall preserve the V.34 modem connection, but use it to support V.76
v34DuplexFAX	The terminal shall preserve the V.34 modem connection, but use it to support T.30 FAX [21]
v34H324	The terminal shall preserve the V.34 modem connection, but use it to support H.324 [18]

7.11.5 Miscellaneous Command

This is used for a variety of commands, some of which are present in Recommendations H.221 [5] and H.230 [10].

logicalChannelNumber indicates the logical channel number to which the command applies. It shall indicate a logical channel opened for video data when the type is one of videoFreezePicture, videoFastUpdatePicture, videoFastUpdateGOB, videoTemporalSpatialTradeOff, videoSendSyncEveryGOB, videoFastUpdateMB, and videoSendSyncEveryGOBCancel. When the type is one of equaliseDelay, zeroDelay, multipointModeCommand or cancelMultipointModeCommand where multiple logical channels are involved, the logicalChannelNumber shall be arbitrary, but shall be a valid LogicalChannelNumber (i.e. in the range 1-65535) and the receiver shall ignore the value.

equaliseDelay and zeroDelay shall have the same meaning as the commands ACE and ACZ defined in Recommendation H.230 [10].

multipointModeCommand commands that a terminal in receipt shall comply with all requestMode requests issued by the MCU. An example of a mode change is an audio coding change from G.711 to G.728.

cancelMultipointModeCommand cancels a previously sent multipointModeCommand command.

videoFreezePicture commands the video decoder to complete updating the current video frame and subsequently display the frozen picture until receipt of the appropriate freeze-picture release control signal.

videoFastUpdatePicture commands the video encoder to enter the fast-update mode at its earliest opportunity.

videoFastUpdateGOB commands the far-end video encoder to perform a fast update of one or more GOBs. firstGOB indicates the number of the first GOB to be updated, and numberOfGOBs indicates the number of GOBs to be updated. It shall only be used with video compression algorithms that define GOBs, for example, H.261 and H.263.

videoTemporalSpatialTradeOff commands the far-end video encoder to change its trade-off between temporal and spatial resolution. A value of 0 commands a high spatial resolution and a value of 31 commands a high frame rate. The values from 0 to 31 indicate monotonically a desire for higher frame rate. Actual values do not correspond to precise values of spatial resolution or frame rate.

videoSendSyncEveryGOB commands the far-end video encoder to use sync for every GOB as defined in Recommendation H.263 [15], until the command videoSendSyncEveryGOBCancel is received, from which time the far-end video encoder may decide the frequency of GOB syncs. These commands shall only be used with video encoded according to Recommendation H.263.

videoFastUpdateMB commands the far-end video encoder to perform a fast update of one or more MBs. firstGOB indicates the number of the first GOB to be updated and is only relative to H.263, firstMB indicates the number of the first MB to be updated and is only relative to H.261 and numberOfMBs indicates the number of MBs to be updated. It shall only be used with video compression algorithms that define MBs, for example, H.261 and H.263. Terminals may respond to this command with a GOB update which includes the MBs requested.

maxH223MUXPDUsize commands the transmitter to restrict the size of the H223 MUX-PDUs that it transmits to a maximum of the specified number of octets.

7.11.6 Conference Command

BroadcastMyLogicalChannel shall be similar to H.230 MCV but shall only refer to a single logical channel.

CancelBroadcastMyLogicalChannel shall be similar to as H.230 Cancel-MCV but shall only refer to a single logical channel.

MakeTerminalBroadcaster shall be defined as H.230 VCB.

CancelMakeTerminalBroadcaster shall be defined as Cancel-VCB.

SendThisSource shall be defined as H.230 VCS.

CancelSendThisSource shall be defined as H.230 Cancel-VCS.

DropConference shall be defined as H.230 CCK.

7.12 Indications

An indication contains information that does not require action or response.

7.12.1 Function Not Understood

This is used to return requests, responses and commands that are not understood to the transmitter.

If a terminal receives a request, response or command that it does not understand, either because it is non-standard or has been defined in a subsequent revision of this Recommendation, it should respond by sending FunctionNotSupported or FunctionNotUnderstood.

NOTE – FunctionNotUnderstood was named FunctionNotSupported in the 1996 version of this Recommendation. The name of this function was changed to allow for the addition of a more powerful FunctionNotSupported command without breaking backward compatibility with the 1996 version syntax.

7.12.2 Miscellaneous Indication

This is used for a variety of indications, some of which are present in Recommendations H.221 [5] and H.230 [10].

logicalChannelNumber indicates the logical channel number to which the indication applies. It shall indicate a logical channel opened for video data when the type is videoIndicateReadyToActivate, and videoTemporalSpatialTradeOff. When the type is one of multipointConference, cancelMultipointConference, multipointZeroComm, cancelMultipointZeroComm, multipointSecondaryStatus, or cancelMultipointSecondaryStatus where multiple logical channels are involved, the logicalChannelNumber shall be arbitrary, but shall be a valid LogicalChannelNumber (i.e. in the range 1-65535) and the receiver shall ignore the value.

logicalChannelInactive is used to indicate that the content of the logical channel does not represent a normal signal. It is analogous to AIM and VIS defined in Recommendation H.230.

logicalChannelActive is complementary to logicalChannelInactive. It is analogous to AIA and VIA defined in Recommendation H.230. MultipointZeroComm, cancelMultipointZeroComm, multipointSecondaryStatus, and cancelMultipointSecondaryStatus shall have the same meaning as MIZ, cancelMIZ, MIS and cancelMIS respectively, as defined in Recommendation H.230.

multipointConference indicates that the terminal is joined to an H.243 multipoint conference, and the terminal is expected to obey bit rate symmeterization. However, bit rate symmeterization will be enforced via FlowControlCommand messages. Note that multipointConference has exactly the same meaning as MCC in Recommendation H.230. Note that multipointConference, like MCC, does not require mode symmetry.

videoIndicateReadyToActivate shall have the same meaning as VIR defined in Recommendation H.230, that is, it is transmitted by a terminal whose user has decided not to send video unless he will also receive video from the other end.

videoTemporalSpatialTradeOff indicates to the far-end video decoder its current trade-off between temporal and spatial resolution. A value of 0 indicates a high spatial resolution and a value of 31 indicates a high frame rate. The values from 0 to 31 indicate monotonically a higher frame rate. Actual values do not correspond to precise values of spatial resolution or frame rate. A terminal that has indicated temporalSpatialTradeOffCapability shall transmit this indication whenever it changes its trade-off and when a video logical channel is initially opened.

videoNotDecodedMBs indicates to the far-end video encoder that a set of MBs has been received erroneously and that any MB in the specified set has been treated as not coded. The encoder may use this information to compensate transmission errors, as illustrated in Appendix I/H.263. firstMB indicates the number of the first MB treated as not coded, and numberOfMBs indicates the number of MBs treated as not coded. The MB numbering is done according to Recommendation H.263. The temporal reference of the picture containing not decoded MBs is indicated in temporalReference. This indication shall only be used with the H.263 video compression algorithm.

7.12.3 Jitter Indication

This is used to indicate the amount of jitter, as estimated by the receive terminal, of a logical channel. It may be useful for choice of bit-rate and buffer control in video channels, or to determine an appropriate rate of transmission of timing information, etc. The video encoder will then have the option of using this information to restrict the video bit-rate or the video decoder buffer fluctuations to help prevent decoder buffer underflow or overflow, given the occurring jitter. If the encoder takes this option, it will enable correct operation for existing designs of video decoder buffers, regardless of the amplitude of received jitter, as well as allow correct operation with minimum delay.

When scope is of type logicalChannelNumber the information applies to the given logical channel, when scope is of type virtualChannelID the information applies to the given ATM virtual channel, and when scope is of type wholeMultiplex the information applies to the whole multiplex.

estimatedReceivedJitterMantissa and estimatedReceivedJitterExponent provide an estimate of the jitter that has been received by the terminal that has sent the message.

estimatedReceivedJitterMantissa indicates the mantissa of the jitter estimate as given in Table 15.

Table 15/H.245 – Mantissa of estimatedReceivedJitterMantissa in JitterIndication

estimatedReceivedJitterMantissa	Mantissa
0	1
1	2.5
2	5
3	7.5

estimatedReceivedJitterExponent indicates the exponent of the jitter estimate as given in Table 16.

Table 16/H.245 – Exponent of estimatedReceivedJitterExponent in JitterIndication

estimatedReceivedJitterExponent	Exponent
0	Out of range
1	1 μs
2	10 μs
3	100 μs
4	1 ms
5	10 ms
6	100 ms
7	1 s

The jitter estimate is obtained by multiplying the mantissa by the exponent, unless estimatedReceivedJitterExponent is equal to zero, in which case the estimate is just known to be more than 7.5 seconds.

skippedFrameCount indicates how many frames have been skipped by the decoder since the last JitterIndication message was received. Since the maximum value that can be encoded is 15, if this option is implemented, this information must be transmitted before more than 15 frames have been skipped.

NOTE – Since frames are skipped when the decoder buffer underflows, additional jitter may cause the decoder buffer to underflow more or less often than the encoder expects frame skips to happen.

additionalDecoderBuffer indicates the additional size of the video decoder buffer over and above that required by the indicated profile and level. This is defined in the same way as vbv_buffer_size H.262 [14].

7.12.4 H.223 Skew Indication

This is used to indicate to the far-end terminal the average amount of time skew between two logical channels.

logicalChannelNumber1 and logicalChannelNumber2 are logical channel numbers of opened logical channels.

skew is measured in milliseconds, and indicates the delay that must be applied to data belonging to logicalChannelNumber2 as measured at the output of the multiplex, to achieve synchronization with logicalChannelNumber1 as measured at the output of the multiplex. The skew includes differences in: sample time, encoder delay, and transmitter buffer delay, and is measured relative to the transmission time of the first bit of data representing a given sample point. The actual delay necessary for synchronization is dependent on decoder implementation, and is a local matter for the receiver.

7.12.5 New ATM Virtual Channel Indication

This is used to indicate the parameters of an ATM virtual channel that the terminal intends to open.

resourceID is used to identify the ATM virtual channel. The means by which this parameter is associated with an ATM virtual channel is not specified in this Recommendation.

bitRate indicates the bit rate, measured at the AAL-SAP, of the virtual channel, and is measured in units of 64 kbit/s.

bitRateLockedToPCRClock indicates that the bit rate of the virtual channel is clocked to the clock used to produce H.222.0 clock reference values (Program clock reference or System clock reference).

bitRateLockedToNetworkClock indicates that the bit rate of the virtual channel is clocked to the local network clock. This does not guarantee that the bit rate clock will be locked to the local network at the receiver, as common network clocks may not be available.

aal indicates which ATM Adaptation Layer will be used, and its parameters.

The sequence aal1 indicates which of the options for ATM adaptation layer 1, as specified in Recommendation I.363 [19], are supported. The codepoints are defined in Table 1.

The sequence aal5 indicates which of the options for ATM adaptation layer 5, as specified in Recommendation I.363 [19], are supported. forwardMaximumSDUSize and backwardMaximumSDUSize indicate the maximum CPCS-SDU size in the forward and reverse directions, measured in octets.

multiplex indicates the type of multiplex that will be used on the ATM virtual channel. The options are noMultiplex (No H.222.0 multiplex), H.222.0 Transport Stream and H.222.0 Program Stream.

7.12.6 User Input

This is used for User Input messages.

alphanumeric is a string of characters coded according to Recommendation T.51 [23]. This could be used for keypad input, an equivalent to DTMF.

userInputSupportIndication: Indicates to the remote terminal which GENERALSTRING types the terminal supports.

NOTE – It is expected that most implementations of PER decoders will not be capable of decoding other strings than IA5. This indication should be used to "warn" the remote terminal not to attempt fancy variable length coding schemes.

nonStandard is a NonStandardParameter indicating a non-standard use of the UserInput indication message.

The boolean basicString, when true, indicates that the characters 0-9, * and # are supported.

The boolean iA5String, when true, indicates that the complete IA5String character set is supported.

The boolean generalString, when true, indicates that the complete GeneralString character set is supported.

NOTE – Any data that is carried in this Recommendation, including user input messages, will not be encrypted.

7.12.7 Conference Indications

sbeNumber shall be defined as H.230 SBE Number.

terminalNumberAssign shall be defined as H.230 TIA.

terminalJoinedConference shall be defined as H.230 TIN.

terminalLeftConference shall be defined as H.230 TID.

seenByAtLeastOneOther shall be defined as H.230 MIV.

cancelSeenByAtLeastOneOther shall be defined as H.230 cancel-MIV.

seenByAll shall be defined as H.230 MIV.

cancelSeenByAll shall be defined as H.230 MIV.

terminalYouAreSeeing shall be defined as H.230 TIN.

requestForFloor shall be defined as H.230 TIF.

7.12.8 H2250 Maximum Logical Channel Skew

H2250MaximumSkewIndication indicates the maximum skew between logical channels.

skew is measured in milliseconds, and indicates the maximum number of milliseconds that the data on logicalChannelNumber2 is delayed from the data on logicalChannelNumber1 as delivered to the network transport. The skew is measured relative to the time of delivery to the network transport of the first bit of data representing a given sample point. Lip synchronization, if desired, is a local matter for the receiver and shall be achieved via use of timestamps.

7.12.9 MC Location Indication

This indication is sent by the MC to indicate to other terminals the signalling address that should be used to reach the MC.

7.12.10 Vendor Identification Indication

vendorIdentification indication should be sent at the start of each call to identify the manufacturer, product, and product version number.

7.12.11 Function Not Supported

This is used to return requests, responses and commands that are not understood back to the transmitter.

The whole of the RequestMessage, ResponseMessage or CommandMessage is returned.

If a terminal receives a request, response or command that it does not understand, either because it is non-standard or has been defined in a subsequent revision of this Recommendation, it shall respond by sending FunctionNotSupported.

If a terminal receives a request, response or command that has incorrect encoding, it shall set cause to the value syntaxError. If it has correct encoding, but the encoded values are semantically incorrect, it shall set cause to the value semanticError. If the message is an unrecognized extension to

MultimediaSystemControlMessage, RequestMessage, ResponseMessage or CommandMessage, it shall set cause to the value unknownFunction.

In each case, the whole MultimediaSystemControlMessage should be returned as an octet string in returnedFunction.

FunctionNotSupported shall not be used at any other time. In particular, when an unrecognized extension is present at other points in the syntax, FunctionNotSupported shall not be used: the terminal shall respond to the message in the normal way, as if no extension were present. FunctionNotSupported shall never be sent in response to a received indication.

8 Procedures

8.1 Introduction

This subclause defines generic multimedia system control procedures that use the messages defined in this Recommendation. Recommendations using this Recommendation shall indicate which of these procedures are applicable, as well as defining any specific requirements.

Procedures to perform the following functions are described in this subclause:

- master-slave determination;
- terminal capability exchange;
- uni-directional logical channel signalling;
- bi-directional logical channel signalling;
- receive terminal close logical channel request;
- H.223 multiplex table entry modification;
- request multiplex entry;
- receiver to transmitter transmit mode request;
- round trip delay determination;
- maintenance loop.

8.1.1 Method of specification

Procedures are generally specified in this subclause using SDLs. The SDL provides a graphical specification of the procedures, and includes specification of actions in the event of exception conditions.

8.1.2 Communication between protocol entity and protocol user

The interaction with the user of a particular function is specified in terms of primitives transferred at the interface between the protocol entity and the protocol user. Primitives are for the purpose of defining protocol procedures and are not intended to specify or constrain implementation. There may be a number of parameters associated with each primitive.

To assist in the specification, protocol states are defined. These states are conceptual and reflect general conditions of the protocol entity in the sequences of primitives exchanged between the protocol entity and the user, and the exchange of messages between the protocol entity and its peer.

For each protocol entity the allowed sequence of primitives between the user and the protocol entity is defined using a state transition diagram. The allowed sequence constrains the actions of the user, and defines the possible responses from the protocol entity.

A primitive parameter described as being null, is equivalent to the parameter not being present.

8.1.3 Peer-to-peer communication

Protocol information is transferred to the peer protocol entity via the relevant messages defined in clause 6. Some protocol entities described have state variables associated with them. A number of protocol entities described also have timers associated with them.

A timer is identified by the notation Tn, where n is a number. In the SDL diagrams setting a timer means that a timer is loaded with a specified value and the timer is started. Resetting a timer means that a timer is stopped with its value at the time of reset being retained. Timer expiry means that a timer has run for its specified time and has reached the value of zero.

A protocol entity may also have associated parameters. A parameter is identified by the notation Nn, where n is a number.

These timers and counters are listed in Appendix III.

Some protocol entities define an error primitive to report protocol error conditions to a management entity.

8.1.4 SDL diagrams

The SDL diagrams show actions to the allowed interactions with the protocol user, and to reception of messages from the peer protocol entity. Primitives which are not allowed for a given state, as specified by the state transition diagrams, are not shown in the SDL diagrams. However the responses to the reception of inappropriate messages are described in the SDL diagrams.

8.1.5 SDL key

The SDL key is shown in Figure 1.

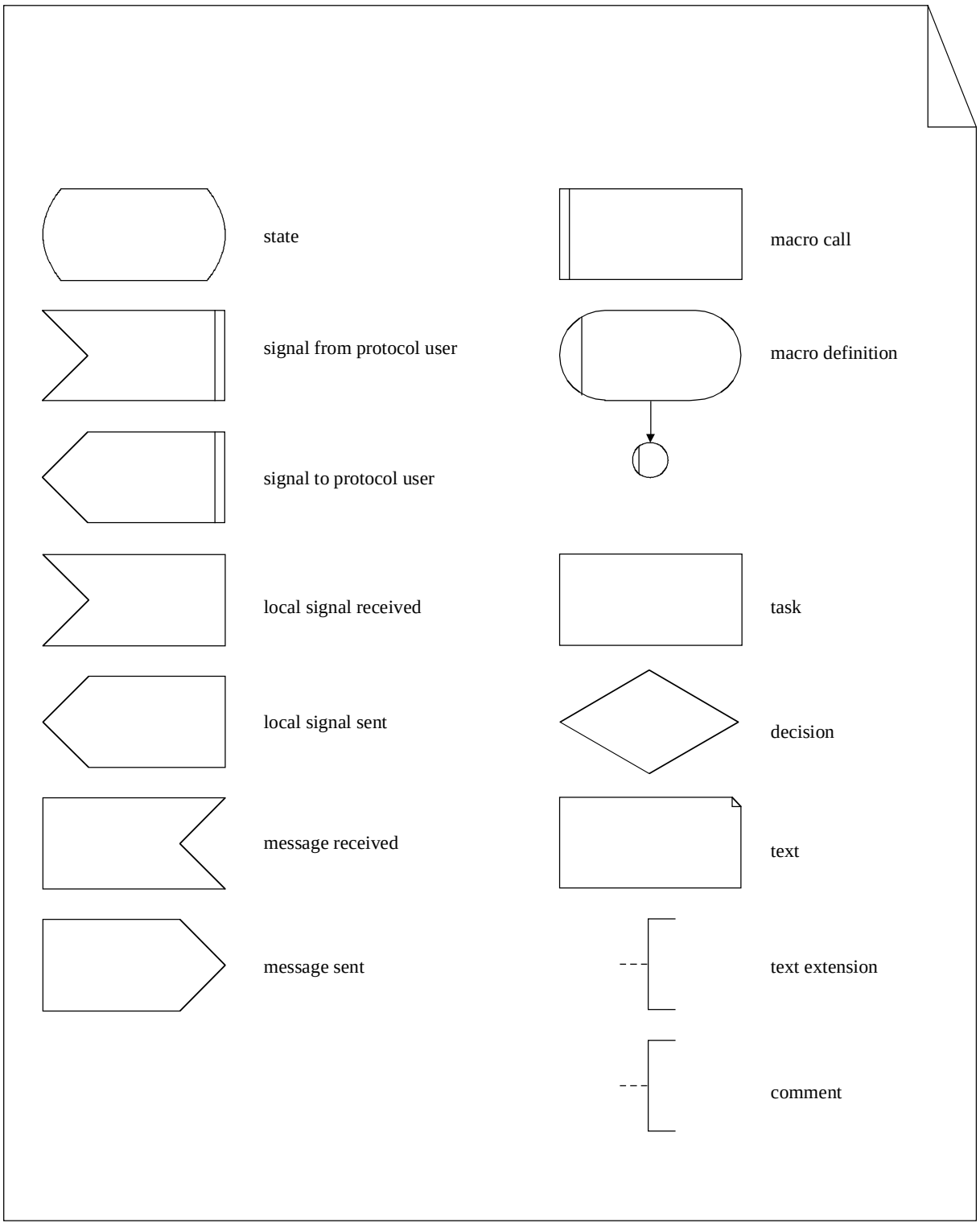


Figure 1/H.245 – SDL key

8.2 Master slave determination procedures

8.2.1 Introduction

Conflicts may arise when two or more terminals involved in a call initiate similar events simultaneously, for which resources are available for only one occurrence of the event e.g. opening of logical channels. To resolve such conflicts, one terminal may act as a master and the other

terminals(s) may act as slave terminal(s). The procedures described here allow terminals in the call to determine which is the master terminal and which is the slave terminal(s).

The protocol described here is referred to as the Master Slave Determination Signalling Entity (MSDSE). There is one instance of the MSDSE in each terminal involved in a call.

Either terminal may initiate the master slave determination process by issuing the DETERMINE.request primitive to its MSDSE. The result of the procedure is returned by the DETERMINE.indication and DETERMINE.confirm primitives. While the DETERMINE.indication primitive indicates the result, it does not indicate that the result is known at the remote terminal. The DETERMINE.confirm primitive indicates the result and confirms that it is also known at the remote terminal.

A terminal shall respond to procedures that rely on knowledge of the result and are initiated by the remote terminal any time after the status determination result is known at the local terminal. This may be before the local terminal has received confirmation that the remote terminal also has knowledge of the result. A terminal shall not initiate procedures that rely on knowledge of the result until it has received confirmation that the remote terminal also has knowledge of the result.

The following text provides an overview of the operation of the protocol. In the case of any discrepancy with the formal specification of the protocol that follows, the formal specification will supersede.

8.2.1.1 Protocol overview – Initiation by local user

A master slave determination procedure is initiated when the DETERMINE.request primitive is issued by the MSDSE user. A MasterSlaveDetermination message is sent to the peer MSDSE, and timer T106 is started. If a MasterSlaveDeterminationAck message is received in response to the MasterSlaveDetermination message then timer T106 is stopped and the user is informed with the DETERMINE.confirm primitive that the master slave determination procedure was successful and a MasterSlaveDeterminationAck message is sent to the peer MSDSE. If however a MasterSlaveDeterminationReject message is received in response to the MasterSlaveDetermination message, then a new status determination number is generated, timer T106 is restarted, and another MasterSlaveDetermination message is sent. If after sending a MasterSlaveDetermination message N100 times, a MasterSlaveDeterminationAck still has not been received, then timer T106 is stopped and the user is informed with the REJECT.indication primitive that the master slave determination procedure has failed to produce a result.

If timer T106 expires then the MSDSE user is informed with the REJECT.indication primitive and a MasterSlaveDeterminationRelease message is sent to the peer MSDSE.

8.2.1.2 Protocol overview – Initiation by remote user

When a MasterSlaveDetermination message is received at the MSDSE, a status determination procedure is initiated. If the status determination procedure returns a determinate result, then the user is informed of the master slave determination result with the DETERMINE.indication primitive, a MasterSlaveDeterminationAck message is sent to the peer MSDSE, and timer T106 is started. If a MasterSlaveDeterminationAck message is received in response to the MasterSlaveDeterminationAck message, then timer T106 is stopped and the user is informed with the DETERMINE.confirm primitive that the master slave determination procedure was successful.

If timer T106 expires then the MSDSE user is informed with the REJECT.indication primitive.

If however the status determination procedure returns an indeterminate result, then the MasterSlaveDeterminationReject message is sent to the peer MSDSE.

8.2.1.3 Protocol overview – Simultaneous initiation

When a MasterSlaveDetermination message is received at the MSDSE that itself has already initiated a status determination procedure, and is awaiting a MasterSlaveDeterminationAck or MasterSlaveDeterminationReject message, then a status determination procedure is initiated. If the status determination procedure returns a determinate result, the MSDSE responds as if the procedure was initiated by the remote user, and the procedures described above for this condition apply.

If however the status determination procedure returns an indeterminate result, then a new status determination number is generated, and the MSDSE responds as if the procedure was again initiated by the local MSDSE user as described above.

8.2.1.4 Status determination procedure

The following procedure is used to determine which terminal is the master from the terminalType and statusDeterminationNumber values. Firstly, the terminalType values are compared and the terminal with the larger terminal type number is determined as the master. If the terminal type numbers are the same, the statusDeterminationNumbers are compared using modulo arithmetic to determine which is master.

If both terminals have equal terminalType field values and the difference between statusDeterminationNumber field values modulo 2^{24} is 0 or 2^{23}, an indeterminate result is obtained.

8.2.2 Communication between the MSDSE and the MSDSE user

8.2.2.1 Primitives between the MSDSE and the MSDSE user

Communication between the MSDSE, and MSDSE user, is performed using the primitives shown in Table 17.

Table 17/H.245 – Primitives and parameters

Generic name	Type			
	Request	**Indication**	**Response**	**Confirm**
DETERMINE	– (Note 1)	TYPE	not defined (Note 2)	TYPE
REJECT	not defined	–	not defined	not defined
ERROR	not defined	ERRCODE	not defined	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive is not defined.				

8.2.2.2 Primitive definition

The definition of these primitives is as follows:

a) The DETERMINE primitive is used to initiate, and to return the result from, the master slave determination procedure.

The DETERMINE.request primitive is used to initiate the master slave determination procedure.

The DETERMINE.indication primitive is used to indicate the result of the master slave determination procedure. As the result of the procedure may not be known at the remote terminal, the terminal shall not initiate any procedures that rely on knowledge of the result, although it shall respond to any procedures that rely on knowledge of the result.

The DETERMINE.confirm primitive is used to indicate the result of the master slave determination procedure and that the result of the procedure is known at both terminals. The terminal may initiate, and shall respond to, any procedures that rely on knowledge of the result.

b) The REJECT primitive indicates that the master slave determination procedure was unsuccessful.

c) The ERROR primitive reports MSDSE errors to a management entity.

8.2.2.3 Parameter definition

The definition of the primitive parameters shown in Table 17 are as follows:

a) The TYPE parameter indicates the terminal status. It has the value of "MASTER" or "SLAVE".

b) The ERRCODE value indicates the type of MSDSE error. Table 21 indicates the values that the ERRCODE parameter may take.

8.2.2.4 MSDSE states

The following states are used to specify the allowed sequence of primitives between the MSDSE and the MSDSE user.

State 0: IDLE

No master slave determination procedure has been initiated.

State 1: OUTGOING AWAITING RESPONSE

The local MSDSE user has requested a master slave determination procedure. A response from the remote MSDSE is awaited.

State 2: INCOMING AWAITING RESPONSE

The remote MSDSE has initiated a master slave determination procedure in the local MSDSE. An acknowledgement was sent to the remote MSDSE and a response from the remote MSDSE is awaited.

8.2.2.5 State transition diagram

The allowed sequence of primitives between the MSDSE and the MSDSE user is defined here. The allowed sequences are shown in Figure 2.

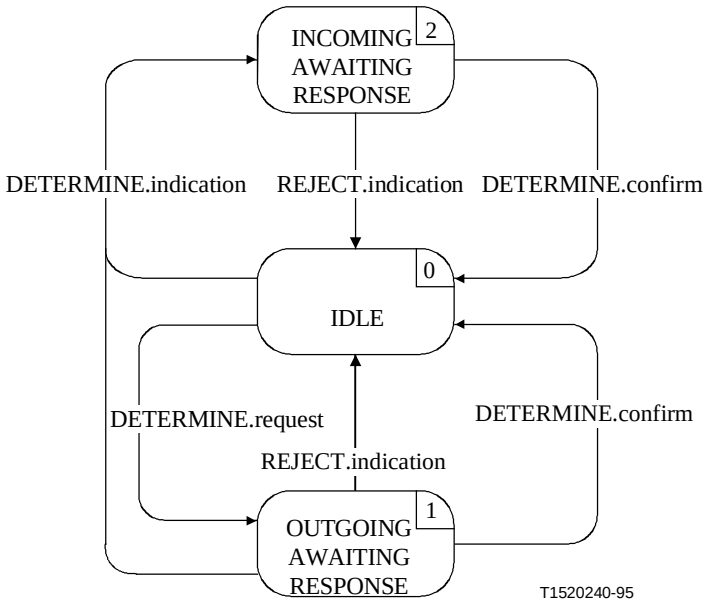


Figure 2/H.245 – State transition diagram for sequence of primitives at MSDSE

8.2.3 Peer-to-peer MSDSE communication

8.2.3.1 MSDSE messages

Table 18 shows the MSDSE messages and fields, defined in clause 6, which are relevant to the MSDSE protocol.

Table 18/H.245 – MSDSE message names and fields

Function	Message	Field
determination	MasterSlaveDetermination	terminalType statusDeterminationNumber
	MasterSlaveDeterminationAck	decision
	MasterSlaveDeterminationReject	cause
error recovery	MasterSlaveDeterminationRelease	–

8.2.3.2 MSDSE state variables

The following MSDSE state variables are defined:

sv_TT

This state variable holds the terminal type number for this terminal.

sv_SDNUM

This state variable holds the status determination number for this terminal.

sv_STATUS

This state variable is used to store the result of the latest master slave determination procedure. It has values of "master", "slave", and "indeterminate".

sv_NCOUNT

This state variable is used to count the number of MasterSlaveDetermination messages that have been sent during the OUTGOING AWAITING RESPONSE state.

8.2.3.3 MSDSE timers

The following timer is specified for the outgoing MSDSE:

T106

This timer is used during the OUTGOING AWAITING RESPONSE state and during the INCOMING AWAITING RESPONSE state. It specifies the maximum allowed time during which no acknowledgement message may be received.

8.2.3.4 MSDSE counters

The following parameter is specified for the MSDSE:

N100

This parameter specifies the maximum value of sv_NCOUNT.

8.2.4 MSDSE procedures

8.2.4.1 Introduction

Figure 3 summarizes the MSDSE primitives and their parameters, and messages.

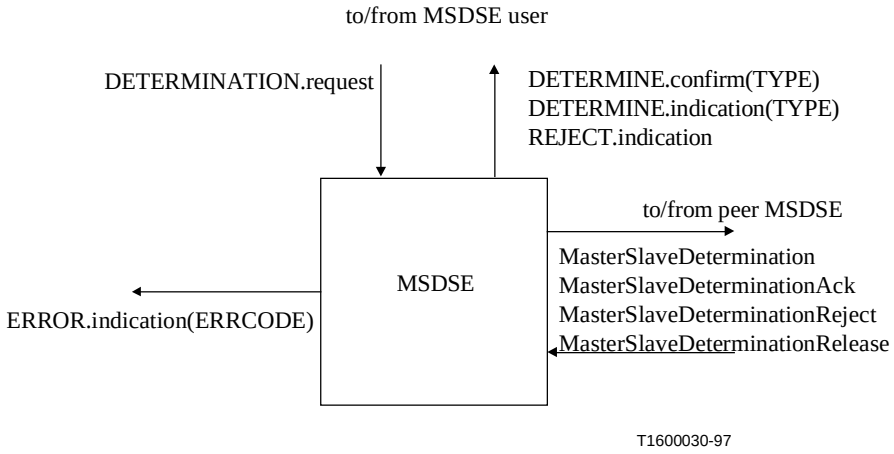


Figure 3/H.245 – Primitives and messages in the MSDSE

8.2.4.2 Primitive parameter default values

Where not explicitly stated in the SDL diagrams, the parameters of the indication and confirm primitives assume values as shown in Table 19.

Table 19/H.245 – Default primitive parameter values

Primitive	Parameter	Default value
DETERMINE.confirm	TYPE	MasterSlaveDeterminationAck.decision
DETERMINE.indication	TYPE	sv_STATUS

8.2.4.3 Message field default values

Where not explicitly stated in the SDL diagrams, the message fields assume values as shown in Table 20.

Table 20/H.245 – Default message field values

Message	Field	Default value
MasterSlave Determination	terminalType statusDetermination Number	sv_TT sv_SDNUM

MasterSlave DeterminationAck	decision	Opposite of sv_STATUS i.e.
		if (sv_STATUS == master) decision = slave
		if (sv_STATUS == slave) decision = master

MasterSlave DeterminationReject	cause	identicalNumbers

8.2.4.4 ERRCODE parameter values

Table 21 shows the values that the ERRCODE parameter of the ERROR.indication primitive may take for the MSDSE.

Table 21/H.245 – ERRCODE parameter values at MSDSE

Error type	Error code	Error condition	State
No response from remote MSDSE	A	local timer T106 expiry	OUTGOING AWAITING RESPONSE INCOMING AWAITING RESPONSE
Remote sees no response from local MSDSE	B	remote timer T106 expiry	OUTGOING AWAITING RESPONSE INCOMING AWAITING RESPONSE
Inappropriate message	C	MasterSlaveDetermination	INCOMING AWAITING RESPONSE
	D	MasterSlaveDetermination Reject	INCOMING AWAITING RESPONSE
Inconsistent field value	E	MasterSlaveDetermination Ack.decision ! = sv_STATUS	INCOMING AWAITING RESPONSE
Maximum number of retries	F	sv_NCOUNT == N100	OUTGOING AWAITING RESPONSE

8.2.4.5 SDLs

The MSDSE procedures are expressed in SDL form in Figure 4.

terminalTypeProcess is process that returns a number that identifies different types of terminal, such as, terminals, MCUs and gateways.

randomNumber is process that returns a random number in the range 0 .. 2^{24} –1.

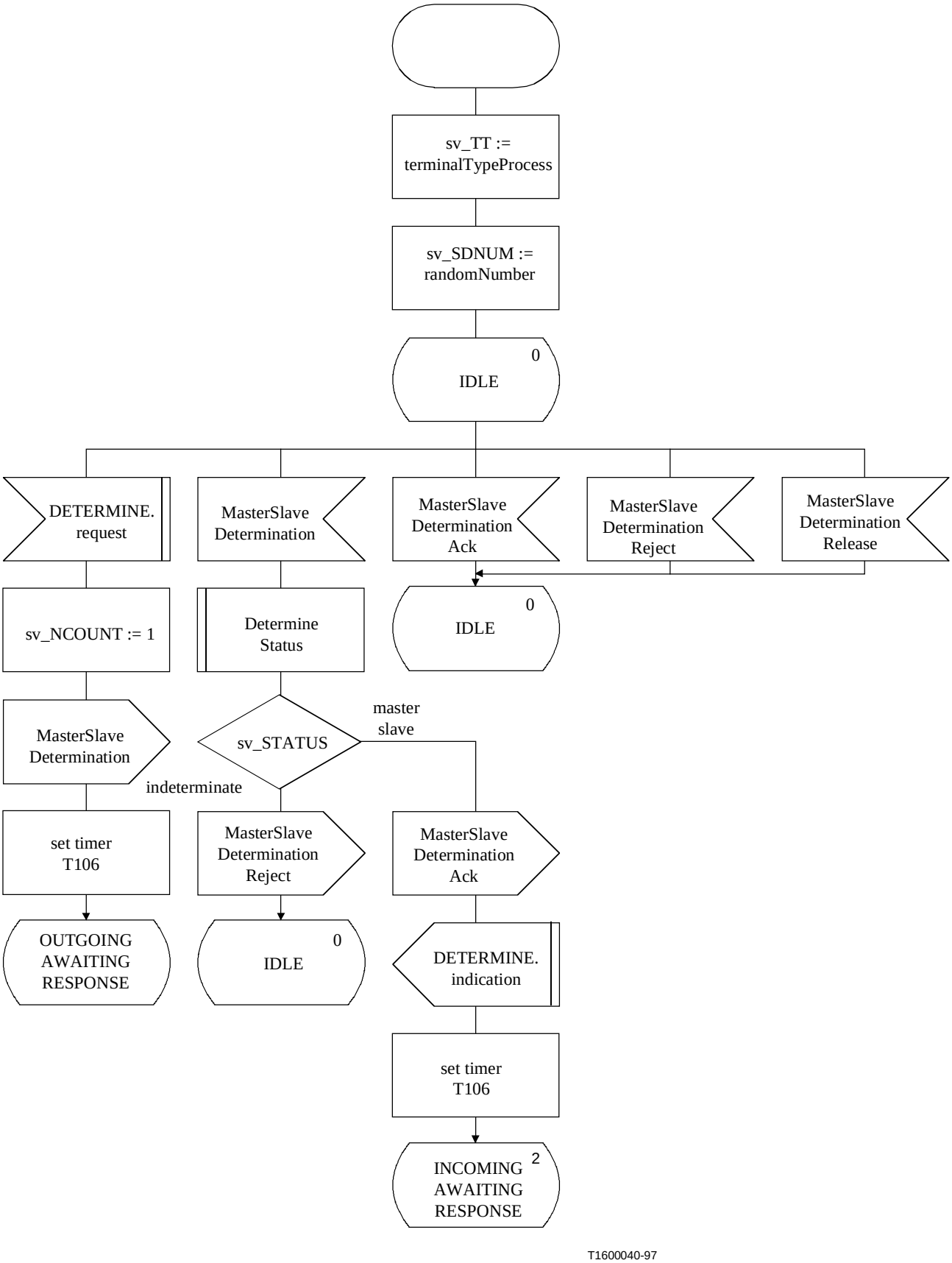


Figure 4 i)/H.245 – MSDSE SDL

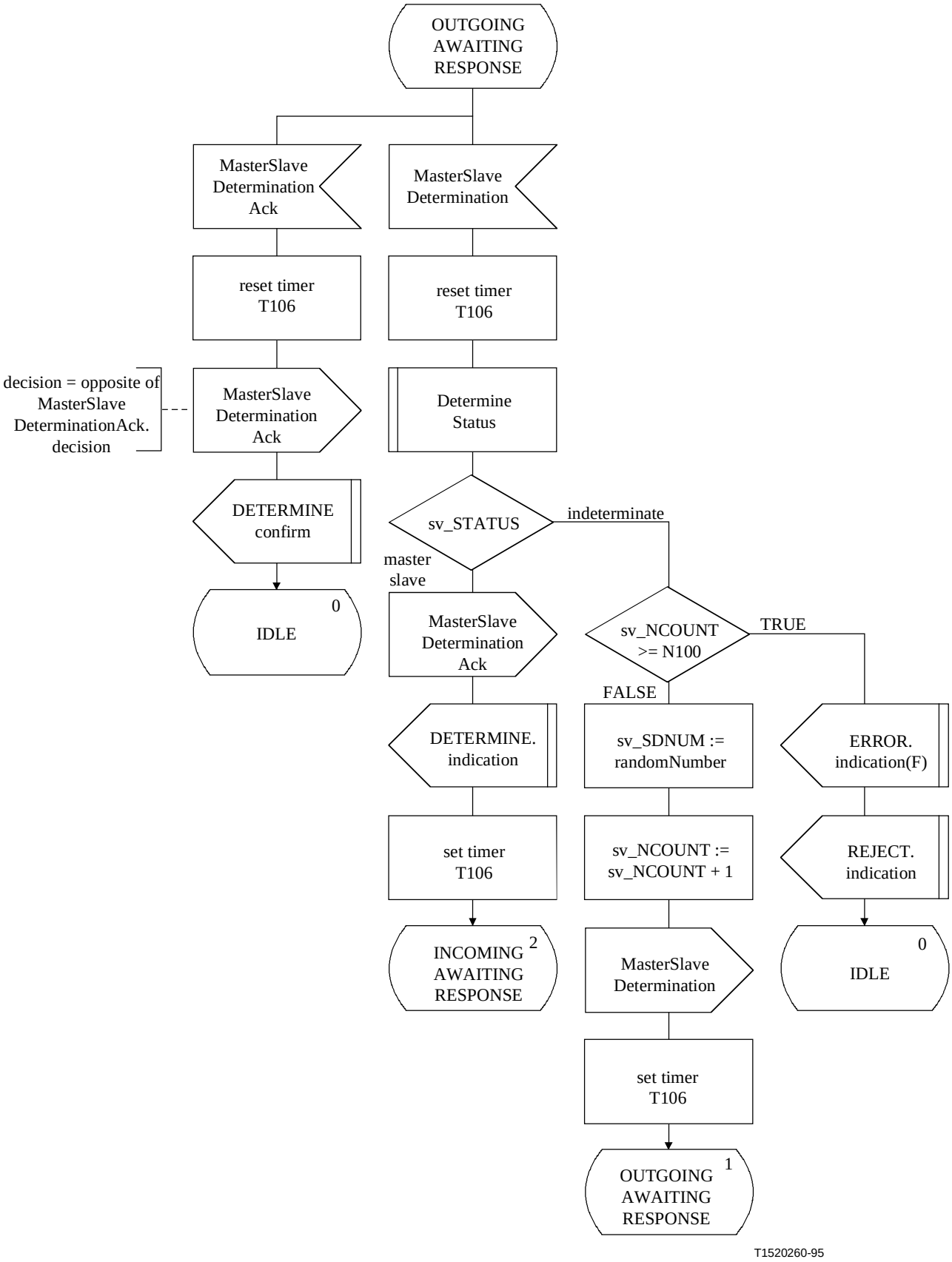


Figure 4 ii)/H.245 – MSDSE SDL

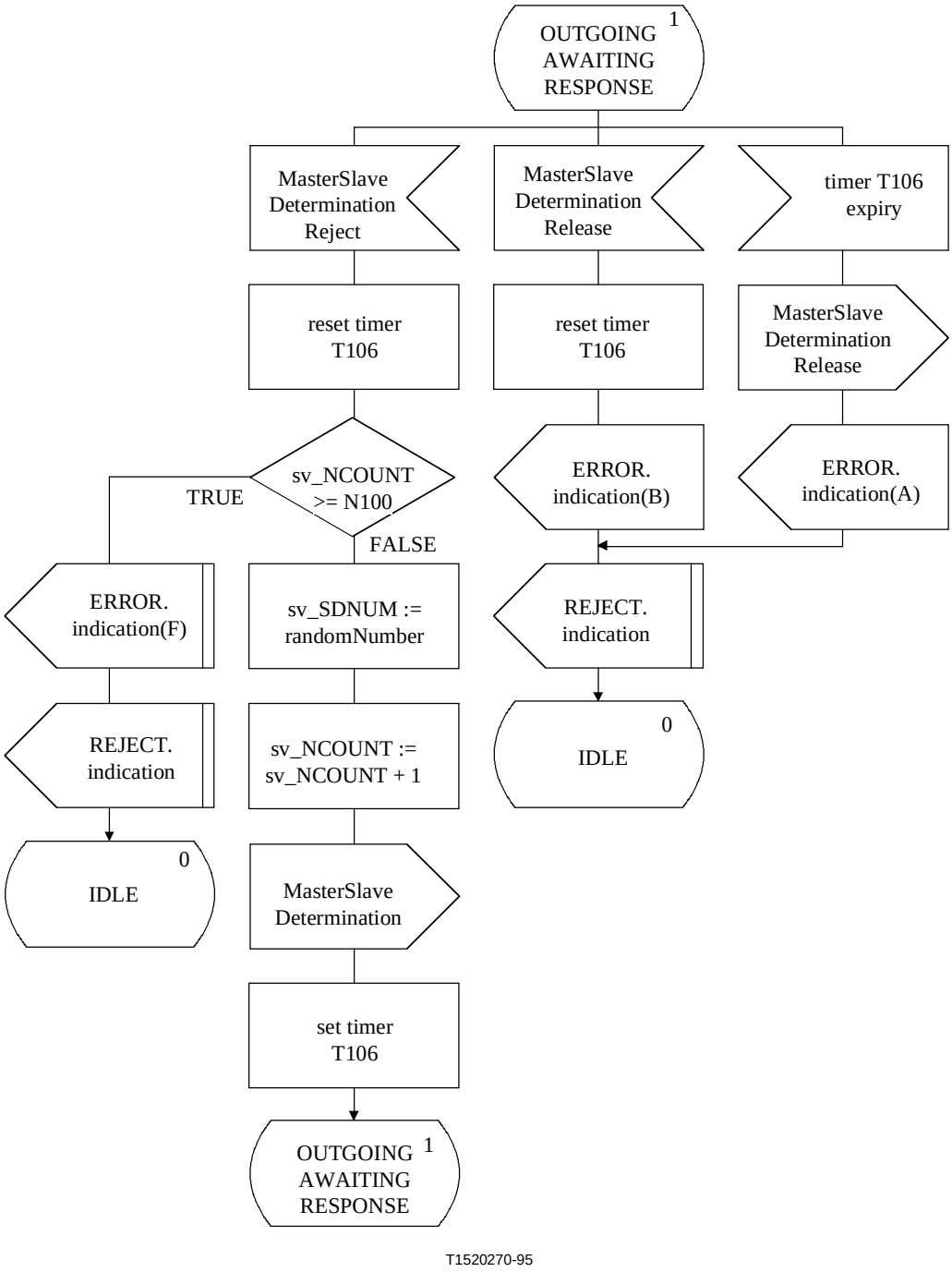


Figure 4 iii)/H.245 – MSDSE SDL

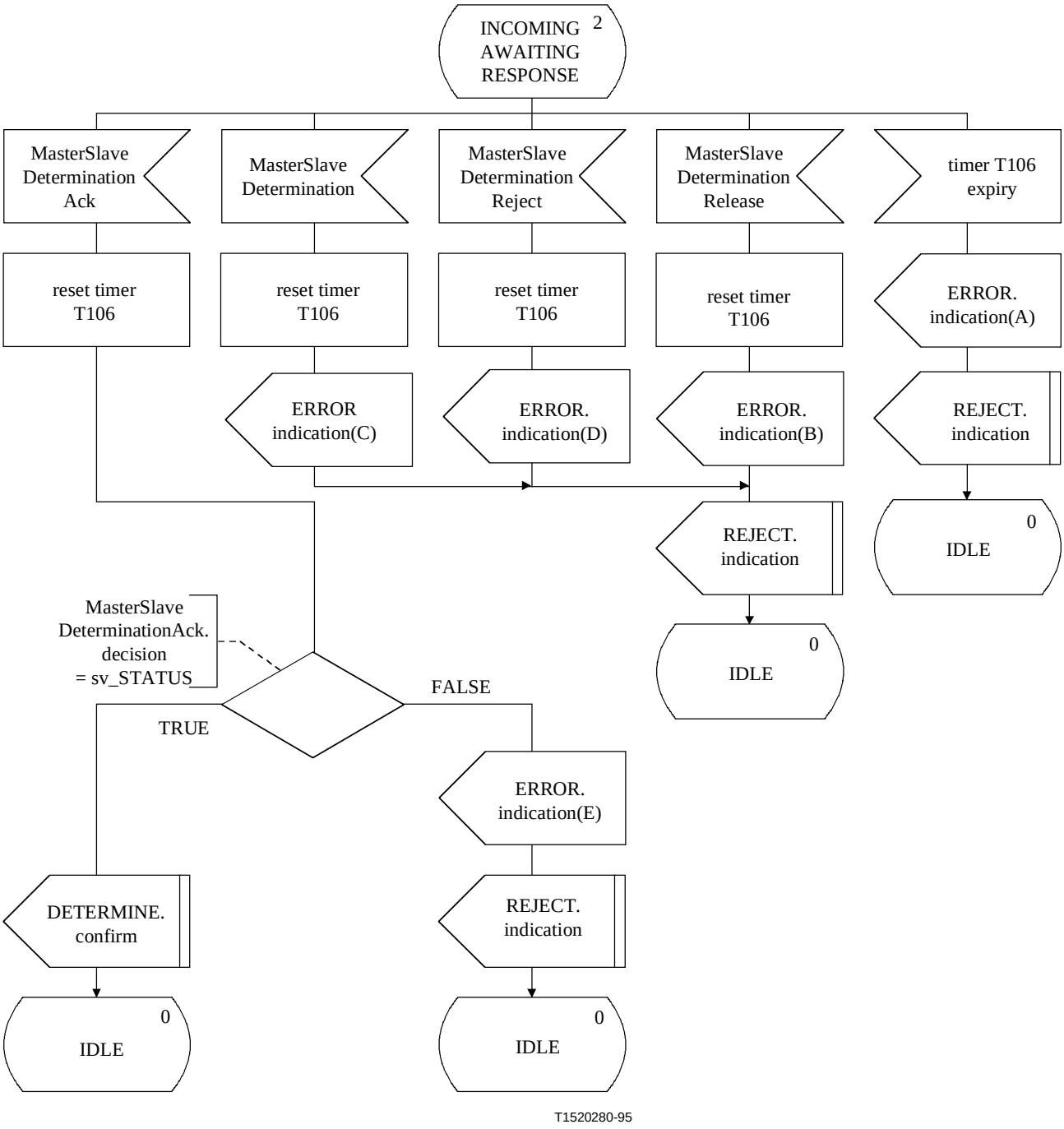


Figure 4 iv)/H.245 – MSDSE SDL

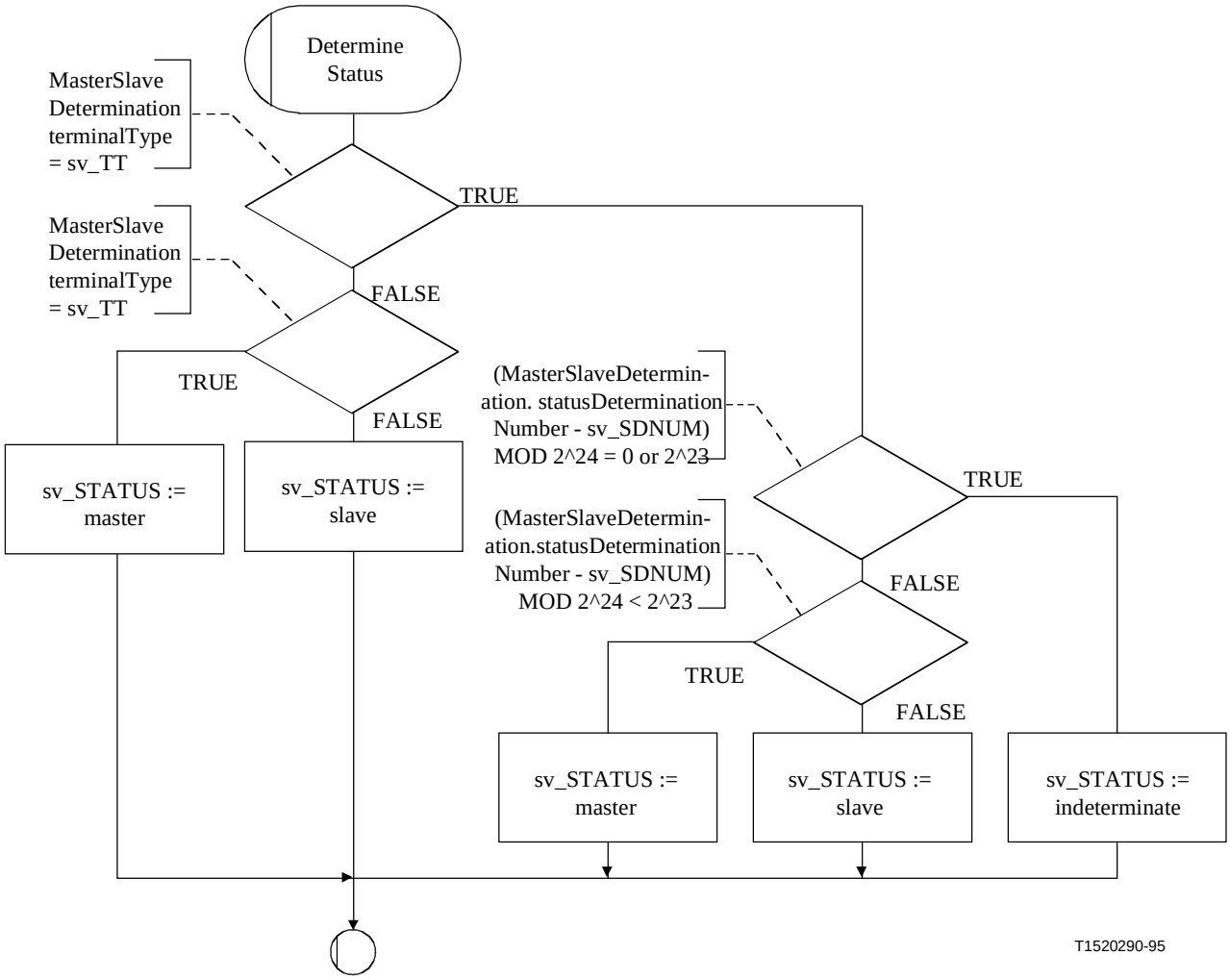


Figure 4 v)/H.245 – MSDSE SDL

8.3 Capability exchange procedures

8.3.1 Introduction

These procedures are used by terminals to communicate their capabilities, and are referred to as the Capability Exchange Signalling Entity (CESE). Procedures are specified in terms of primitives and states at the interface between the CESE and the CESE user. Protocol information is transferred to the peer CESE via relevant messages defined in clause 6. There is an outgoing CESE and an incoming CESE. At each of the outgoing and incoming ends there is one instance of the CESE for each call.

All terminals intended for use in point-to-point applications or those connected to an MCU shall be able to identify a TerminalCapabilitySet and its structure, and such capability values therein that are mandatory for those applications; any unrecognized capability values shall be ignored, and no fault shall be implied.

The capability exchange may be performed at any time. The capability exchange may signal both changed and unchanged capabilities. Unchanged capabilities should not be sent repetitively without strong cause.

The following text provides an overview of the operation of the protocol. In the case of any discrepancy with the formal specification of the protocol that follows, the formal specification will supersede.

8.3.1.1 Protocol overview – Outgoing CESE

A capability exchange is initiated when the TRANSFER.request primitive is issued by the user at the outgoing CESE. A TerminalCapabilitySet message is sent to the peer incoming CESE, and timer T101 is started. If a TerminalCapabilitySetAck message is received in response to the TerminalCapabilitySet message, then timer T101 is stopped and the user is informed with the TRANSFER.confirm primitive that the capability exchange was successful. If however a TerminalCapabilitySetReject message is received in response to the TerminalCapabilitySet message, then timer T101 is stopped and the user is informed with the REJECT.indication primitive that the peer CESE user has refused the capability exchange.

If timer T101 expires, then the outgoing CESE user is informed with the REJECT.indication primitive and a TerminalCapabilitySetRelease message is sent.

8.3.1.2 Protocol overview – Incoming CESE

When a TerminalCapabilitySet message is received at the incoming CESE, the user is informed of the capability exchange request with the TRANSFER.indication primitive. The incoming CESE user signals acceptance of the capability exchange request by issuing the TRANSFER.response primitive, and a TerminalCapabilitySetAck message is sent to the peer outgoing CESE. The incoming CESE user signals rejection of the capability exchange request by issuing the REJECT.request primitive, and a TerminalCapabilitySetReject message is sent to the peer outgoing CESE.

8.3.2 Communication between CESE and CESE user

8.3.2.1 Primitives between CESE and CESE user

Communication between the CESE and CESE user is performed using the primitives shown in Table 22.

Table 22/H.245 – Primitives and parameters

		Type		
Generic name	**Request**	**Indication**	**Response**	**Confirm**
TRANSFER	PROTOID MUXCAP CAPTABLE CAPDESCRIPTORS	PROTOID MUXCAP CAPTABLE CAPDESCRIPTORS	– Note 1)	–
REJECT	CAUSE	SOURCE CAUSE	not defined (Note 2)	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive is not defined.				

8.3.2.2 Primitive definition

The definition of these primitives is as follows:

a) The TRANSFER primitives are used for transfer of the capability exchange.

b) The REJECT primitives are used to reject a capability descriptor entry, and to terminate a current capability transfer.

8.3.2.3 Parameter definition

The definition of the primitive parameters shown in Table 22 are as follows:

a) The PROTOID parameter is the protocol identifier parameter. This parameter is mapped to the protocolIdentifier field of the TerminalCapabilitySet message and carried transparently to the peer CESE user. This parameter is mandatory.

b) The MUXCAP parameter is the multiplex capability parameter. This parameter is mapped to the multiplexCapability field of the TerminalCapabilitySet message and carried transparently to the peer CESE user. This parameter is optional.

c) The CAPTABLE parameter is the capability table parameter. There may be one or more capability table entries described within this parameter. This parameter is mapped to the capabilityTable field of the TerminalCapabilitySet message and carried transparently to the peer CESE user. This parameter is optional.

d) The CAPDESCRIPTORS parameter is the capability descriptors parameter. There may be one or more capability descriptors described within this parameter. This parameter is mapped to the capabilityDescriptors field of the TerminalCapabilitySet message and carried transparently to the peer CESE user. This parameter is optional.

e) The SOURCE parameter indicates the source of the REJECT.indication primitive. The SOURCE parameter has the value of "USER" or "PROTOCOL". The latter case may occur as the result of a timer expiry.

f) The CAUSE parameter indicates the reason for rejection of a CAPTABLE or CAPDESCRIPTORS parameter. The CAUSE parameter is not present when the SOURCE parameter indicates "PROTOCOL".

8.3.2.4 CESE states

The following states are used to specify the allowed sequence of primitives between the CESE and the CESE user.

The states for an outgoing CESE are:

State 0: IDLE

The CESE is idle.

State 1: AWAITING RESPONSE

The CESE is waiting for a response from the remote CESE.

The states for an incoming CESE are:

State 0: DLE

The CESE is idle.

State 1: AWAITING RESPONSE

The CESE is waiting for a response from the CESE user.

8.3.2.5 State transition diagram

The allowed sequence of primitives between the CESE and the CESE user is defined here. The allowed sequence of primitives relates to states of the CESE as viewed from the CESE user. The allowed sequences are specified separately for each of an outgoing CESE and an incoming CESE, as shown in Figures 5 and 6 respectively.

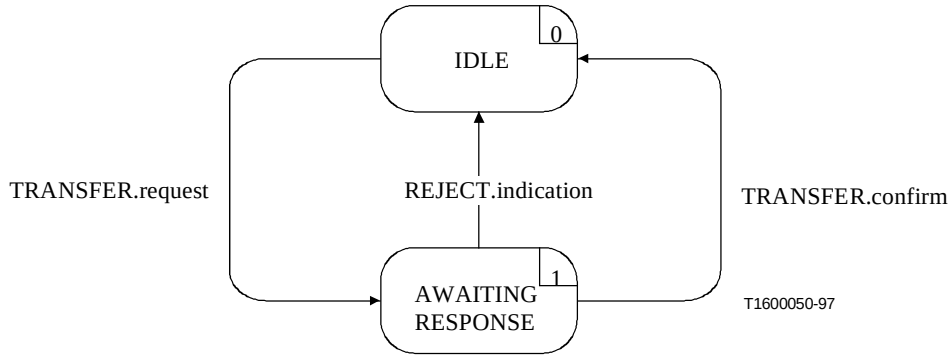


Figure 5/H.245 – State transition diagram for sequence of primitives at CESE outgoing

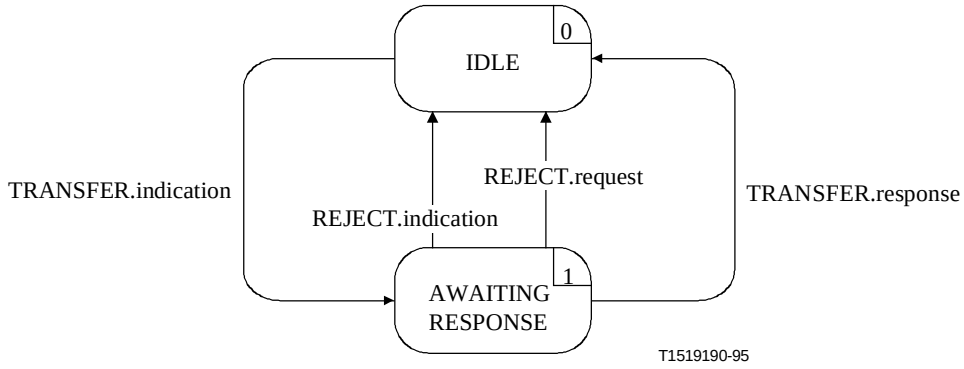


Figure 6/H.245 – State transition diagram for sequence of primitives at CESE incoming

8.3.3 Peer-to-peer CESE communication

8.3.3.1 Messages

Table 23 shows the CESE messages and fields, defined in clause 6, which are relevant to the CESE protocol.

Table 23/H.245 – CESE message names and fields

Function	Message	Direction	Field
transfer	TerminalCapabilitySet	O → I	sequenceNumber protocolIdentifier multiplexCapability capabilityTable capabilityDescriptors
	TerminalCapabilitySetAck	O ← I	sequenceNumber
reject	TerminalCapabilitySetReject	O ← I	sequenceNumber cause
reset	TerminalCapabilitySetRelease	O → I	–
O Outgoing I Incoming			

8.3.3.2 CESE state variables

The following state variables are defined at the outgoing CESE:

out_SQ

This state variable is used to indicate the most recent TerminalCapabilitySet message. It is incremented by one and mapped to the TerminalCapabilitySet message sequenceNumber field before transmission of the TerminalCapabilitySet message. Arithmetic performed on out_SQ is modulo 256.

The following state variables are defined at the incoming CESE:

in_SQ

This state variable is used to store the value of the sequenceNumber field of the most recently received TerminalCapabilitySet message. The TerminalCapabilitySetAck and TerminalCapabilitySetReject messages have their sequenceNumber fields set to the value of in_SQ, before being sent to the peer CESE.

8.3.3.3 CESE timers

The following timer is specified for the outgoing CESE:

T101

This timer is used during the AWAITING RESPONSE state. It specifies the maximum time during which no TerminalCapabilitySetAck or TerminalCapabilitySetReject message may be received.

8.3.4 CESE procedures

Figure 7 summarizes the CESE primitives and their parameters, and messages, for each of the outgoing and incoming CESE.

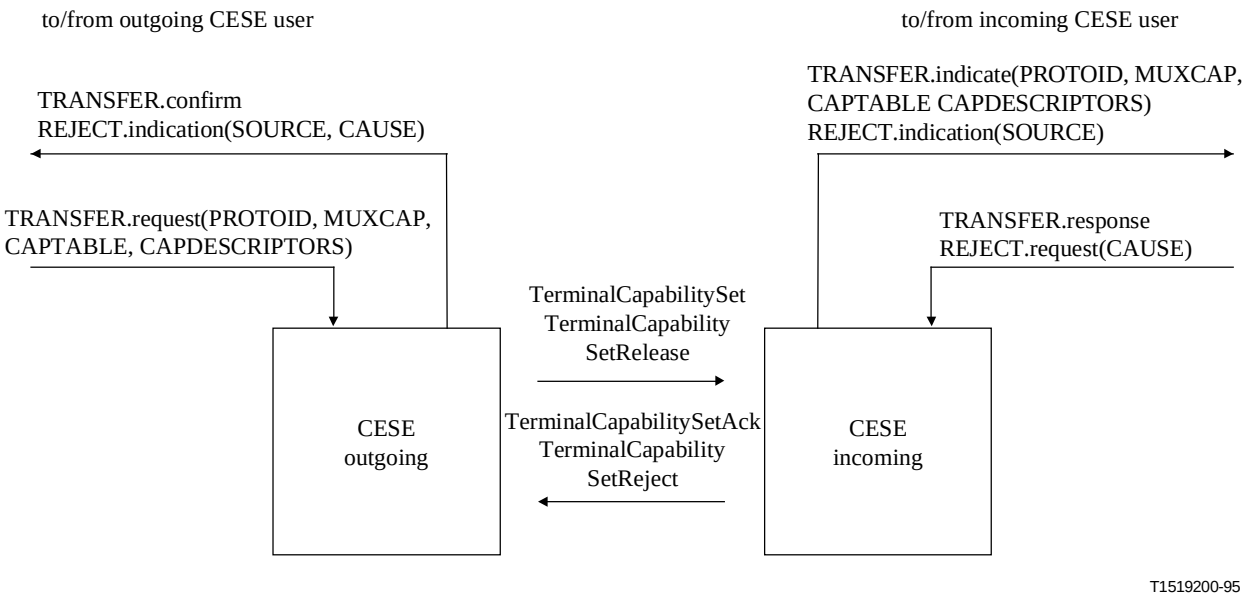


Figure 7/H.245 – Primitives and messages in the Capability Exchange Signalling Entity

8.3.4.1 Primitive parameter default values

Where not explicitly stated in the SDL diagrams, the parameters of the indication and confirm primitives assume values as shown in Table 24.

Table 24/H.245 – Default primitive parameter values

Primitive	Parameter	Default value
TRANSFER.indication	PROTOID	TerminalCapabilitySet.protocolIdentifier
	MUXCAP	TerminalCapabilitySet.multiplexCapability
	CAPTABLE	TerminalCapabilitySet.capabilityTable
	CAPDESCRIPTORS	TerminalCapabilitySet.capabilityDescriptors
REJECT.indication	SOURCE	USER
	CAUSE	null

8.3.4.2 Message field default values

Where not explicitly stated in the SDL diagrams the message fields assume values as shown in Table 25.

Table 25/H.245 – Default message field values

Message	Field	Default value (Note)
TerminalCapabilitySet	sequenceNumber	out_SQ
	protocolIdentifier	TRANSFER.request(PROTOID)
	multiplexCapability	TRANSFER.request(MUXCAP)
	capabilityTable	TRANSFER.request(CAPTABLE)
	capabilityDescriptors	TRANSFER.request(CAPDESCRIPTORS)

Table 25/H.245 – Default message field values (*concluded*)

Message	Field	Default value (Note)
TerminalCapabilitySetAck	sequenceNumber	in_SQ
TerminalCapabilitySetReject	sequenceNumber cause	in_SQ REJECT.request(CAUSE)
TerminalCapabilitySetRelease	–	–
NOTE – A message field shall not be coded if the corresponding primitive parameter is null, i.e. not present.		

8.3.4.3 SDLs

The outgoing CESE and the incoming CESE procedures are expressed in SDL form in Figures 8 and 9 respectively.

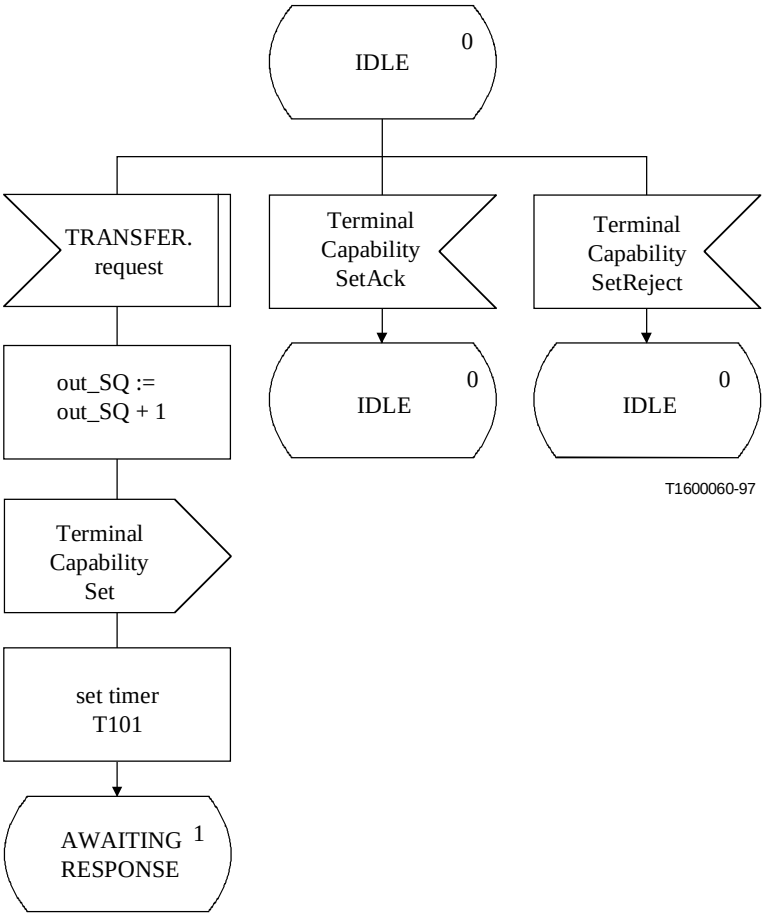


Figure 8 i)/H.245 – Outgoing CESE SDL

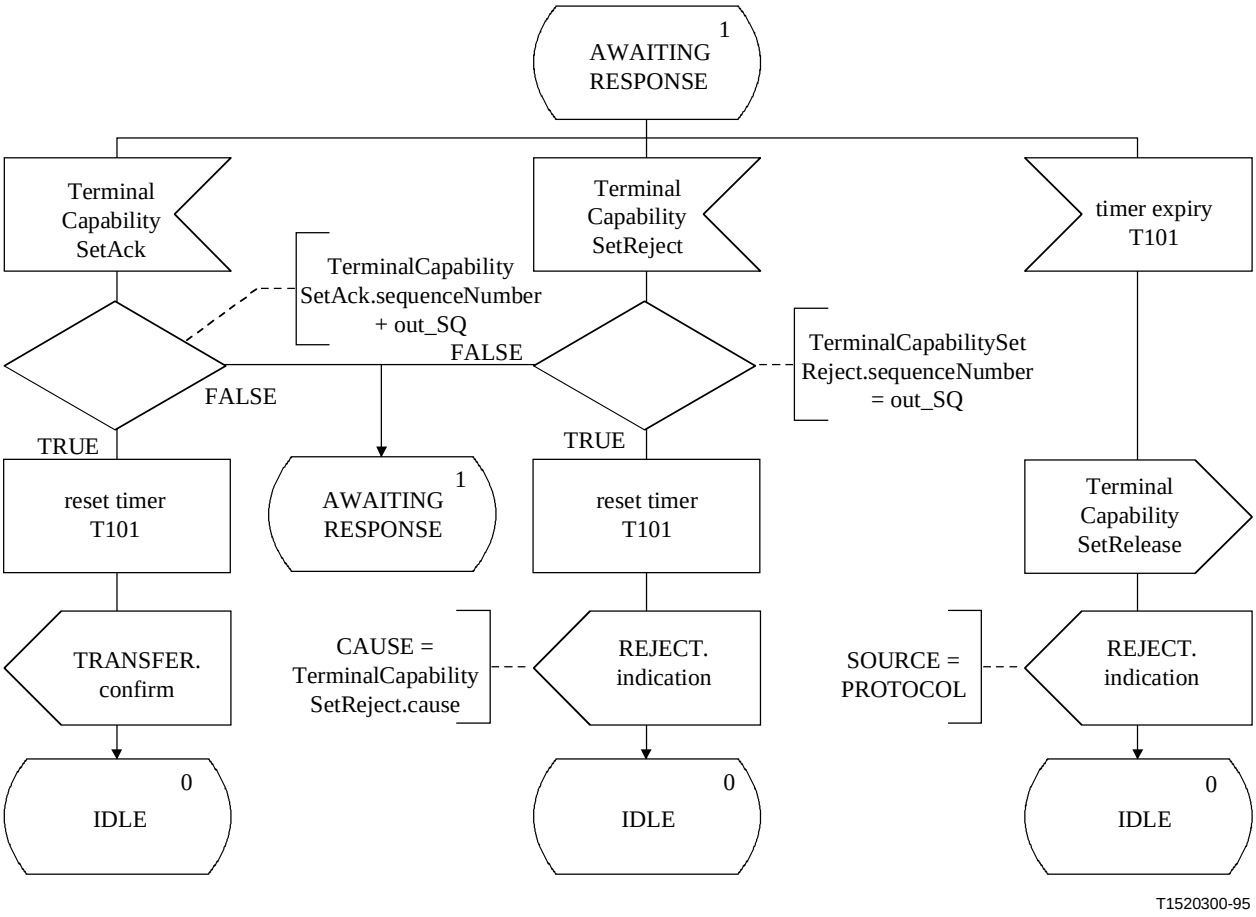


Figure 8 ii)/H.245 – Outgoing CESE SDL

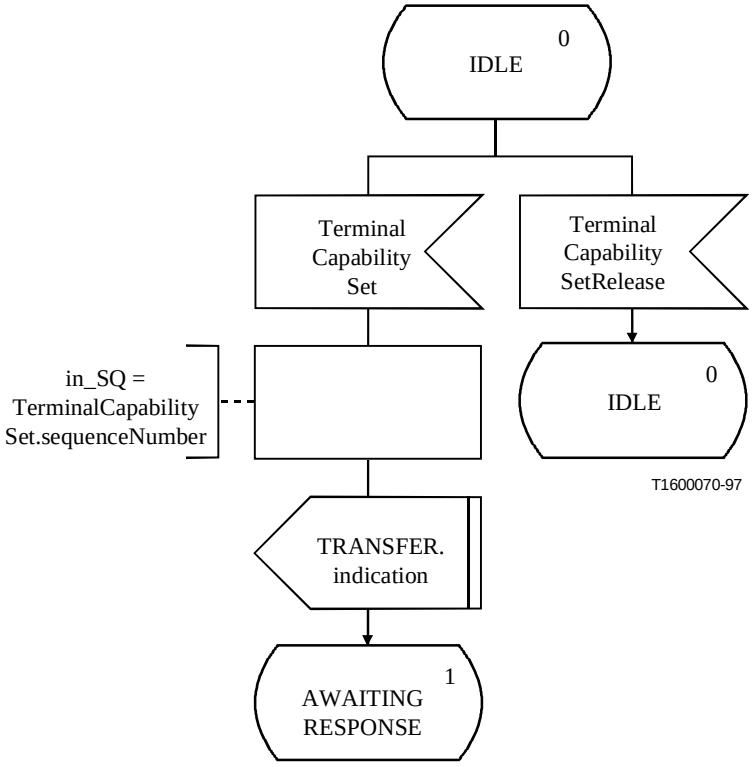


Figure 9 i)/H.245 – Incoming CESE SDL

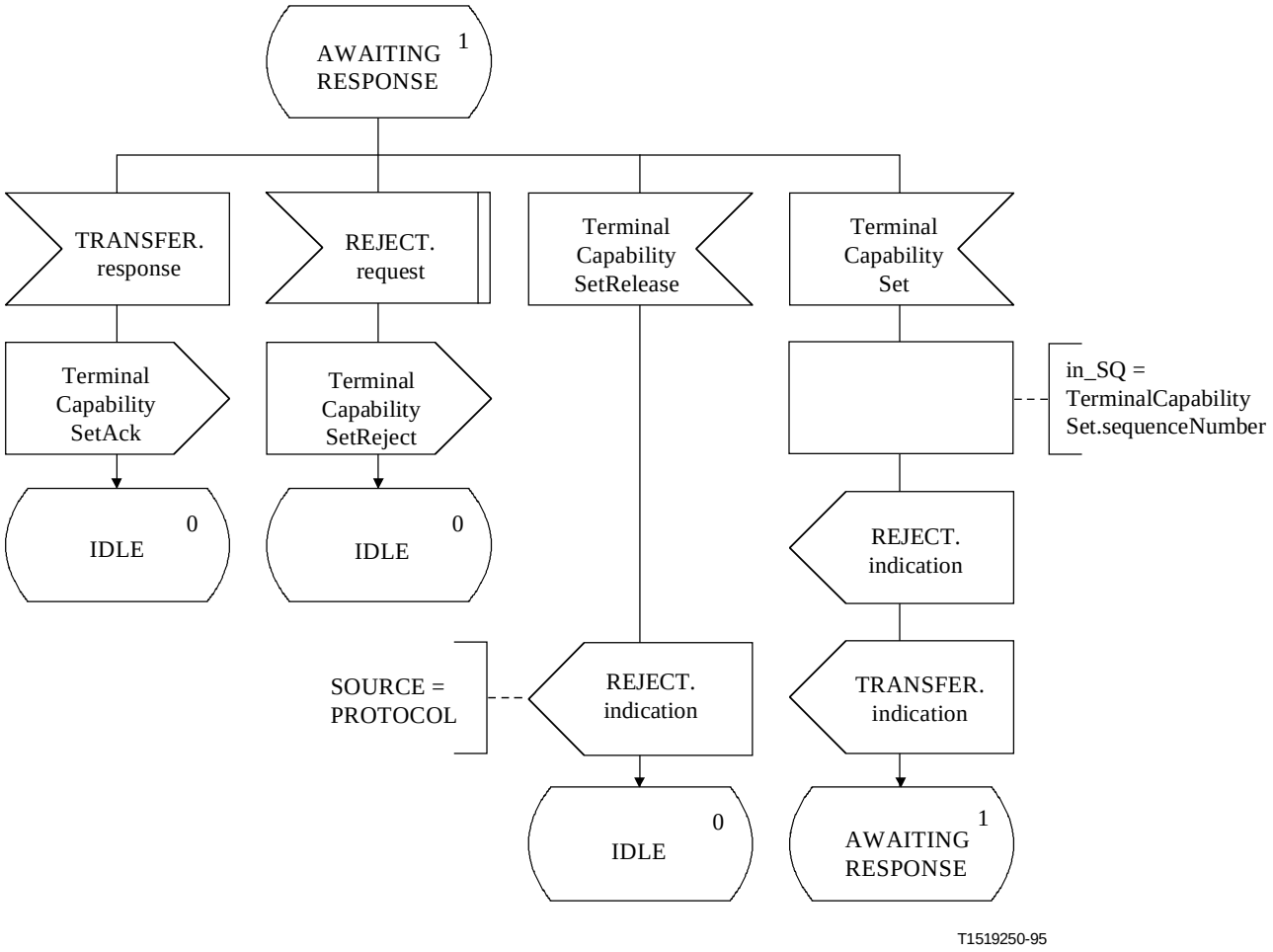


Figure 9 ii)/H.245 – Incoming CESE SDL

8.4 Uni-directional Logical Channel signalling procedures

8.4.1 Introduction

The protocol specified here provides reliable opening and closing of uni-directional logical channels using acknowledged procedures.

The protocol specified here is referred to as the Logical Channel Signalling Entity (LCSE). Procedures are specified in terms of primitives at the interface between the LCSE and the LCSE user, and LCSE states. Protocol information is transferred to the peer LCSE via relevant messages defined in clause 6.

There is an outgoing LCSE and an incoming LCSE. At each of the outgoing and incoming sides there is one instance of the LCSE for each uni-directional logical channel. There is no connection between an incoming LCSE and an outgoing LCSE at one side, other than via primitives to and from the LCSE user. LCSE error conditions are reported.

Data shall only be sent on a logical channel in the ESTABLISHED state. If data is received on a logical channel that is not in the ESTABLISHED state the data shall be discarded and no fault shall be considered to have occurred.

Mode switching should be performed by closing and opening existing logical channels, or by opening new logical channels.

NOTE – Some Recommendations that use this Recommendation may define some default logical channels. These shall be considered ESTABLISHED from the start of communication and shall not be opened using these procedures. They may, however, be closed by these procedures, and subsequently be re-opened for the same or a different purpose.

A terminal that is no longer capability of processing the signals on a logical channel should take appropriate action: this should include closing the logical channel and transmitting the relevant (changed) capability information to the remote terminal.

The following text provides an overview of the operation of the LCSE protocol. In the case of discrepancy between this and the formal specification, the formal specification will supersede.

8.4.1.1 Protocol overview

The opening of a logical channel is initiated when the ESTABLISH.request primitive is issued by the user at the outgoing LCSE. An OpenLogicalChannel message, containing forward logical channel parameters but not including reverse logical channel parameters, is sent to the peer incoming LCSE, and timer T103 is started. If an OpenLogicalChannelAck message is received in response to the OpenLogicalChannel message, then timer T103 is stopped and the user is informed with the ESTABLISH.confirm primitive that the logical channel has been successfully opened. The logical channel may now be used to transmit user information. If however an OpenLogicalChannelReject message is received in response to the OpenLogicalChannel message, then timer T103 is stopped and the user is informed with the RELEASE.indication primitive that the peer LCSE user has refused establishment of the logical channel.

If timer T103 expires in this period, then the user is informed with the RELEASE.indication primitive, and a CloseLogicalChannel message is sent to the peer incoming LCSE.

A logical channel which has been successfully established may be closed when the RELEASE.request primitive is issued by the user at the outgoing LCSE. A CloseLogicalChannel message is sent to the peer incoming LCSE, and the timer T103 is started. When a CloseLogicalChannelAck message is received, timer T103 is stopped and the user is informed that the logical channel has been successfully closed with the RELEASE.confirm primitive.

If timer T103 expires in this period, then the user is informed with the RELEASE.indication primitive.

Before either of the OpenLogicalChannelAck or OpenLogicalChannelReject messages have been received in response to a previously sent OpenLogicalChannel message, the user at the outgoing LCSE may close the logical channel using the RELEASE.request primitive.

Before the CloseLogicalChannelAck message is received in response to a previously sent CloseLogicalChannel message, the user at the outgoing LCSE may establish a new logical channel by issuing the ESTABLISH.request primitive.

8.4.1.2 Protocol overview – Incoming LCSE

When an OpenLogicalChannel message is received at the incoming LCSE, the user is informed of the request to open a new logical channel with the ESTABLISH.indication primitive. The incoming LCSE user signals acceptance of the request to establish the logical channel by issuing the ESTABLISH.response primitive, and an OpenLogicalChannelAck message is sent to the peer outgoing LCSE. The logical channel may now be used to receive user information. The incoming LCSE user signals rejection of the request to establish the logical channel by issuing the RELEASE.request primitive, and an OpenLogicalChannelReject message is sent to the peer outgoing LCSE.

A logical channel which has been successfully established may be closed when the CloseLogicalChannel message is received at the incoming LCSE. The incoming LCSE user is informed with the RELEASE.indication primitive, and the CloseLogicalChannelAck message is sent to the peer outgoing LCSE.

8.4.1.3 Conflict resolution

Conflicts may arise when requests to open logical channels are initiated at the same time. It may be possible to determine that there is a conflict from knowledge of exchanged capabilities.

Terminals shall be capable of detecting when conflict has arisen, or might arise, and shall act as follows.

Before logical channels can be opened, one terminal must be determined as the master terminal, and the other as the slave. The protocol defined in 8.2 provides one means to make this decision. The master terminal shall reject immediately any request from the slave that it identifies as a conflicting request. The slave terminal may identify such conflicts, but shall respond to the request from the master terminal, with the knowledge that its earlier request will be rejected.

NOTE – Such conflicts might be caused by limited terminal resources, for example, when receive and transmission capabilities are dependent, as in the case of a terminal that can support a number of audio algorithms, but can only decode the same algorithm as it is encoding.

8.4.2 Communication between the LCSE and the LCSE user

8.4.2.1 Primitives between the LCSE and the LCSE user

Communication between the LCSE and the LCSE user is performed using the primitives shown in Table 26.

Table 26/H.245 – Primitives and parameters

Generic name	Type			
	Request	**Indication**	**Response**	**Confirm**
ESTABLISH	FORWARD_PARAM	FORWARD_PARAM	– (Note 1)	–
RELEASE	CAUSE	SOURCE CAUSE	not defined (Note 2)	–
ERROR	not defined	ERRCODE	not defined	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive does not exist.				

8.4.2.2 Primitive definition

The definition of these primitives is as follows:

a) The ESTABLISH primitives are used to establish a logical channel for audiovisual and data communication.

b) The RELEASE primitives are used to release a logical channel.

c) The ERROR primitive reports LCSE errors to a management entity.

8.4.2.3 Parameter definition

The definition of the primitive parameters shown in Table 26 are as follows:

a) The FORWARD_PARAM parameter specifies the parameters associated with the logical channel. This parameter is mapped to the forwardLogicalChannelParameters field of the OpenLogicalChannel message and is carried transparently to the peer LCSE user.

b) The SOURCE parameter indicates to the LCSE user the source of the logical channel release. The SOURCE parameter has the value of "USER" or "LCSE", indicating either the LCSE user, or the LCSE. The latter may occur as the result of a protocol error.

c) The CAUSE parameter indicates the reason as to why the peer LCSE user rejected a request to establish a logical channel. The CAUSE parameter is not present when the SOURCE parameter indicates "LCSE".

d) The ERRCODE parameter indicates the type of LCSE error. Table 30 shows the allowed values of the ERRCODE parameter.

8.4.2.4 LCSE states

The following states are used to specify the allowed sequence of primitives between the LCSE and the LCSE user, and the exchange of messages between peer LCSEs. The states are specified separately for each of an outgoing LCSE and an incoming LCSE. The states for an outgoing LCSE are:

State 0: RELEASED

The logical channel is released. The logical channel shall not be used to send outgoing data.

State 1: AWAITING ESTABLISHMENT

The outgoing LCSE is waiting to establish a logical channel with a peer incoming LCSE. The logical channel shall not be used to send outgoing data.

State 2: ESTABLISHED

The LCSE peer-to-peer logical channel connection has been established. The logical channel may be used to send outgoing data.

State 3: AWAITING RELEASE

The outgoing LCSE is waiting to release a logical channel with the peer incoming LCSE. The logical channel shall not be used to send outgoing data.

The states for an incoming LCSE are:

State 0: RELEASED

The logical channel is released. The logical channel shall not be used to receive incoming data.

State 1: AWAITING ESTABLISHMENT

The incoming LCSE is waiting to establish a logical channel with a peer outgoing LCSE. The logical channel shall not be used to receive incoming data.

State 2: ESTABLISHED

An LCSE peer-to-peer logical channel connection has been established. The logical channel may be used to receive incoming data.

8.4.2.5 State transition diagram

The allowed sequence of primitives between the LCSE and the LCSE user is defined here. The allowed sequence of primitives relates to states of the LCSE as viewed from the LCSE user. The allowed sequences are specified separately for each of an outgoing LCSE and an incoming LCSE, as shown in Figures 10 and 11 respectively.

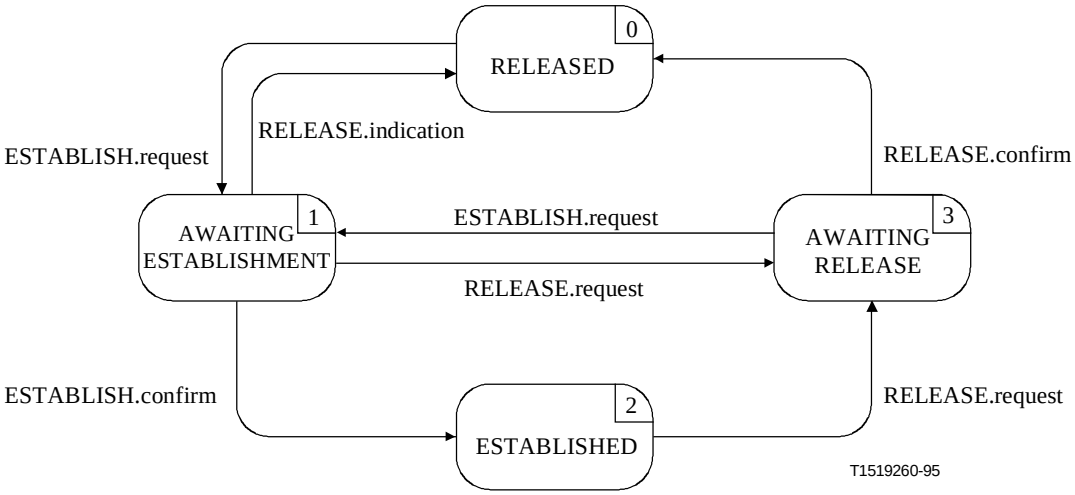


Figure 10/H.245 – State transition diagram for sequence of primitives at outgoing LCSE

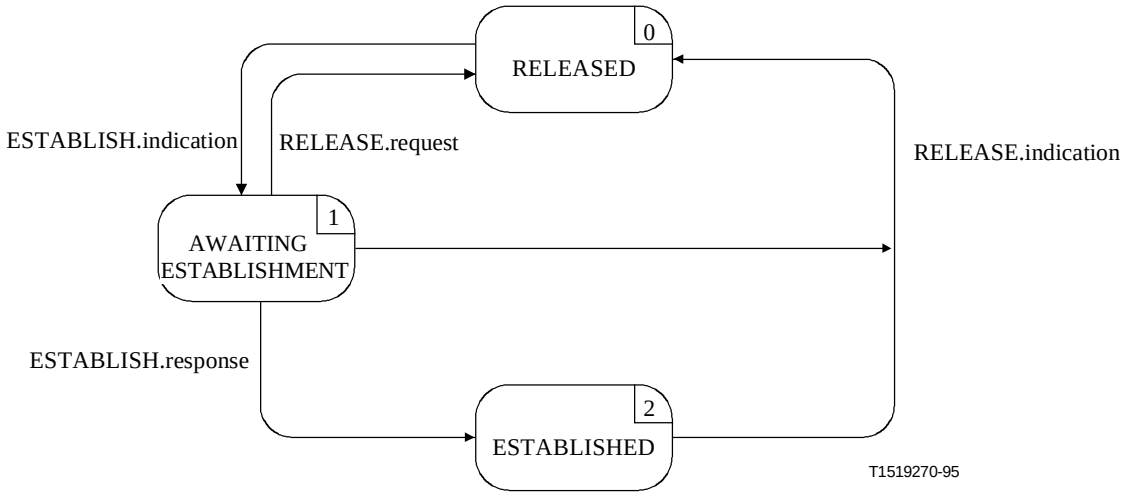


Figure 11/H.245 – State transition diagram for sequence of primitives at incoming LCSE

8.4.3 Peer-to-peer LCSE communication

8.4.3.1 LCSE messages

Table 27 shows the LCSE messages and fields, defined in clause 6, which are relevant to the LCSE protocol.

Table 27/H.245 – LCSE message names and fields

Function	Message	Direction	Field
establishment	OpenLogicalChannel	O → I	forwardLogicalChannelNumber forwardLogicalChannelParameters
	OpenLogicalChannelAck	O ← I	forwardLogicalChannelNumber
	OpenLogicalChannelReject	O ← I	forwardLogicalChannelNumber cause
release	CloseLogicalChannel	O → I	forwardLogicalChannelNumber source
	CloseLogicalChannelAck	O ← I	forwardLogicalChannelNumber
O Outgoing I Incoming			

8.4.3.2 LCSE state variables

The following state variable is defined at the outgoing LCSE:

out_LCN

This state variable distinguishes between outgoing LCSEs. It is initialized at outgoing LCSE initialization. The value of out_LCN is used to set the forwardLogicalChannelNumber field of LCSE messages sent from an outgoing LCSE. For LCSE messages received at an outgoing LCSE, the message forwardLogicalChannelNumber field value is identical to the value of out_LCN.

The following state variable is defined at the incoming LCSE:

in_LCN

This state variable distinguishes between incoming LCSEs. It is initialized at incoming LCSE initialization. The value of in_LCN is used to set the forwardLogicalChannelNumber field of LCSE messages sent from an incoming LCSE. For LCSE messages received at an incoming LCSE, the message forwardLogicalChannelNumber field value is identical to the value of in_LCN.

8.4.3.3 LCSE timers

The following timer is specified for the outgoing LCSE:

T103

This timer is used during the AWAITING ESTABLISHMENT and AWAITING RELEASE states. It specifies the maximum allowed time during which no OpenLogicalChannelAck, OpenLogicalChannelReject or CloseLogicalChannelAck message may be received.

8.4.4 LCSE procedures

8.4.4.1 Introduction

Figure 12 summarizes the primitives and their parameters, and the messages, for each of the outgoing and incoming LCSE.

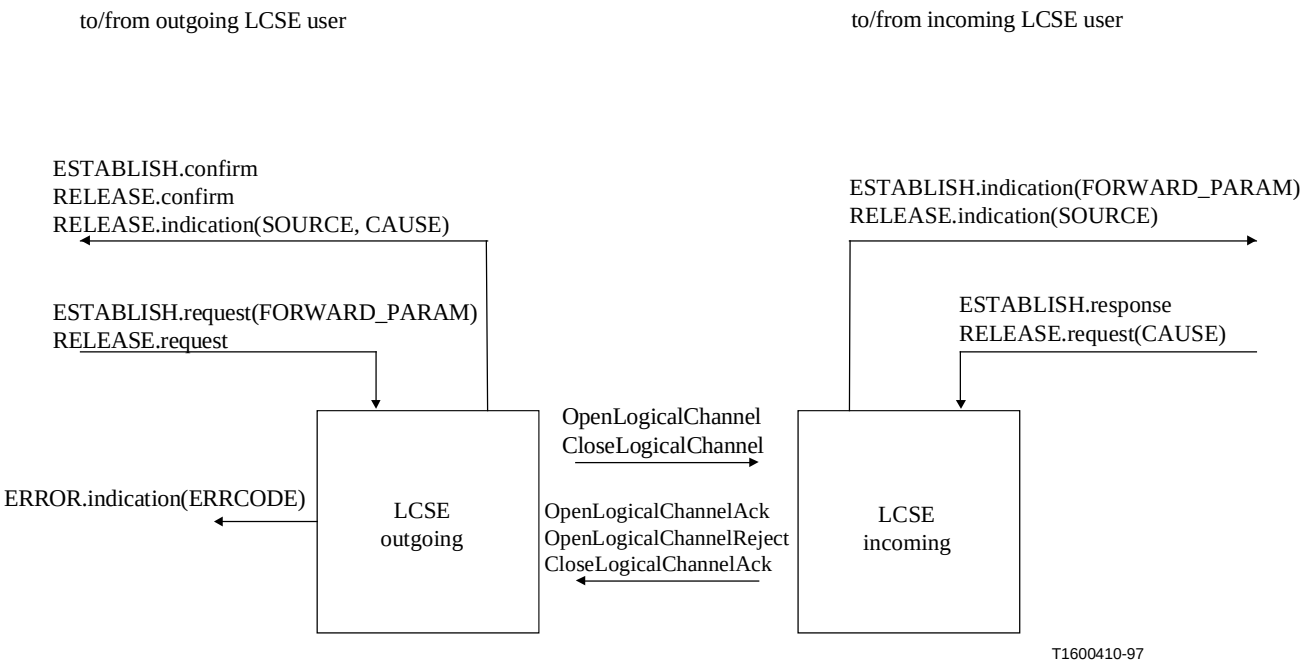


Figure 12/H.245 – Primitives and messages in the Logical Channel Signalling Entity

8.4.4.2 Primitive parameter default values

Where not explicitly stated in the SDL diagrams, the parameters of the indication and confirm primitives assume values as shown in Table 28.

Table 28/H.245 – Default primitive parameter values

Primitive	Parameter	Default value (Note)
ESTABLISH.indication	FORWARD_PARAM	OpenLogicalChannel.forwardLogicalChannelParameters
RELEASE.indication	SOURCE CAUSE	CloseLogicalChannel.source null
NOTE – A primitive parameter shall be coded as null if an indicated message field is not present in the message.		

8.4.4.3 Message field default values

Where not explicitly stated in the SDL diagrams, the message fields assume values as shown in Table 29.

Table 29/H.245 – Default message field values

Message	Field	Default value (Note 1)
OpenLogicalChannel (Note 2)	forwardLogicalChannelNumber forwardLogicalChannelParameters	out_LCN ESTABLISH.request(FORWARD_PARAM)
OpenLogicalChannelAck	forwardLogicalChannelNumber	in_LCN
OpenLogicalChannelReject	forwardLogicalChannelNumber cause	in_LCN RELEASE.request(CAUSE)
CloseLogicalChannel	forwardLogicalChannelNumber source	out_LCN user
CloseLogicalChannelAck	forwardLogicalChannelNumber	in_LCN
NOTE 1 – A message field shall not be coded if the corresponding primitive parameter is null, i.e. not present. NOTE 2 – reverseLogicalChannelParameters are not coded in uni-directional logical channel signalling procedures.		

8.4.4.4 ERRCODE parameter values

The ERRCODE parameter of the ERROR.indication primitive indicates a particular error condition. Table 30 shows the values that the ERRCODE parameter may take at the outgoing LCSE. There is no ERROR.indication primitive associated with the incoming LCSE.

Table 30/H.245 – ERRCODE parameter values at outgoing LCSE

Error type	Error code	Error condition	State
inappropriate message	A	OpenLogicalChannelAck	RELEASED
	B	OpenLogicalChannelReject	RELEASED ESTABLISHED
	C	CloseLogicalChannelAck	ESTABLISHED
no response from peer LCSE	D	timer T103 expiry	AWAITING ESTABLISHMENT AWAITING RELEASE

8.4.4.5 SDLs

The outgoing LCSE and the incoming LCSE procedures are expressed in SDL form in Figures 13 and 14 respectively.

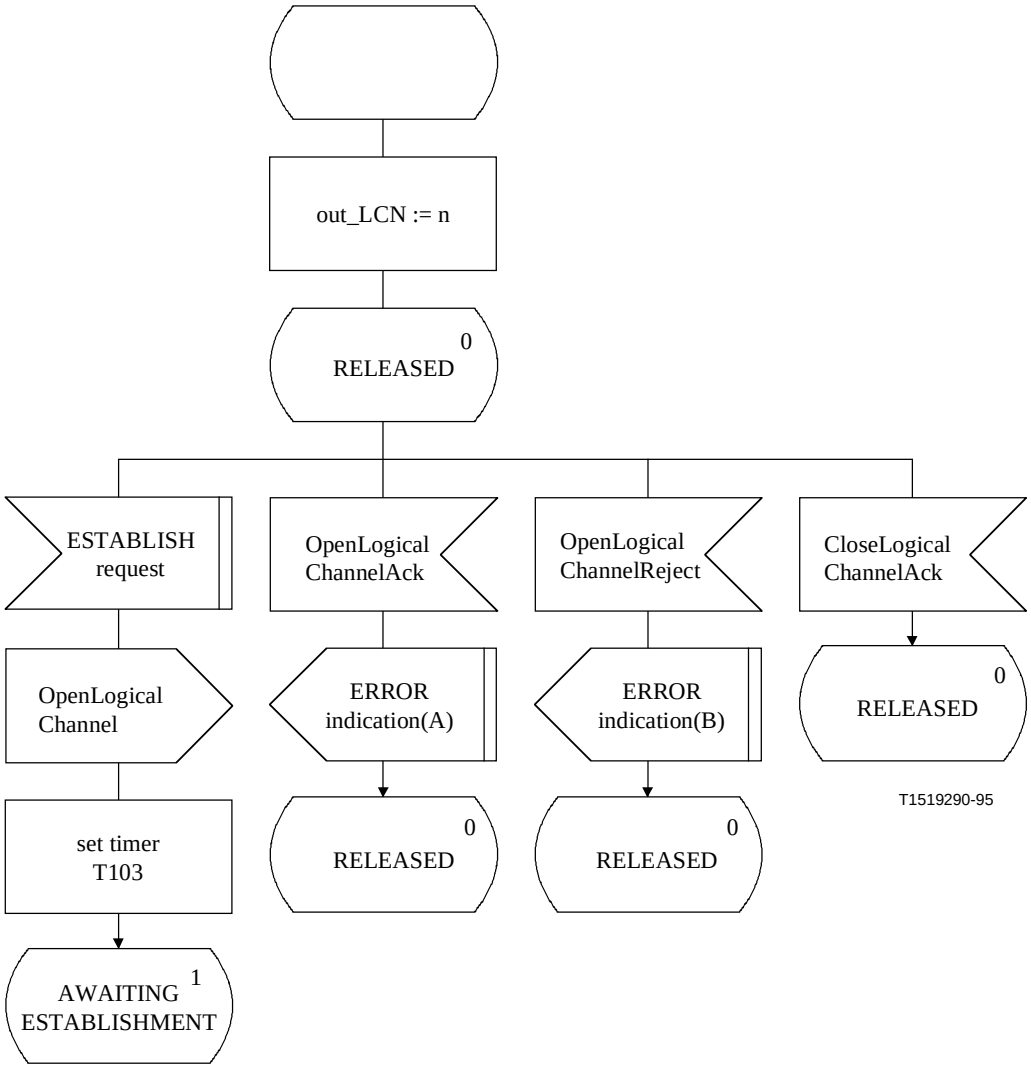


Figure 13 i)/H.245 – Outgoing LCSE SDL

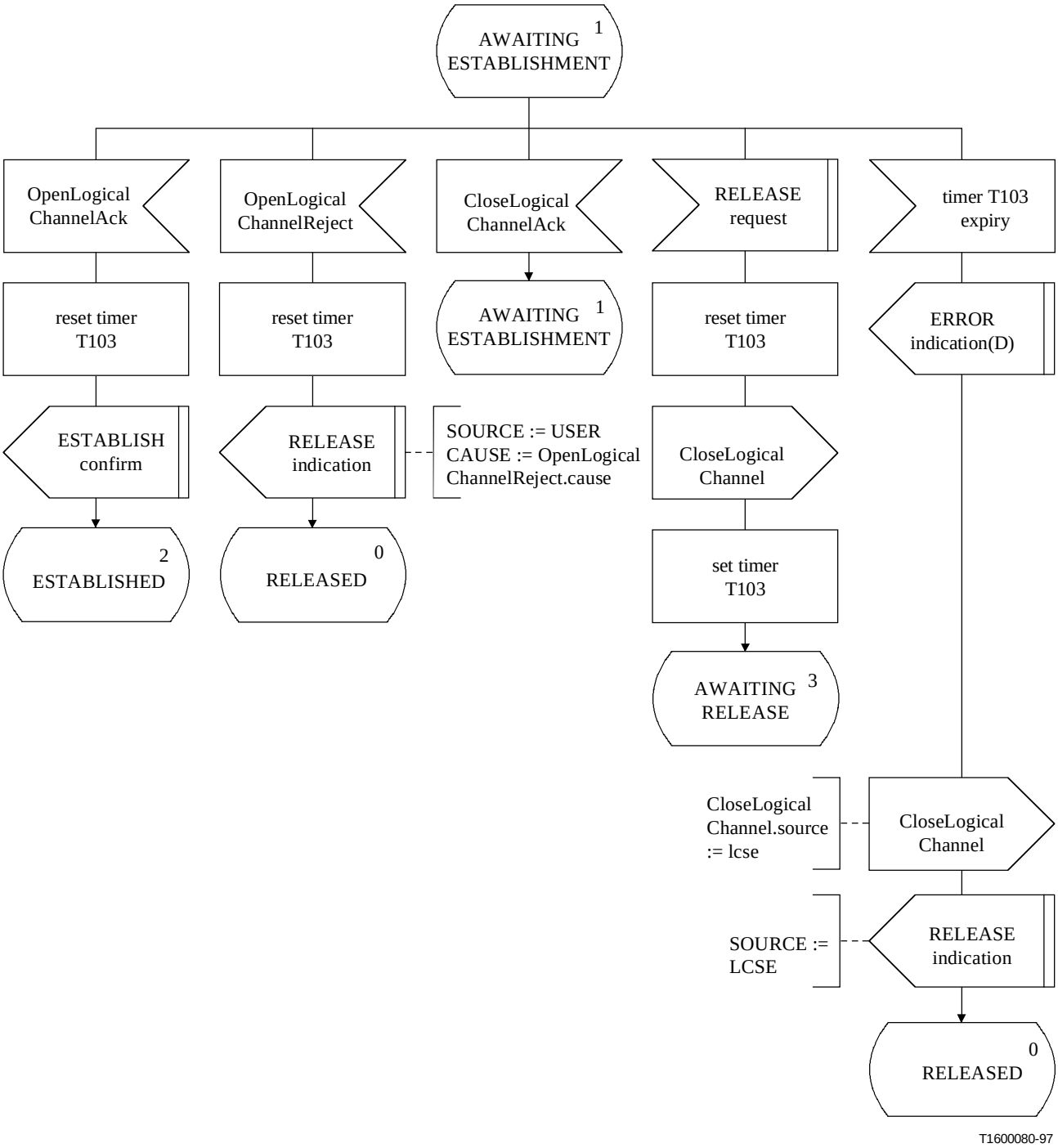


Figure 13 ii)/H.245 – Outgoing LCSE SDL

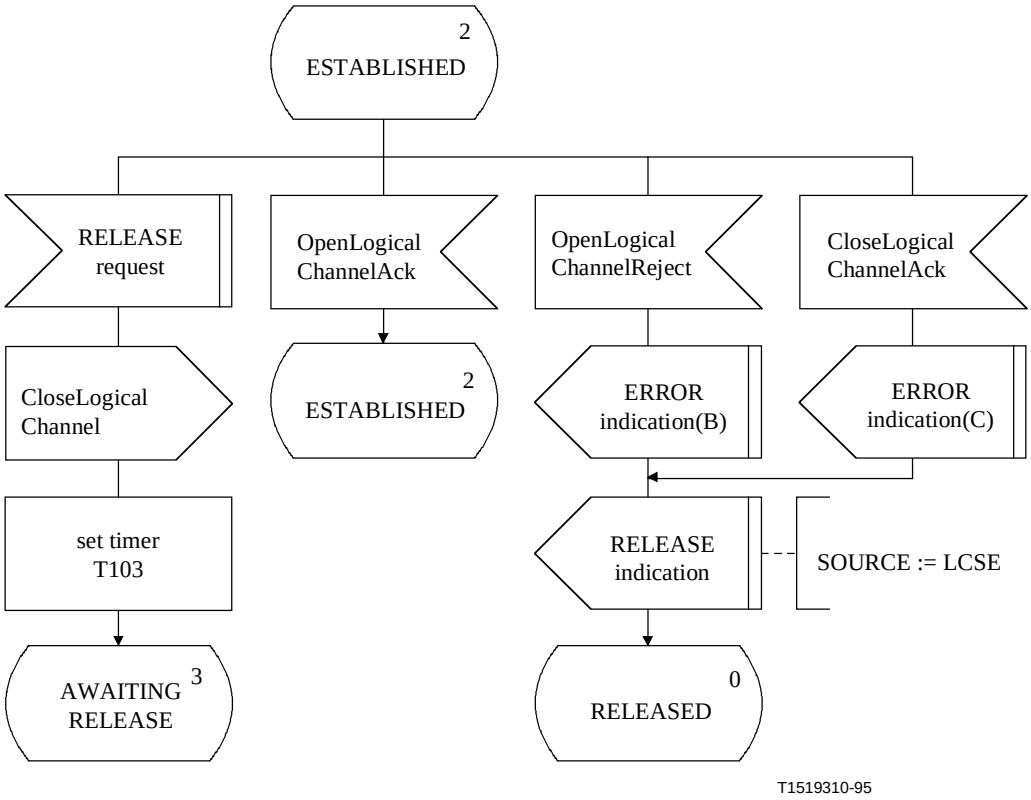


Figure 13 iii)/H.245 – Outgoing LCSE SDL

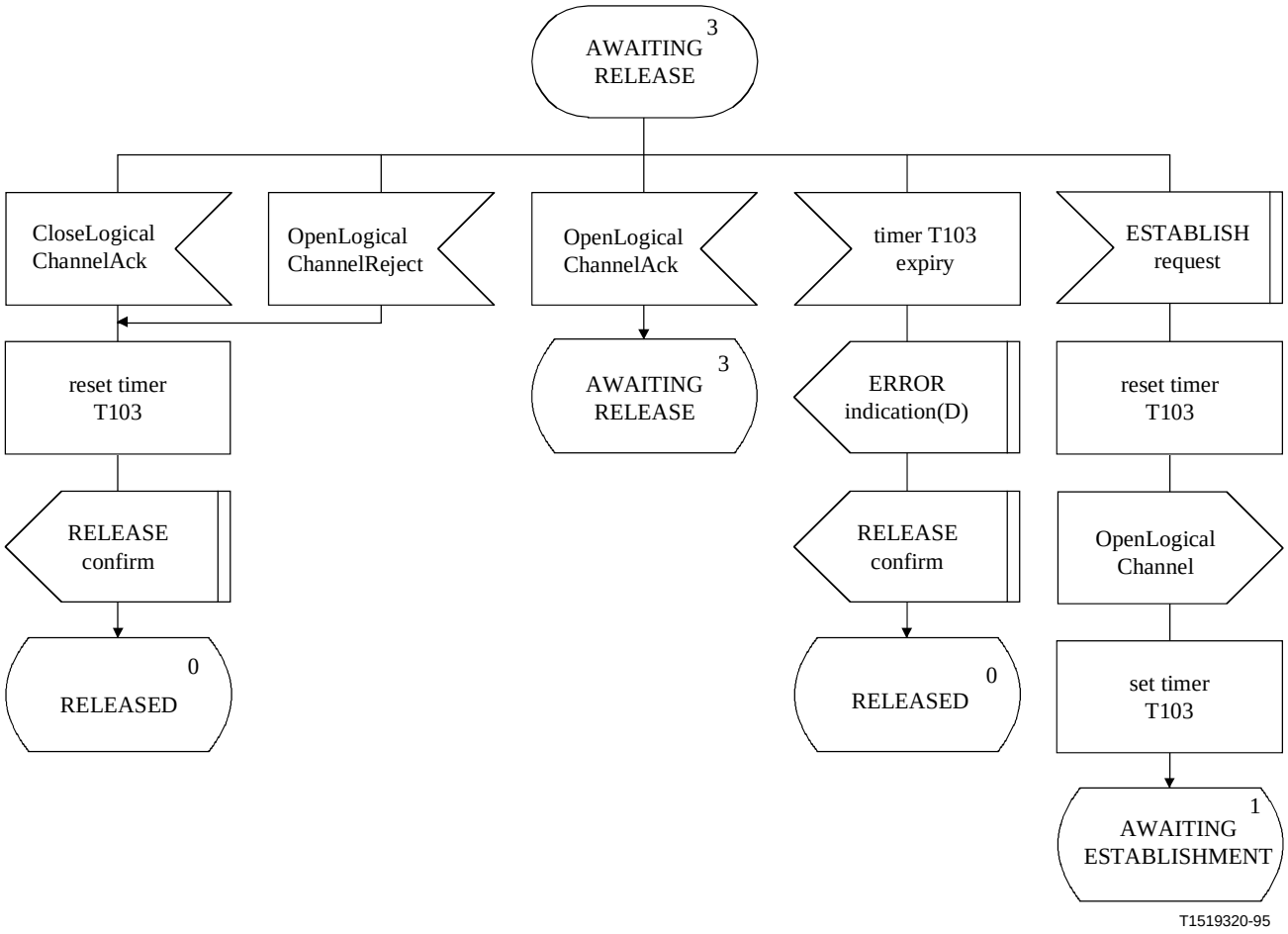


Figure 13 iv)/H.245 – Outgoing LCSE SDL

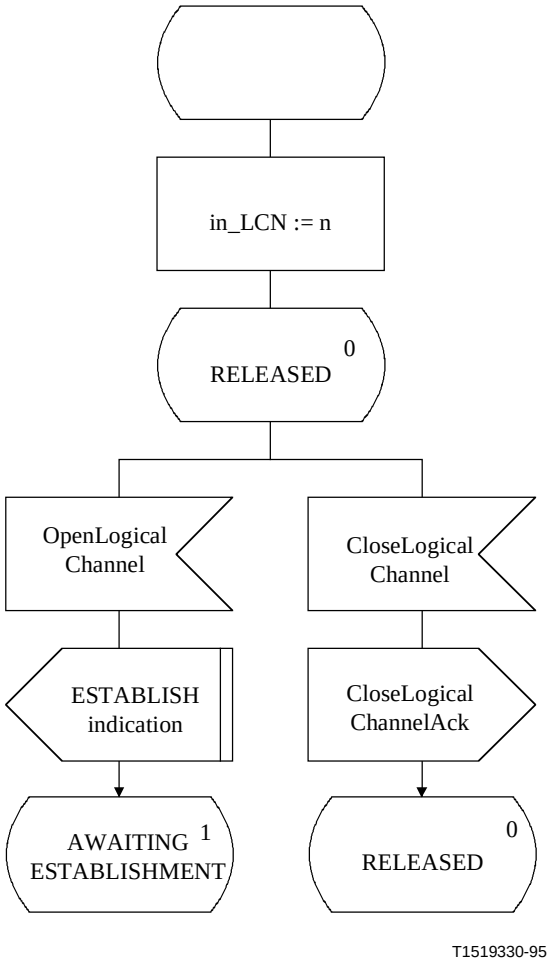


Figure 14 i)/H.245 – Incoming LCSE SDL

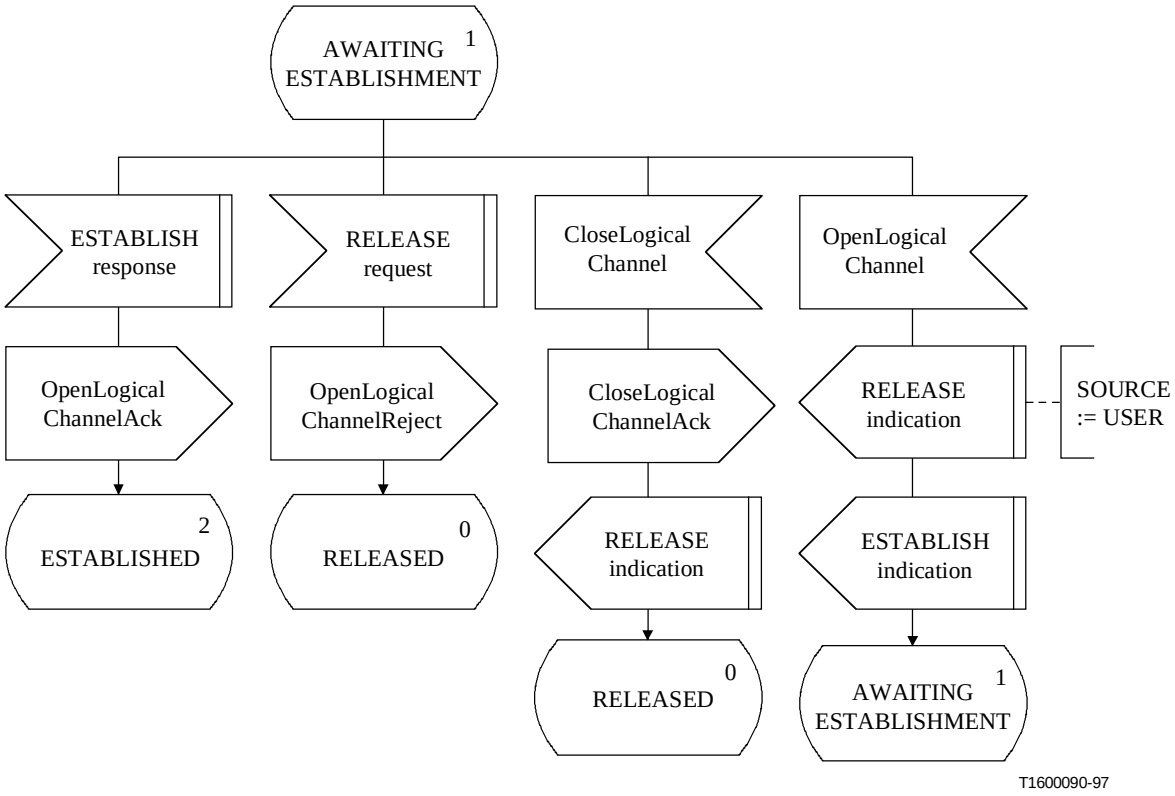


Figure 14 ii)/H.245 – Incoming LCSE SDL

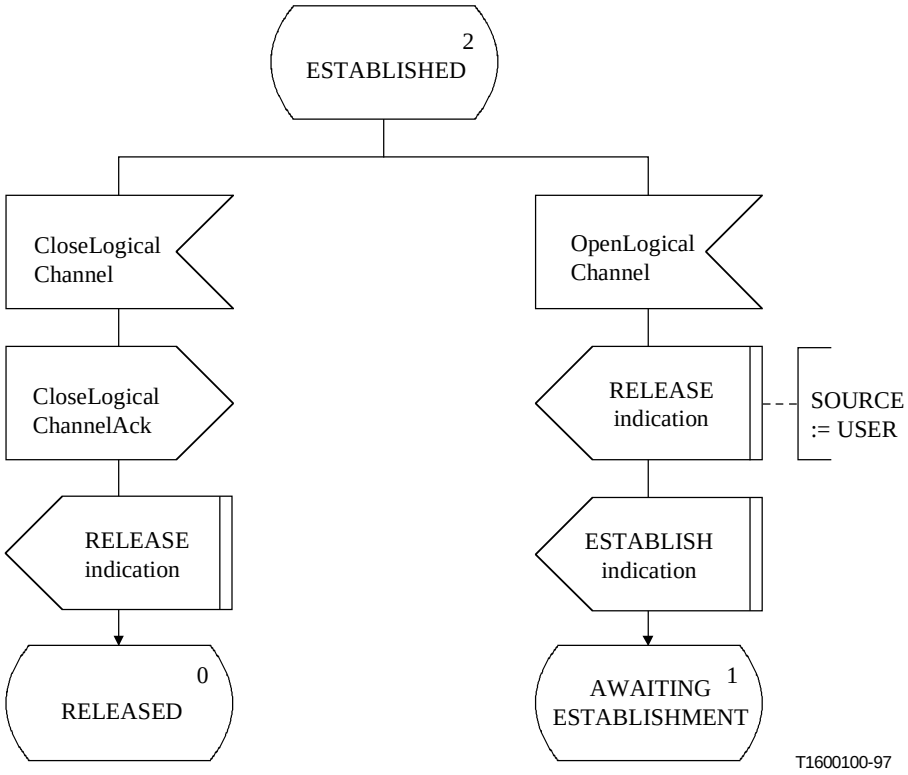


Figure 14 iii)/H.245 – Incoming LCSE SDL

8.5 Bi-directional Logical Channel signalling procedures

8.5.1 Introduction

The protocol specified here provides reliable opening and closing of bi-directional logical channels using acknowledged procedures.

The protocol specified here is referred to as the Bi-directional Logical Channel Signalling Entity (B-LCSE). Procedures are specified in terms of primitives at the interface between the B-LCSE and the B-LCSE user, and B-LCSE states. Protocol information is transferred to the peer B-LCSE via relevant messages defined in clause 6.

There is an outgoing B-LCSE and an incoming B-LCSE. At each of the outgoing and incoming sides there is one instance of the B-LCSE for each bi-directional logical channel. There is no connection between an incoming B-LCSE and an outgoing B-LCSE at one side, other than via primitives to and from the B-LCSE user. B-LCSE error conditions are reported.

A bi-directional logical channel consists of a pair of associated uni-directional channels. "Forward" (Outgoing side) is used to refer to transmission in the direction from the terminal making the request for a bi-directional logical channel to the other terminal, and "reverse" (Incoming side) is used to refer to the opposite direction of transmission.

Data shall only be sent on a bi-directional logical channel in the ESTABLISHED state. However, data may be received on the forward channel when the incoming B-LCSE is in the AWAITING CONFIRMATION state. Data that is received while in other states than the ESTABLISHED state and the AWAITING CONFIRMATION state shall be discarded and no fault shall be considered to have occurred.

A terminal may reject a request to open a bi-directional logical channel solely because it can not support the requested reverse channel parameters. In this case it shall reject the request with cause equal to unsuitableReverseParameters, and shall immediately initiate procedures to establish a bi-directional logical channel as requested by the remote terminal, in which the reverse parameters are identical to the forward parameters of the remote terminal's failed request, and with forward parameters that the terminal can support and which the remote terminal is known to be able to support.

Mode switching should be performed by closing and opening existing logical channels, or by opening new logical channels.

NOTE – Some Recommendations that use this Recommendation may define some default logical channels. These shall be considered ESTABLISHED from the start of communication and shall not be opened using these procedures. They may, however, be closed by these procedures, and subsequently be re-opened for the same or a different purpose.

A terminal that is no longer capable of processing the signals on a logical channel should take appropriate action: this should include closing the logical channel and transmitting the relevant (changed) capability information to the remote terminal.

The following text provides an overview of the operation of the B-LCSE protocol. In the case of discrepancy between this and the formal specification, the formal specification will supersede.

8.5.1.1 Protocol overview – Outgoing B-LCSE

The opening of a logical channel is initiated when the ESTABLISH.request primitive is issued by the user at the outgoing B-LCSE. An OpenLogicalChannel message, containing both forward and reverse logical channel parameters, is sent to the peer incoming B-LCSE, and timer T103 is started. If an OpenLogicalChannelAck message is received in response to the OpenLogicalChannel message then timer T103 is stopped, an OpenLogicalChannelConfirm message is sent to the peer incoming

B-LCSE, and the user is informed with the ESTABLISH.confirm primitive that the logical channel has been successfully opened. The logical channel may now be used to transmit and receive user information. If however an OpenLogicalChannelReject message is received in response to the OpenLogicalChannel message, then timer T103 is stopped and the user is informed with the RELEASE.indication primitive that the peer B-LCSE user has refused establishment of the logical channel.

If timer T103 expires in this period, then the user is informed with the RELEASE.indication primitive, and a CloseLogicalChannel message is sent to the peer incoming B-LCSE.

A logical channel which has been successfully established may be closed when the RELEASE.request primitive is issued by the user at the outgoing B-LCSE. A CloseLogicalChannel message is sent to the peer incoming B-LCSE, and the timer T103 is started. When a CloseLogicalChannelAck message is received, timer T103 is stopped and the user is informed that the logical channel has been successfully closed with the RELEASE.confirm primitive.

If timer T103 expires in this period, then the user is informed with the RELEASE.indication primitive.

Before either of the OpenLogicalChannelAck or OpenLogicalChannelReject messages have been received in response to a previously sent OpenLogicalChannel message, the user at the outgoing B-LCSE may close the logical channel using the RELEASE.request primitive.

Before the CloseLogicalChannelAck message is received in response to a previously sent CloseLogicalChannel message, the user at the outgoing B-LCSE may establish a new logical channel by issuing the ESTABLISH.request primitive.

8.5.1.2 Protocol overview – Incoming B-LCSE

When an OpenLogicalChannel message is received at the incoming B-LCSE, the user is informed of the request to open a new logical channel with the ESTABLISH.indication primitive. The incoming B-LCSE user signals acceptance of the request to establish the logical channel by issuing the ESTABLISH.response primitive, and an OpenLogicalChannelAck message is sent to the peer outgoing B-LCSE. The forward channel of the bi-directional logical channel may now be used to receive user information. The incoming B-LCSE user signals rejection of the request to establish the logical channel by issuing the RELEASE.request primitive, and an OpenLogicalChannelReject message is sent to the peer outgoing B-LCSE.

When an OpenLogicalChannelConfirm message is received at the incoming B-LCSE, the user is informed that the bi-directional logical channel is established with the ESTABLISH.confirm primitive. The reverse channel of the bi-directional logical channel may now be used to transmit user information.

A logical channel which has been successfully established may be closed when the CloseLogicalChannel message is received at the incoming B-LCSE. The incoming B-LCSE user is informed with the RELEASE.indication primitive, and the CloseLogicalChannelAck message is sent to the peer outgoing B-LCSE.

8.5.1.3 Conflict resolution

Conflicts may arise when requests to open logical channels are initiated at the same time. It may be possible to determine that there is conflict from knowledge of exchanged capabilities. On other occasions, both terminals may initiate the opening of a bi-directional logical channel for the same purpose, even though the exact parameters requested may be different, and both terminals have sufficient capability for both requests. Terminals shall be capable of detecting when both of these situations have arisen, any shall act as follows.

Before logical channels can be opened, one terminal must be determined as the master terminal, and the other as the slave. The protocol defined in 8.2 provides one means to make this decision. The master terminal shall reject immediately any request from the slave that it identifies as a conflicting request. The slave terminal may identify such conflicts, but shall respond to the request from the master terminal, with the knowledge that its earlier request will be rejected.

In the second type of conflict defined above, it is impossible to distinguish when two bi-directional channels are actually wanted from the case when only one is wanted. Terminals shall respond assuming that only one is wanted, but a terminal may subsequently repeat its request if the assumption was incorrect.

8.5.2 Communication between the B-LCSE and the B-LCSE user

8.5.2.1 Primitives between the B-LCSE and the B-LCSE user

Communication between the B-LCSE and the B-LCSE user is performed using the primitives shown in Table 31.

Table 31/H.245 – Primitives and parameters

Generic name	Type			
	Request	**Indication**	**Response**	**Confirm**
ESTABLISH	FORWARD_PARAM REVERSE_PARAM	FORWARD_PARAM REVERSE_PARAM	REVERSE_DATA	REVERSE_DATA
RELEASE	CAUSE	SOURCE CAUSE	not defined (Note 2)	– (Note 1)
ERROR	not defined	ERRCODE	not defined	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive does not exist.				

8.5.2.2 Primitive definition

The definition of these primitives is as follows:

a) The ESTABLISH primitives are used to establish a logical channel for audiovisual and data communication.

b) The RELEASE primitives are used to release a logical channel.

c) The ERROR primitive reports B-LCSE errors to a management entity.

8.5.2.3 Parameter definition

The definition of the primitive parameters shown in Table 31 are as follows:

a) The FORWARD_PARAM parameter specifies the parameters associated with the forward channel, that is, from the terminal containing the outgoing B-LCSE to the terminal containing the incoming B-LCSE. This parameter is mapped to the forwardLogicalChannelParameters field of the OpenLogicalChannel message and is carried transparently to the peer LCSE user.

b) The REVERSE_PARAM parameter specifies the parameters associated with the reverse channel, that is, from the terminal containing the incoming B-LCSE to the terminal containing the outgoing B-LCSE. This parameter is mapped to the reverseLogicalChannelParameters field of the OpenLogicalChannel message and is carried transparently to the peer LCSE user.

c) The REVERSE_DATA parameter specifies some parameters associated with the reverse channel, that is, from the terminal containing the incoming B-LCSE to the terminal containing the outgoing B-LCSE. This parameter is mapped to the reverseLogicalChannelParameters field of the OpenLogicalChannelAck message and is carried transparently to the peer B-LCSE user.

d) The SOURCE parameter indicates to the B-LCSE user the source of the logical channel release. The SOURCE parameter has the value of "USER" or "B-LCSE", indicating either the B-LCSE user, or the B-LCSE. The latter may occur as the result of a protocol error.

e) The CAUSE parameter indicates the reason as to why the peer B-LCSE user rejected a request to establish a logical channel. The CAUSE parameter is not present when the SOURCE parameter indicates "B-LCSE".

f) The ERRCODE parameter indicates the type of B-LCSE error. Table 35 shows the allowed values of the ERRCODE parameter.

8.5.2.4 B-LCSE states

The following states are used to specify the allowed sequence of primitives between the B-LCSE and the B-LCSE user, and the exchange of messages between peer B-LCSEs. The states are specified separately for each of an outgoing B-LCSE and an incoming B-LCSE. The states for an outgoing B-LCSE are:

State 0: RELEASED

The logical channel is released. The logical channel shall not be used to send or receive data.

State 1: AWAITING ESTABLISHMENT

The outgoing B-LCSE is waiting to establish a logical channel with a peer incoming B-LCSE. The logical channel shall not be used to send or receive data.

State 2: ESTABLISHED

The B-LCSE peer-to-peer logical channel connection has been established. The logical channel may be used to send and receive data.

State 3: AWAITING RELEASE

The outgoing B-LCSE is waiting to release a logical channel with the peer incoming B-LCSE. The logical channel shall not be used to send data, but data may continue to be received.

The states for an incoming B-LCSE are:

State 0: RELEASED

The logical channel is released. The logical channel shall not be used to receive or send data.

State 1: AWAITING ESTABLISHMENT

The incoming B-LCSE is waiting to establish a logical channel with a peer outgoing B-LCSE. The logical channel shall not be used to receive or send data.

State 2: AWAITING CONFIRMATION

The incoming B-LCSE is awaiting confirmation that the logical channel is established with a peer outgoing B-LCSE. The logical channel shall not be used to send data, but data may be received.

State 3: ESTABLISHED

An B-LCSE peer-to-peer logical channel connection has been established. The logical channel may be used to receive and send data.

8.5.2.5 State transition diagram

The allowed sequence of primitives between the B-LCSE and the B-LCSE user is defined here. The allowed sequence of primitives relates to states of the B-LCSE as viewed from the B-LCSE user. The allowed sequences are specified separately for each of an outgoing B-LCSE and an incoming B-LCSE, as shown in Figures 15 and 16 respectively.

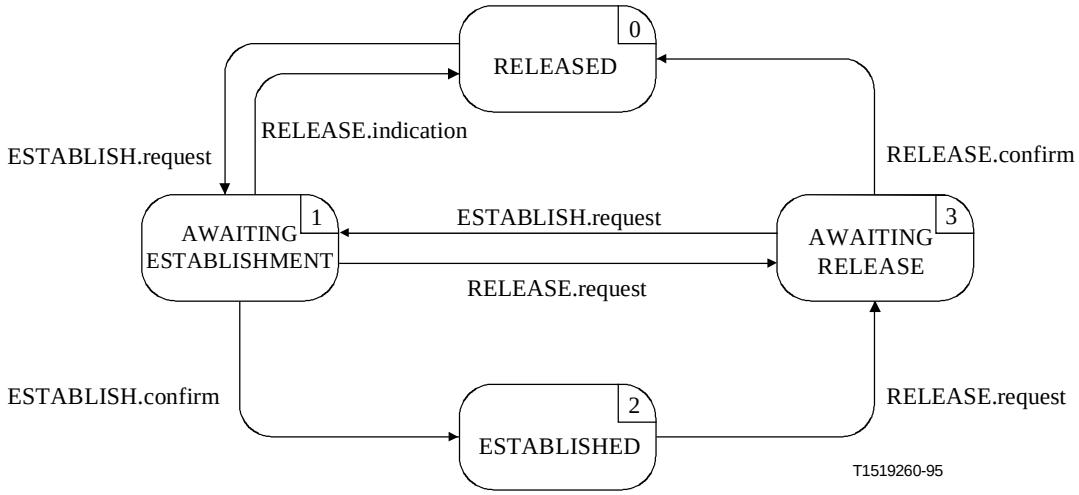


Figure 15/H.245 – State transition diagram for sequence of primitives at outgoing B-LCSE

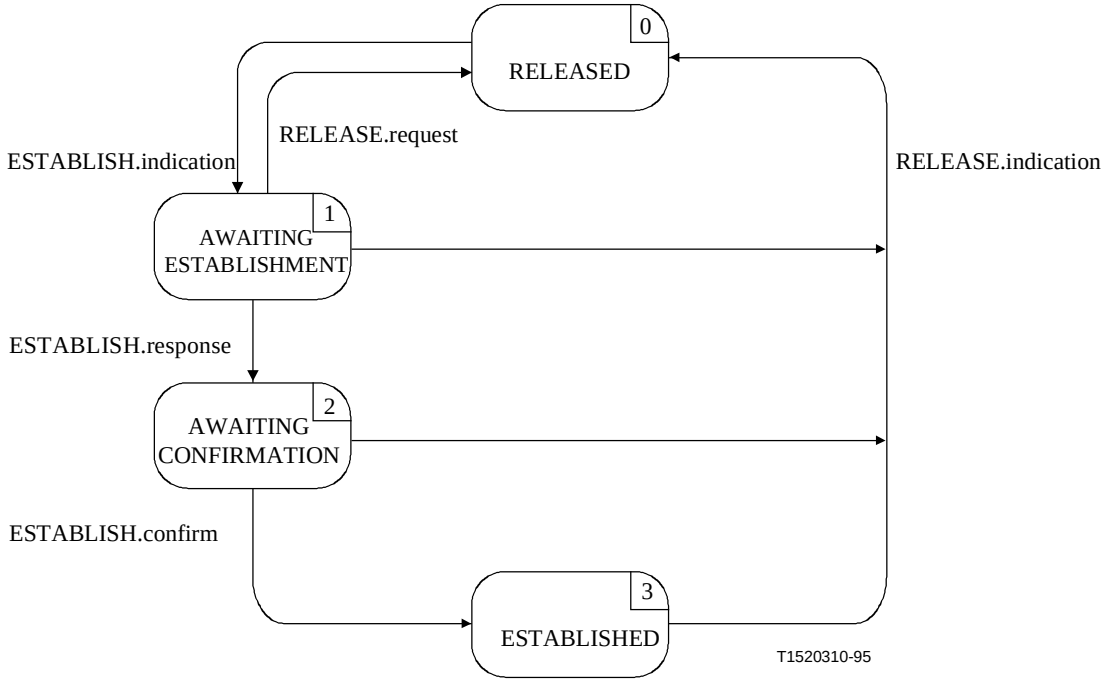


Figure 16/H.245 – State transition diagram for sequence of primitives at incoming B-LCSE

8.5.3 Peer-to-peer B-LCSE communication

8.5.3.1 B-LCSE messages

Table 32 shows the B-LCSE messages and fields, defined in clause 6, which are relevant to the B-LCSE protocol.

Table 32/H.245 – B-LCSE message names and fields

Function	Message	Direction	Field
establishment	OpenLogicalChannel	O → I	forwardLogicalChannelNumber forwardLogicalChannelParameters reverseLogicalChannelParameters
	OpenLogicalChannelAck	O ← I	forwardLogicalChannelNumber reverseLogicalChannelParameters
	OpenLogicalChannelReject	O ← I	forwardLogicalChannelNumber cause
	OpenLogicalChannelConfirm	O → I	forwardLogicalChannelNumber
release	CloseLogicalChannel	O → I	forwardLogicalChannelNumber
	CloseLogicalChannelAck	O ← I	source forwardLogicalChannelNumber
O Outgoing I Incoming			

8.5.3.2 B-LCSE state variables

The following state variable is defined at the outgoing B-LCSE:

out_LCN

This state variable distinguishes between outgoing B-LCSEs. It is initialized at outgoing B-LCSE initialization. The value of out_LCN is used to set the forwardLogicalChannelNumber field of B-LCSE messages sent from an outgoing B-LCSE. For B-LCSE messages received at an outgoing B-LCSE, the message forwardLogicalChannelNumber field value is identical to the value of out_LCN.

The following state variable is defined at the incoming B-LCSE:

in_LCN

This state variable distinguishes between incoming B-LCSEs. It is initialized at incoming B-LCSE initialization. The value of in_LCN is used to set the forwardLogicalChannelNumber field of B-LCSE messages sent from an incoming B-LCSE. For B-LCSE messages received at an incoming B-LCSE, the message forwardLogicalChannelNumber field value is identical to the value of in_LCN.

8.5.3.3 B-LCSE timers

The following timer is specified for the outgoing and incoming B-LCSE:

T103

At the outgoing B-LCSE this timer is used during the AWAITING ESTABLISHMENT and AWAITING RELEASE states. It specifies the maximum time during which no OpenLogicalChannelAck, OpenLogicalChannelReject or CloseLogicalChannelAck message may be received.

At the incoming B-LCSE, this timer is used during the AWAITING CONFIRMATION state. It specifies the maximum time during which no OpenLogicalChannelConfirm message may be received.

8.5.4 B-LCSE procedures

8.5.4.1 Introduction

Figure 17 summarizes the primitives and their parameters, and the messages, for each of the outgoing and incoming B-LCSE.

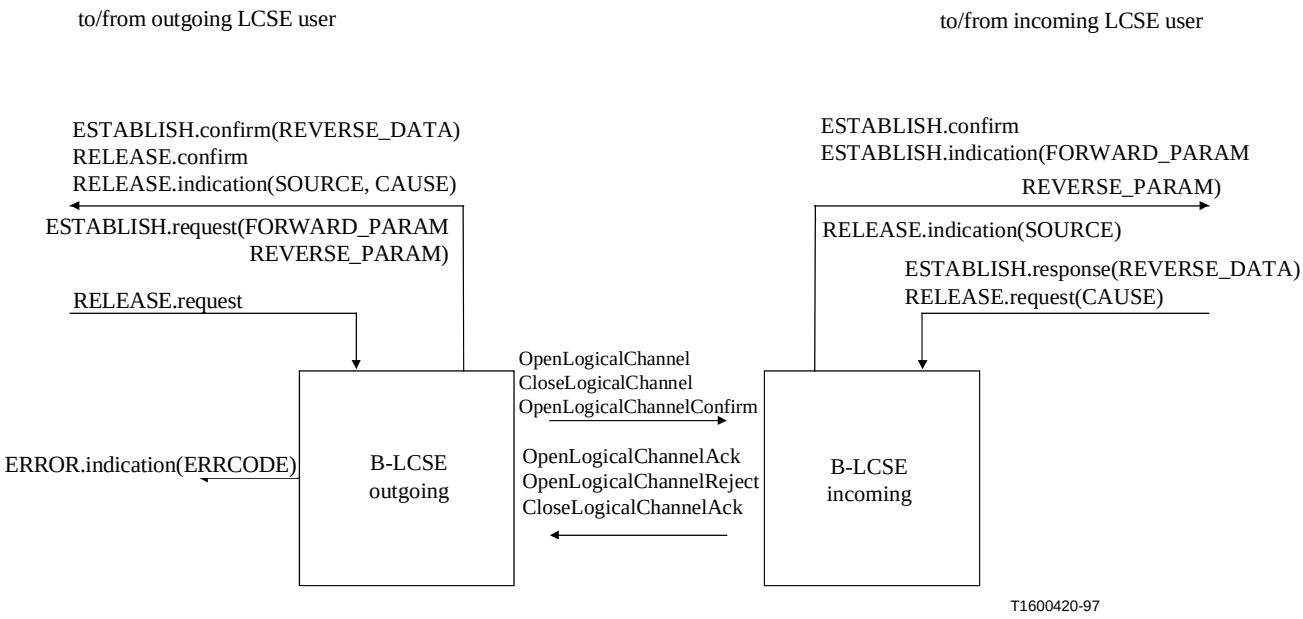


Figure 17/H.245 – Primitives and messages in the Bi-directional Logical Channel Signalling Entity

8.5.4.2 Primitive parameter default values

Where not explicitly stated in the SDL diagrams, the parameters of the indication and confirm primitives assume values as shown in Table 33.

Table 33/H.245 – Default primitive parameter values

Primitive	Parameter	Default value (Note)
ESTABLISH.indication	FORWARD_PARAM REVERSE_PARAM	OpenLogicalChannel.forwardLogicalChannelParameters OpenLogicalChannel.reverseLogicalChannelParameters
ESTABLISH.confirm	REVERSE_DATA	OpenLogicalChannelAck.reverseLogicalChannelParameters
RELEASE.indication	SOURCE CAUSE	CloseLogicalChannel.source null
NOTE – A primitive parameter shall be coded as null if an indicated message field is not present in the message.		

8.5.4.3 Message field default values

Where not explicitly stated in the SDL diagrams, the message fields assume values as shown in Table 34.

Table 34/H.245 – Default message field values

Message	Field	Default value (Note)
OpenLogicalChannel	forwardLogicalChannelNumber forwardLogicalChannelParameters reverseLogicalChannelParameters	out_LCN ESTABLISH.request (FORWARD_PARAM) ESTABLISH.request (REVERSE_PARAM)
OpenLogicalChannelAck	forwardLogicalChannelNumber reverseLogicalChannelParameters	in_LCN ESTABLISH.response (REVERSE_DATA)
OpenLogicalChannelReject	forwardLogicalChannelNumber cause	in_LCN RELEASE.request(CAUSE)
OpenLogicalChannelConfirm	forwardLogicalChannelNumber	out_LCN
CloseLogicalChannel	forwardLogicalChannelNumber source	out_LCN user
CloseLogicalChannelAck	forwardLogicalChannelNumber	in_LCN
NOTE – A message field shall not be coded if the corresponding primitive parameter is null, i.e. not present.		

8.5.4.4 ERRCODE parameter values

The ERRCODE parameter of the ERROR.indication primitive indicates a particular error condition. Table 35 shows the values that the ERRCODE parameter may take at the outgoing B-LCSE and Table 36 shows the values that the ERRCODE parameter may take at the incoming B-LCSE.

Table 35/H.245 – ERRCODE parameter values at outgoing B-LCSE

Error type	Error code	Error condition	State
inappropriate message	A	OpenLogicalChannelAck	RELEASED
	B	OpenLogicalChannelReject	RELEASED ESTABLISHED
	C	CloseLogicalChannelAck	ESTABLISHED
no response from peer B-LCSE	D	timer T103 expiry	AWAITING ESTABLISHMENT AWAITING RELEASE

Table 36/H.245 – ERRCODE parameter values at incoming B-LCSE

Error type	Error code	Error condition	State
inappropriate message	E	OpenLogicalChannelConfirm	AWAITING ESTABLISHMENT
no response from peer B-LCSE	F	timer T103 expiry	AWAITING CONFIRMATION

8.5.4.5 SDLs

The outgoing B-LCSE and the incoming B-LCSE procedures are expressed in SDL form in Figures 18 and 19 respectively.

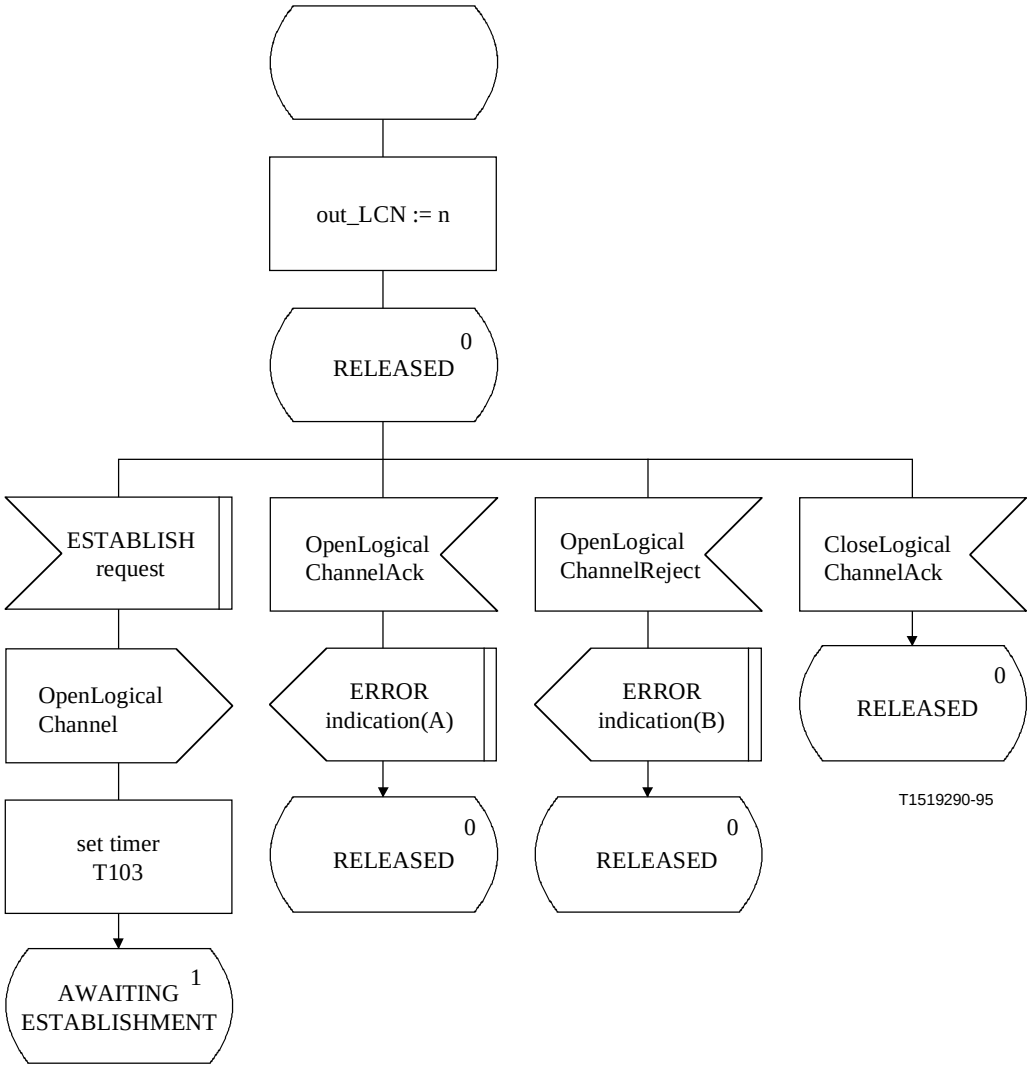


Figure 18 i)/H.245 – Outgoing B-LCSE SDL

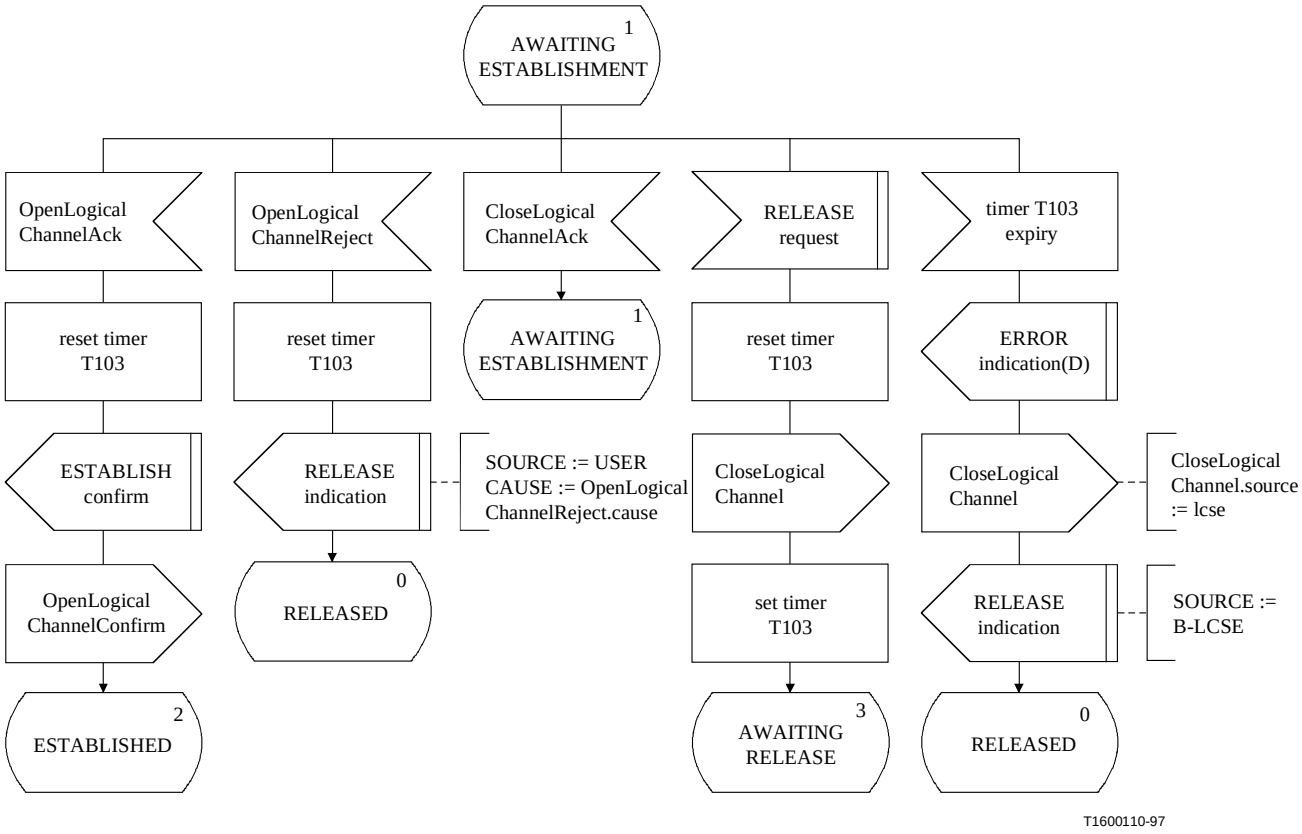


Figure 18 ii)/H.245 – Outgoing B-LCSE SDL

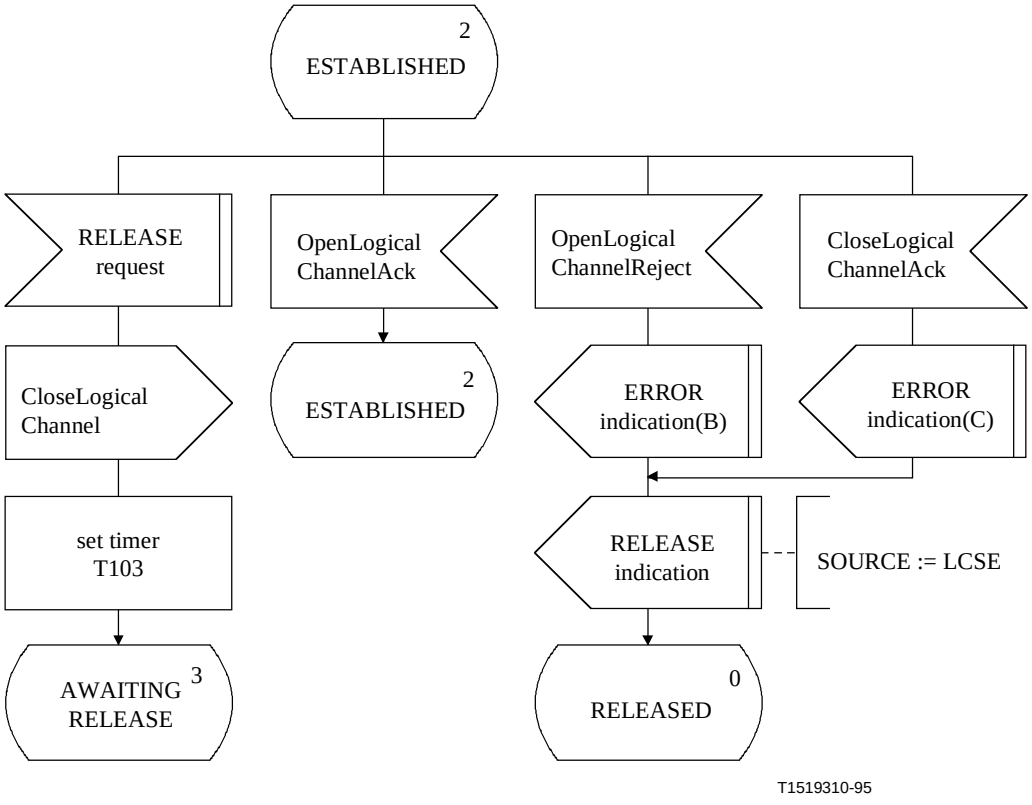


Figure 18 iii)/H.245 – Outgoing B-LCSE SDL

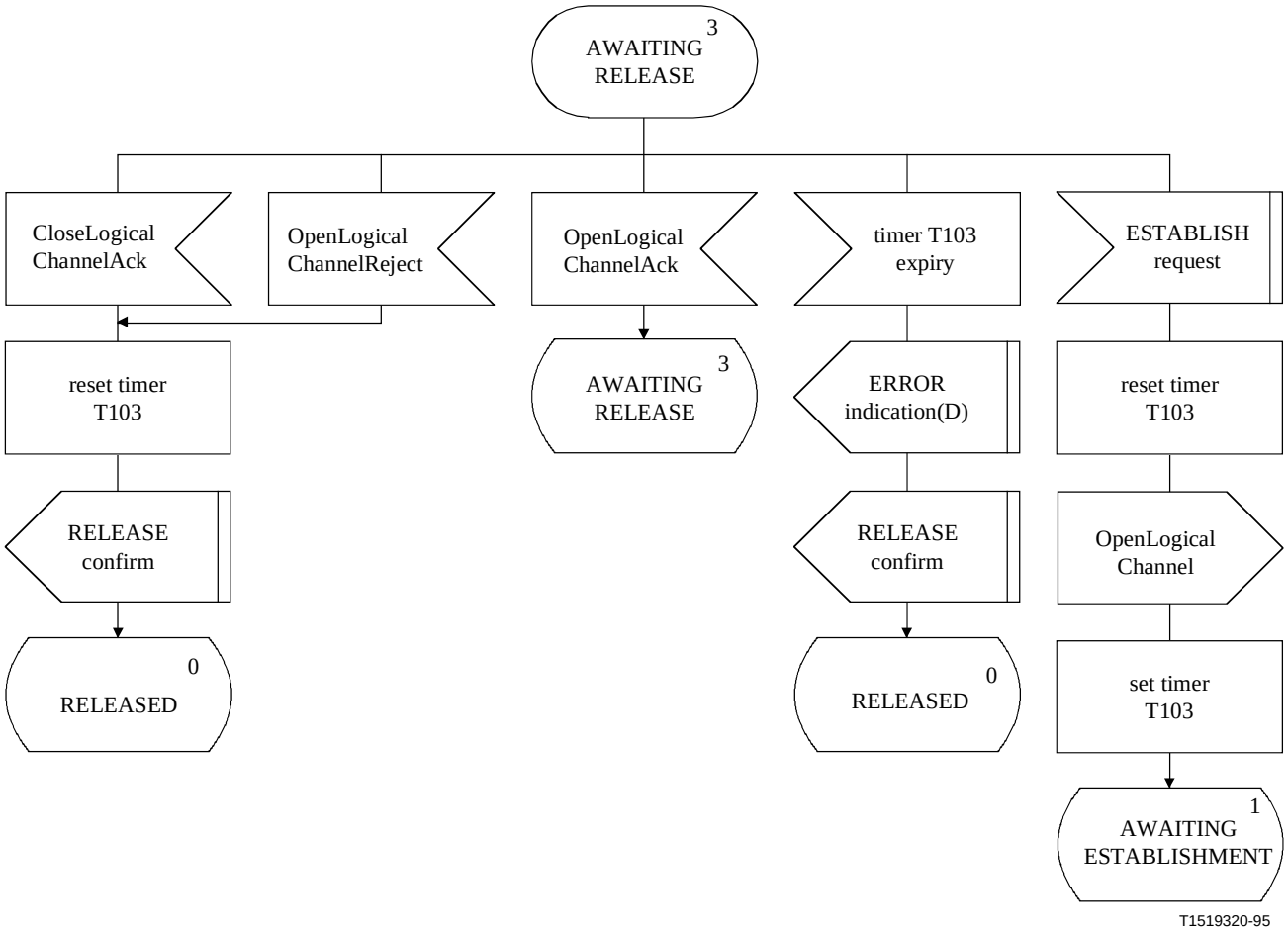


Figure 18 iv)/H.245 – Outgoing B-LCSE SDL

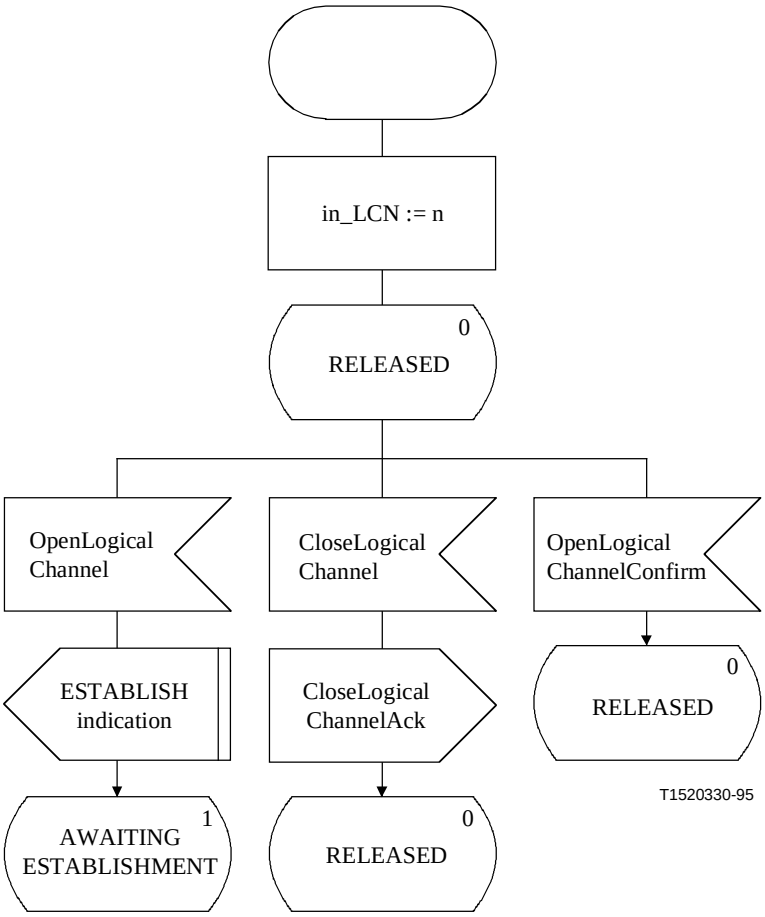


Figure 19 i)/H.245 – Incoming B-LCSE SDL

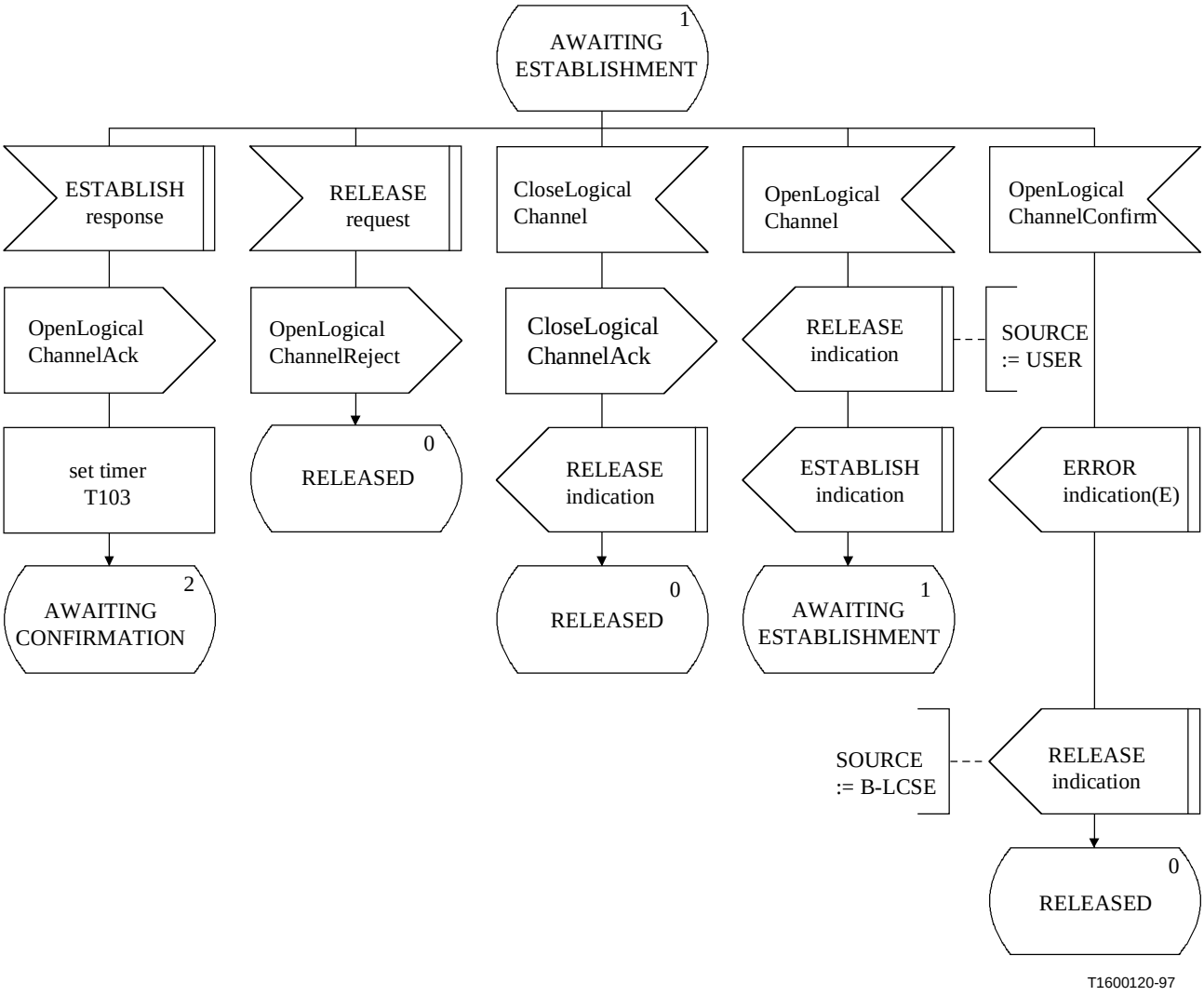


Figure 19 ii)/H.245 – Incoming B-LCSE SDL

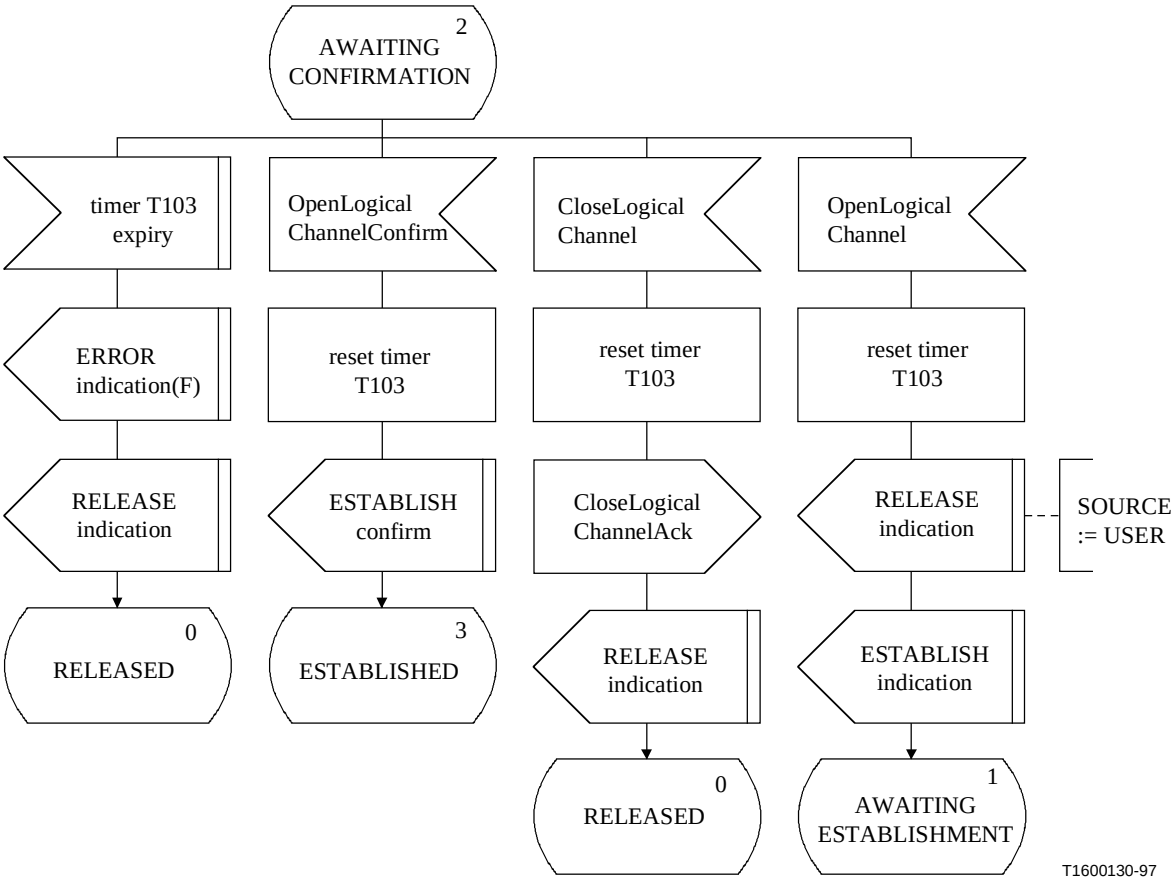


Figure 19 iii)/H.245 – Incoming B-LCSE SDL

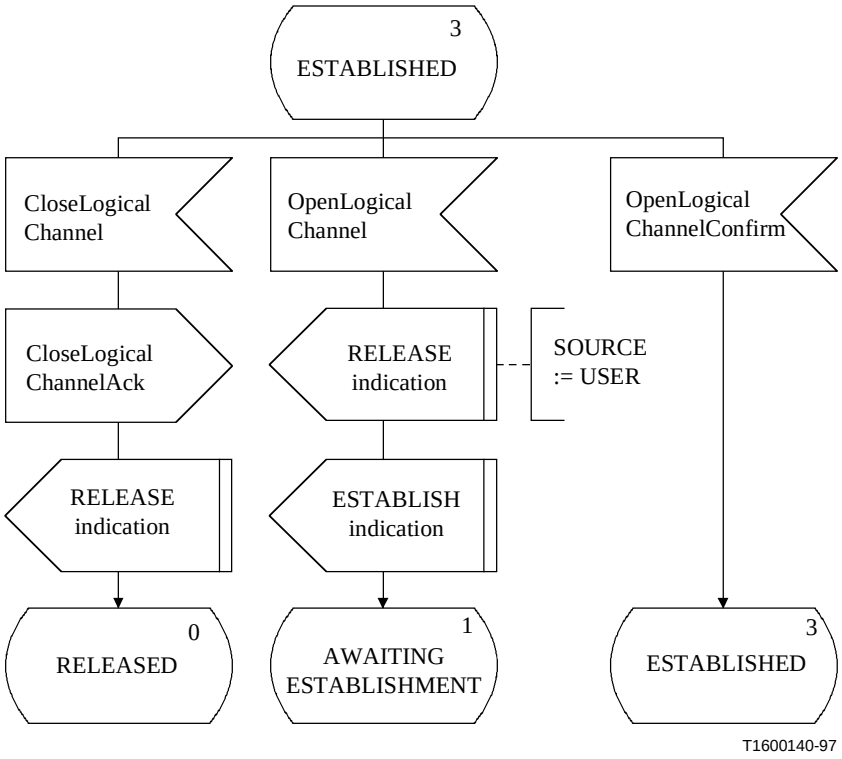


Figure 19 iv)/H.245 – Incoming B-LCSE SDL

8.6 Close Logical Channel procedures

8.6.1 Introduction

These procedures are used by a terminal to request the remote terminal to close a logical channel. Note that these are only close request procedures; the actual logical channel close occurs using the LCSE and B-LCSE procedures. The procedures are referred to here as the Close Logical Channel Signalling Entity (CLCSE). Procedures are specified in terms of primitives and states at the interface between the CLCSE and the CLCSE user. Protocol information is transferred to the peer CLCSE via relevant messages defined in clause 6. There is an outgoing CLCSE and an incoming CLCSE. At each of the outgoing and incoming ends there is one instance of the CLCSE for each logical channel.

If a terminal is incapable of processing the incoming signals, it may use these procedures to request the closing of the relevant logical channels.

A terminal that answers such a response positively, that is, by issuing the CLOSE.response primitive, shall initiate the closing of the logical channel by sending the RELEASE.request primitive to the appropriate LCSE or B-LCSE as soon as possible.

The following text provides an overview of the operation of the protocol. In the case of any discrepancy with the formal specification of the protocol that follows, the formal specification will supersede.

8.6.1.1 Protocol overview – Outgoing CLCSE

A close logical channel request procedure is initiated when the CLOSE.request primitive is issued by the user at the outgoing CLCSE. A RequestChannelClose message is sent to the peer incoming CLCSE, and timer T108 is started. If a RequestChannelCloseAck message is received in response to the RequestChannelClose message, then timer T108 is stopped and the user is informed with the CLOSE.confirm primitive that the close logical channel request procedure was successful. If however a RequestChannelCloseReject message is received in response to the RequestChannelClose message, then timer T108 is stopped and the user is informed with the REJECT.indication primitive that the peer CLCSE user has refused to close the logical channel.

If timer T108 expires, then the outgoing CLCSE user is informed with the REJECT.indication primitive and a RequestChannelCloseRelease message is sent.

8.6.1.2 Protocol overview – Incoming CLCSE

When a RequestChannelClose message is received at the incoming CLCSE, the user is informed of the close logical channel request with the CLOSE.indication primitive. The incoming CLCSE user signals acceptance of the close logical channel request by issuing the CLOSE.response primitive, and a RequestChannelCloseAck message is sent to the peer outgoing CLCSE. The incoming CLCSE user signals rejection of the close logical channel request by issuing the REJECT.request primitive, and a RequestChannelCloseReject message is sent to the peer outgoing CLCSE.

8.6.2 Communication between CLCSE and CLCSE user

8.6.2.1 Primitives between CLCSE and CLCSE user

Communication between the CLCSE and CLCSE user is performed using the primitives shown in Table 37.

Table 37/H.245 – Primitives and parameters

Generic name	Type			
	Request	Indication	Response	Confirm
CLOSE	– (Note 1)	–	–	–
REJECT	CAUSE	SOURCE CAUSE	not defined (Note 2)	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive is not defined.				

8.6.2.2 Primitive definition

The definition of these primitives is as follows:

a) The CLOSE primitives are used to request closure of a logical channel.

b) The REJECT primitives are used to reject the closing of a logical channel.

8.6.2.3 Parameter definition

The definition of the primitive parameters shown in Table 37 are as follows:

a) The SOURCE parameter indicates the source of the REJECT.indication primitive. The SOURCE parameter has the value of "USER" or "PROTOCOL". The latter case may occur as the result of a timer expiry.

b) The CAUSE parameter indicates the reason for refusal to close a logical channel. The CAUSE parameter is not present when the SOURCE parameter indicates "PROTOCOL".

8.6.2.4 CLCSE states

The following states are used to specify the allowed sequence of primitives between the CLCSE and the CLCSE user.

The states for an outgoing CLCSE are:

State 0: IDLE

The CLCSE is idle.

State 1: AWAITING RESPONSE

The CLCSE is waiting for a response from the remote CLCSE.

The states for an incoming CLCSE are:

State 0: IDLE

The CLCSE is idle.

State 1: AWAITING RESPONSE

The CLCSE is waiting for a response from the CLCSE user.

8.6.2.5 State transition diagram

The allowed sequence of primitives between the CLCSE and the CLCSE user is defined here. The allowed sequences are specified separately for each of an outgoing CLCSE and an incoming CLCSE, as shown in Figures 20 and 21 respectively.

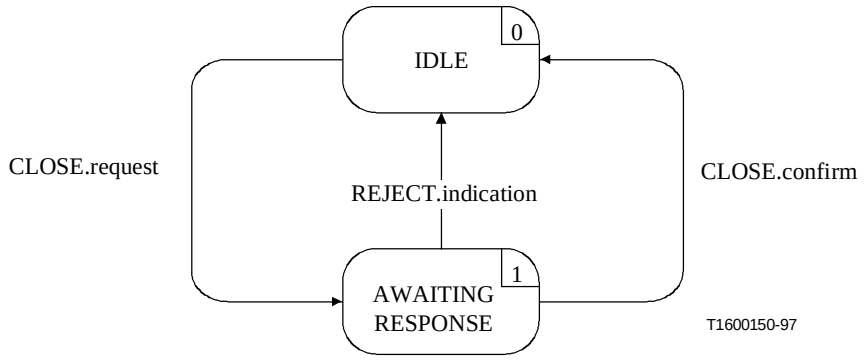


Figure 20/H.245 – State transition diagram for sequence of primitives at CLCSE outgoing

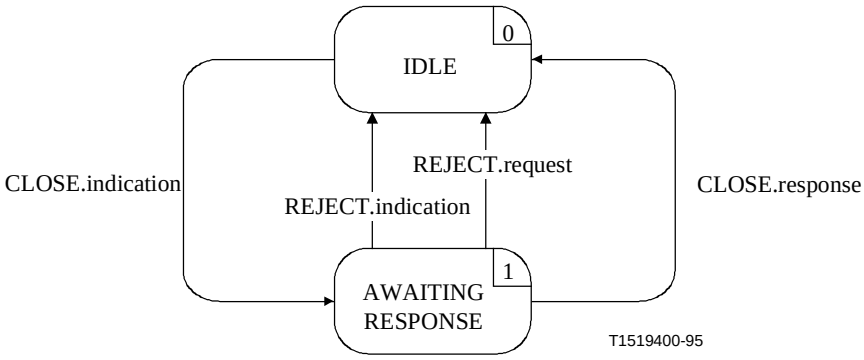


Figure 21/H.245 – State transition diagram for sequence of primitives at CLCSE incoming

8.6.3 Peer-to-peer CLCSE communication

8.6.3.1 Messages

Table 38 shows the CLCSE messages and fields, defined in clause 6, which are relevant to the CLCSE protocol.

Table 38/H.245 – CLCSE message names and fields

Function	Message	Direction	Field
Transfer	RequestChannelClose	O → I	forwardLogicalChannelNumber
	RequestChannelCloseAck	O ← I	forwardLogicalChannelNumber
	RequestChannelCloseReject	O ← I	forwardLogicalChannelNumber
Reset	RequestChannelCloseRelease	O → I	forwardLogicalChannelNumber
O Outgoing I Incoming			

8.6.3.2 CLCSE state variables

The following state variable is defined at the outgoing CLCSE:

out_LCN

This state variable distinguishes between outgoing CLCSEs. It is initialized at outgoing CLCSE initialization. The value of out_LCN is used to set the forwardLogicalChannelNumber field of CLCSE messages sent from an outgoing CLCSE. For CLCSE messages received at an outgoing CLCSE, the message forwardLogicalChannelNumber field value is identical to the value of out_LCN.

The following state variable is defined at the incoming CLCSE:

in_LCN

This state variable distinguishes between incoming CLCSEs. It is initialized at incoming CLCSE initialization. The value of in_LCN is used to set the forwardLogicalChannelNumber field of CLCSE messages sent from an incoming CLCSE. For CLCSE messages received at an incoming CLCSE, the message forwardLogicalChannelNumber field value is identical to the value of in_LCN.

8.6.3.3 CLCSE timers

The following timer is specified for the outgoing CLCSE:

T108

This timer is used during the AWAITING RESPONSE state. It specifies the maximum time during which no RequestChannelCloseAck or RequestChannelCloseReject message may be received.

8.6.4 CLCSE procedures

Figure 22 summarizes the CLCSE primitives and their parameters, and messages, for each of the outgoing and incoming CLCSE.

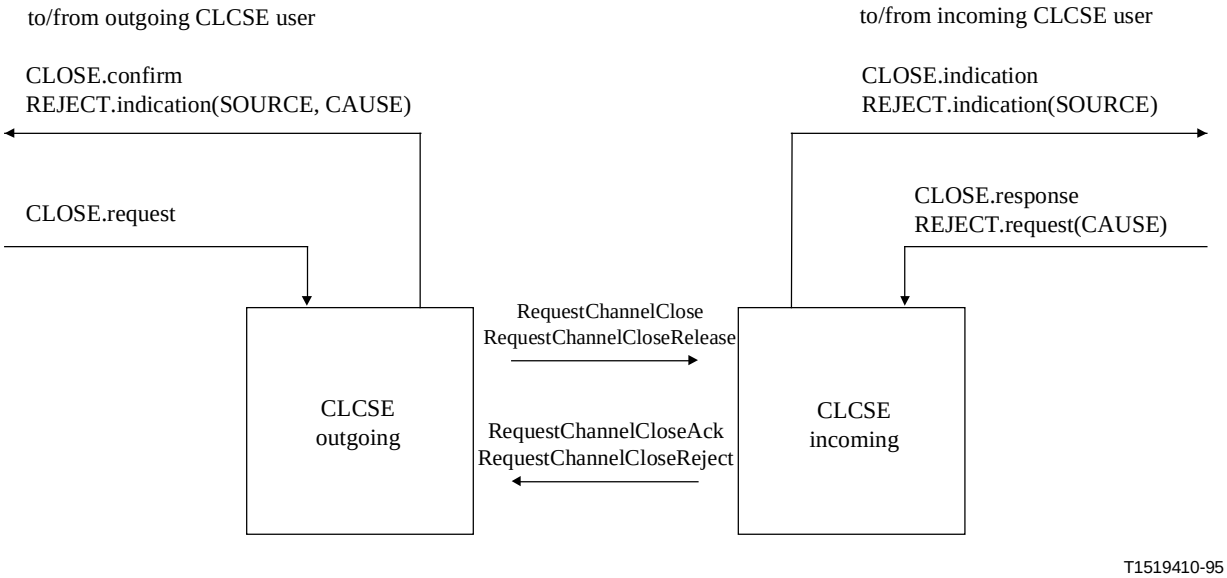


Figure 22/H.245 – Primitives and messages in the Close Logical Channel Signalling Entity

8.6.4.1 Primitive parameter default values

Where not explicitly stated in the SDL diagrams the parameters of the indication and confirm primitives assume values as shown in Table 39.

Table 39/H.245 – Default primitive parameter values

Primitive	Parameter	Default value
REJECT.indication	SOURCE CAUSE	USER null

8.6.4.2 Message field default values

Where not explicitly stated in the SDL diagrams the message fields assume values as shown in Table 40.

Table 40/H.245 – Default message field values

Message	Field	Default value
RequestChannelClose	forwardLogicalChannelNumber	out_LCN
RequestChannelCloseAck	forwardLogicalChannelNumber	in_LCN
RequestChannelCloseReject	forwardLogicalChannelNumber cause	in_LCN REJECT.request(CAUSE)
RequestChannelCloseRelease	forwardLogicalChannelNumber	out_LCN

8.6.4.3 SDLs

The outgoing CLCSE and the incoming CLCSE procedures are expressed in SDL form in Figures 23 and 24 respectively.

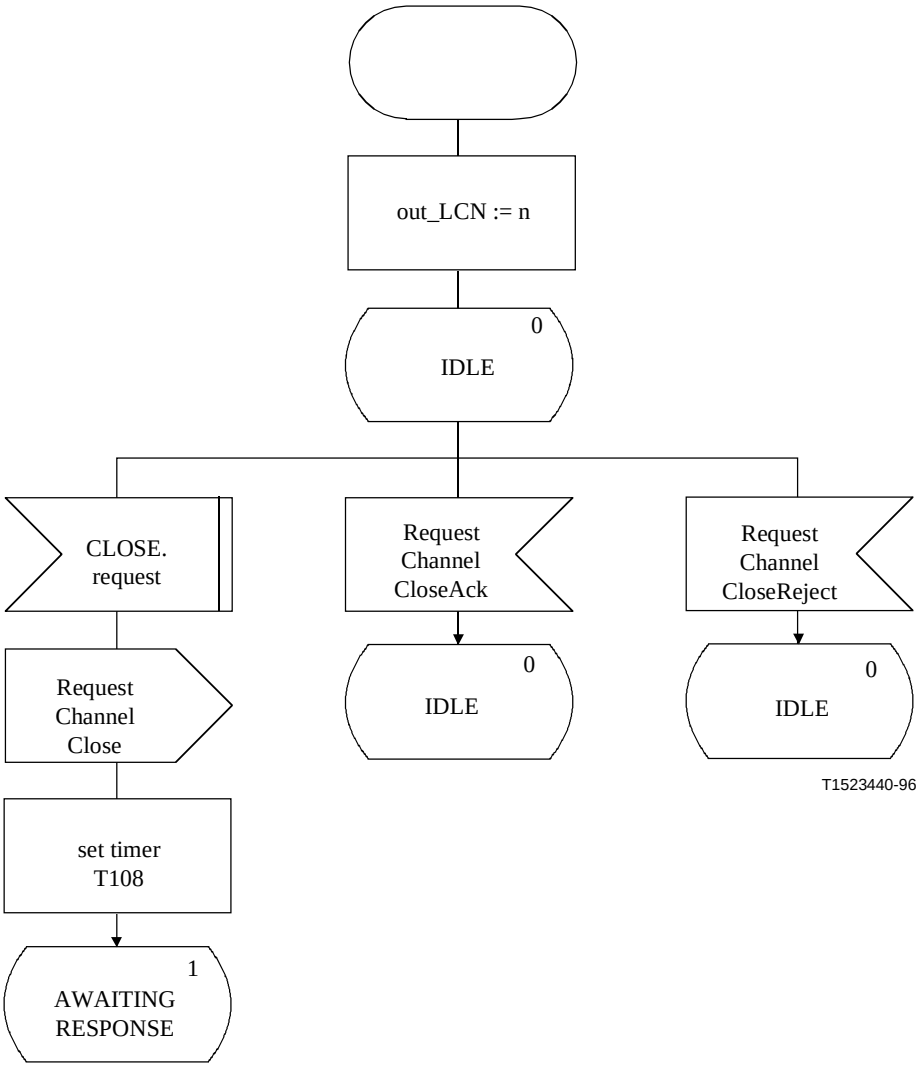


Figure 23 i)/H.245 – Outgoing CLCSE SDL

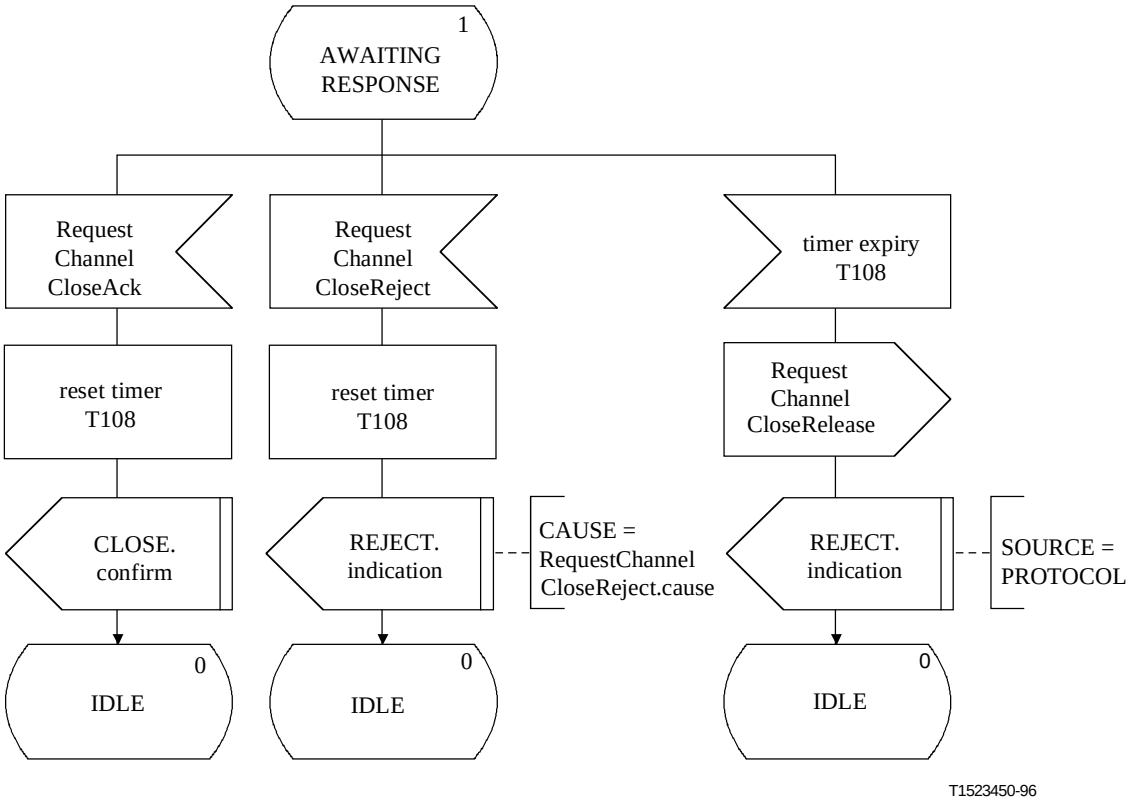


Figure 23 ii)/H.245 – Outgoing CLCSE SDL

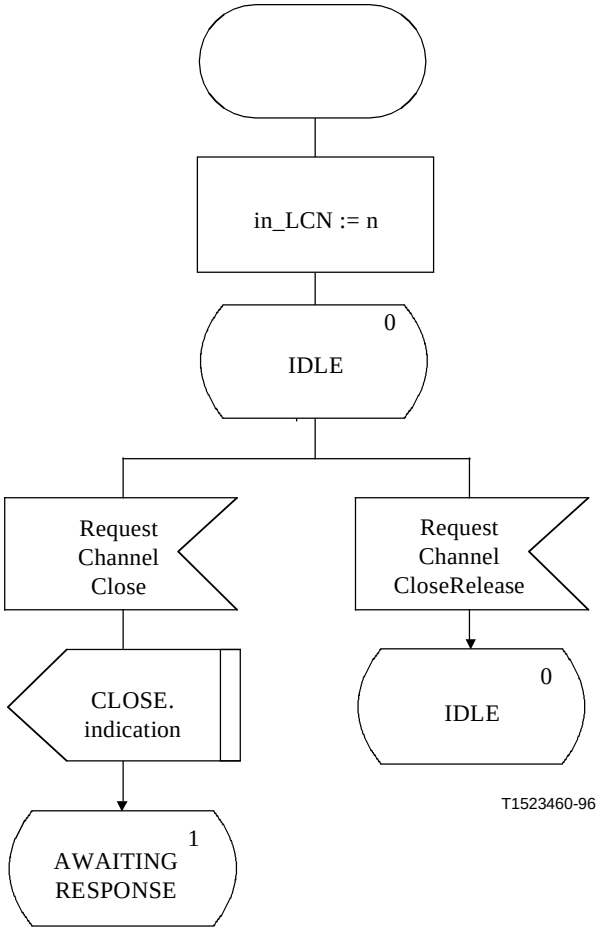


Figure 24 i)/H.245 – Incoming CLCSE SDL

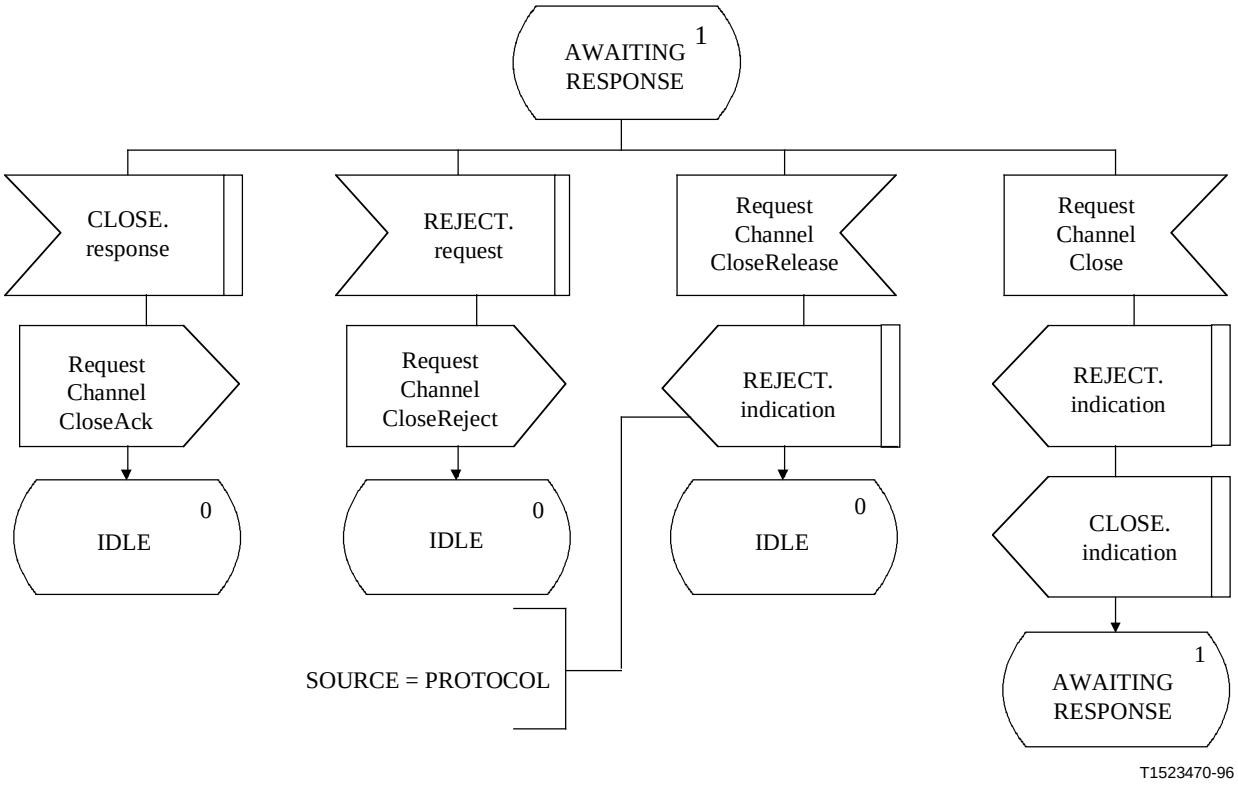


Figure 24 ii)/H.245 – Incoming CLCSE SDL

8.7 H.223 Multiplex table procedures

8.7.1 Introduction

The multiplex table serves to associate each octet within a H.223 MUX-PDU [8] with a particular logical channel number. The H.223 multiplex table may have up to 16 entries, numbered from 0 to 15. Table entries 1 to 15 shall be sent from transmitters to receivers as specified in the following procedures.

The procedures described here are referred to as the Multiplex Table Signalling Entity (MTSE). Procedures are specified in terms of primitives and states at the interface between the MTSE and the MTSE user. Protocol information is transferred to the peer MTSE via relevant messages defined in clause 6.

There is an outgoing MTSE and an incoming MTSE. There is one instance of the MTSE for each multiplex table entry.

A transmit terminal uses this protocol to signal to a remote terminal one or more new multiplex table entries. The remote terminal may accept or reject the new multiplex table entries. If the remote terminal accepts a multiplex table entry, the previous entry at the given entry number is replaced with the new entry.

The transmitter may deactivate a multiplex table entry by sending a MultiplexEntryDescriptor with no elementList. The transmitter shall at no time use a multiplex table entry that is deactivated. Before transmitting a MultiplexEntrySend, the transmitter shall stop using the entries that are described by it. It shall not restart using those entries until it has received a MultiplexEntrySendAck. This procedure is used because if the use of these multiplex table entries is not stopped before sending the MultiplexEntrySend, errors may cause an ambiguity in the receiver.

The transmitter shall stop using deactivated entries before sending the MultiplexEntrySend indicating that they have been deactivated. Deactivated entries may be used again at any time by transmitting a MultiplexEntrySend message for activating that entry. Deactivating entries that are no longer required by the transmitter may increase the probability of detecting errors in the H.223 Multiplex Code field.

NOTE – While some multiplex table entries are being updated, other (active) entries may continue to be used. Also, a multiplex table entry may be deleted in the same MultiplexEntrySend that is used to modify other multiplex table entries.

At the start of communication, unless specified otherwise in an appropriate Recommendation, only table entry 0 is available for transmission, and table entries 1 to 15 are deactivated.

A Request Multiplex Entry procedure may be used at any time to elicit retransmission of specified multiplex table entries from the remote terminal, for example, following an interruption or other cause for uncertainty.

The following text provides an overview of the operation of the protocol. In the case of any discrepancy with the formal specification of the protocol that follows, the formal specification will supersede.

8.7.1.1 Protocol overview – Outgoing MTSE

A multiplex table entry send request procedure is initiated when the TRANSFER.request primitive is issued by the user at the outgoing MTSE. A MultiplexEntrySend message is sent to the peer incoming MTSE, and timer T104 is started. If a MultiplexEntrySendAck message is received in response to the MultiplexEntrySend message, then timer T104 is stopped and the user is informed with the TRANSFER.confirm primitive that the multiplex table entry send request was successful. If however a MultiplexEntrySendReject message is received in response to the MultiplexEntrySend message, then timer T104 is stopped and the user is informed with the REJECT.indication primitive that the peer MTSE user has refused to accept the multiplex table entry.

If timer T104 expires, then the outgoing MTSE user is informed with the REJECT.indication primitive and a MultiplexEntrySendRelease message is sent.

Only MultiplexEntrySendAck and MultiplexEntrySendReject messages which are in response to the most recent MultiplexEntrySend message are accepted. Responses to earlier MultiplexEntrySend messages are ignored.

A new multiplex table entry send request procedure may be initiated with the TRANSFER.request primitive by the user at the outgoing MTSE before a MultiplexEntrySendAck or a MultiplexEntrySendReject message has been received.

8.7.1.2 Protocol overview – Incoming MTSE

When a MultiplexEntrySend message is received at the incoming MTSE, the user is informed of the multiplex table entry send request with the TRANSFER.indication primitive. The incoming MTSE user signals acceptance of the multiplex table entry by issuing the TRANSFER.response primitive, and a MultiplexEntrySendAck message is sent to the peer outgoing MTSE. The incoming MTSE user signals rejection of the multiplex table entry by issuing the REJECT.request primitive, and a MultiplexEntrySendReject message is sent to the peer outgoing MTSE.

A new MultiplexEntrySend message may be received before the incoming MTSE user has responded to an earlier MultiplexEntrySend message. The incoming MTSE user is informed with the REJECT.indication primitive, followed by the TRANSFER.indication primitive, and the incoming MTSE user responds to the new multiplex table entry.

If a MultiplexEntrySendRelease message is received before the incoming MTSE user has responded to an earlier MultiplexEntrySend message, then the incoming MTSE user is informed with the REJECT.indication, and the earlier multiplex table entry is discarded.

8.7.2 Communication between the MTSE and MTSE user

8.7.2.1 Primitives between MTSE and MTSE user

Communication between the MTSE and MTSE user is performed using the primitives shown in Table 41.

Table 41/H.245 – Primitives and parameters

Generic name	Type			
	Request	**Indication**	**Response**	**Confirm**
TRANSFER	MUX-DESCRIPTOR	MUX-DESCRIPTOR	– (Note 1)	–
REJECT	CAUSE	SOURCE CAUSE	not defined (Note 2)	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive is not defined.				

8.7.2.2 Primitive definition

The definition of these primitives is as follows:

a) The TRANSFER primitives are used to transfer multiplex table entries.

b) The REJECT primitives are used to reject a multiplex table entry, and to terminate a multiplex table entry transfer.

8.7.2.3 Parameter definition

The definition of the primitive parameters shown in Table 41 are as follows:

a) The MUX-DESCRIPTOR parameter is a multiplex table entry. This parameter is mapped to the MultiplexEntryDescriptor field of the multiplexEntrySend message and carried transparently from the MTSE user at the outgoing MTSE to the MTSE user at the incoming MTSE. There may be multiple MUX-DESCRIPTORs associated with the TRANSFER primitive.

b) The SOURCE parameter indicates the source of the REJECT.indication primitive. The SOURCE parameter has the value of "USER" or "PROTOCOL". The latter case may occur as the result of a timer expiry.

c) The CAUSE parameter indicates the reason for rejection of a multiplex table entry. The CAUSE parameter is not present when the SOURCE parameter indicates "PROTOCOL".

8.7.2.4 MTSE states

The following states are used to specify the allowed sequence of primitives between the MTSE and the MTSE user. The states are specified separately for each of an outgoing MTSE and an incoming MTSE. The states for an outgoing MTSE are:

State 0: IDLE

There is no MTSE transfer in progress. The multiplex table entry may be used by the transmitter.

State 1: AWAITING RESPONSE

The MTSE user has requested the transfer of a multiplex table entry, and a response from the peer MTSE is awaited. The multiplex table entry shall not be used by the transmitter.

The states for an incoming MTSE are:

State 0: IDLE

There is no MTSE transfer in progress. The multiplex table entry may be in use by the transmitter.

State 1: AWAITING RESPONSE

The peer MTSE has transferred a multiplex table entry, and a response from the MTSE user is awaited. The multiplex table entry may not be in use by the transmitter.

8.7.2.5 State transition diagram

The allowed sequence of primitives between the MTSE and the MTSE user is defined here. The allowed sequences are specified separately for each of an outgoing MTSE and an incoming MTSE, as shown in Figures 25 and 26 respectively.

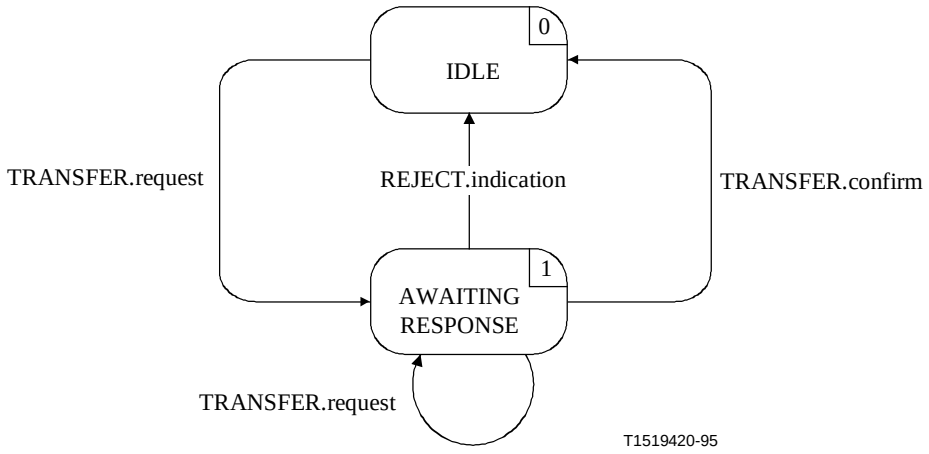


Figure 25/H.245 – State transition diagram for sequence of primitives at outgoing MTSE

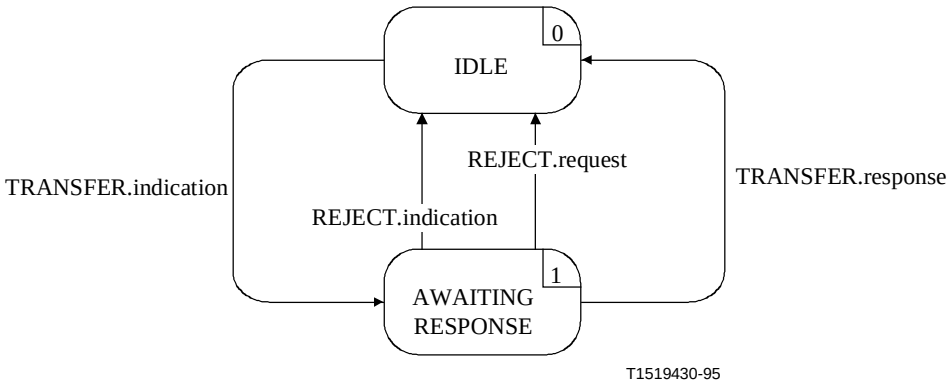


Figure 26/H.245 – State transition diagram for sequence of primitives at incoming MTSE

8.7.3 Peer-to-peer MTSE communication

8.7.3.1 Messages

Table 42 shows the MTSE messages and fields, defined in clause 6, which are relevant to the MTSE protocol.

Table 42/H.245 – MTSE message names and fields

Function	Message	Direction	Field
transfer	MultiplexEntrySend	O → I	sequenceNumber multiplexEntryDescriptors multiplexTableEntryNumber multiplexEntryDescriptors elementList
	MultiplexEntrySendAck	O ← I	sequenceNumber multiplexTableEntryNumber
reject	MultiplexEntrySendReject	O ← I	sequenceNumber multiplexTableEntryNumber rejectionDescriptions.cause
reset	MultiplexEntrySendRelease	O → I	multiplexTableEntryNumber
O Outgoing I Incoming			

8.7.3.2 MTSE state variables

The following state variables are defined at the outgoing MTSE:

out_ENUM

This state variable distinguishes between outgoing MTSEs. It is initialized at outgoing MTSE initialization. The value of out_ENUM is used to set the multiplexTableEntryNumber field of MTSE messages sent from an outgoing MTSE. For MTSE messages received at an outgoing MTSE, the message multiplexTableEntryNumber field value is identical to the value of out_ENUM.

out_SQ

This state variable is used to indicate the most recently sent MultiplexEntrySend message. It is incremented by one and mapped to the MultiplexEntrySend message sequenceNumber field before transmission of a MultiplexEntrySend message. Arithmetic performed on out_SQ is modulo 256.

The following state variables are defined at the incoming MTSE:

in_ENUM

This state variable distinguishes between incoming MTSEs. It is initialized at incoming MTSE initialization. The value of in_ENUM is used to set the multiplexTableEntryNumber field of MTSE messages sent from an incoming MTSE. For MTSE messages received at an incoming MTSE, the message multiplexTableEntryNumber field value is identical to the value of in_ENUM.

in_SQ

This state variable is used to store the value of the sequenceNumber field of the most recently received MultiplexEntrySend message. The MultiplexEntrySendAck and MultiplexEntrySendReject

messages have their sequenceNumber fields set to the value of in_SQ, before being sent to the peer MTSE.

8.7.3.3 MTSE timers

The following timer is specified for the outgoing MTSE:

T104

This timer is used during the AWAITING RESPONSE state. It specifies the maximum time during which no MultiplexEntrySendAck or MultiplexEntrySendReject message may be received.

8.7.4 MTSE procedures

8.7.4.1 Introduction

Figure 27 summarizes the primitives and their parameters, and the messages and relevant fields, for each of the outgoing and incoming MTSE.

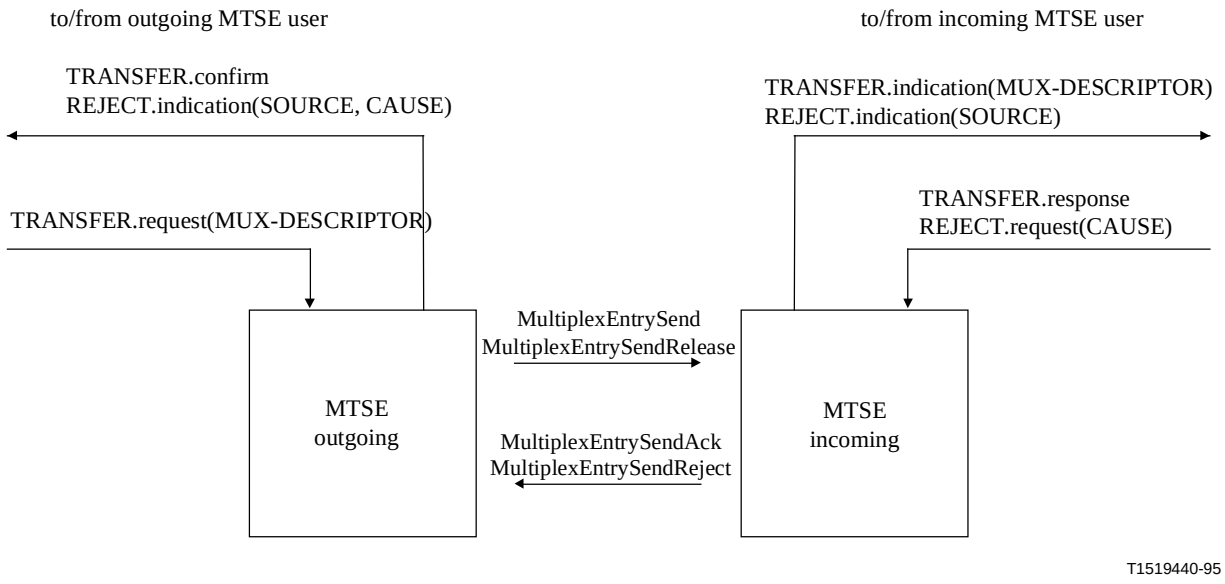


Figure 27/H.245 – Primitives and messages in the Multiplex Table Signalling Entity

8.7.4.2 Primitive parameter default values

Where not explicitly stated in the SDL diagrams the parameters of the indication and confirm primitives assume values as shown in Table 43.

Table 43/H.245 – Default primitive parameter values

Primitive	Parameter	Default value
TRANSFER.indication	MUX-DESCRIPTOR	MultiplexEntrySend.multiplexEntryDescriptors.elementList
REJECT.indication	SOURCE CAUSE	USER null

8.7.4.3 Message field default values

Where not explicitly stated in the SDL diagrams the message fields assume values as shown in Table 44.

Table 44/H.245 – Default message field values

Message	Field	Default value (Note)
MultiplexEntrySend	sequenceNumber	out_SQ
	multiplexEntryDescriptors. multiplexTableEntryNumber	out_ENUM
	multiplexEntryDescriptors.elementList	TRANSFER.request (MUX-DESCRIPTOR)
MultiplexEntrySendAck	sequenceNumber	in_SQ
	multiplexTableEntryNumber	in_ENUM
MultiplexEntrySendReject	sequenceNumber	in_SQ
	rejectionDescriptions.multiplexTableEntryNumber	in_ENUM
	rejectionDescriptions.cause	REJECT.request(CAUSE)
MultiplexEntrySendRelease	multiplexTableEntryNumber	out_ENUM
NOTE – A message field shall not be coded if the corresponding primitive parameter is null, i.e. not present.		

8.7.4.4 SDLs

The outgoing MTSE and the incoming MTSE procedures are expressed in SDL form in Figures 28 and 29 respectively.

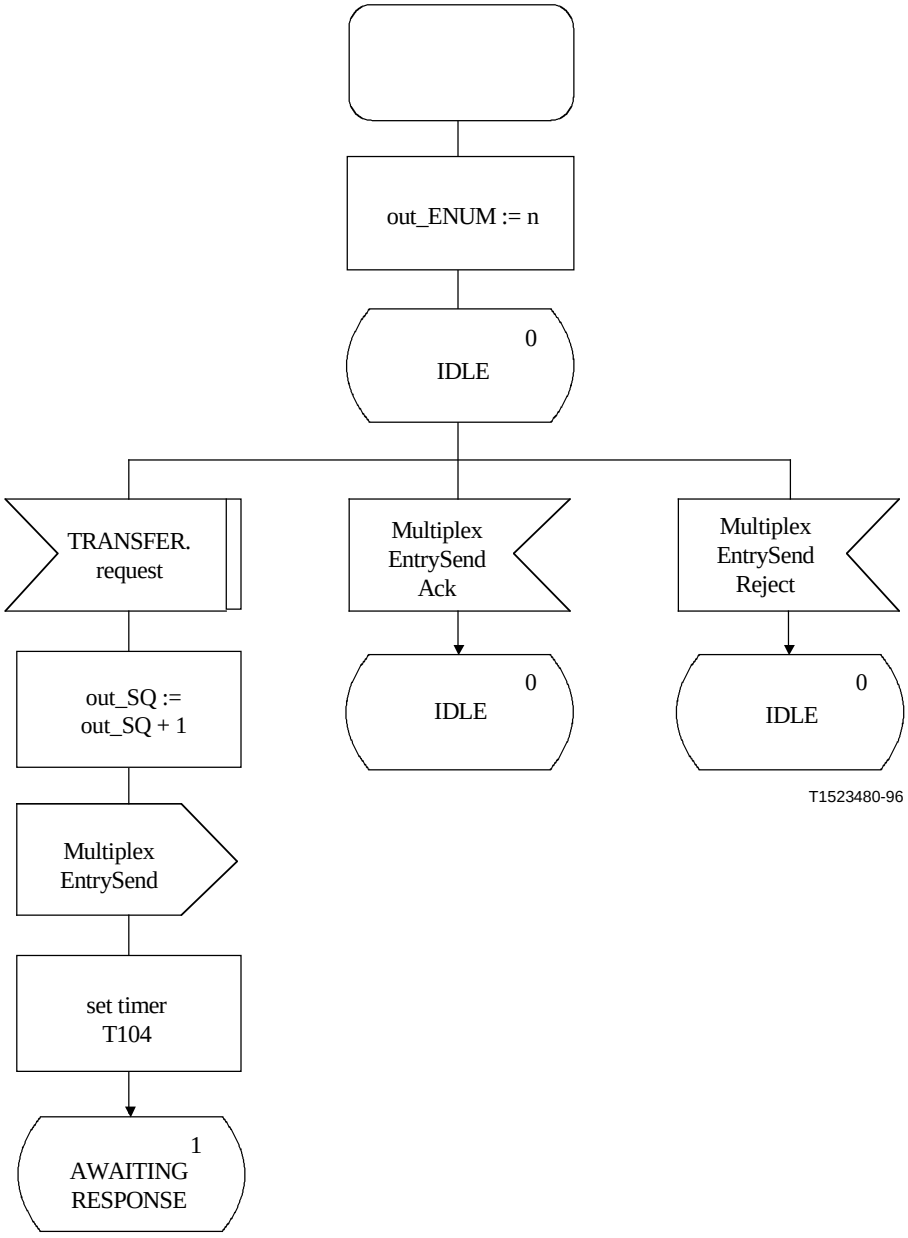


Figure 28 i)/H.245 – Outgoing MTSE SDL

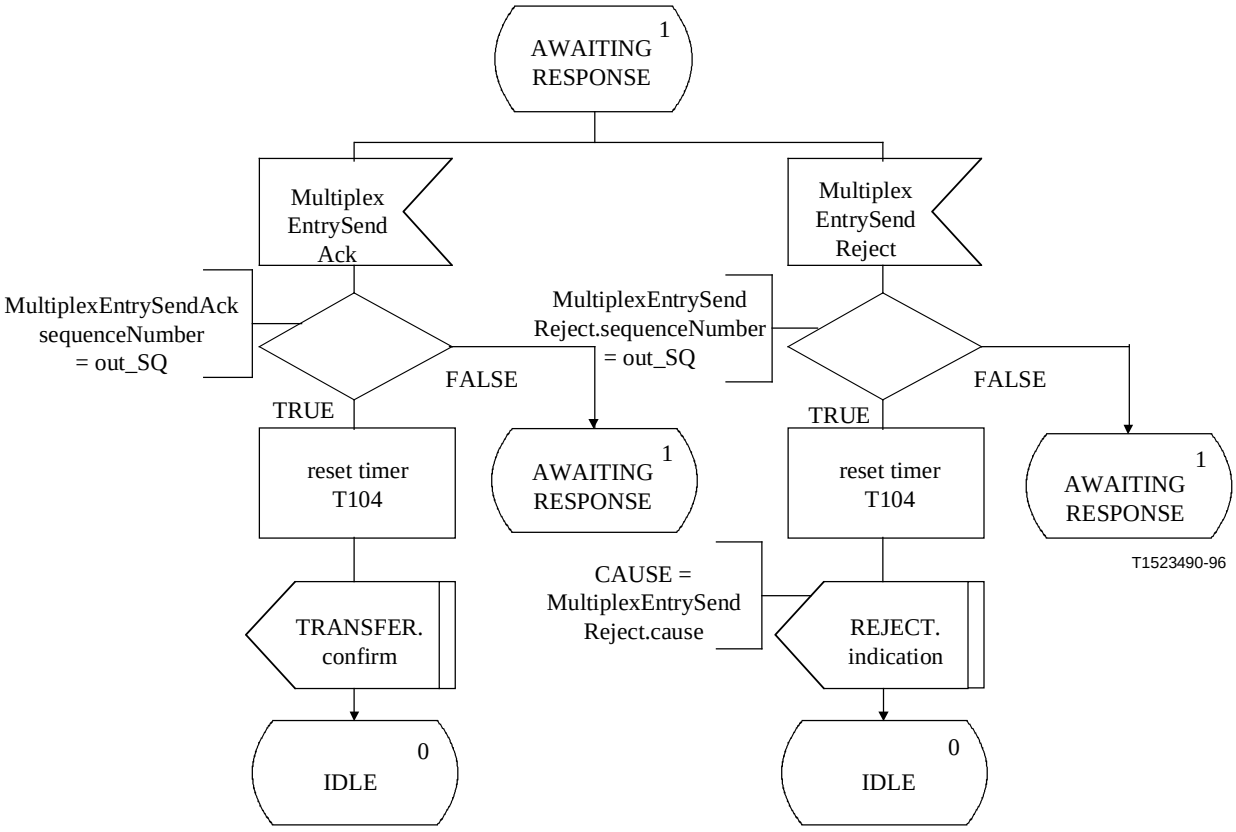


Figure 28 ii)/H.245 – Outgoing MTSE SDL

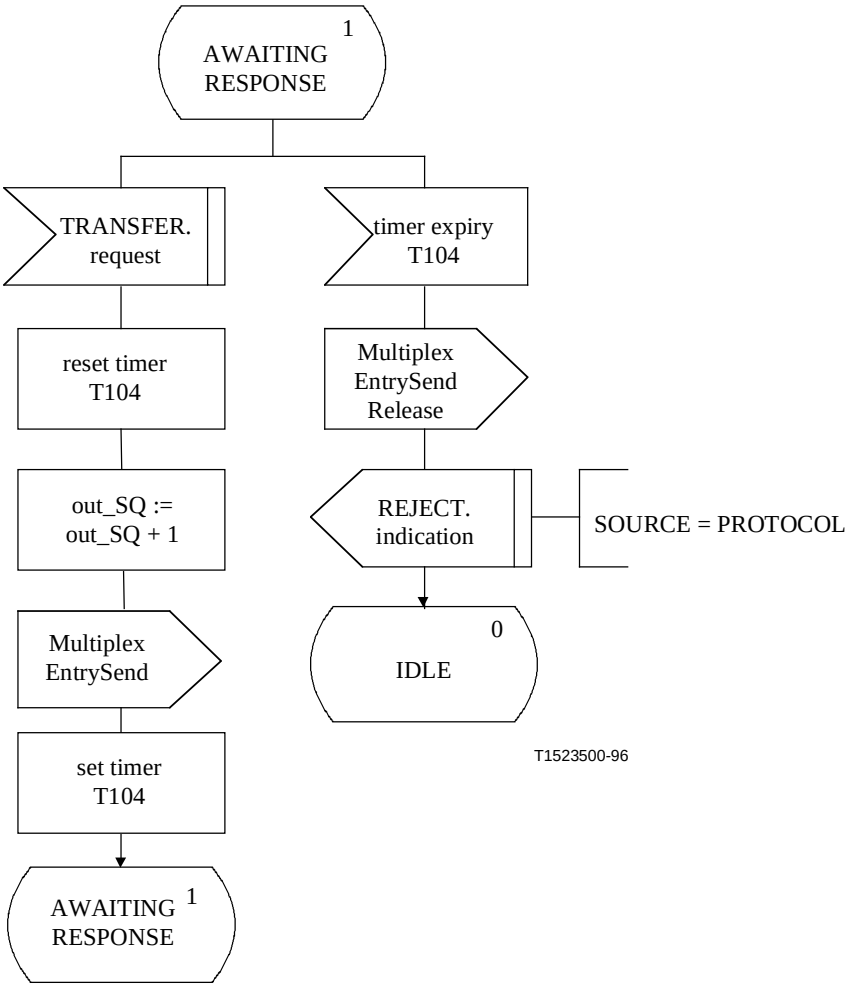


Figure 28 iii)/H.245 – Outgoing MTSE SDL

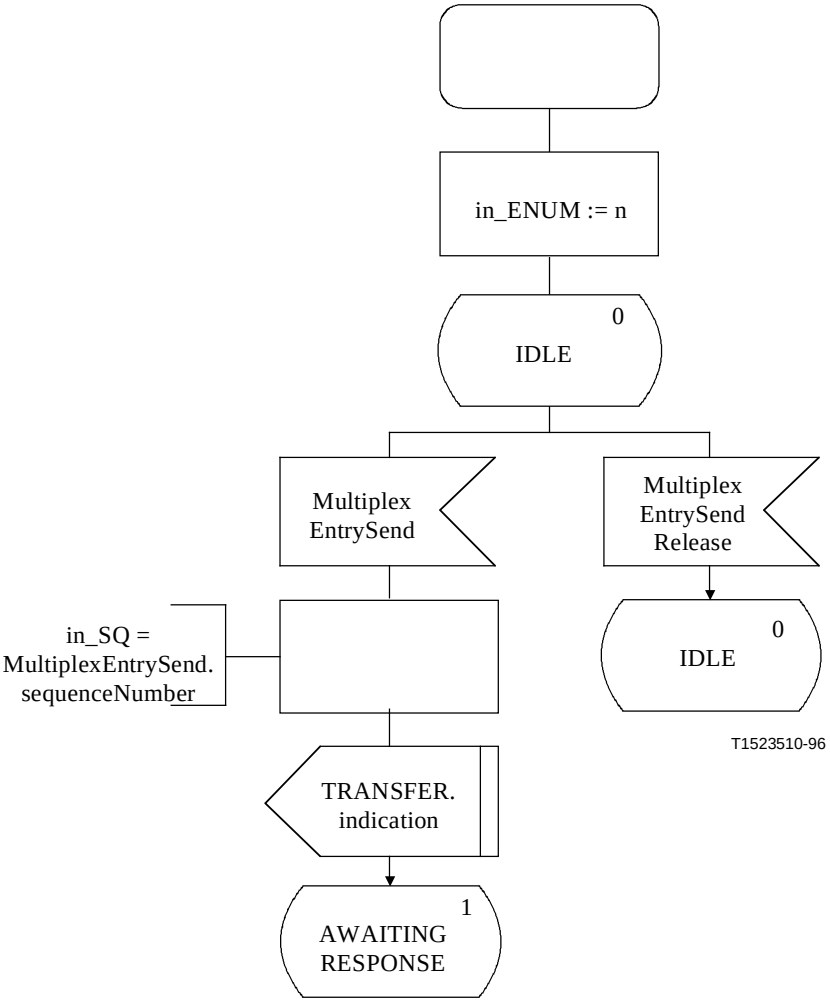


Figure 29 i)/H.245 – Incoming MTSE SDL

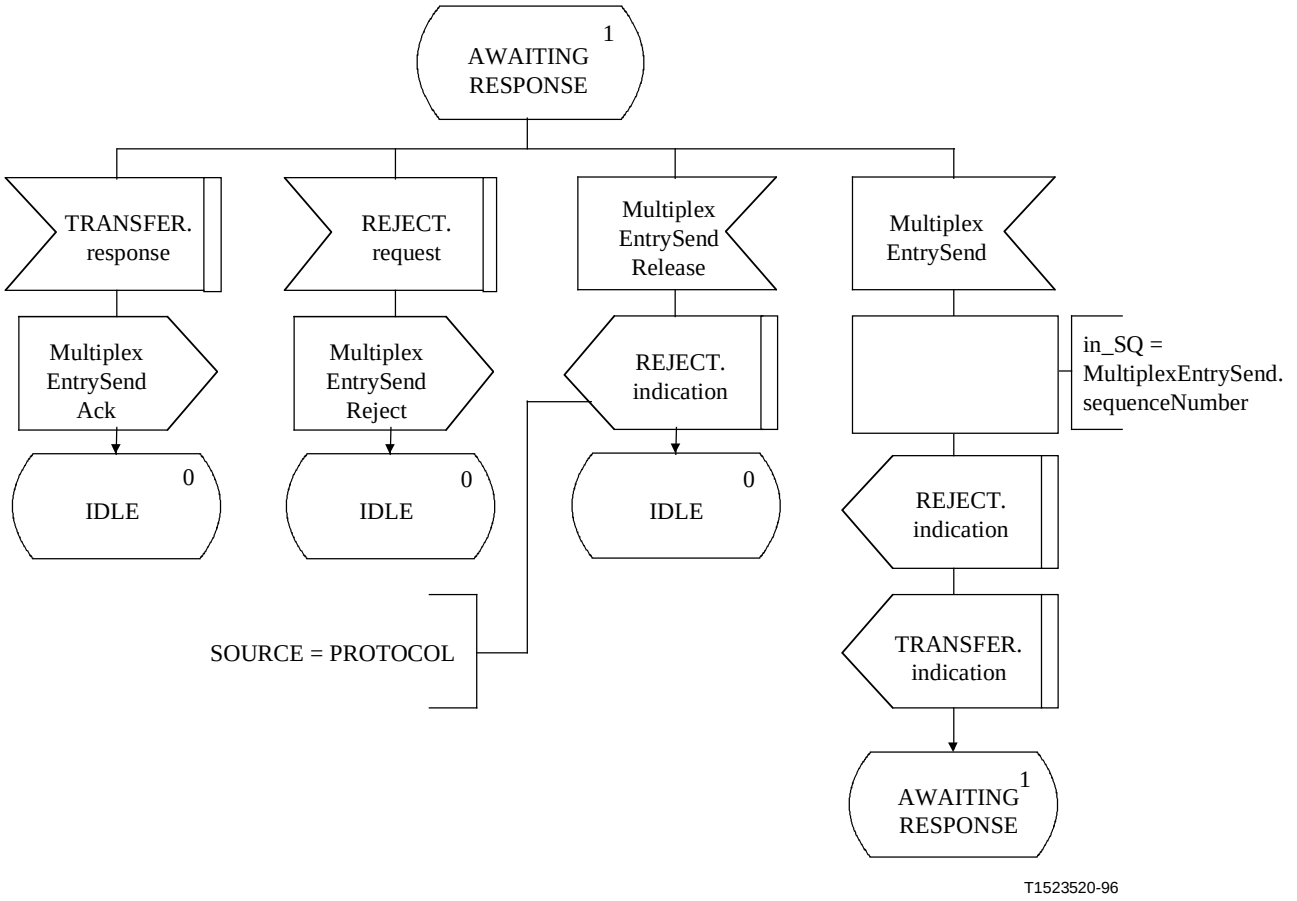


Figure 29 ii)/H.245 – Incoming MTSE SDL

8.8 Request Multiplex Entry procedures

8.8.1 Introduction

These procedures are used by a terminal to request the retransmission of one or more MultiplexEntryDescriptors. The procedures are referred to here as the Request Multiplex Entry Signalling Entity (RMESE). Procedures are specified in terms of primitives and states at the interface between the RMESE and the RMESE user. Protocol information is transferred to the peer RMESE via relevant messages defined in clause 6. There is an outgoing RMESE and an incoming RMESE. There is one instance of the RMESE for each multiplex table entry.

A terminal that answers such a response positively, that is, by issuing the SEND.response primitive, shall initiate the Multiplex Table procedures to send the multiplex table entry as soon as possible.

The following text provides an overview of the operation of the protocol. In the case of any discrepancy with the formal specification of the protocol that follows, the formal specification will supersede.

NOTE – This protocol has been defined so that there is an independent RMESE for each multiplex table entry, and the syntax has been defined to allow a single message to carry information relating to one or more multiplex table entries. The way that messages are constructed is an implementation decision: for example, a terminal may respond to a RequestMultiplexEntry message requesting three entries to be sent with one, two or three response messages.

8.8.1.1 Protocol overview – Outgoing RMESE

A request multiplex entry procedure is initiated when the SEND.request primitive is issued by the user at the outgoing RMESE. A RequestMultiplexEntry message is sent to the peer incoming RMESE, and timer T107 is started. If a RequestMultiplexEntryAck message is received in response to the RequestMultiplexEntry message, then timer T107 is stopped and the user is informed with the SEND.confirm primitive that the request multiplex entry procedure was successful. If however a RequestMultiplexEntryReject message is received in response to the RequestMultiplexEntry message, then timer T107 is stopped and the user is informed with the REJECT.indication primitive that the peer RMESE user has refused to send the multiplex entry.

If timer T107 expires, then the outgoing RMESE user is informed with the REJECT.indication primitive and a RequestMultiplexEntryRelease message is sent.

8.8.1.2 Protocol overview – Incoming RMESE

When a RequestMultiplexEntry message is received at the incoming RMESE, the user is informed of the multiplex entry request with the SEND.indication primitive. The incoming RMESE user signals acceptance of the multiplex entry request by issuing the SEND.response primitive, and a RequestMultiplexEntryAck message is sent to the peer outgoing RMESE. The incoming RMESE user signals rejection of the multiplex entry request by issuing the REJECT.request primitive, and a RequestMultiplexEntryReject message is sent to the peer outgoing RMESE.

8.8.2 Communication between RMESE and RMESE user

8.8.2.1 Primitives between RMESE and RMESE user

Communication between the RMESE and RMESE user is performed using the primitives shown in Table 45.

Table 45/H.245 – Primitives and parameters

Generic name	Type			
	Request	**Indication**	**Response**	**Confirm**
SEND	– (Note 1)	–	–	–
REJECT	CAUSE	SOURCE CAUSE	not defined (Note 2)	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive is not defined.				

8.8.2.2 Primitive definition

The definition of these primitives is as follows:

a) The SEND primitives are used to request the transmission of a multiplex entry.

b) The REJECT primitives are used to reject the request for transmission of a multiplex entry.

8.8.2.3 Parameter definition

The definition of the primitive parameters shown in Table 45 are as follows:

a) The SOURCE parameter indicates the source of the REJECT.indication primitive. The SOURCE parameter has the value of "USER" or "PROTOCOL". The latter case may occur as the result of a timer expiry.

b) The CAUSE parameter indicates the reason for refusal to send a multiplex table entry. The CAUSE parameter is not present when the SOURCE parameter indicates "PROTOCOL".

8.8.2.4 RMESE states

The following states are used to specify the allowed sequence of primitives between the RMESE and the RMESE user.

The states for an outgoing RMESE are:

State 0: IDLE

The RMESE is idle.

State 1: AWAITING RESPONSE

The RMESE is waiting for a response from the remote RMESE.

The states for an incoming RMESE are:

State 0: IDLE

The RMESE is idle.

State 1: AWAITING RESPONSE

The RMESE is waiting for a response from the RMESE user.

8.8.2.5 State transition diagram

The allowed sequence of primitives between the RMESE and the RMESE user is defined here. The allowed sequences are specified separately for each of an outgoing RMESE and an incoming RMESE, as shown in Figures 30 and 31 respectively.

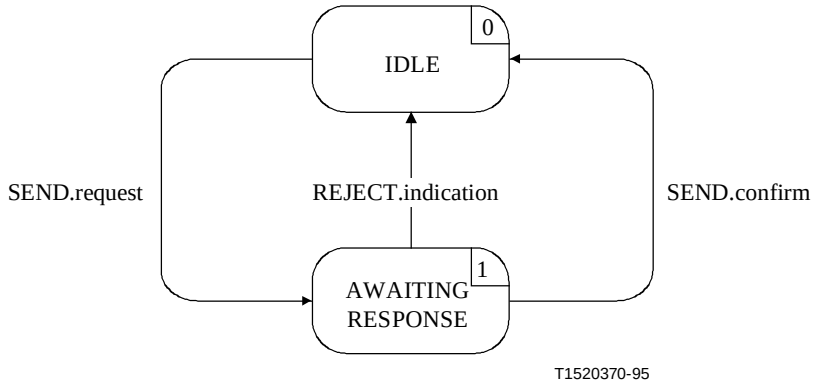


Figure 30/H.245 – State transition diagram for sequence of primitives at RMESE outgoing

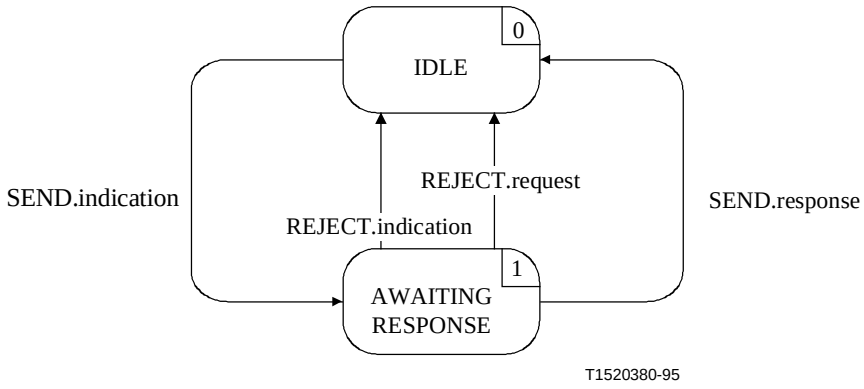


Figure 31/H.245 – State transition diagram for sequence of primitives at RMESE incoming

8.8.3 Peer-to-peer RMESE communication

8.8.3.1 Messages

Table 46 shows the RMESE messages and fields, defined in clause 6, which are relevant to the RMESE protocol.

Table 46/H.245 – RMESE message names and fields

Function	Message	Direction	field
transfer	RequestMultiplexEntry	O → I	multiplexTableEntryNumber
	RequestMultiplexEntryAck	O ← I	multiplexTableEntryNumber
	RequestMultiplexEntryReject	O ← I	multiplexTableEntryNumber rejectionDescriptions.cause
reset	RequestMultiplexEntryRelease	O → I	
O Outgoing I Incoming			

8.8.3.2 RMESE state variables

The following state variable is defined at the outgoing RMESE:

out_ENUM

This state variable distinguishes between outgoing RMESEs. It is initialized at outgoing RMESE initialization. The value of out_ENUM is used to set the multiplexTableEntryNumber field of RMESE messages sent from an outgoing RMESE. For RMESE messages received at an outgoing RMESE, the message multiplexTableEntryNumber field value is identical to the value of out_ENUM.

The following state variable is defined at the incoming RMESE:

in_ENUM

This state variable distinguishes between incoming RMESEs. It is initialized at incoming RMESE initialization. The value of in_ENUM is used to set the multiplexTableEntryNumber field of RMESE messages sent from an incoming RMESE. For RMESE messages received at an incoming RMESE, the message multiplexTableEntryNumber field value is identical to the value of in_ENUM.

8.8.3.3 RMESE timers

The following timer is specified for the outgoing RMESE:

T107

This timer is used during the AWAITING RESPONSE state. It specifies the maximum time during which no RequestMultiplexEntryAck or RequestMultiplexEntryReject message may be received.

8.8.4 RMESE procedures

Figure 32 summarizes the RMESE primitives and their parameters, and messages, for each of the outgoing and incoming RMESE.

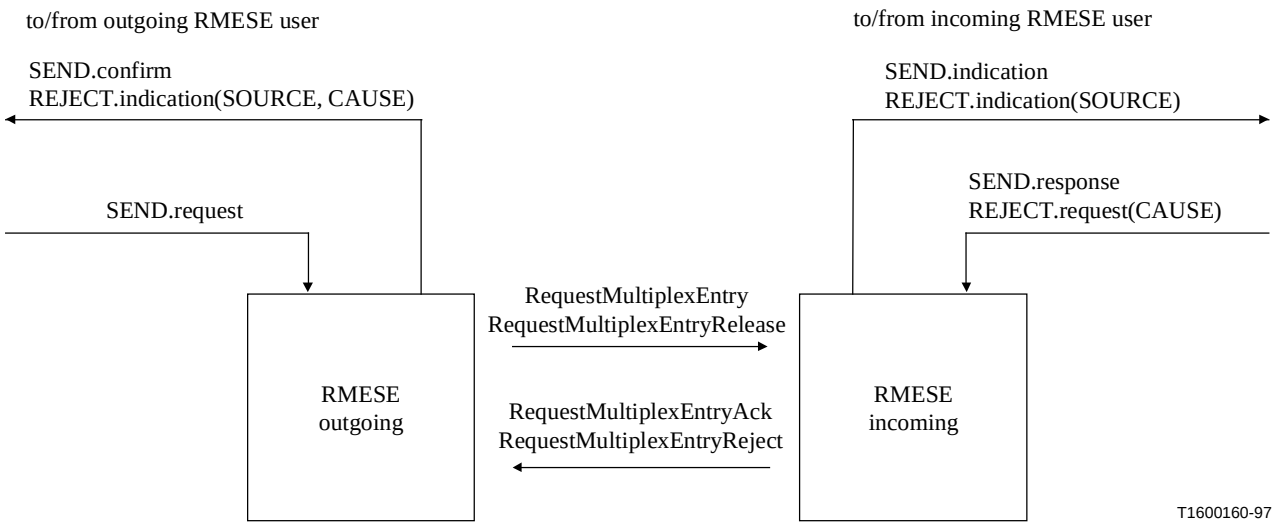


Figure 32/H.245 – Primitives and messages in the Request Multiplex Entry Signalling Entity

8.8.4.1 Primitive parameter default values

Where not explicitly stated in the SDL diagrams, the parameters of the indication and confirm primitives assume values as shown in Table 47.

Table 47/H.245 – Default primitive parameter values

Primitive	Parameter	Default value
REJECT.indication	SOURCE	USER
	CAUSE	null

8.8.4.2 Message field default values

Where not explicitly stated in the SDL diagrams, the message fields assume values as shown in Table 48.

Table 48/H.245 – Default message field values

Message	Field	Default value
RequestMultiplexEntry	multiplexTableEntryNumber	out_ENUM
RequestMultiplexEntryAck	multiplexTableEntryNumber	in_ENUM
RequestMultiplexEntryReject	multiplexTableEntryNumber	in_ENUM
	cause	REJECT.request(CAUSE)
RequestMultiplexEntryRelease	multiplexTableEntryNumber	out_ENUM

8.8.4.3 SDLs

The outgoing RMESE and the incoming RMESE procedures are expressed in SDL form in Figures 33 and 34 respectively.

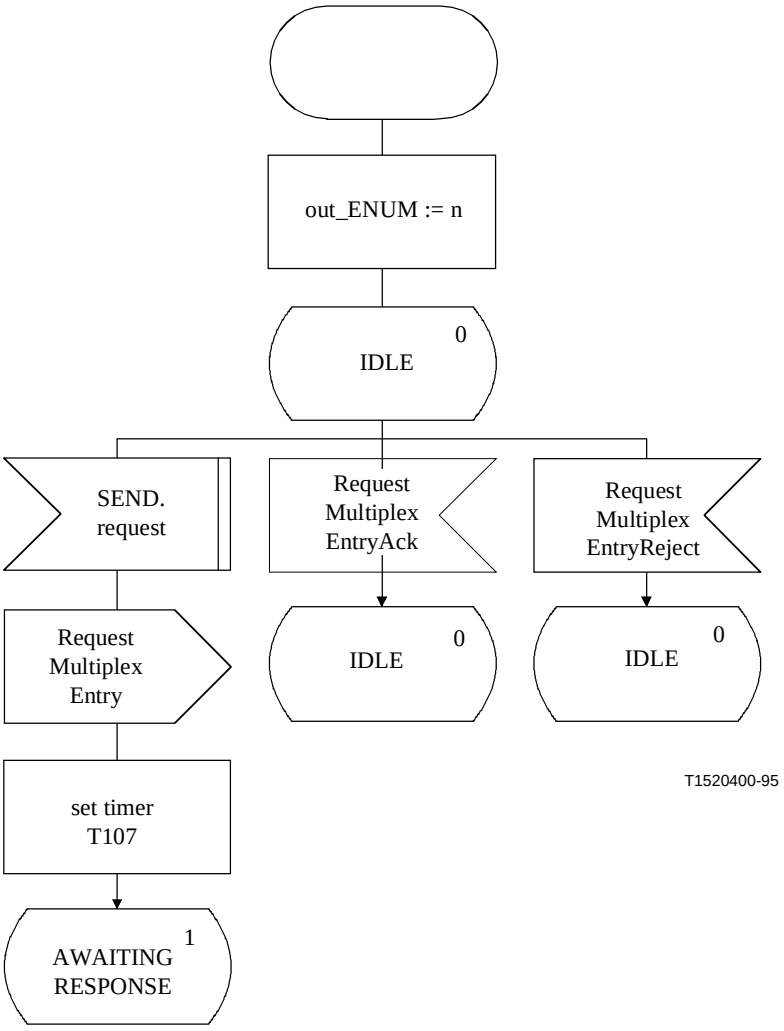


Figure 33 i)/H.245 – Outgoing RMESE SDL

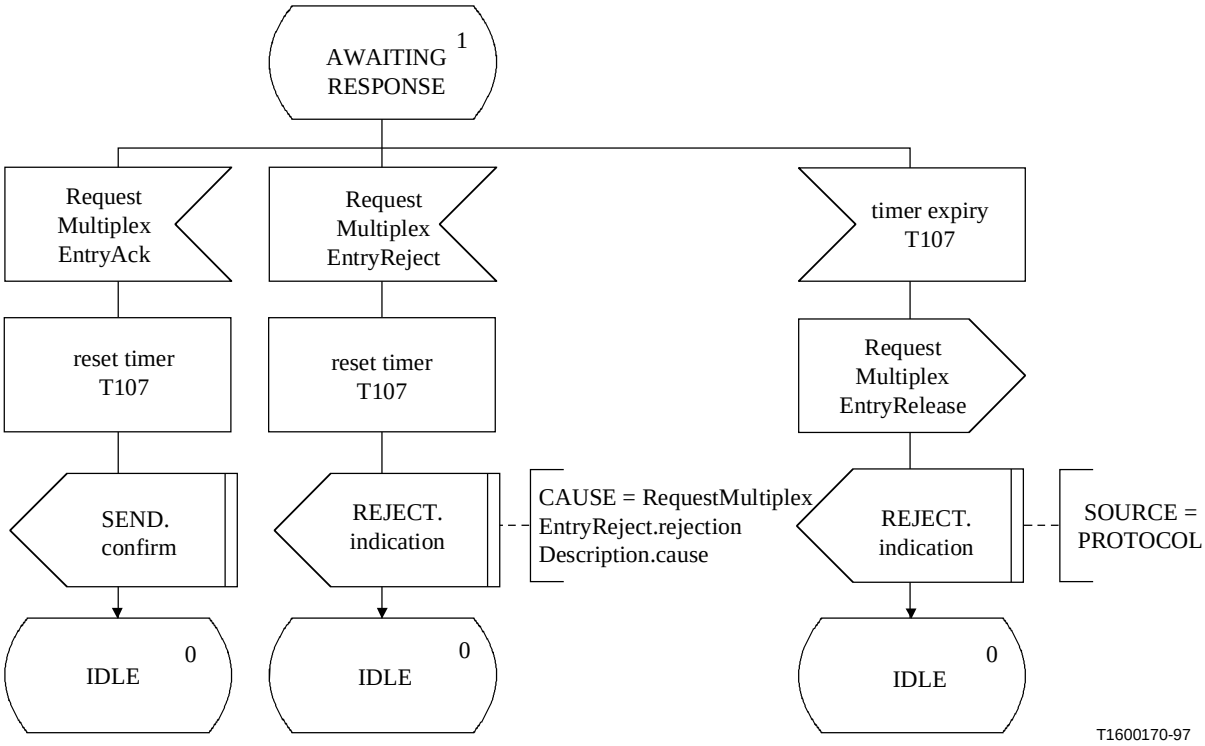


Figure 33 ii)/H.245 – Outgoing RMESE SDL

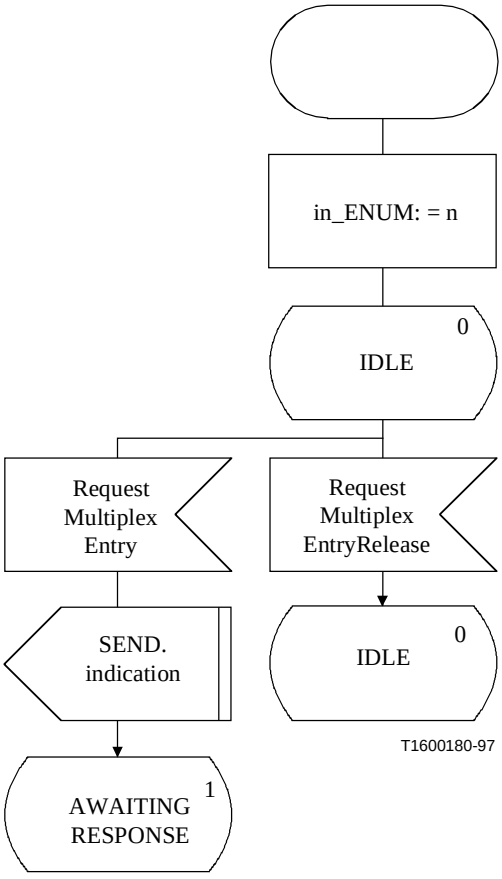


Figure 34 i)/H.245 – Incoming RMESE SDL

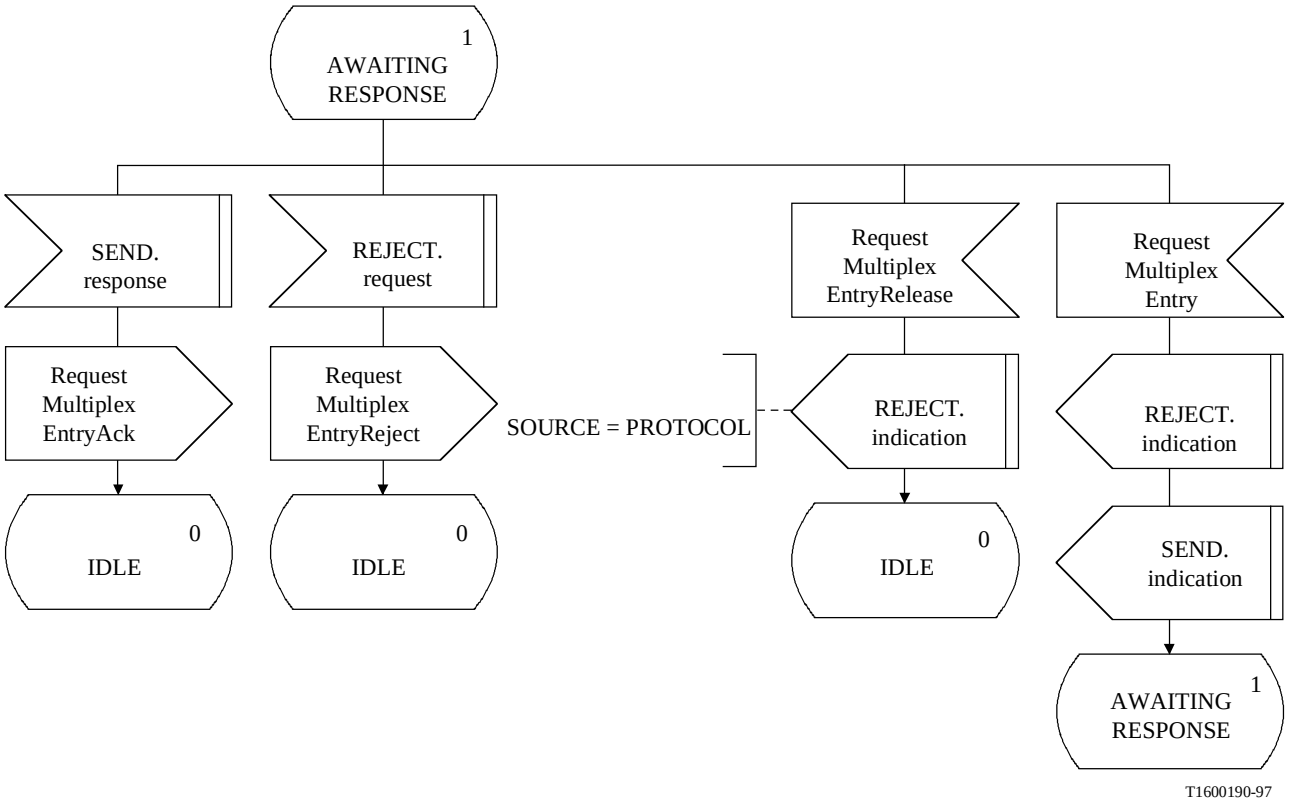


Figure 34 ii)/H.245 – Incoming RMESE SDL

8.9 Mode Request procedures

8.9.1 Introduction

The procedures described here allow a terminal to request a remote terminal to use a particular mode of operation in its transmit direction. The procedures are referred to here as the Mode Request Signalling Entity (MRSE). Procedures are specified in terms of primitives and states at the interface between the MRSE and the MRSE user. Protocol information is transferred to the peer MRSE via relevant messages defined in clause 6. There is an outgoing MRSE and an incoming MRSE. At each of the outgoing and incoming ends there is one instance of the MRSE per call.

A terminal that answers such a response positively, that is, by issuing the TRANSFER.response primitive, shall initiate the logical channel signalling procedures to establish the appropriate mode of transmission as soon as possible.

If the currently valid capabilities received from the remote terminal contain one or more transmission capabilities, a terminal may select a mode that it prefers to have transmitted to it by performing the Mode Request procedures. A terminal whose currently valid capabilities contain one or more transmission capabilities and which is in receipt of such a request, should comply with the request.

A mode request shall not be sent to a terminal whose currently valid capabilities contain no transmission capabilities, that is, the terminal does not wish to, and shall not, be remotely controlled. If such a terminal does however receive a mode request, it may comply.

A terminal that receives multipointModeCommand shall comply with all received mode requests, until the command is cancelled by receipt of cancelMultipointModeCommand. A mode request may be sent to a terminal whose currently valid capabilities contain no transmission capabilities when multipointModeCommand has previously been sent.

The requested mode may include channels which are already open. For example, if a channel for G.723.1 was currently open and a terminal wished to receive an additional G.728 channel, it would send a mode request containing both the G.723.1 and the G.728 channel. If the G.723.1 channel request were absent, this would indicate that G.723.1 was no longer desired.

NOTE – The request mode description specifies a complete mode. If, for example, video is currently being transmitted and a mode request is received that does not include any specification for video, then this requests video transmission to stop.

Where one source is feeding several receivers it may be unable to respond to any received signals such as requests to transmit in a particular mode.

The following text provides an overview of the operation of the MRSE protocol. In the case of any discrepancy between this and the formal specification, the formal specification will supersede.

8.9.1.1 Protocol overview – Outgoing MRSE

A mode request procedure is initiated when the TRANSFER.request primitive is issued by the user at the outgoing MRSE. A RequestMode message is sent to the peer incoming MRSE, and timer T109 is started. If a RequestModeAck message is received in response to the RequestMode message, then timer T109 is stopped and the user is informed with the TRANSFER.confirm primitive that the mode request was successful. If however a RequestModeReject message is received in response to the RequestMode message, then timer T109 is stopped and the user is informed with the REJECT.indication primitive that the peer MRSE user has refused to accept the mode request.

If timer T109 expires, then the outgoing MRSE user is informed with the REJECT.indication primitive and a RequestModeRelease message is sent.

Only RequestModeAck and RequestModeReject messages which are in response to the most recent RequestMode message are accepted. Messages in response to earlier RequestMode messages are ignored.

A new mode request procedure may be initiated with the TRANSFER.request primitive by the user at the outgoing MRSE before a RequestModeAck or a RequestModeReject message has been received.

8.9.1.2 Protocol overview – Incoming MRSE

When a RequestMode message is received at the incoming MRSE, the user is informed of the mode request with the TRANSFER.indication primitive. The incoming MRSE user signals acceptance of the mode request by issuing the TRANSFER.response primitive, and a RequestModeAck message is sent to the peer outgoing MRSE. The incoming MRSE user signals rejection of the mode request by issuing the REJECT.request primitive, and a RequestModeReject message is sent to the peer outgoing MRSE.

A new RequestMode message may be received before the incoming MRSE user has responded to an earlier RequestMode message. The incoming MRSE user is informed with the REJECT.indication primitive, followed by the TRANSFER.indication primitive, and the incoming MRSE user responds to the new multiplex table entry.

If a RequestModeRelease message is received before the incoming MRSE user has responded to an earlier RequestMode message, then the incoming MRSE user is informed with the REJECT.indication, and the earlier mode request is discarded.

8.9.2 Communication between MRSE and MRSE user

8.9.2.1 Primitives between MRSE and MRSE user

Communication between the MRSE and MRSE user is performed using the primitives shown in Table 49.

Table 49/H.245 – Primitives and parameters

Generic name	Type			
	Request	**Indication**	**Response**	**Confirm**
TRANSFER	MODE-ELEMENT	MODE-ELEMENT	MODE-PREF	MODE-PREF
REJECT	CAUSE	SOURCE CAUSE	not defined (Note)	not defined
NOTE – "not defined" means that this primitive is not defined.				

8.9.2.2 Primitive definition

The definition of these primitives is as follows:

a) The TRANSFER primitives are used for the transfer of the mode request.

b) The REJECT primitives are used to reject a mode request.

8.9.2.3 Parameter definition

The definition of the primitive parameters shown in Table 49 are as follows:

a) The MODE-ELEMENT parameter specifies a mode element. This parameter is mapped to the requestedModes field of the RequestMode message and is carried transparently from the outgoing MRSE user to the incoming MRSE user. This parameter is mandatory. There may be multiple MODE-ELEMENT associated with the TRANSFER primitives.

b) The MODE-PREF parameter informs the user as to whether the most preferred mode requested will be used or not. This parameter is mapped to the response field of the RequestModeAck message and carried transparently from the incoming RMSE user to the outgoing RMSE user. It has two values being "MOST-PREFERRED" and "LESS-PREFERRED".

c) The SOURCE parameter indicates the source of the REJECT.indication primitive. The SOURCE parameter has the value of "USER" or "PROTOCOL". The latter case may occur as the result of a timer expiry.

d) The CAUSE parameter indicates the reason for refusal to reject a mode request. The CAUSE parameter is not present when the SOURCE parameter indicates "PROTOCOL".

8.9.2.4 MRSE states

The following states are used to specify the allowed sequence of primitives between the MRSE and the MRSE user. The states for an outgoing MRSE are:

State 0: IDLE

The MRSE is idle.

State 1: AWAITING RESPONSE

The MRSE is waiting for a response from the remote MRSE.

The states for an incoming MRSE are:

State 0: IDLE

The MRSE is idle.

State 1: AWAITING RESPONSE

The MRSE is waiting for a response from the MRSE user.

8.9.2.5 State transition diagram

The allowed sequence of primitives between the MRSE and the MRSE user is defined here. The allowed sequences are specified separately for each of an outgoing MRSE and an incoming MRSE, as shown in Figures 35 and 36 respectively.

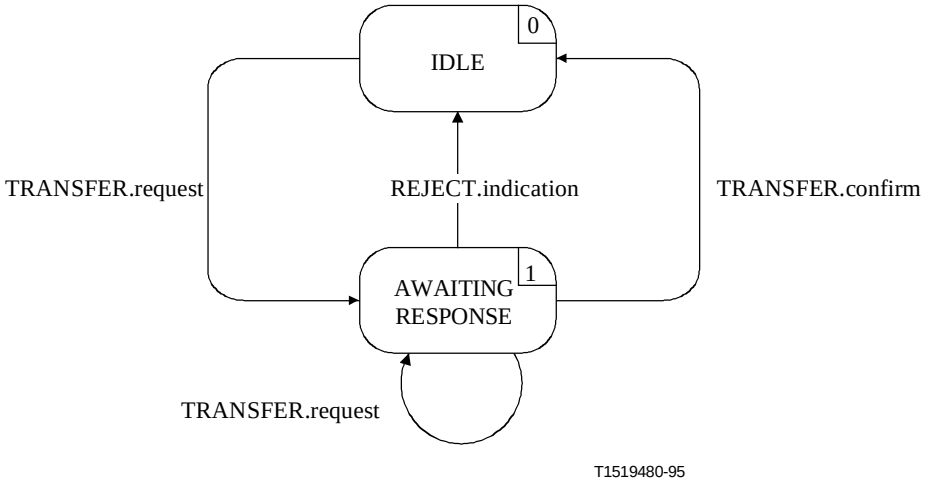


Figure 35/H.245 – State transition diagram for sequence of primitives at MRSE outgoing

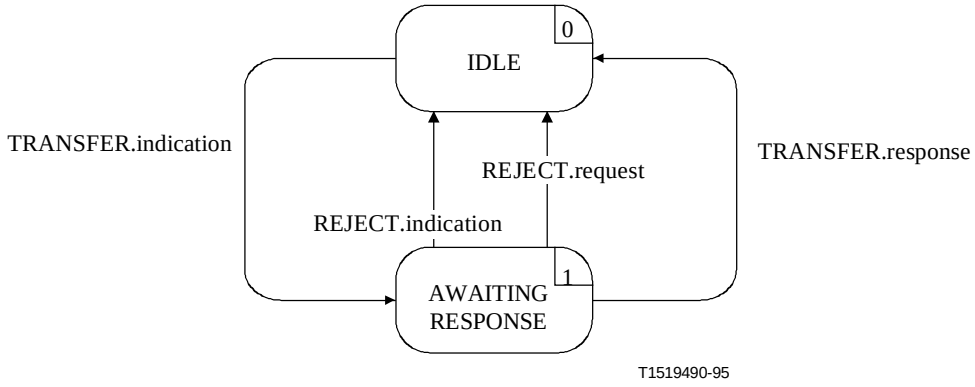


Figure 36/H.245 – State transition diagram for sequence of primitives at MRSE incoming

8.9.3 Peer-to-peer MRSE communication

8.9.3.1 Messages

Table 50 shows the MRSE messages and fields, defined in clause 6, which are relevant to the MRSE protocol.

Table 50/H.245 – MRSE message names and fields

Function	Message	Direction	Field
mode request	RequestMode	O → I	sequenceNumber requestedModes
	RequestModeAck	O ← I	sequenceNumber response
	RequestModeReject	O ← I	sequenceNumber cause
reset	RequestModeRelease	O → I	–
O Outgoing I Incoming			

8.9.3.2 MRSE state variables

The following state variables are defined at the outgoing MRSE:

out_SQ

This state variable is used to indicate the most recent RequestMode message. It is incremented by one and mapped to the RequestMode message sequenceNumber field before transmission of the RequestMode message. Arithmetic performed on out_SQ is modulo 256.

The following state variables are defined at the incoming MRSE:

in_SQ

This state variable is used to store the value of the sequenceNumber field of the most recently received RequestMode message. The RequestModeAck and RequestModeReject messages have their sequenceNumber fields set to the value of in_SQ, before being sent to the peer MRSE.

8.9.3.3 MRSE timers

The following timer is specified for the outgoing MRSE:

T109

This timer is used during the AWAITING RESPONSE state. It specifies the maximum time during which no RequestModeAck or RequestModeReject message may be received.

8.9.4 MRSE procedures

Figure 37 summarizes the MRSE primitives and their parameters, and messages, for each of the outgoing and incoming MRSE.

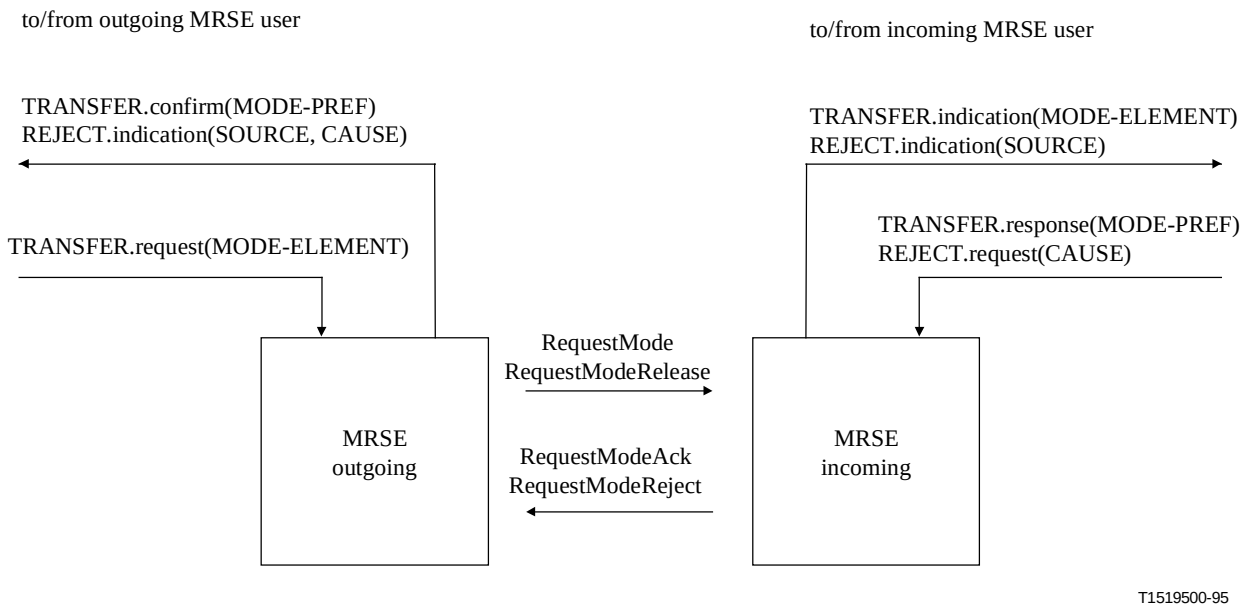


Figure 37/H.245 – Primitives and messages in the Mode Request Signalling Entity

8.9.4.1 Primitive parameter default values

Where not explicitly stated in the SDL diagrams the parameters of the indication and confirm primitives assume values as shown in Table 51.

Table 51/H.245 – Default primitive parameter values

Primitive	Parameter	Default value
TRANSFER.indication	MODE-ELEMENT	RequestMode.requestedModes
TRANSFER.confirm	MODE-PREF	RequestModeAck.response
REJECT.indication	SOURCE	USER
	CAUSE	null

8.9.4.2 Message field default values

Where not explicitly stated in the SDL diagrams the message fields assume values as shown in Table 52.

Table 52/H.245 – Default message field values

Message	Field	Default value
RequestMode	sequenceNumber requestedModes	out_SQ TRANSFER.request(MODE-ELEMENT)
RequestModeAck	sequenceNumber response	in_SQ TRANSFER.response(MODE-PREF)
RequestModeReject	sequenceNumber cause	in_SQ REJECT.request(CAUSE)
RequestModeRelease	–	–

8.9.4.3 SDLs

The outgoing MRSE and the incoming MRSE procedures are expressed in SDL form in Figures 38 and 39 respectively.

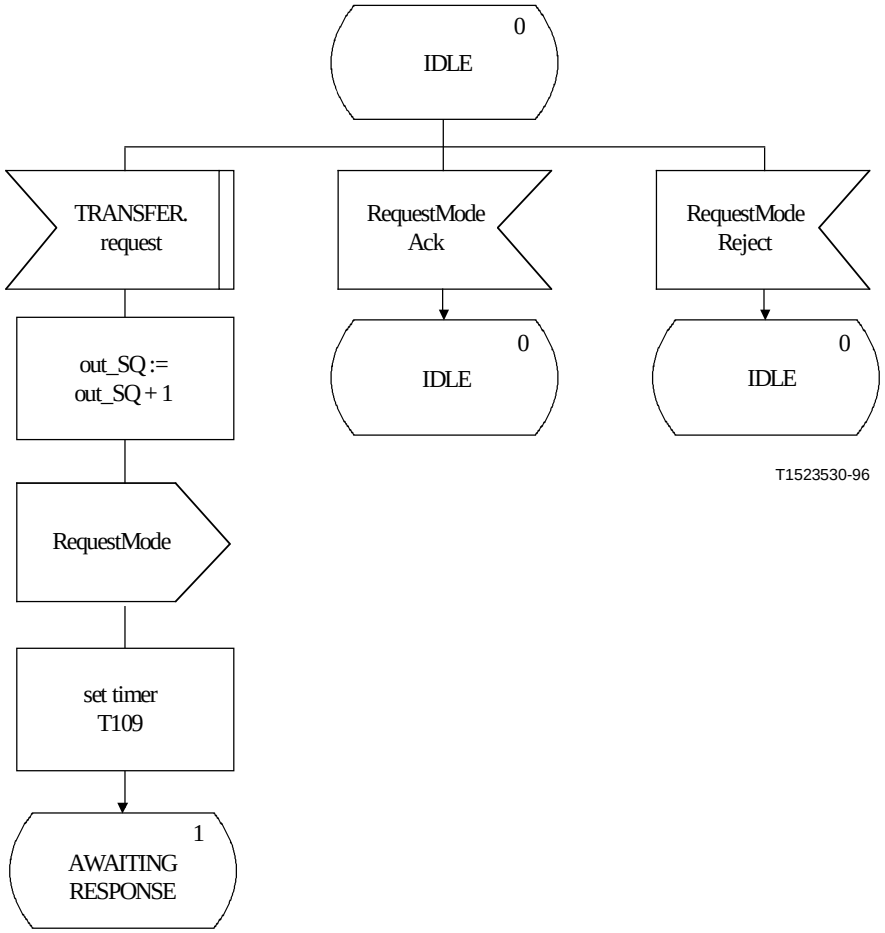


Figure 38 i)/H.245 – Outgoing MRSE SDL

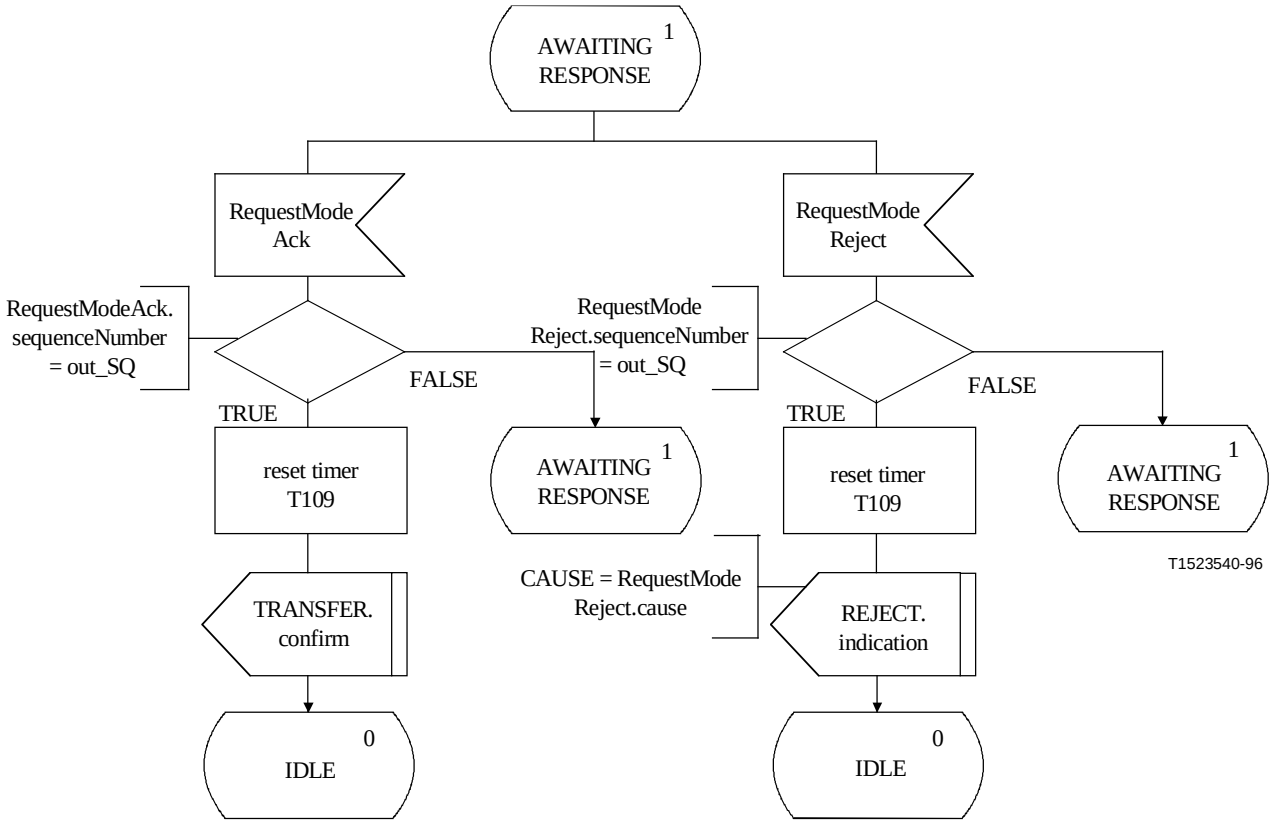


Figure 38 ii)/H.245 – Outgoing MRSE SDL

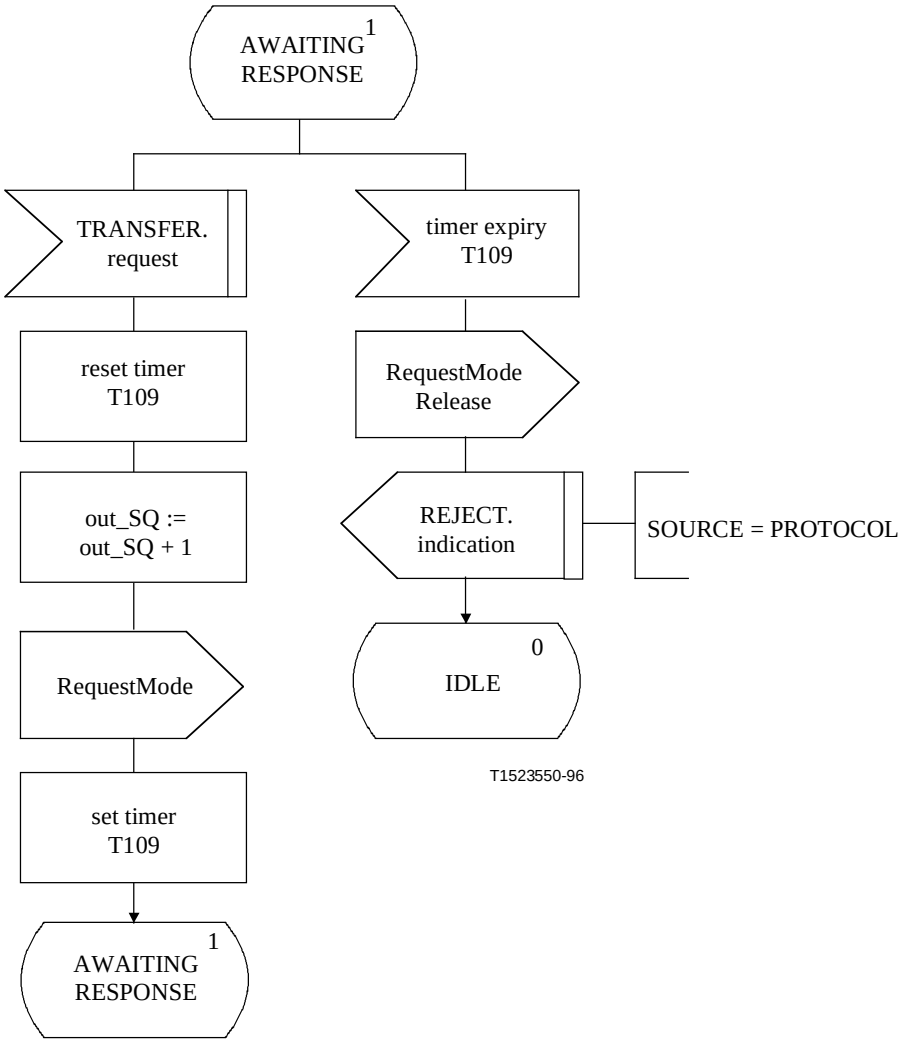


Figure 38 iii)/H.245 – Outgoing MRSE SDL

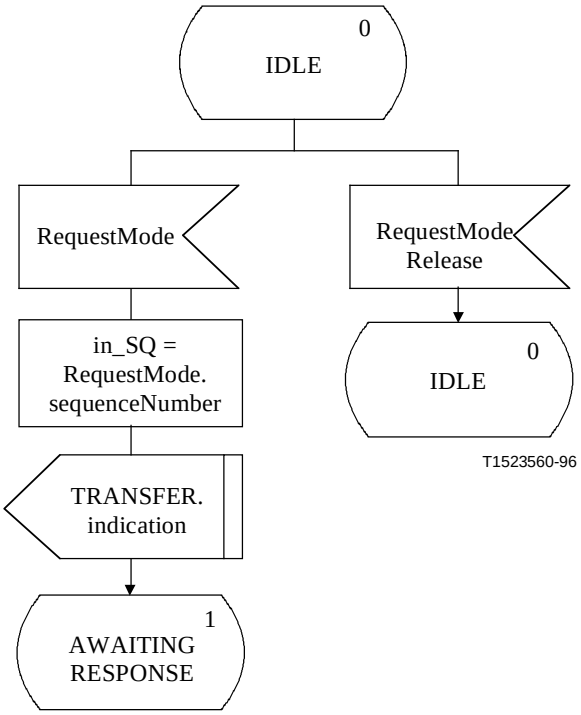


Figure 39 i)/H.245 – Incoming MRSE SDL

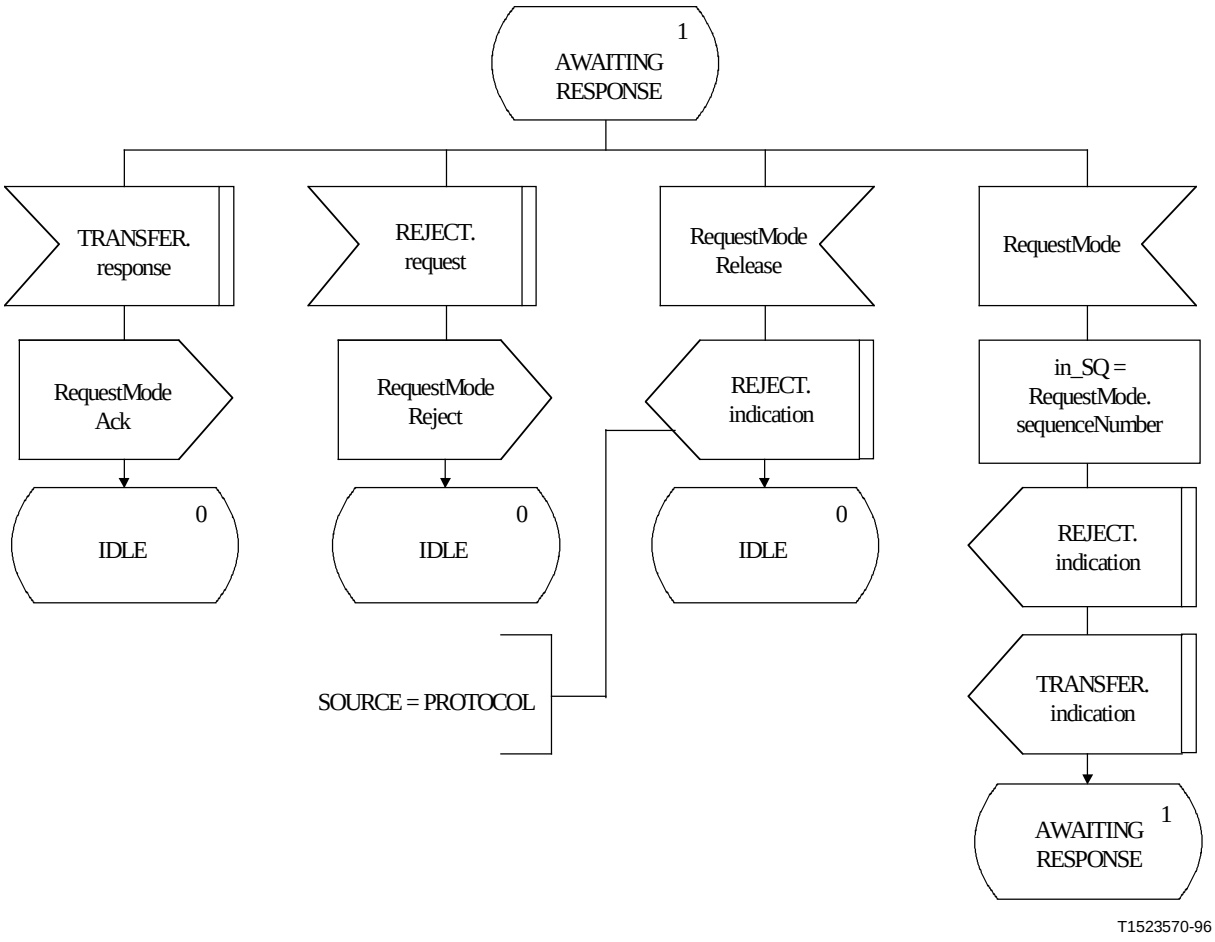


Figure 39 ii)/H.245 – Incoming MRSE SDL

8.10 Round trip delay procedures

8.10.1 Introduction

Procedures are described here that allow the determination of the round trip delay between two communicating terminals. This function also enables an H.245 user to determine if the peer H.245 protocol entity is still alive.

The function described here is referred to as the Round Trip Delay Signalling Entity (RTDSE). Procedures are specified in terms of primitives and states at the interface between the RTDSE and the RTDSE user. There is one instance of the RTDSE in each terminal. Any terminal may perform the round trip delay determination.

The following text provides an overview of the operation of the RTDSE protocol. In the case of any discrepancy between this and the formal specification, the formal specification will supersede.

8.10.1.1 Protocol overview – RTDSE

A round trip delay determination procedure is initiated when the TRANSFER.request primitive is issued by the RTDSE user. A RoundTripDelayRequest message is sent to the peer RTDSE, and timer T105 is started. If a RoundTripDelayResponse message is received in response to the RoundTripDelayRequest message, then timer T105 is stopped and the user is informed with the TRANSFER.confirm primitive of the round trip delay, which is the value of timer T105.

If a RoundTripDelayRequest message is at any time received from the peer RTDSE, a RoundTripDelayResponse message is immediately sent to the peer RTDSE.

If timer T105 expires, then the RTDSE user is informed with the EXPIRY.indication primitive

Only the RoundTripDelayResponse message which is in response to the most recent RoundTripDelayRequest message is accepted. Messages in response to earlier RoundTripDelayRequest messages are ignored.

A new round trip delay determination procedure may be initiated with the TRANSFER.request primitive by the RTDSE user before a RoundTripDelayResponse message has been received.

8.10.2 Communication between the RTDSE and the RTDSE user

8.10.2.1 Primitives between the RTDSE and the RTDSE user

Communication between the RTDSE, and RTDSE user, is performed using the primitives shown in Table 53. These primitives are for the purpose of defining RTDSE procedures and are not meant to specify or constrain implementation.

Table 53/H.245 – Primitives and parameters

Generic name	Type			
	Request	**Indication**	**Response**	**Confirm**
TRANSFER	– (Note 1)	not defined (Note 2)	not defined	DELAY
EXPIRY	not defined	–	not defined	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive is not defined.				

8.10.2.2 Primitive definition

The definition of these primitives is as follows:

a) The TRANSFER primitive is used to request, and report upon, the round trip delay determination.

b) The EXPIRY primitive indicates that no response has been received from the peer terminal.

8.10.2.3 Parameter definition

The definition of the primitive parameters shown in Table 53 are as follows:

a) The DELAY parameter returns the measured round trip delay.

8.10.2.4 RTDSE states

The following states are used to specify the allowed sequence of primitives between the RTDSE and the RTDSE user.

State 0: IDLE

There is no RTDSE transfer in progress.

State 1: AWAITING RESPONSE

The RTDSE user has requested the measurement of the round trip delay. A response from the peer RTDSE is awaited.

8.10.2.5 State transition diagram

The allowed sequence of primitives between the RTDSE and the RTDSE user is defined here. The allowed sequences are shown in Figure 40.

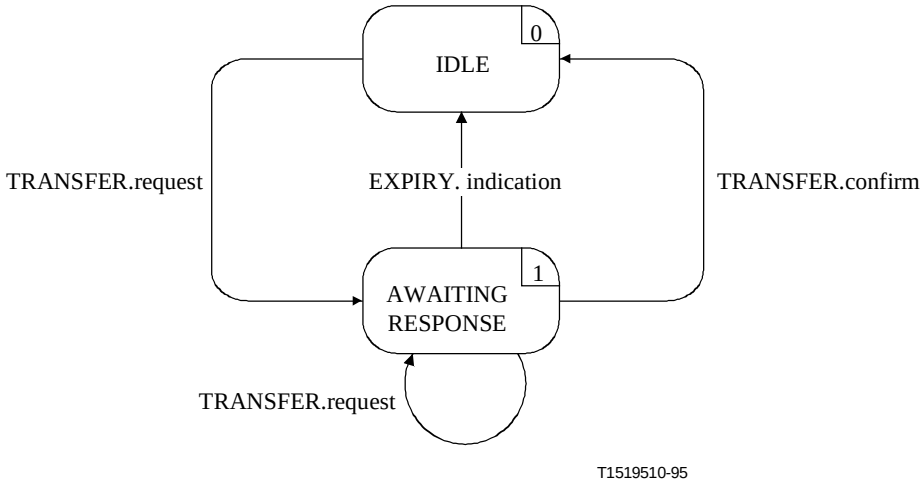


Figure 40/H.245 – State transition diagram for sequence of primitives at RTDSE

8.10.3 Peer-to-peer RTDSE communication

8.10.3.1 Messages

Table 54 shows the RTDSE messages and fields, defined in clause 6, which are relevant to the RTDSE protocol.

Table 54/H.245 – RTDSE Message names and fields

Function	Message	Field
transfer	RoundTripDelayRequest	sequenceNumber
	RoundTripDelayResponse	sequenceNumber

8.10.3.2 RTDSE state variables

The following RTDSE state variables are defined:

out_SQ

This state variable is used to indicate the most recent RoundTripDelayRequest message. It is incremented by one and mapped to the RoundTripDelayRequest message sequenceNumber field before transmission of an RoundTripDelayRequest message. Arithmetic performed on out_SQ is modulo 256.

8.10.3.3 RTDSE timers

The following timer is specified for the RTDSE:

T105

This timer is used during the AWAITING RESPONSE state. It specifies the maximum time during which no RoundTripDelayResponse message may be received.

8.10.4 RTDSE procedures

8.10.4.1 Introduction

Figure 41 summarizes the RTDSE primitives and their parameters, and messages.

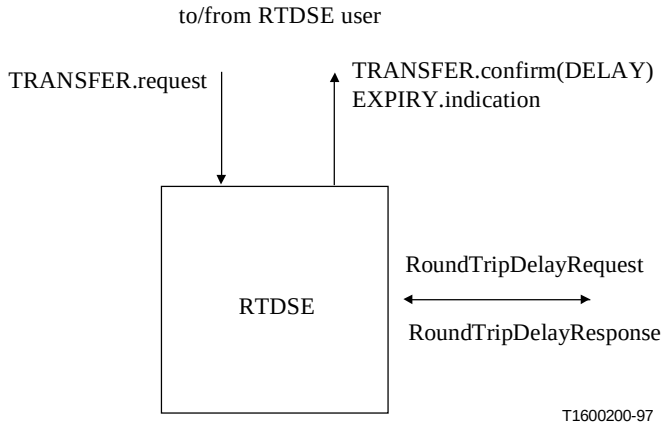


Figure 41/H.245 – Primitives and messages in the RTDSE

8.10.4.2 Primitive parameter default values

Where not explicitly stated in the SDL diagrams the parameters of the indication and confirm primitives assume values as shown in Table 55.

Table 55/H.245 – Default primitive parameter values

Primitive	Parameter	Default value
TRANSFER.confirm	DELAY	initial value of timer T105 minus value of timer T105
EXPIRY.indication	–	–

NOTE – Timers are defined to count down to zero. The DELAY parameter indicates the time that the timer has been running, and so has the value of the difference between the initial setting and the retained value of the timer.

8.10.4.3 Message field default values

Where not explicitly stated in the SDL diagrams the message fields assume values as shown in Table 56.

Table 56/H.245 – Default message field values

Message	Field	Default value
RoundTripDelayRequest	sequenceNumber	out_SQ
RoundTripDelayResponse	sequenceNumber	RoundTripDelayRequest.sequenceNumber

8.10.4.4 SDLs

The RTDSE procedures are expressed in SDL form in Figure 42.

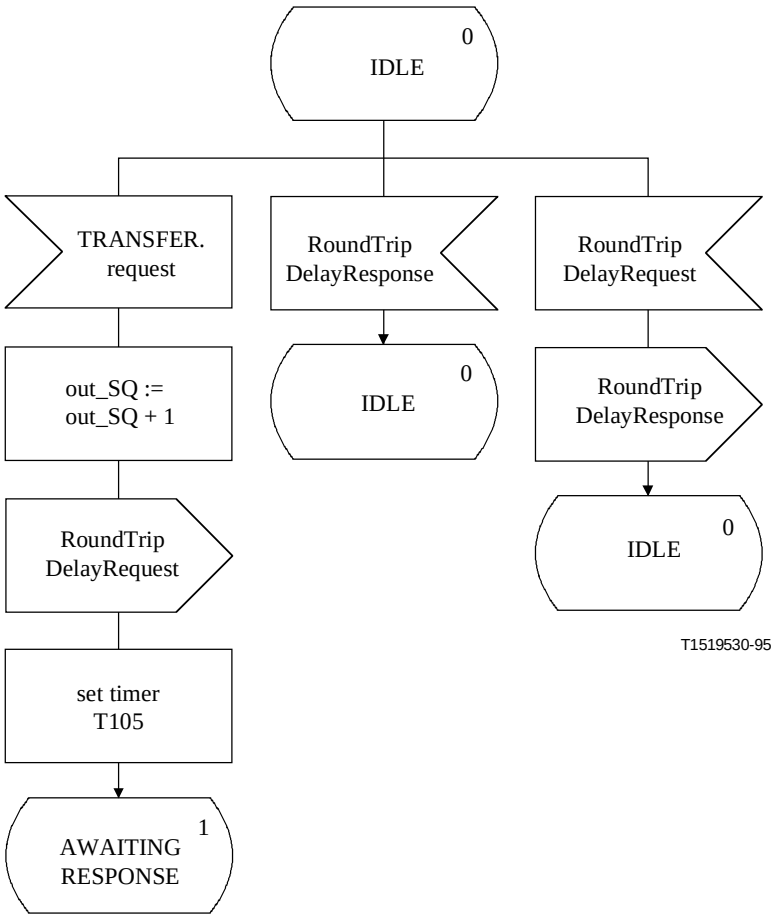


Figure 42 i)/H.245 – RTDSE SDL

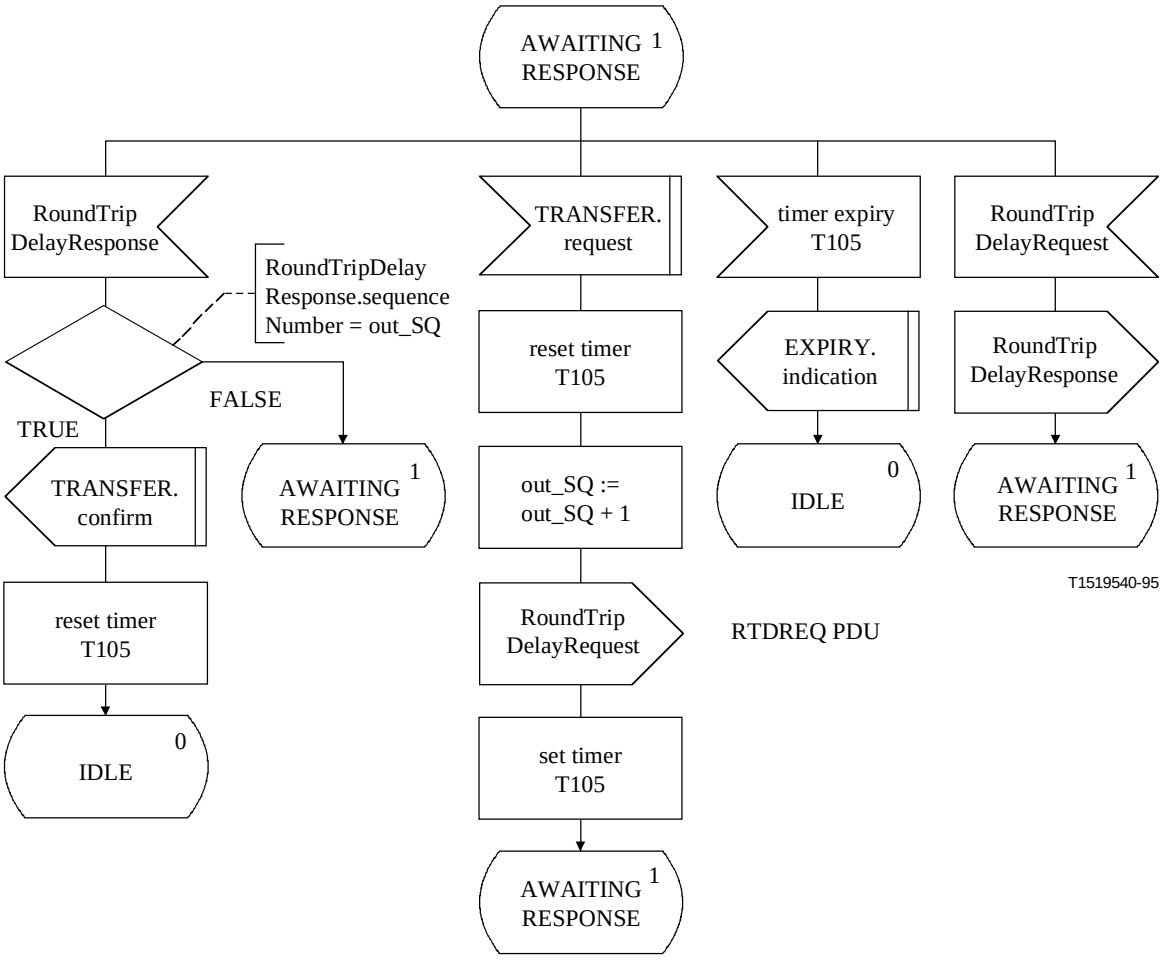


Figure 42 ii)/H.245 – RTDSE SDL

8.11 Maintenance Loop procedures

8.11.1 Introduction

The protocol specified here provides reliable operation of maintenance loops using acknowledged procedures.

The protocol specified here is referred to as the Maintenance Loop Signalling Entity (MLSE). Procedures are specified in terms of primitives at the interface between the MLSE and the MLSE user, and MLSE states. Protocol information is transferred to the peer MLSE via relevant messages defined in clause 6.

There is an outgoing MLSE and an incoming MLSE. At each of the outgoing and incoming sides there is one instance of the MLSE for each bi-directional logical channel, and one for the system loop. There is no connection between an incoming MLSE and an outgoing MLSE at one side, other than via primitives to and from the MLSE user. MLSE error conditions are reported.

The terminal that contains the incoming MLSE shall loop the appropriate data while it is in the LOOPED state, and not at any other time. The terminal that contains the outgoing MLSE shall be capable of receiving looped data while in any state, but while in the LOOPED state, should receive looped data only.

NOTE – The MaintenanceLoopOffCommand message applies to all MLSEs. It is always used to stop all maintenance loops.

The following text provides an overview of the operation of the MLSE protocol. In the case of discrepancy between this and the formal specification, the formal specification will supersede.

8.11.1.1 Protocol overview – Outgoing

The establishment of a maintenance loop is initiated when the LOOP.request primitive is issued by the user at the outgoing MLSE. An MaintenanceLoopRequest message is sent to the peer incoming MLSE, and timer T102 is started. If an MaintenanceLoopAck message is received in response to the MaintenanceLoopRequest message, then timer T102 is stopped and the user is informed with the LOOP.confirm primitive that the maintenance loop has been successfully established. If however an MaintenanceLoopReject message is received in response to the MaintenanceLoopRequest message, then timer T102 is stopped and the user is informed with the RELEASE.indication primitive that the peer MLSE user has refused establishment of the maintenance loop.

If timer T102 expires in this period, then the user is informed with the RELEASE.indication primitive, and a MaintenanceLoopOffCommand message is sent to the peer incoming MLSE. This will cancel all maintenance loops, and not just the one concerned with the particular MLSE.

A maintenance loop that has been successfully established may be cancelled when the RELEASE.request primitive is issued by the user at the outgoing MLSE. A MaintenanceLoopOffCommand message is sent to the peer incoming MLSE.

Before either of the MaintenanceLoopAck or MaintenanceLoopReject messages have been received in response to a previously sent MaintenanceLoopRequest message, the user at the outgoing MLSE may cancel the maintenance loop using the RELEASE.request primitive.

8.11.1.2 Protocol overview – Incoming

When an MaintenanceLoopRequest message is received at the incoming MLSE, the user is informed of the request to establish a maintenance loop with the LOOP.indication primitive. The incoming MLSE user signals acceptance of the request to establish the maintenance loop by issuing the LOOP.response primitive, and an MaintenanceLoopAck message is sent to the peer outgoing MLSE. The maintenance loop shall now be performed. The incoming MLSE user signals rejection of the request to establish the maintenance loop by issuing the RELEASE.request primitive, and an MaintenanceLoopReject message is sent to the peer outgoing MLSE.

A maintenance loop that has been successfully established may be cancelled when the MaintenanceLoopOffCommand message is received at the incoming MLSE. The incoming MLSE user is informed with the RELEASE.indication primitive.

8.11.2 Communication between the MLSE and the MLSE user

8.11.2.1 Primitives between the MLSE and the MLSE user

Communication between the MLSE and the MLSE user is performed using the primitives shown in Table 57.

Table 57/H.245 – Primitives and parameters

Generic name	Type			
	Request	Indication	Response	Confirm
LOOP	LOOP_TYPE	LOOP_TYPE	– (Note 1)	–
RELEASE	CAUSE	SOURCE CAUSE	not defined (Note 2)	not defined
ERROR	not defined	ERRCODE	not defined	not defined
NOTE 1 – "–" means no parameters. NOTE 2 – "not defined" means that this primitive does not exist.				

8.11.2.2 Primitive definition

The definition of these primitives is as follows:

a) The LOOP primitives are used to establish a maintenance loop.

b) The RELEASE primitives are used to cancel a maintenance loop.

c) The ERROR primitive reports MLSE errors to a management entity.

8.11.2.3 Parameter definition

The definition of the primitive parameters shown in Table 57 are as follows:

a) The LOOP_TYPE parameter specifies the parameters associated with the maintenance loop. It has values of "SYSTEM", "MEDIA", and "LOGICAL_CHANNEL". This parameter, and the logical channel number, determine the value of the type field of the MaintenanceLoopRequest message which is then carried transparently to the peer MLSE user.

b) The SOURCE parameter indicates to the MLSE user the source of the maintenance loop release. The SOURCE parameter has the value of "USER" or "MLSE", indicating either the MLSE user, or the MLSE. The latter may occur as the result of a protocol error.

c) The CAUSE parameter indicates the reason as to why the peer MLSE user rejected a request to establish a maintenance loop. The CAUSE parameter is not present when the SOURCE parameter indicates "MLSE".

d) The ERRCODE parameter indicates the type of MLSE error. Table 61 shows the allowed values of the ERRCODE parameter.

8.11.2.4 MLSE states

The following states are used to specify the allowed sequence of primitives between the MLSE and the MLSE user, and the exchange of messages between peer MLSEs. The states are specified separately for each of an outgoing MLSE and an incoming MLSE. The states for an outgoing MLSE are:

State 0: NOT LOOPED

There is no maintenance loop.

State 1: AWAITING RESPONSE

The outgoing MLSE is waiting to establish a maintenance loop with a peer incoming MLSE.

State 2: LOOPED

The MLSE peer-to-peer maintenance loop has been established. All data received on the appropriate channel should be looped data.

The states for an incoming MLSE are:

State 0: NOT LOOPED

There is no maintenance loop.

State 1: AWAITING RESPONSE

The incoming MLSE is waiting to establish a maintenance loop with a peer outgoing MLSE. The appropriate data shall not be looped.

State 2: LOOPED

An MLSE peer-to-peer maintenance loop has been established. All data received on the appropriate channel shall be looped.

8.11.2.5 State transition diagram

The allowed sequence of primitives between the MLSE and the MLSE user is defined here. The allowed sequence of primitives relates to states of the MLSE as viewed from the MLSE user. The allowed sequences are specified separately for each of an outgoing MLSE and an incoming MLSE, as shown in Figures 43 and 44 respectively.

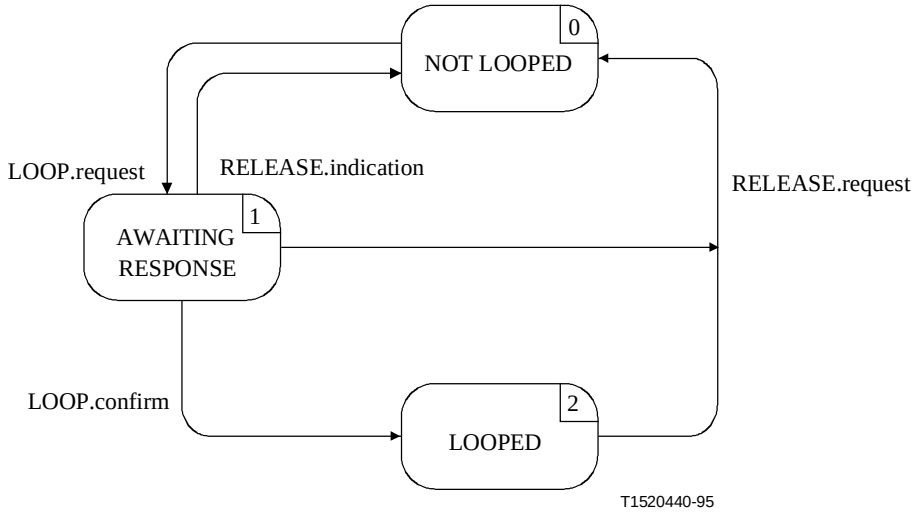


Figure 43/H.245 – State transition diagram for sequence of primitives at outgoing MLSE

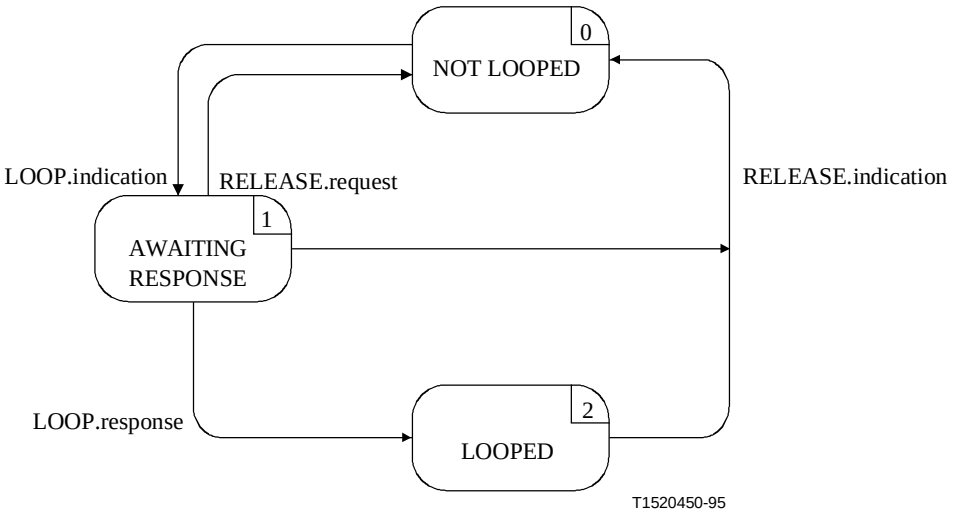


Figure 44/H.245 – State transition diagram for sequence of primitives at incoming MLSE

8.11.3 Peer-to-peer MLSE communication

8.11.3.1 MLSE messages

Table 58 shows the MLSE messages and fields, defined in clause 6, which are relevant to the MLSE protocol.

Table 58/H.245 – MLSE message names and fields

Function	Message	Direction	Field
establish	MaintenanceLoopRequest	O → I	type
	MaintenanceLoopAck	O ← I	type
	MaintenanceLoopReject	O ← I	type cause
release	MaintenanceLoopOffCommand	O → I	–
O Outgoing I Incoming			

8.11.3.2 MLSE state variables

The following state variable is defined at the outgoing MLSE:

out_MLN

This state variable distinguishes between outgoing MLSEs. It is initialized at outgoing MLSE initialization. The value of out_MLN is used to set the type field of MaintenanceLoopRequest messages sent from an outgoing MLSE.

The following state variable is defined at the incoming MLSE:

in_MLN

This state variable distinguishes between incoming MLSEs. It is initialized at incoming MLSE initialization. For MaintenanceLoopRequest messages received at an incoming MLSE, the message type field value is consistent with the value of in_MLN.

in_TYPE

This state variable stores the value of LOOP_TYPE when the MaintenanceLoopRequest is received. This state variable assists in setting the value of the type field in the MaintenanceLoopAck message.

8.11.3.3 MLSE timers

The following timer is specified for the outgoing MLSE:

T102

This timer is used during the AWAITING RESPONSE state. It specifies the maximum allowed time during which no MaintenanceLoopAck or MaintenanceLoopReject message may be received.

8.11.4 MLSE procedures

8.11.4.1 Introduction

Figure 45 summarizes the primitives and their parameters, and the messages, for each of the outgoing and incoming MLSE.

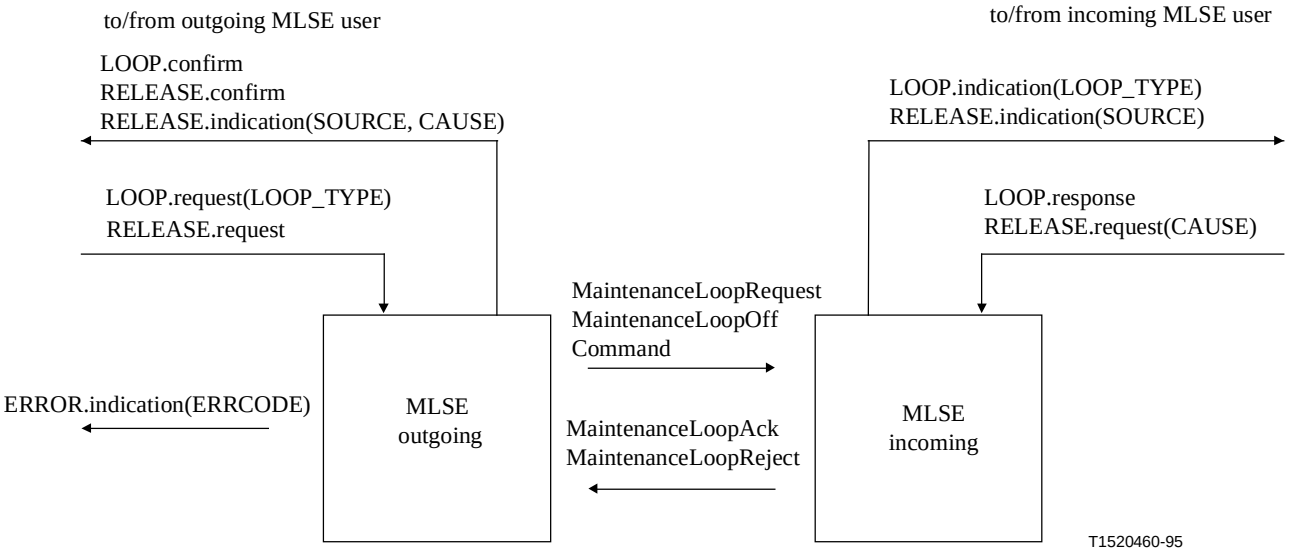


Figure 45/H.245 – Primitives and messages in the maintenance loop signalling entity

8.11.4.2 Primitive parameter default values

Where not explicitly stated in the SDL diagrams the parameters of the indication and confirm primitives assume values as shown in Table 59.

Table 59/H.245 – Default primitive parameter values

Primitive	Parameter	Default value (Note)
LOOP.indication	LOOP_TYPE	MaintenanceLoopRequest.type
RELEASE.indication	SOURCE	USER
	CAUSE	MaintenanceLoopReject.cause
NOTE – A primitive parameter shall be coded as null if an indicated message field is not present in the message.		

8.11.4.3 Message field default values

Where not explicitly stated in the SDL diagrams the message fields assume values as shown in Table 60.

Table 60/H.245 – Default message field values

Message	Field	Default value (Note 1)
MaintenanceLoopRequest	type	LOOP.request(LOOP_TYPE) and out_MLN (Note 2)
MaintenanceLoopAck	type	in_LOOP and in_MLN (Note 3)
MaintenanceLoopReject	type cause	in_LOOP and in_MLN (Note 3) RELEASE.request(CAUSE)
MaintenanceLoopOffCommand	–	–
NOTE 1 – A message field shall not be coded if the corresponding primitive parameter is null, i.e. not present. NOTE 2 – The value of the type field is derived from the LOOP_TYPE parameter and the logical channel number. NOTE 3 – The value of the type field is derived from the in_LOOP and in_MLN state variables.		

8.11.4.4 ERRCODE parameter values

The ERRCODE parameter of the ERROR.indication primitive indicates a particular error condition. Table 61 shows the values that the ERRCODE parameter may take at the outgoing MLSE. There is no ERROR.indication primitive associated with the incoming MLSE.

Table 61/H.245 – ERRCODE parameter values at outgoing MLSE

Error type	Error code	Error condition	State
inappropriate message	A	MaintenanceLoopAck	LOOPED
no response from peer MLSE	B	timer T102 expiry	AWAITING RESPONSE

8.11.4.5 SDLs

The outgoing MLSE and the incoming MLSE procedures are expressed in SDL form in Figures 46 and 47 respectively.

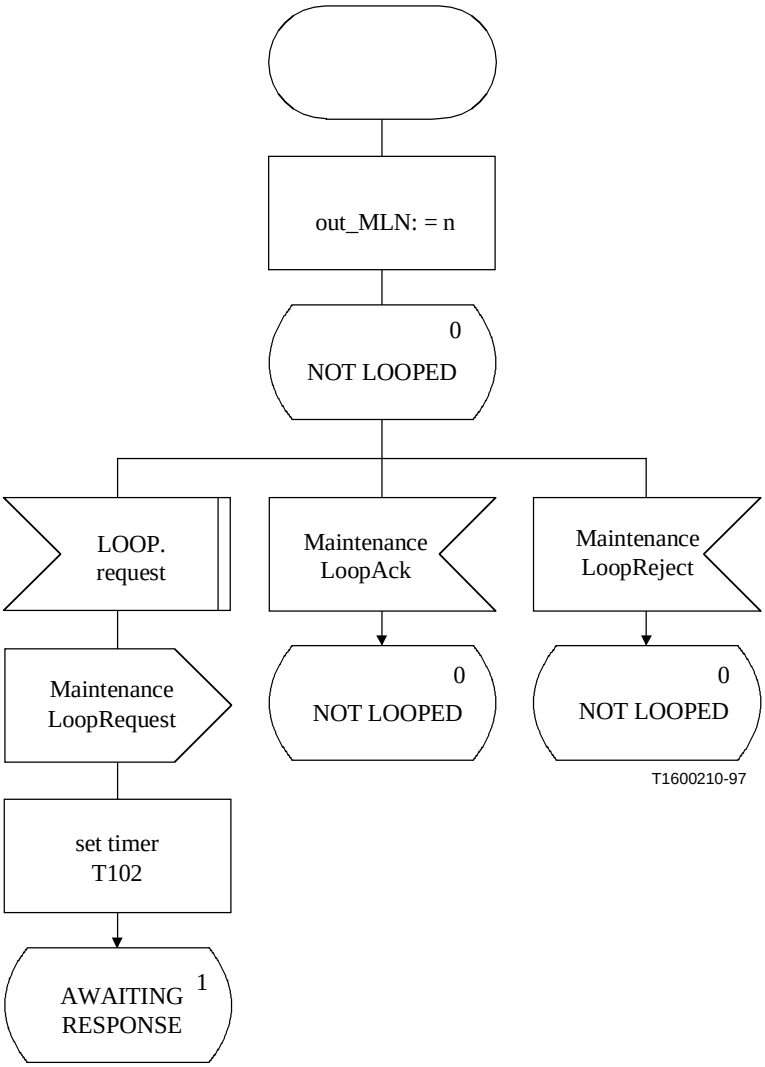


Figure 46 i)/H.245 – Outgoing MLSE SDL

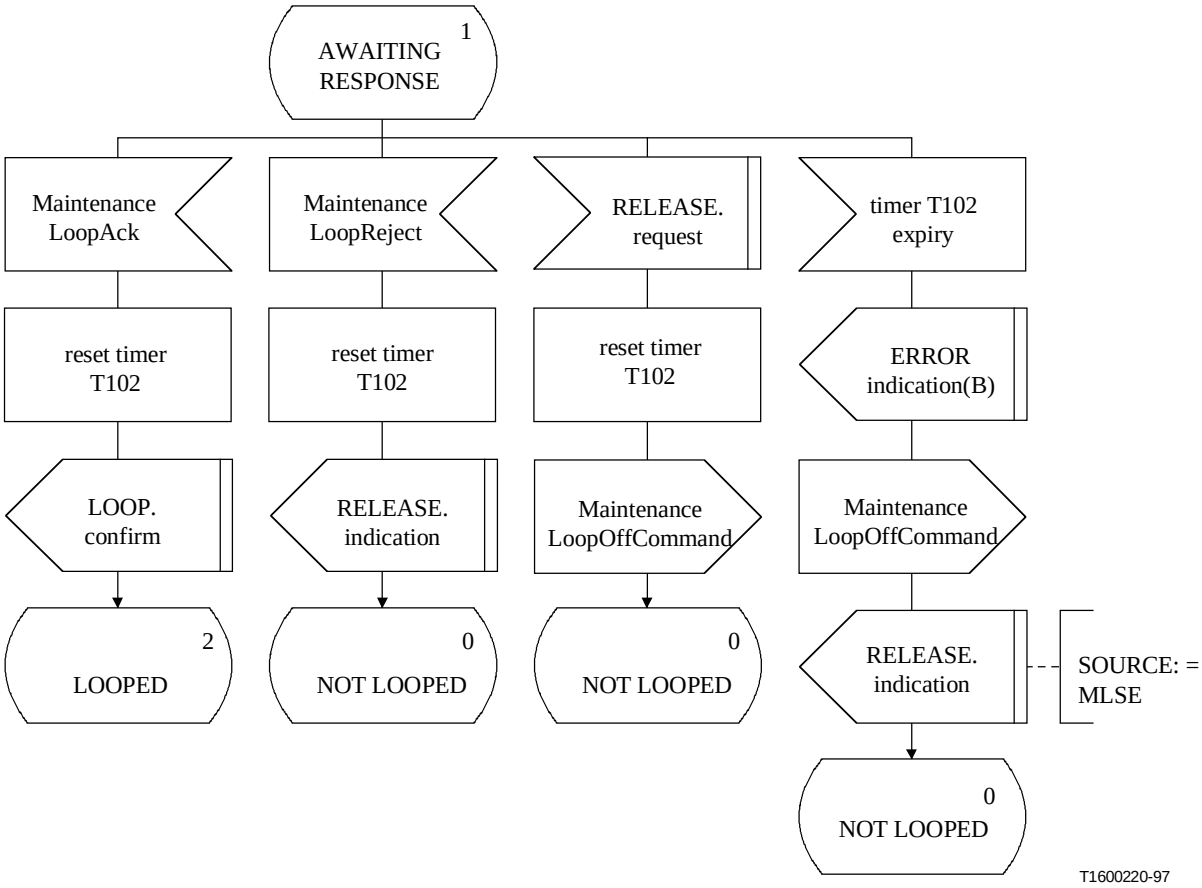


Figure 46 ii)/H.245 – Outgoing MLSE SDL

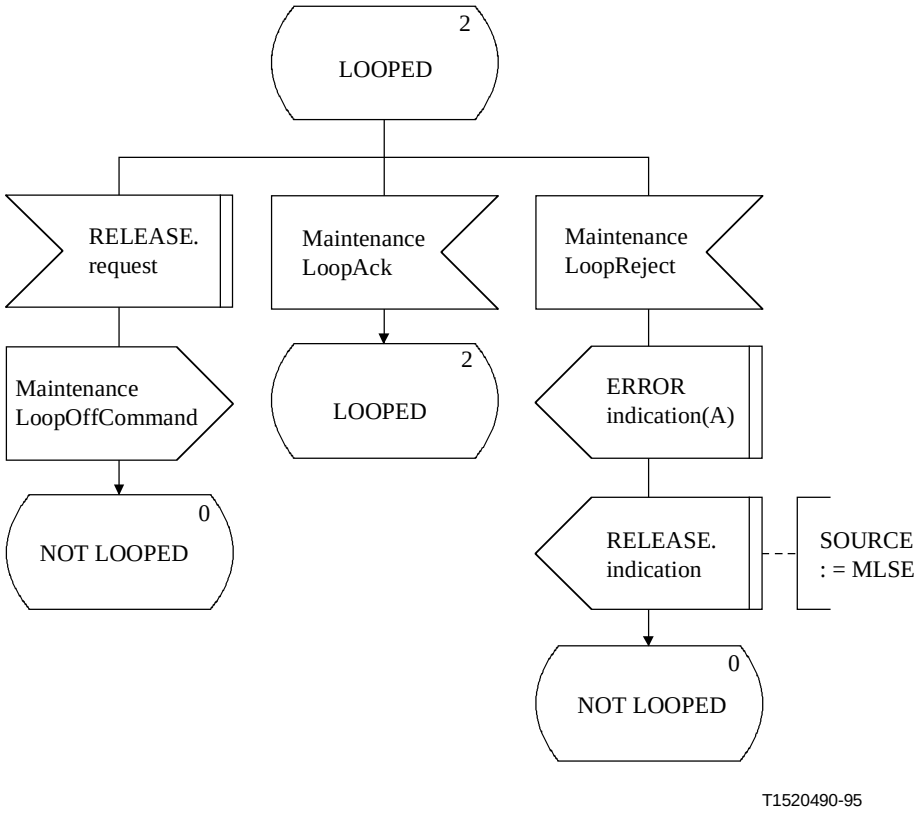


Figure 46 iii)/H.245 – Outgoing MLSE SDL

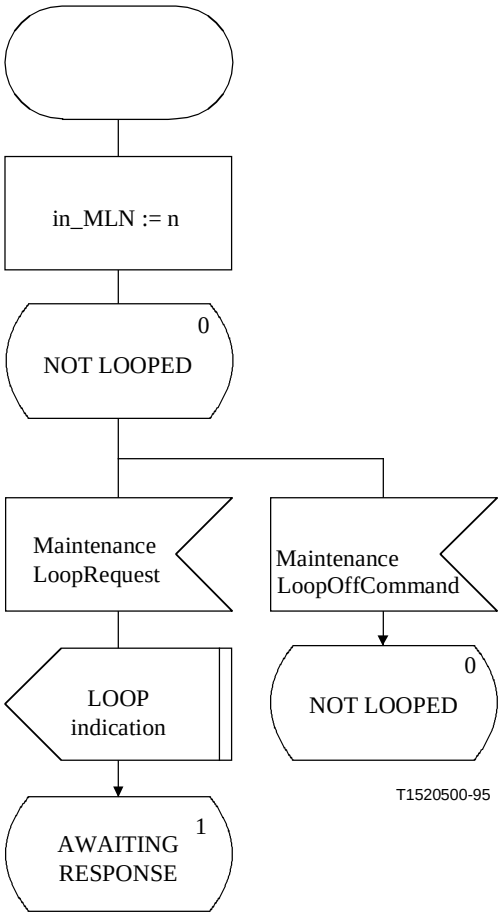


Figure 47 i)/H.245 – Incoming MLSE SDL

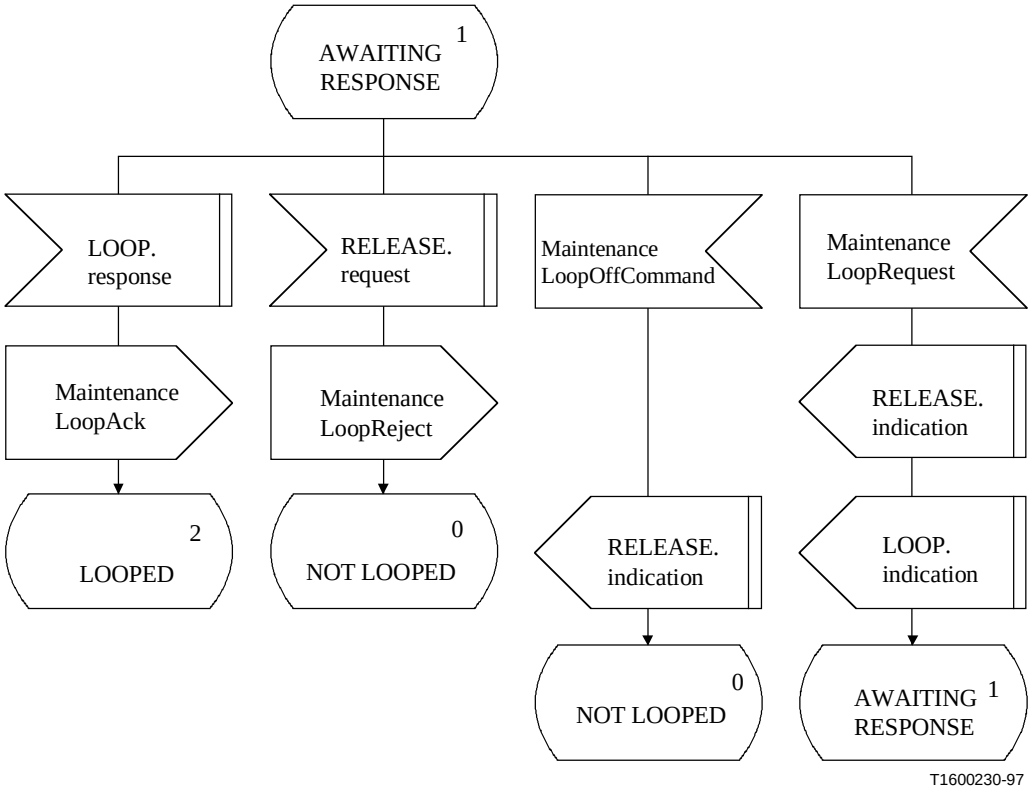


Figure 47 ii)/H.245 – Incoming MLSE SDL

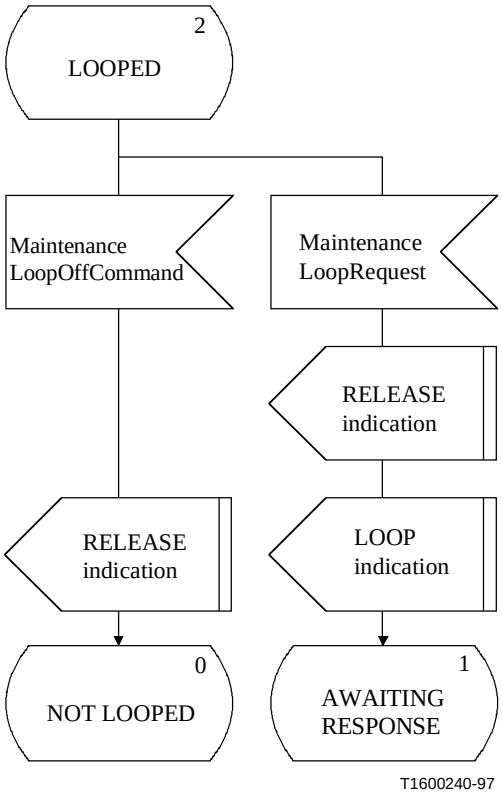


Figure 47 iii)/H.245 – Incoming MLSE SDL

ANNEX A

Object identifier assignments

Table A.1 lists the assignment of Object Identifiers defined for use by this Recommendation.

Table A.1

Object Identifier Value	Description
{itu-t (0) recommendation (0) h (8) 245 version (0) 1}	This Object Identifier is used to indicate the version of this Recommendation in use as a multimedia system control protocol. This indicates the first version of this Recommendation.
{itu-t (0) recommendation (0) h (8) 245 version (0) 2}	This Object Identifier is used to indicate the version of this Recommendation in use as a multimedia system control protocol. At this time there are two standardized versions defined. This indicates the second version of this Recommendation.

APPENDIX I

Overview of ASN.1 syntax

I.1 Introduction to ASN.1

Abstract Syntax Notation One (ASN.1) is a data specification language. It was originally standardized as part of the X.400 electronic mail series as X.409. This evolved to X.208 and most recently X.680. ASN.1 allows unambiguous specification of complex data structures including those with variable-length fields, optional fields and recursion.

The above Recommendations deal only with the syntax and semantics of ASN.1 specifications. The binary encoding of data structures is covered in other Recommendations, notably X.690 (Basic Encoding Rules or BER) and X.691 (Packed Encoding Rules or PER). BER allows data to be deciphered by systems that have general knowledge of ASN.1 but do not know the details of the specification used to form the data. In other words, the data types are encoded along with the data values. PER is much more efficient since only data values are encoded and the coding is designed with very little redundancy. This method can be used when both the transmitter and the receiver expect data to adhere to a known structure.

This Recommendation is implemented using the packed encoding rules. Since both sides of a call know that messages will conform to the H.245 specification, it is not necessary to encode that specification into the messages. For decoding simplicity, the aligned variant of PER is used. This forces fields that require eight or more bits to be aligned on octet boundaries and to consume an integral number of octets. Alignment is done by padding the data with zeros before large fields.

I.2 Basic ASN.1 data types

The simplest data type is BOOLEAN, which represents the values FALSE and TRUE. These are encoded in a single bit as 0 and 1 respectively. For example, **segmentableFlag BOOLEAN** is coded

Value	Encoding
FALSE	0
TRUE	1

The most fundamental data type is INTEGER, which represents whole number values. Integers can be unconstrained as in:

bitRate INTEGER

or they can be constrained to a range of values, for example:

maximumAl2SDUSize INTEGER (0..65535)

Constrained integers are encoded differently depending on the size of the range. Suppose N is the number of integers in the range, i.e. the upper limit minus the lower limit plus one. Depending on N, the constrained integer will be encoded in one of five ways:

N	Encoding
1	No bits needed
2-255	An unaligned field of 1 to 8 bits
256	An aligned 8-bit field
257-65536	An aligned 16-bit field
Larger	As the minimum number of aligned octets preceded by the above encoding of the number of octets

In all cases, the number that is actually used is the value to be encoded minus the lower limit of the range. In these examples "pad" represents zero to seven 0 bits that are added to the encoding so that the following field will start on a 8-bit boundary.

firstGOB INTEGER (0..17)

Value	Encoding
0	00000
3	00011

h233IVResponseTime INTEGER (0..255)

Value	Encoding
3	pad 00000011
254	pad 11111110

skew INTEGER (0..4095)

Value	Encoding
3	pad 00000000 00000011
4095	pad 00001111 11111111

Unconstrained (2's complement) integer values that can be represented in 127 octets or less are encoded in the minimum number of octets needed. The number of octets (the length) is encoded as an aligned octet that precedes the number itself. For example,

–1	pad 00000001 11111111
0	pad 00000001 00000000
128	pad 00000010 00000000 10000000
1000000	pad 00000011 00001111 01000010 01000000

ASN.1 supports a variety of string data types. These are variable-length lists of bits, octets or other short data types. They are typically encoded as a length followed by the data. The length can be encoded as an unconstrained integer or as a constrained integer if the SIZE of the string is specified. For example,

data OCTET STRING

Since the length of the octet string is not bounded, it will have to be encoded as a *semi-constrained whole number* (has a lower bound, but no upper bound). First, the data is padded so that the encoding will be aligned. The rest of the code is as follows:

Length	Encoding
0 to 127	8-bit length followed by the data
128 to 16K-1	16-bit length with the MSB set, then the data
16K to 32K-1	11000001, 16K octets of data, then code the rest
32K to 48K-1	11000010, 32K octets of data, then code the rest
48K to 64K-1	11000011, 48K octets of data, then code the rest
64K or more	11000100, 64K octets of data, then code the rest

This method is called "fragmentation". Note that if the length is a multiple of 16K, then the representation will end with an octet of zero indicating a zero-length string.

I.3 Aggregate data types

ASN.1 includes several aggregate or container data types that are similar in concept to C's union, struct and array types. These are, respectively, CHOICE, SEQUENCE and SEQUENCE OF. In all cases they are encoded with some bits specific to the container followed by the normal encodings of the contents.

CHOICE is used to select exactly one of a group of data types. For example:

```
VideoCapability                 ::= CHOICE
{
        nonStandard             NonStandardParameter,
        h261VideoCapability     H261VideoCapability,
        h262VideoCapability     H262VideoCapability,
        h263VideoCapability     H263VideoCapability,
        is11172VideoCapability  IS11172VideoCapability,
        ...
}
```

An index number is assigned to each choice, starting with zero. The index of the actual choice is encoded as a constrained integer. The index is followed by the encoding of the actual selection or nothing if the selection is **NULL**. If the extension marker is present (as above), the index is preceded by a bit that is zero if the actual choice is from the original list.

SEQUENCE is simply a grouping of dissimilar data types. Individual elements of the sequence may be OPTIONAL. The encoding is very simple. If there is an extension marker the first bit indicates the presence of additional elements. This is followed by a series of bits, one for each optional element that indicates if that data is present. This is followed by the encodings of the components of the sequence. For example:

```
H261VideoCapability                     ::= SEQUENCE
{
        qcifMPI                         INTEGER (1..4) OPTIONAL, -- units 1/29.97 Hz
        cifMPI                          INTEGER (1..4) OPTIONAL, -- units 1/29.97 Hz
        temporalSpatialTradeOffCapability BOOLEAN,
        ...
}
```

The encoding has one bit for the extension marker, two bits for the optional fields, two bits each for any optional field that is present, one bit for the boolean and then any extension data. Note that in this sequence has no padding for octet alignment.

The SEQUENCE OF and SET OF types describe a collection of similar components (an array). SEQUENCE OF implies that the order of the elements is significant, with SET OF the element order is arbitrary. The PER encoding is the same for both types.

These types can have a SIZE constraint or an unconstrained number of elements. If the number is known a priori and is less than 64K, it is not encoded. Otherwise the actual number of components is encoded as a constrained or semi-constrained length. This is followed by the encoding of the data. If the length is at least 16K and is encoded then the list of data will be broken into fragments like the octet string. In this case the fragments are broken after some number of component fields (16K, 32K, etc.), not after some number of octets.

I.4 Object identifier type

Normally, the type of a value is given in the ASN.1 specification so that the only information that needs to be coded and transmitted is the data itself. Occasionally, however, it is desirable to encode the data type as well as the data value. For example, **protocolIdentifier** contains

```
protocolIdentifier   OBJECT IDENTIFIER,
                     -- shall be set to the value
                     -- {itu-t (0) recommendation (0) h (8) 245 version (0) 1}
```

This is encoded as the data encoded with the BER (X.690) preceded by the length of that encoding in octets. The length is encoded as a semi-constrained whole number (see the OCTET STRING example above).The following illustrates how this is encoded.

The first octet indicates the length of the encoding that follows.

The first two components of the object identifier are combined together as 40*first one + second one, in this case 40*0+0 = 0. The others are encoded as they are. Each is encoded into a series of octets, the first bit of which indicates whether there is any more. So:

$0 \rightarrow$ 0000 0000,

$8 \rightarrow$ 0000 0100,

while 245, being more than 127 becomes 1000 0001 0111 0101,

So the entire encoding in hexadecimal consists of the seven octets 06000881 750001.

APPENDIX II

Examples of H.245 procedures

II.1 Introduction

This appendix illustrates examples of the procedures defined in clause 8. Figure II.1-1 shows the key to diagrams used in this appendix.

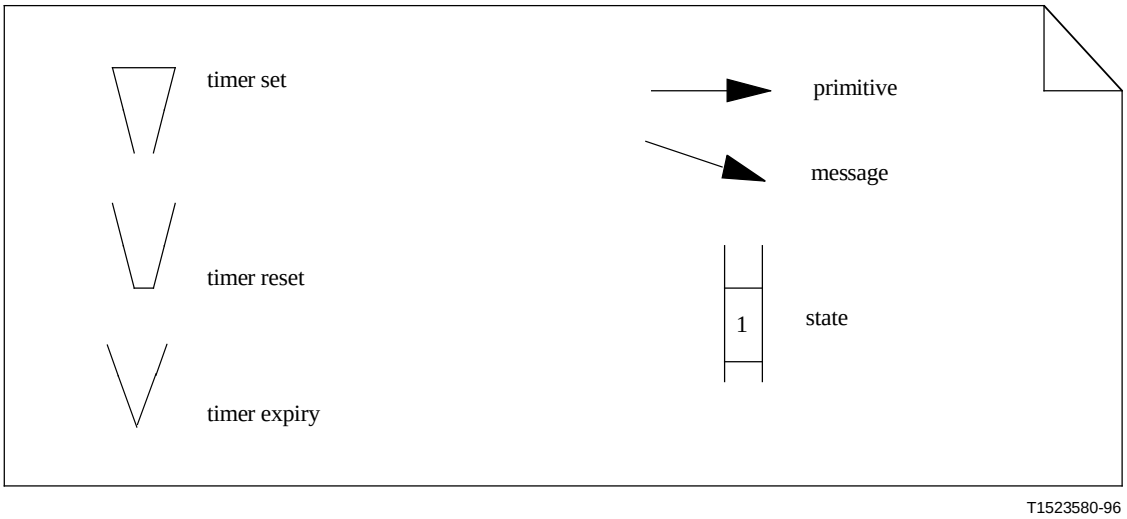


Figure II.1-1 – Key to figures

II.2 Master Slave Determination Signalling Entity

In the following figures, messages are represented by the shortened names given in Table II.2-1.

Table II.2-1/H.245 – Master slave determination shortened names

Message	Name in examples
MasterSlaveDetermination	MSD
MasterSlaveDeterminationAck	MSDAck
MasterSlaveDeterminationReject	MSDReject
MasterSlaveDeterminationRelease	MSDRelease

In Figures II.2-1 to II.2-5, IDLE, OUTGOING AWAITING RESPONSE, and INCOMING AWAITING RESPONSE states are labelled as "0", "1", and "2" respectively.

In Figures II.2-1 to II.2-5, the parameter value associated with the DETERMINE.indication and DETERMINE.confirm primitives is that of the TYPE parameter. The field value associated with the MasterSlaveDeterminationAck message is that of the decision field.

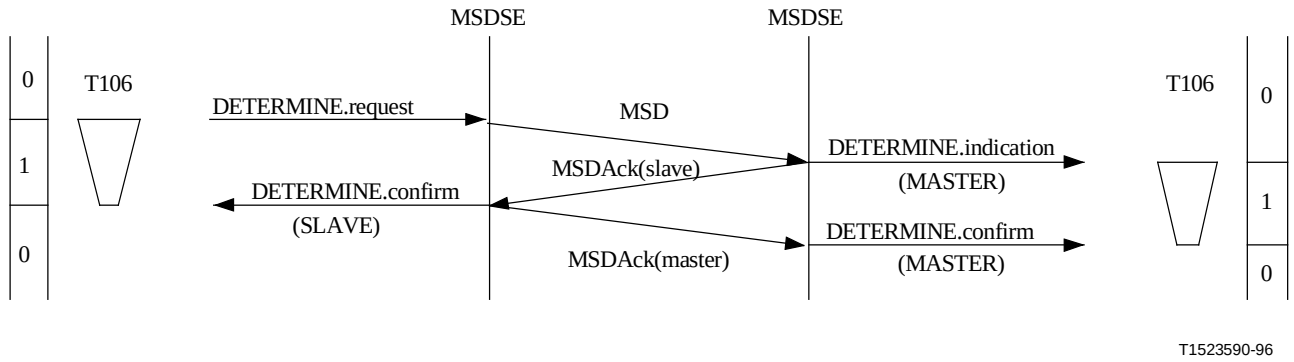


Figure II.2-1/H.245 – Master slave determination – Master at remote MSDSE

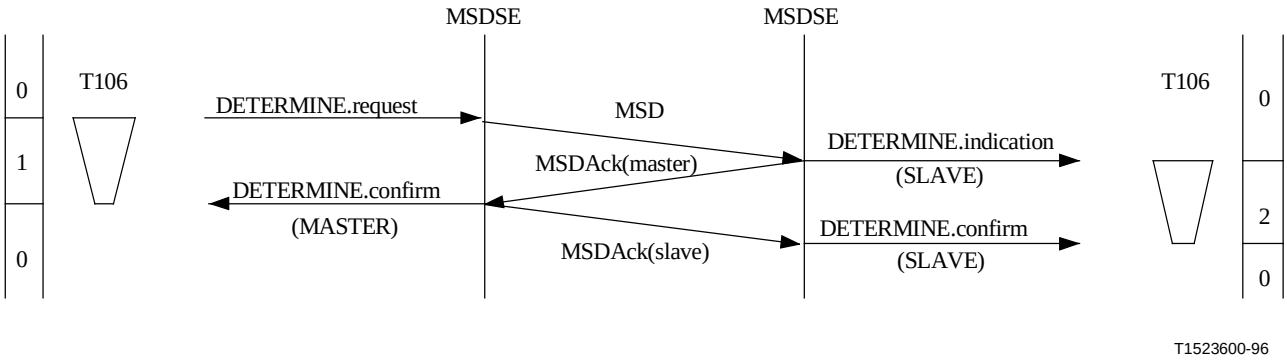


Figure II.2-2/H.245 – Master slave determination – Slave at remote MSDSE

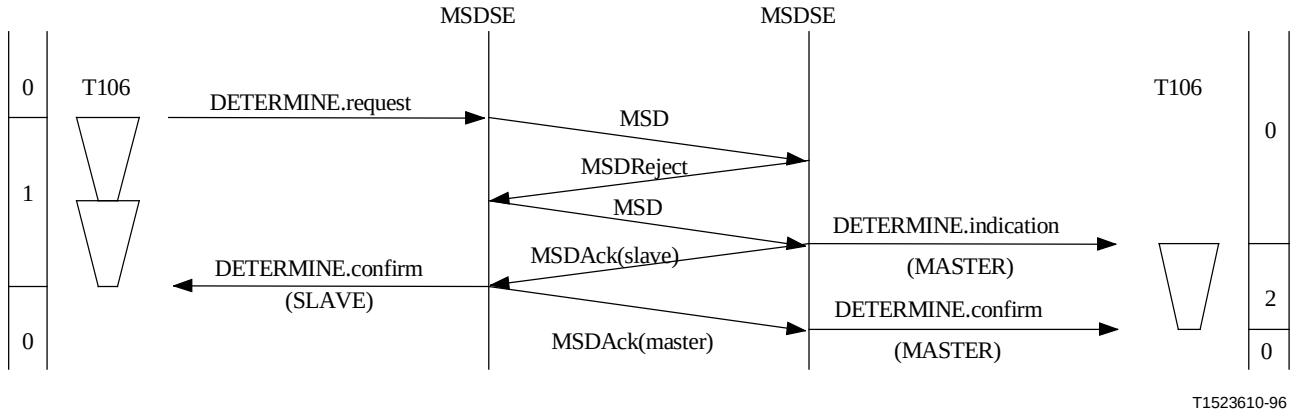


Figure II.2-3/H.245 – Master slave determination – First attempt produced an indeterminate result – The second attempt was successful

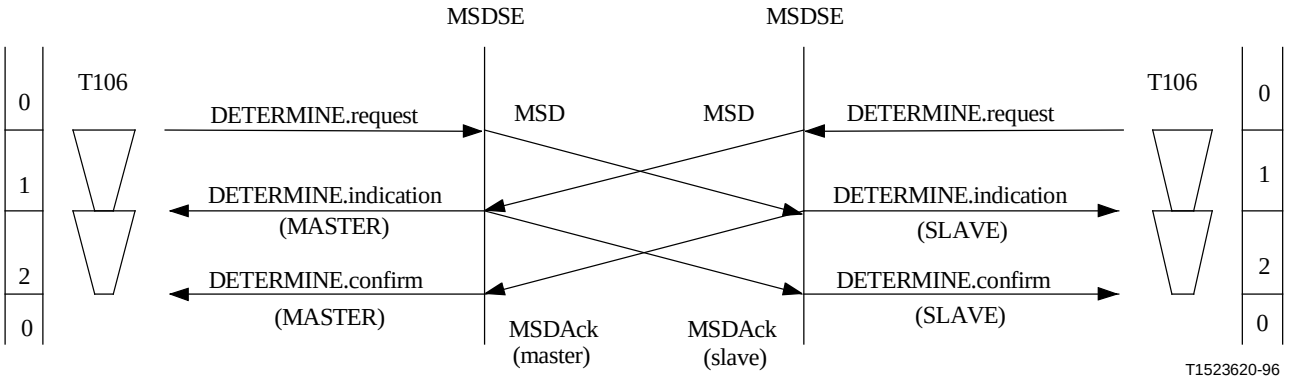


Figure II.2-4/H.245 – Master slave determination – Simultaneous determination

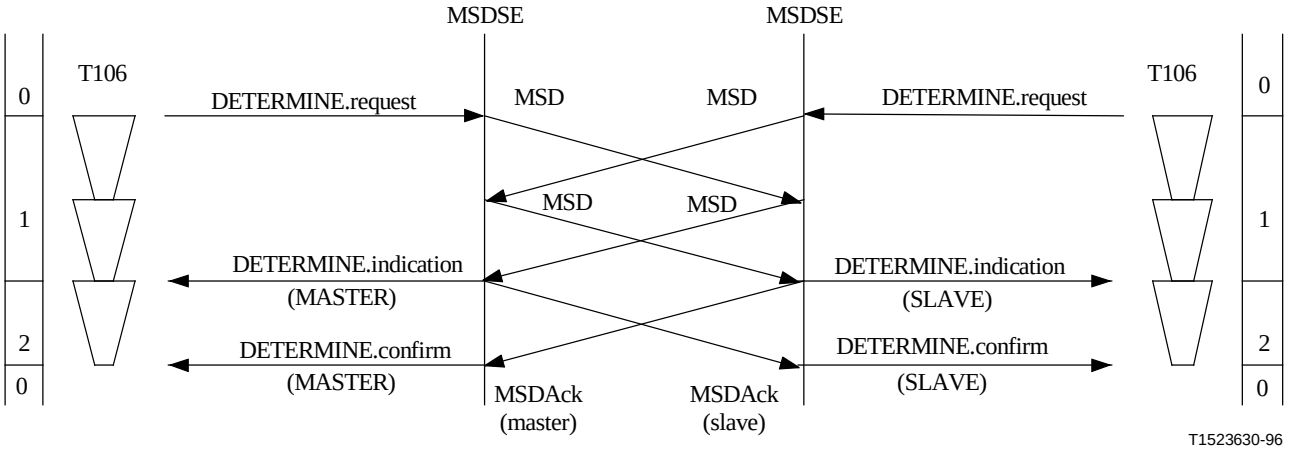


Figure II.2-5/H.245 – Master slave determination – Simultaneous determination but with the first attempt returning an indeterminate result

In Figure II.2-6, local timer T106 has expired. Only the terminal on the right knows its status. The terminal on the right is able to receive new commands but may not request anything of the other terminal that relies on knowledge of the status determination result. The terminal on the left can neither accept nor initiate new procedures. A second status determination procedure should be initiated.

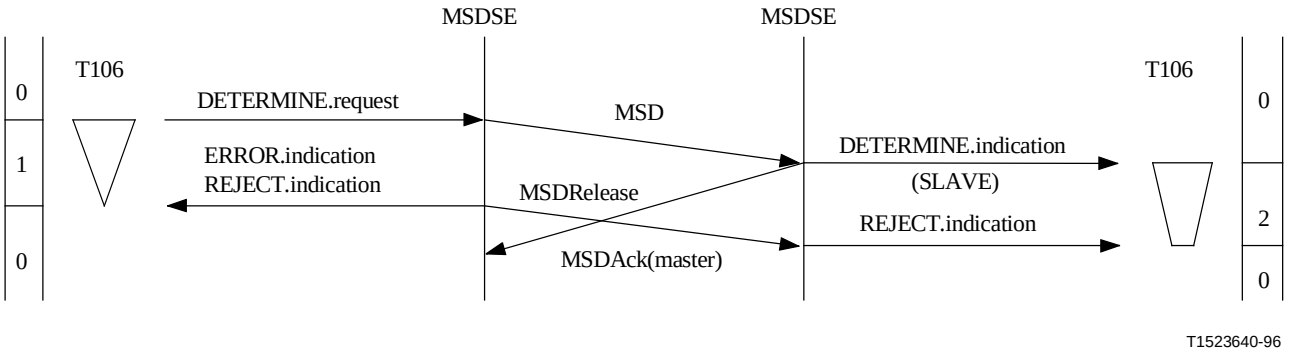


Figure II.2-6/H.245 – Master slave determination – local timer T106 expiry with slave at remote end

In Figure II.2-7, remote timer T106 has expired during the INCOMING AWAITING ACKNOWLEDGEMENT state. Both terminals know their status. The terminal on the left may receive and issue commands. However, the remote terminal does not know if the local terminal is ready to receive, and can not issue commands that rely on knowledge of the status determination result. A second status determination procedure should be initiated.

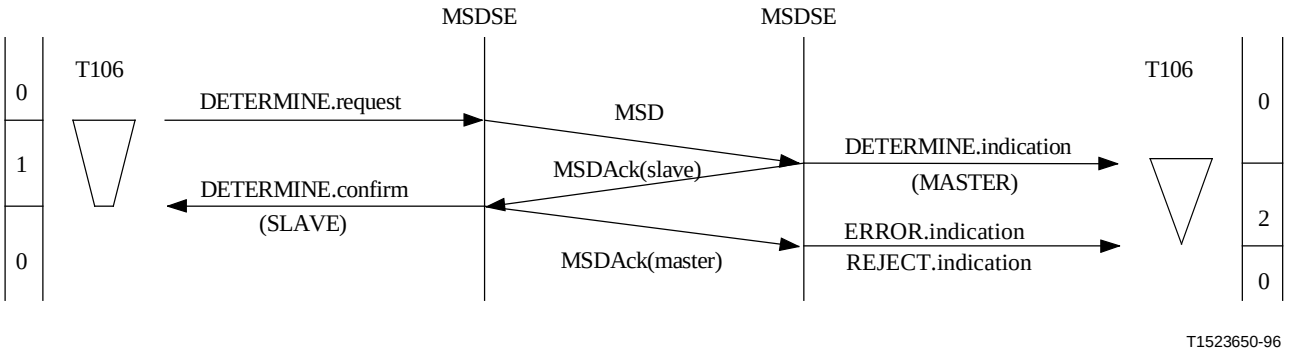


Figure II.2-7/H.245 – Master slave determination –
Remote timer T106 expiry with master at remote end

In Figure II.2-8, remote timer T106 has expired during the OUTGOING AWAITING ACKNOWLEDGEMENT state during a simultaneous determination procedure. Both terminals know their status. The terminal on the right can receive and issue commands. However, the terminal on the left does not know if the other terminal is ready to receive, and can not issue commands that rely on knowledge of the status determination result. It may receive such commands. A second status determination procedure should be initiated.

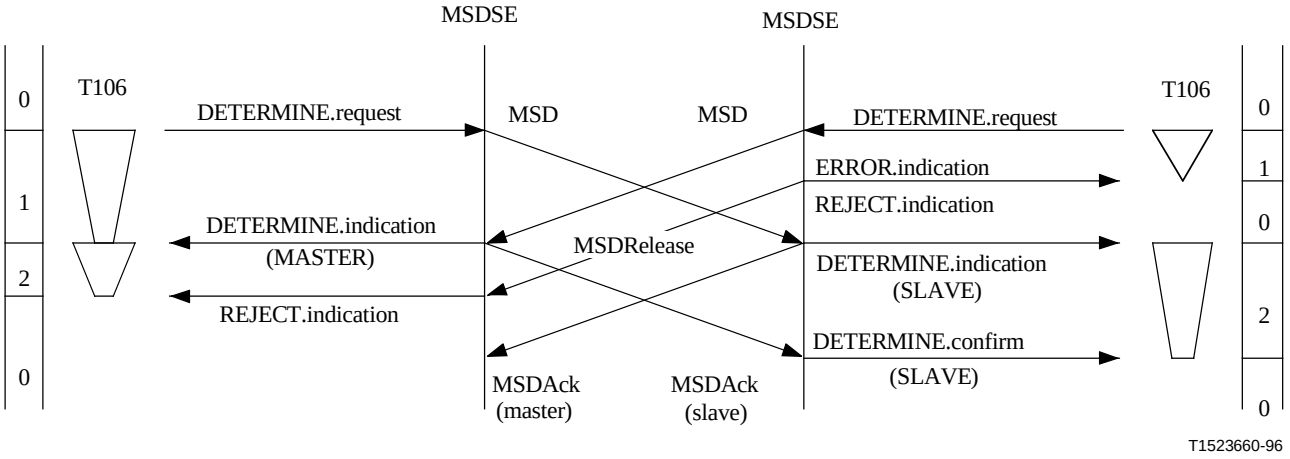


Figure II.2-8/H.245 – Master slave determination – Simultaneous determination procedures with timer T106 expiry at slave

In Figure II.2-9, remote timer T106 has expired during the INCOMING AWAITING ACKNOWLEDGEMENT state, during a simultaneous determination procedure. Both terminals know their status. The terminal on the left can receive and issue commands. However, the terminal on the right does not know if the other terminal is ready to receive, and can not issue commands that

rely on knowledge of the status determination result. It may receive such commands. A second status determination procedure should be initiated.

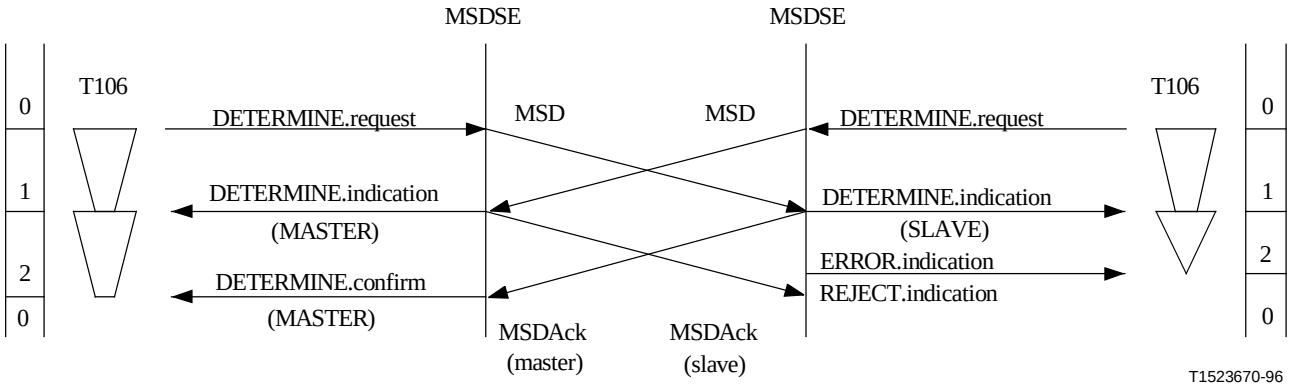


Figure II.2-9/H.245 – Master slave determination – Simultaneous determination procedures with timer T106 expiry during INCOMING AWAITING ACKNOWLEDGEMENT

In Figure II.2-10, an indeterminate result was obtained N100 times. In this case N100 = 3.

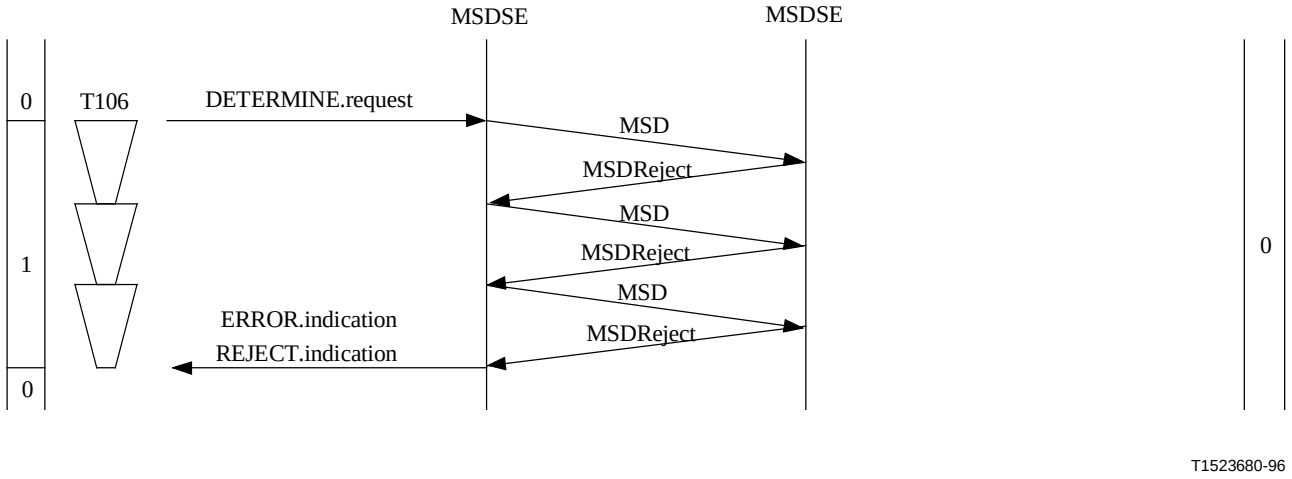


Figure II.2-10/H.245 – Master slave determination – Indeterminate result with N100 = 3

II.3 Capability Exchange Signalling Entity

Figures II.3-1 to II.3-4 illustrate CESE procedures. The IDLE and AWAITING RESPONSE states are labelled as "0" and "1" respectively.

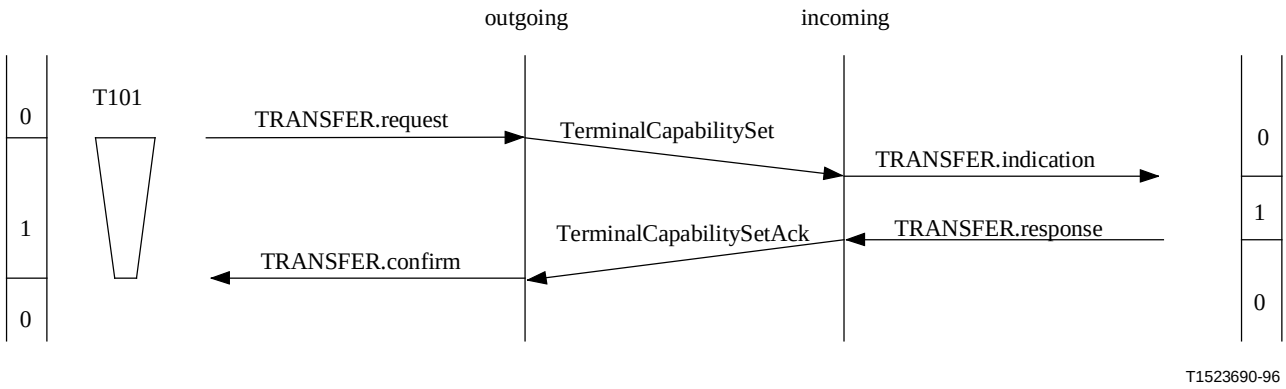


Figure II.3-1/H.245 – Capability exchange with acceptance from the peer incoming CESE user

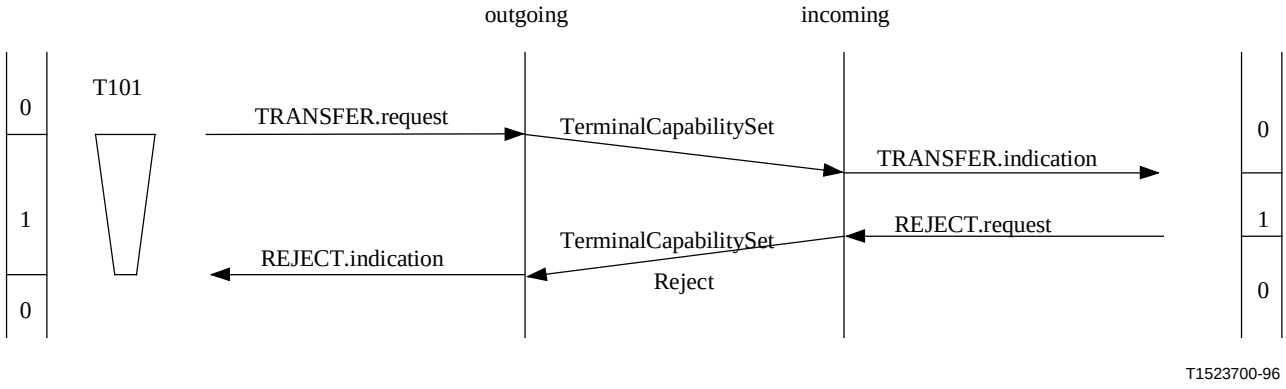


Figure II.3-2/H.245 – Capability exchange with rejection from peer incoming CESE user

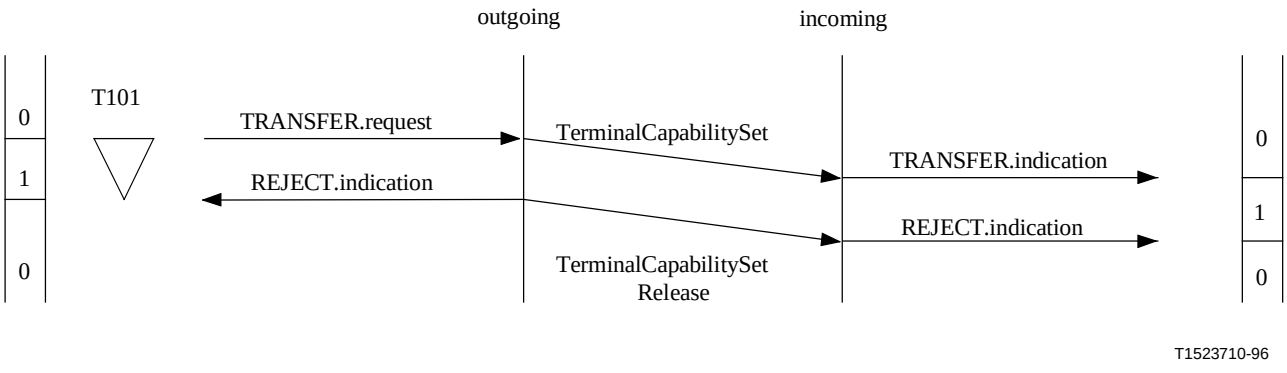


Figure II.3-3/H.245 – Capability exchange with timer T101 expiry – The TerminalCapabilitySetRelease message arrives at the incoming CESE before response from the incoming CESE user

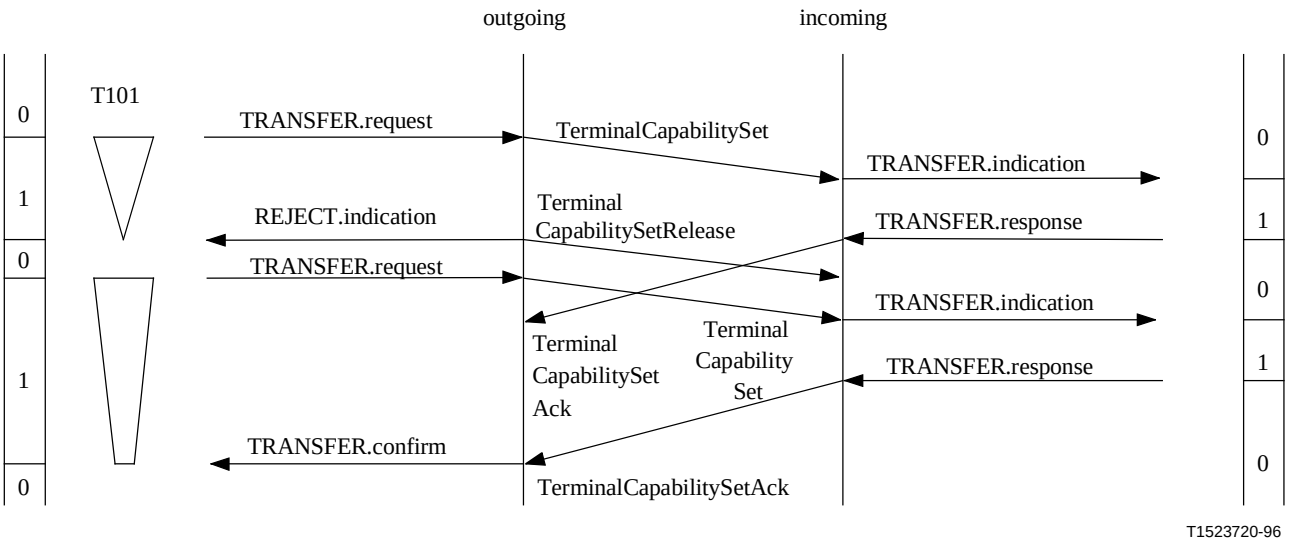


Figure II.3-4/H.245 – Capability exchange with timer T101 expiry followed by a second capability exchange – The TerminalCapabilitySetRelease message arrives at the incoming CESE after response from the incoming CESE user – At the outgoing CESE the TerminalCapabilitySetAck message in response to the first TerminalCapabilitySet message is ignored – Only the second capability exchange is successful

II.4 Logical Channel Signalling Entity

Figures II.4-1 to II.4-7 illustrate LCSE procedures. The outgoing LCSE states of RELEASED, AWAITING ESTABLISHMENT, ESTABLISHED, and AWAITING RELEASE are labelled as "0", "1", "2", and "3" respectively. The incoming LCSE states of RELEASED, AWAITING ESTABLISHMENT, and ESTABLISHED, are labelled as "0", "1", and "2" respectively.

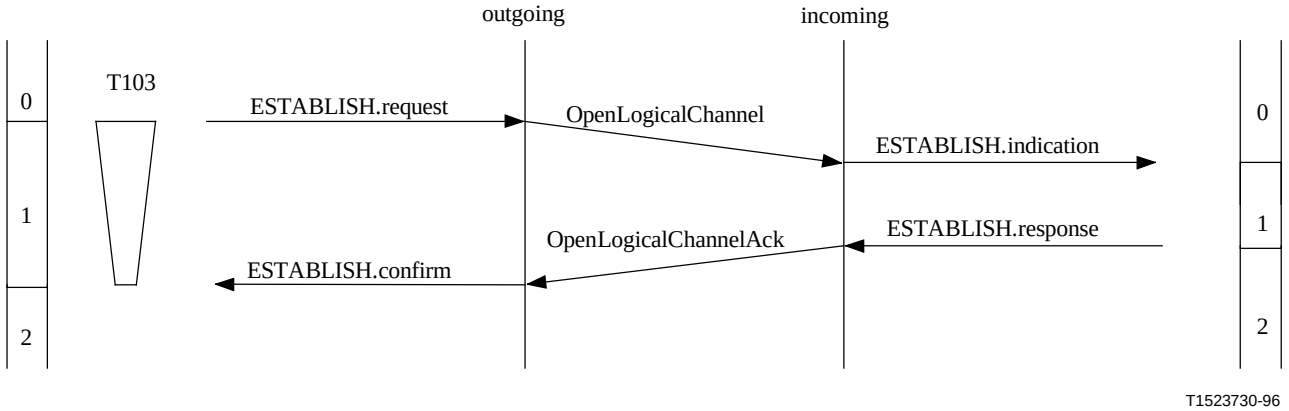


Figure II.4-1/H.245 – Logical channel establishment

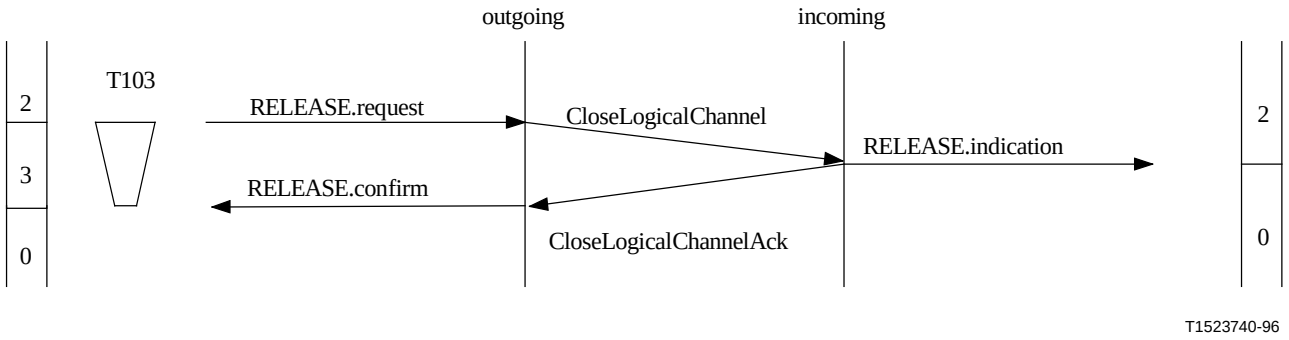


Figure II.4-2/H.245 – Logical channel release

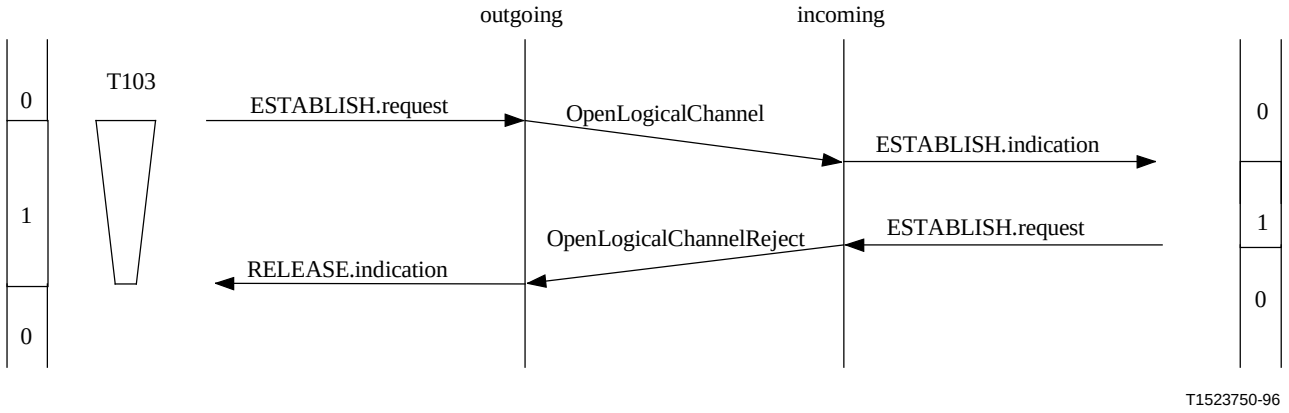


Figure II.4-3/H.245 – Logical channel establishment rejection by peer LCSE user

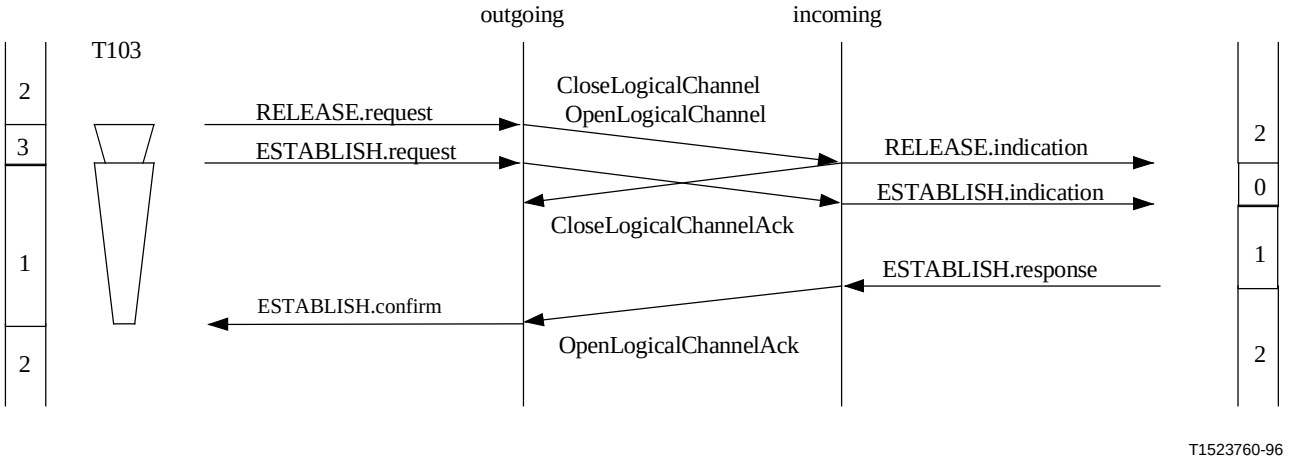


Figure II.4-4/H.245 – Logical channel release followed by immediate re-establishment

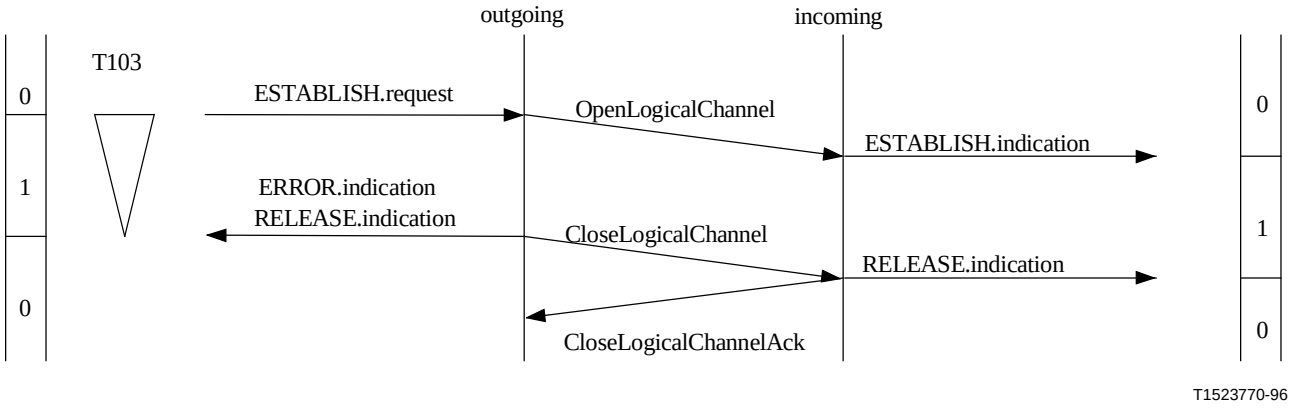


Figure II.4-5/H.245 – Logical channel establishment request with expiry of timer T103 due to slow response from peer incoming LCSE user

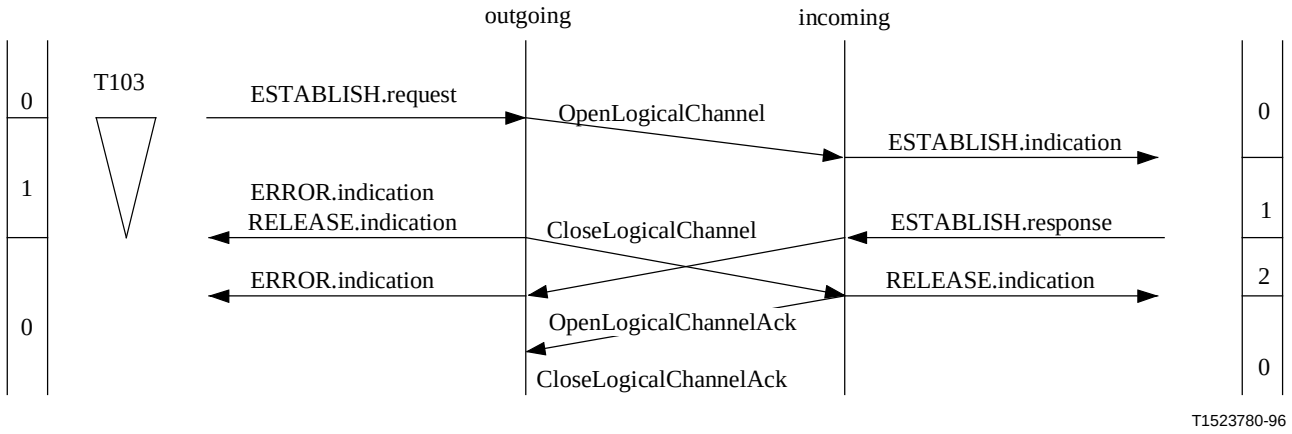


Figure II.4-6/H.245 – Logical channel establishment request with expiry of timer T103 – Timer T103 has expired after transmission of the OpenLogicalChannelAck message at the incoming LCSE, but before reception of the OpenLogicalChannelAck message at the outgoing LCSE

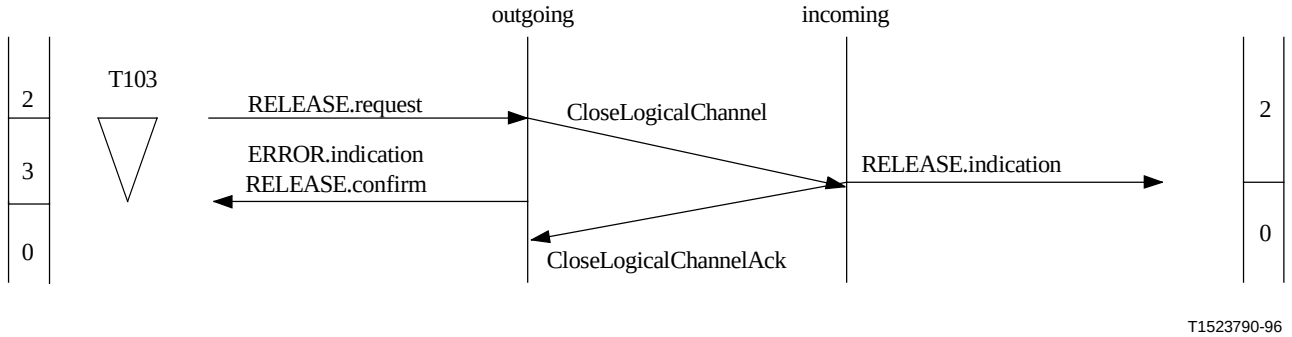


Figure II.4-7/H.245 – Logical channel release request with expiry of timer T103

II.5 Close Logical Channel Signalling Entity

Figures II.5-1 to II.5-4 illustrate CLCSE procedures. The IDLE and AWAITING RESPONSE states are labelled as "0" and "1" respectively.

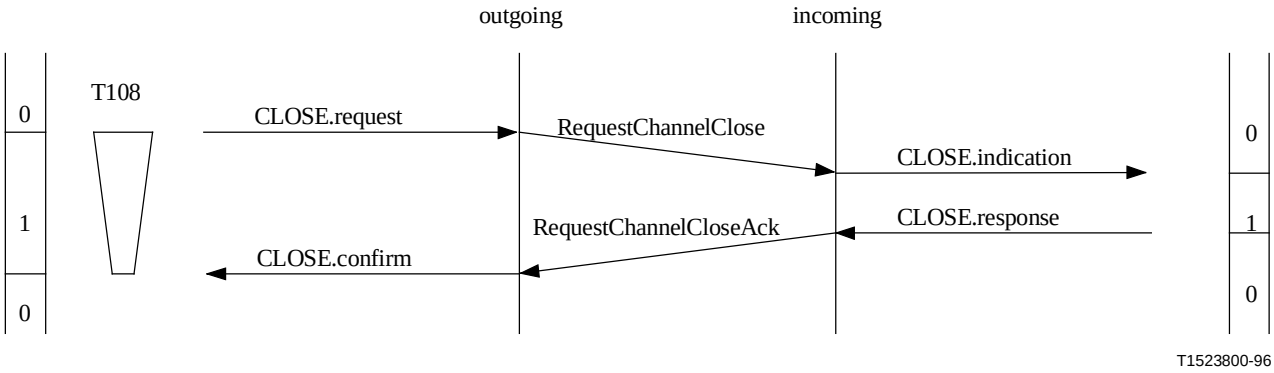


Figure II.5-1/H.245 – Close logical channel request

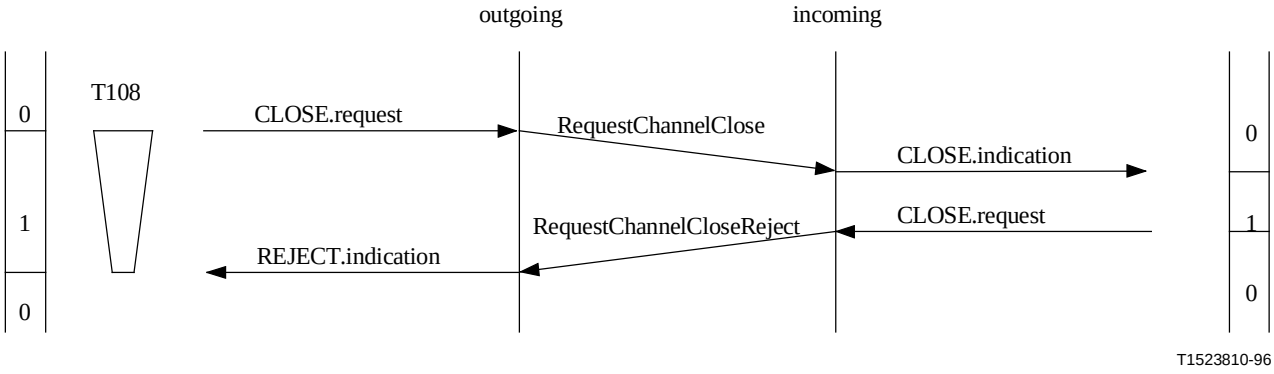


Figure II.5-2/H.245 – Close logical channel request with rejection from peer incoming CLCSE user

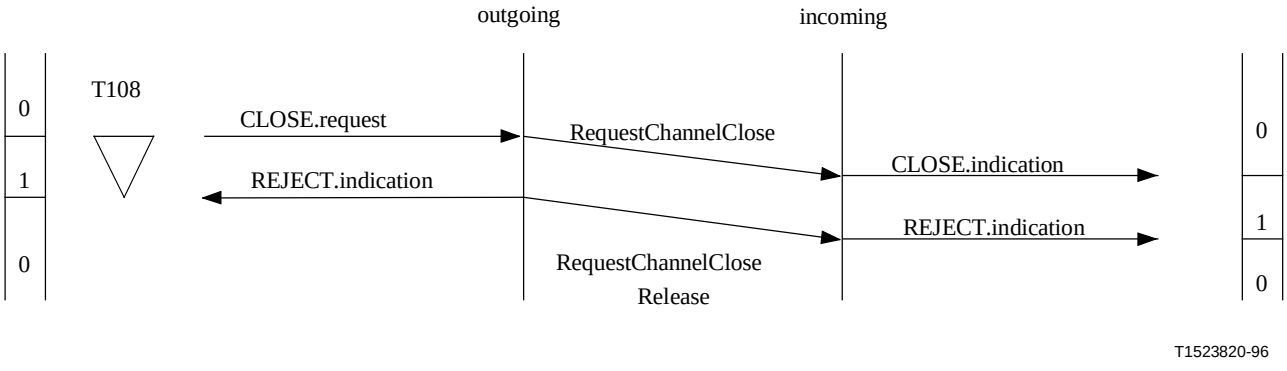


Figure II.5-3/H.245 – Close logical channel request with timer T108 expiry – The RequestChannelCloseRelease message arrives at the incoming CLCSE before response from the incoming CLCSE user

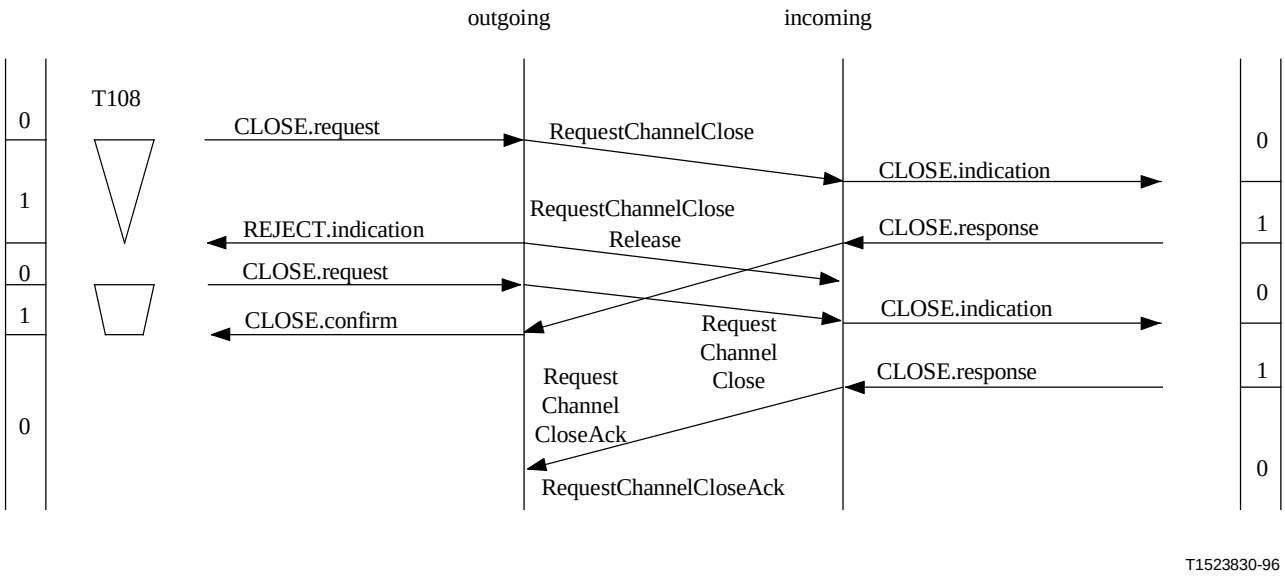


Figure II.5-4/H.245 – Close logical channel request with timer T108 expiry followed by a second close logical channel request – The close channel request is confirmed on reception of the first RequestChannelClose message

II.6 Multiplex Table Signalling Entity

Figures II.6-1 to II.6-5 illustrate MTSE procedures. The IDLE and AWAITING RESPONSE states are labelled as "0" and "1" respectively.

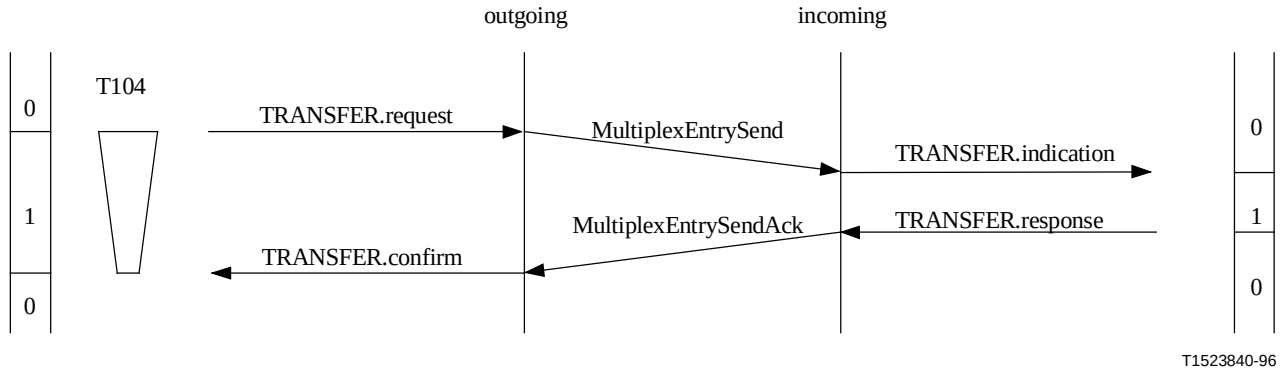


Figure II.6-1/H.245 – Successful multiplex table send request

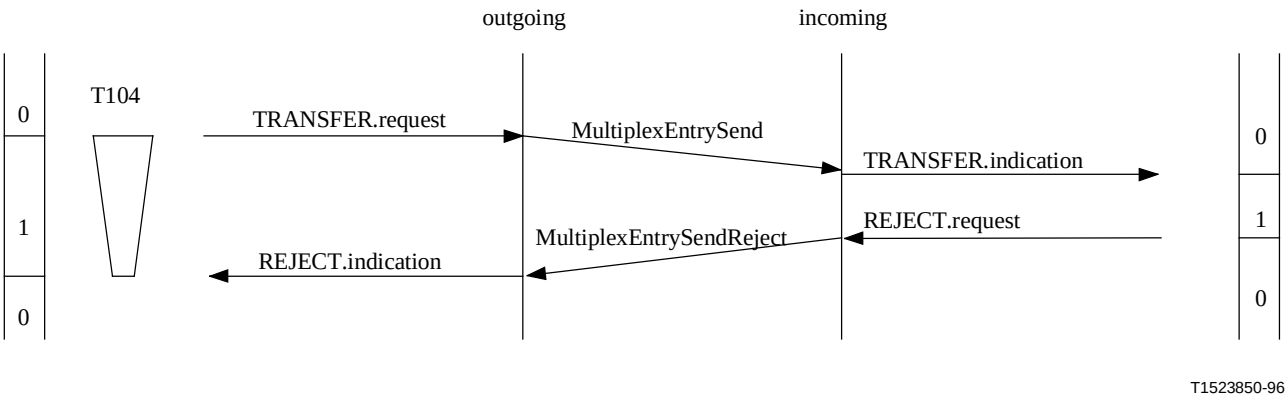


Figure II.6-2/H.245 – Multiplex table send request with rejection from the peer MTSE user

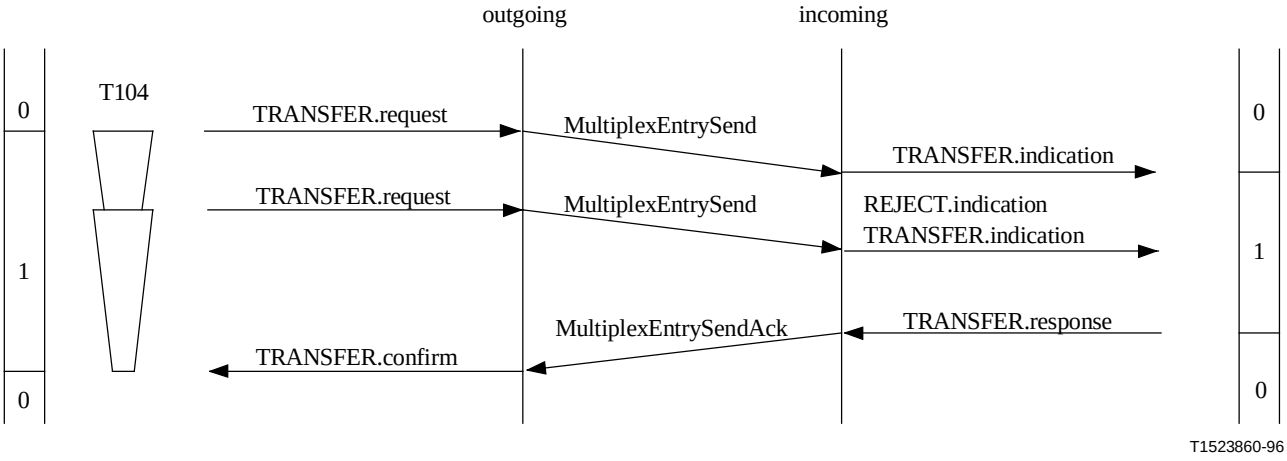


Figure II.6-3/H.245 – Multiplex table send request with a second multiplex table send request before acknowledgement of the first request – The first request was unsuccessful

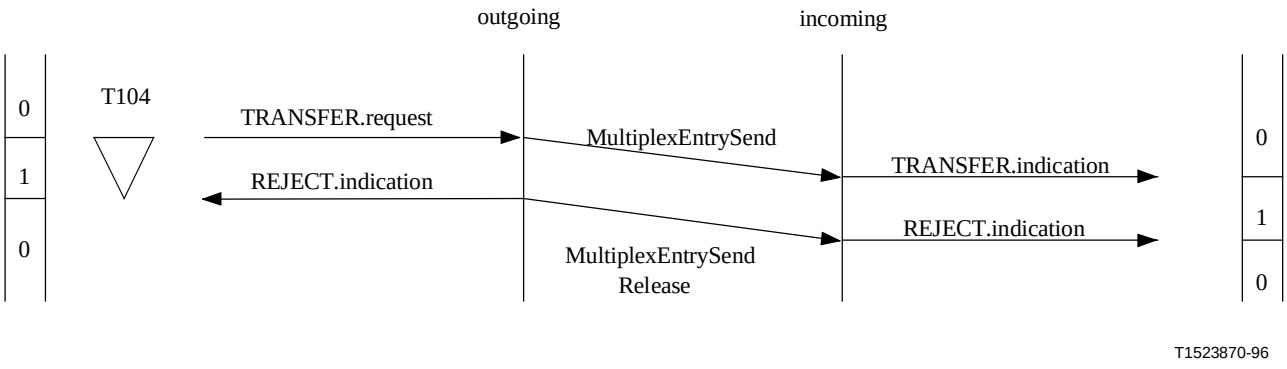


Figure II.6-4/H.245 – Multiplex table send request with timer T104 expiry

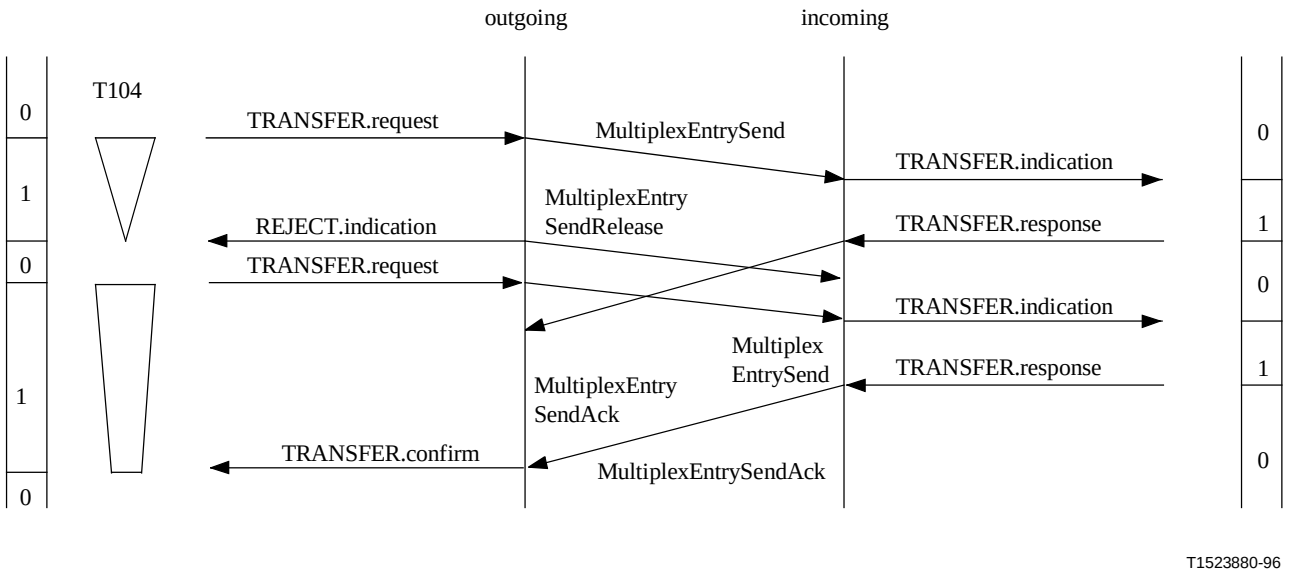


Figure II.6-5/H.245 – Multiplex table send request with timer T104 expiry followed by a second multiplex table send request – The first MultiplexEntrySendAck message is ignored at the outgoing MTSE – Only the second request was successful

II.7 Mode Request Signalling Entity

Figures II.7-1 to II.7-5 illustrate MTSE exchanges. The IDLE and AWAITING RESPONSE states are labelled as "0" and "1" respectively.

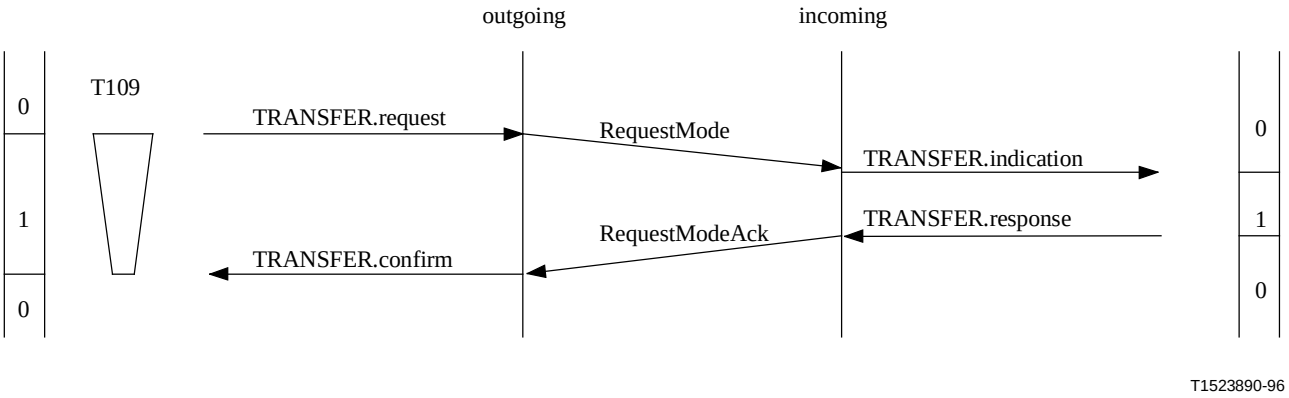


Figure II.7-1/H.245 – Successful mode request

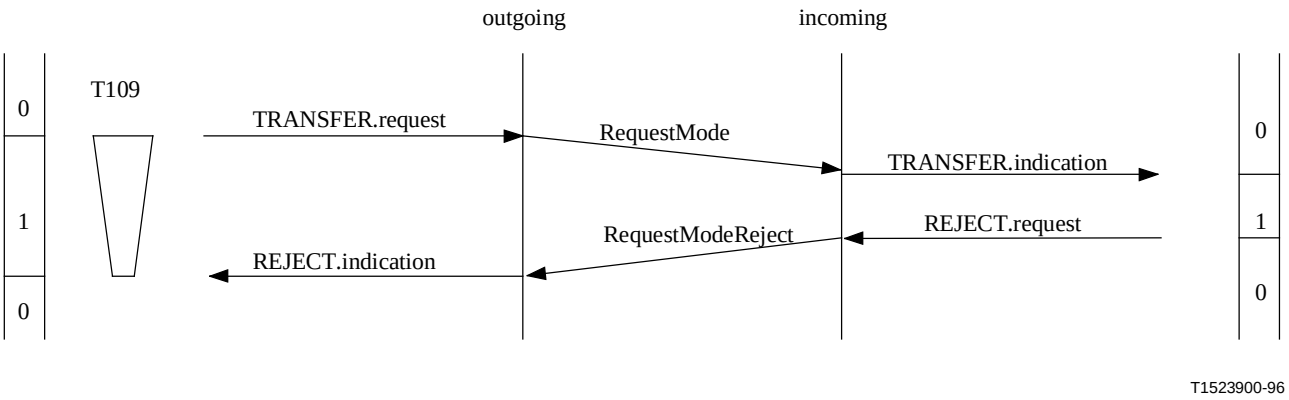


Figure II.7-2/H.245 – Mode request with rejection from the peer MTSE user

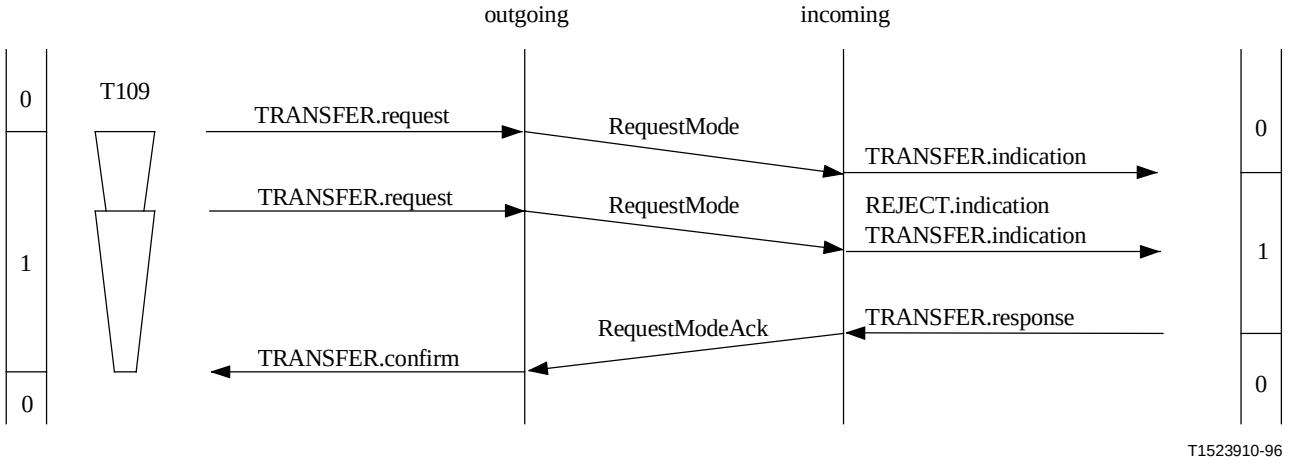


Figure II.7-3/H.245 – Mode request with a second mode request before acknowledgement of the first request – The first request was unsuccessful

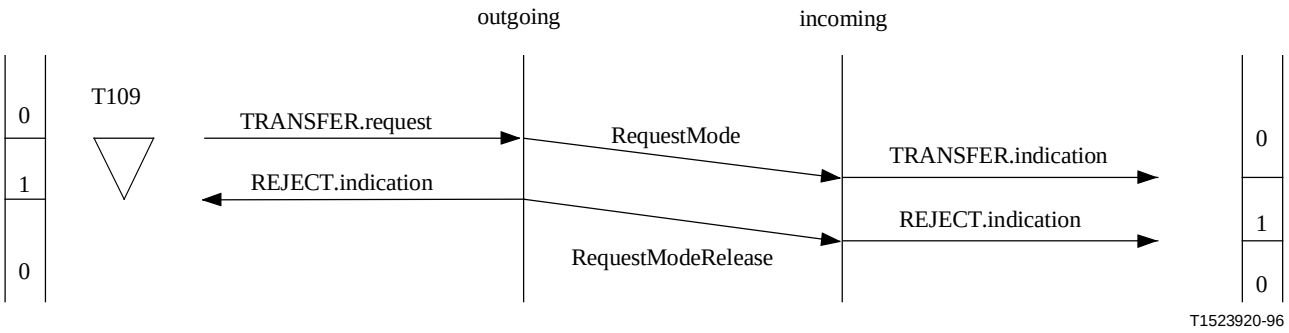


Figure II.7-4/H.245 – Mode request with timer T109 expiry – The mode request was unsuccessful

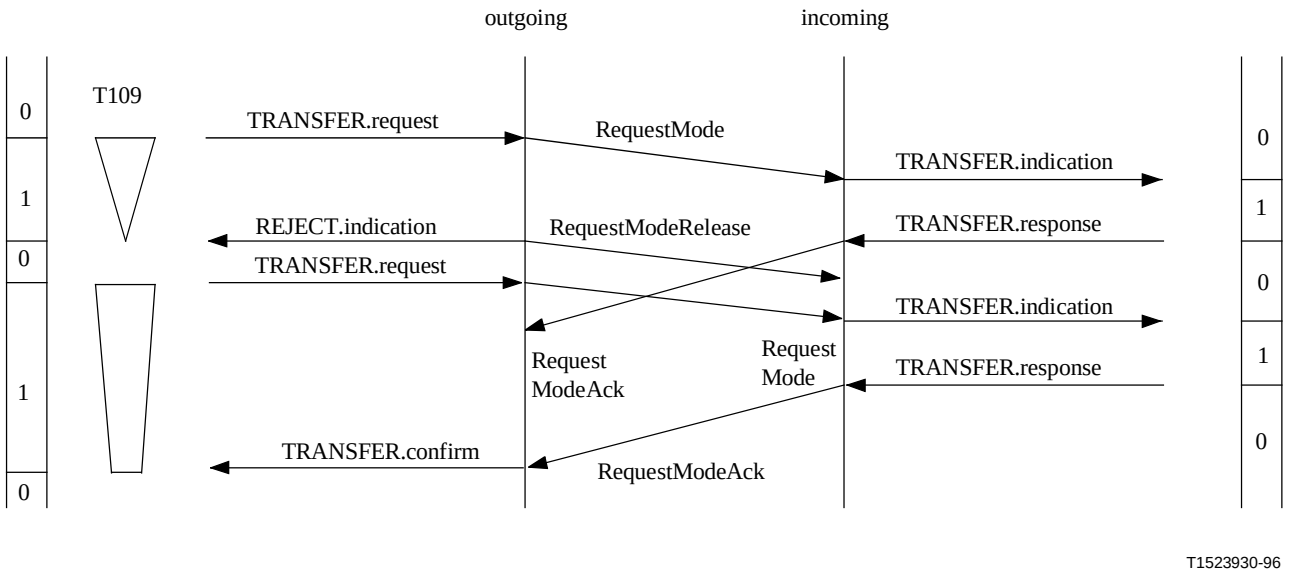


Figure II.7-5/H.245 – Mode request with timer T109 expiry followed by a second mode request – The first RequestModeAck message is ignored at the outgoing MRSE – Only the second request was successful

II.8 Round Trip Delay Signalling Entity

Figures II.8-1 to II.8-4 illustrate RTDSE procedures. The RTDSE states of IDLE and AWAITING RESPONSE are labelled as "0" and "1" respectively.

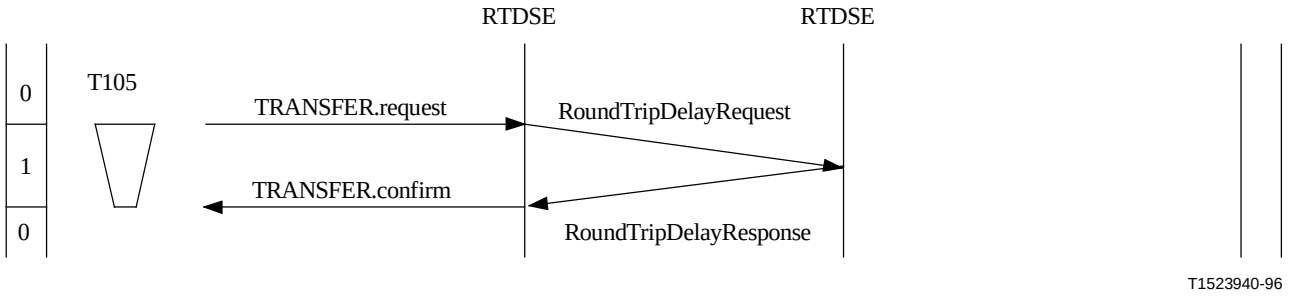


Figure II.8-1/H.245 – Round trip delay determination procedure

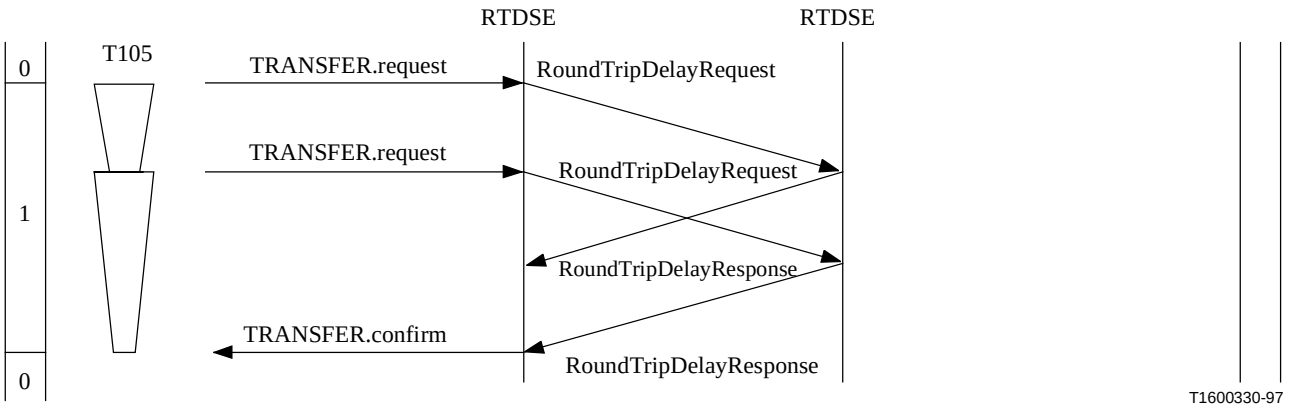


Figure II.8-2/H.245 – Round trip delay determination procedure with an earlier unacknowledged round trip delay procedure outstanding

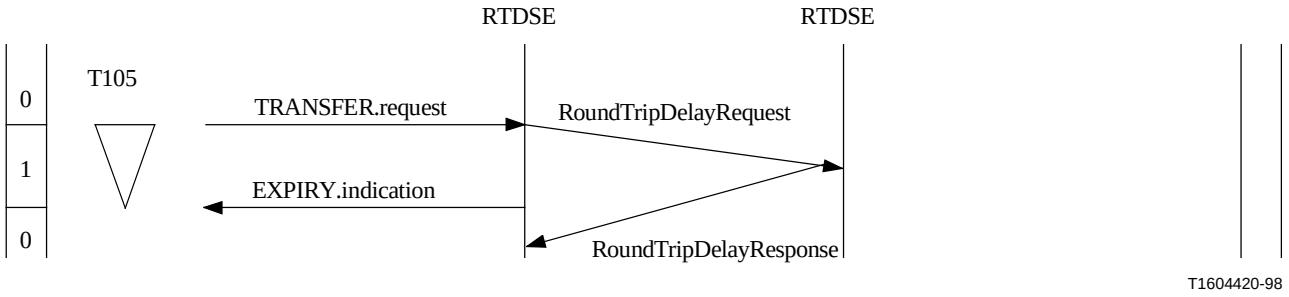


Figure II.8-3/H.245 – Round trip delay determination procedure with timer T105 expiry

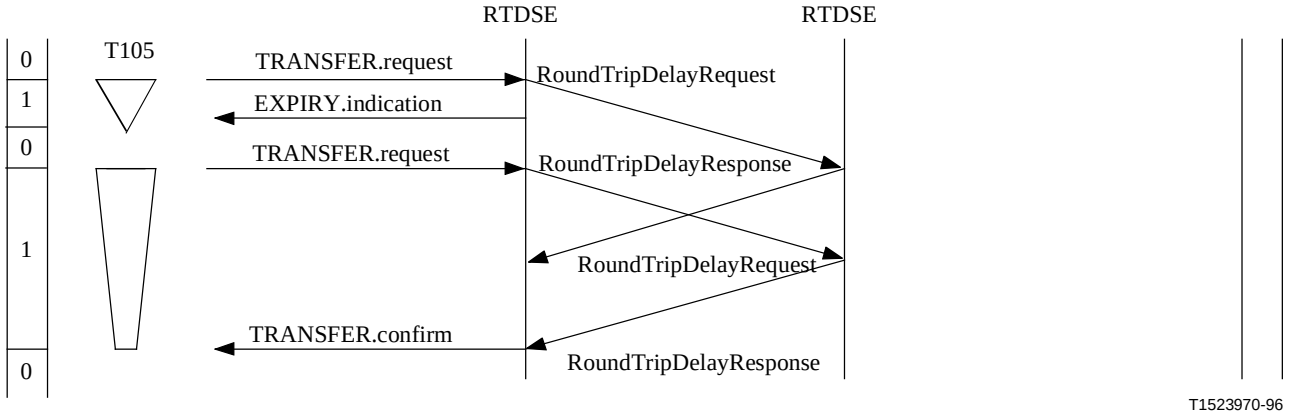


Figure II.8-4/H.245 – Round trip delay determination procedure with timer T105 expiry, followed by a second round trip delay determination procedure – The RoundTripDelayResponse message from the first procedure arrives during the second procedure and is ignored

II.9 Bi-directional Logical Channel Signalling Entity

Figures II.9-1 to II.9-7 illustrate B-LCSE procedures. The outgoing B-LCSE states of RELEASED, AWAITING ESTABLISHMENT, ESTABLISHED, and AWAITING RELEASE are labelled as "0", "1", "2", and "3" respectively. The incoming B-LCSE states of RELEASED, AWAITING ESTABLISHMENT, AWAITING CONFIRMATION, and ESTABLISHED, are labelled as "0", "1", "2", and "3" respectively.

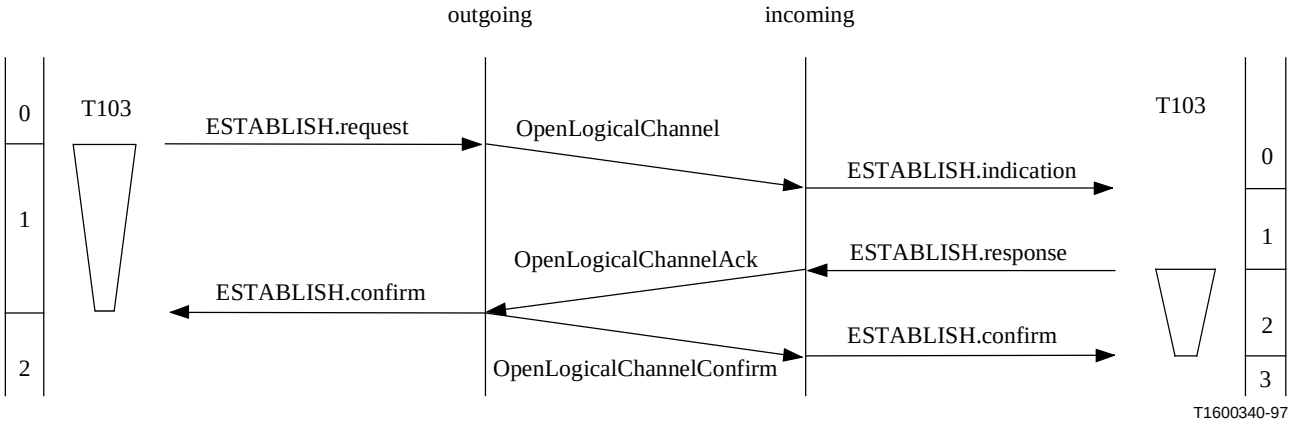


Figure II.9-1/H.245 – Bi-directional logical channel establishment

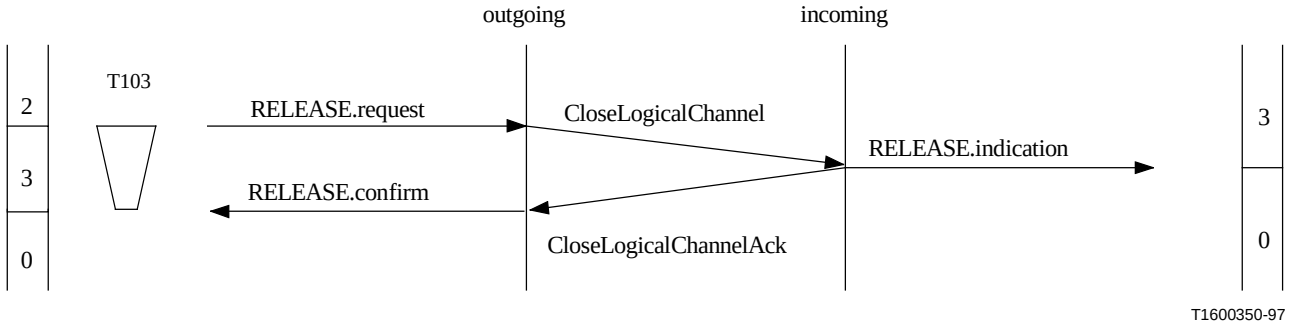


Figure II.9-2/H.245 – Bi-directional logical channel release

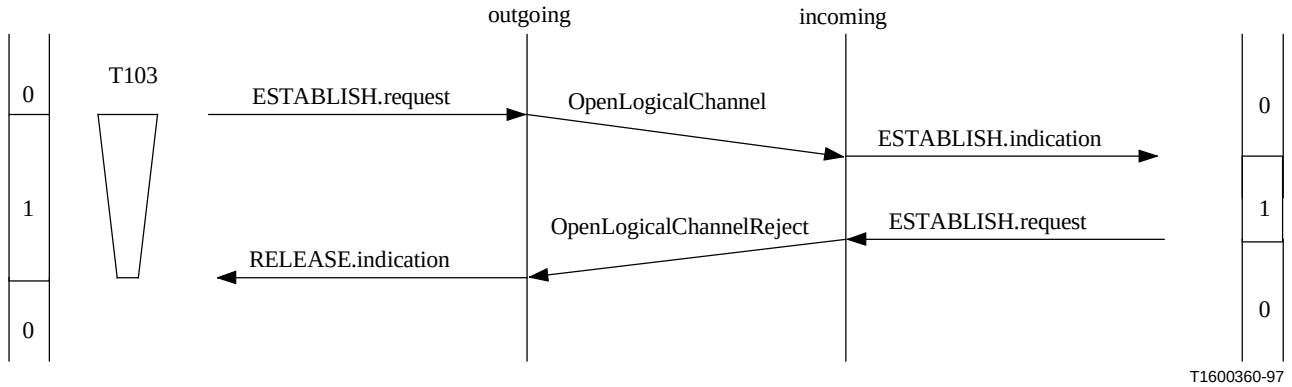


Figure II.9-3/H.245 – Bi-directional logical channel establishment rejection by peer B-LCSE user

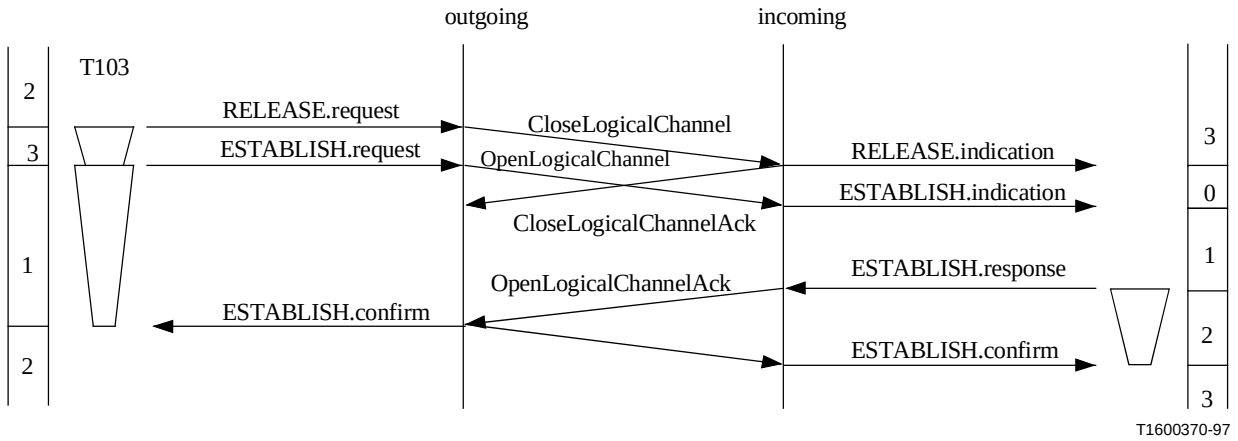


Figure II.9-4/H.245 – Bi-directional logical channel release followed by immediate re-establishment

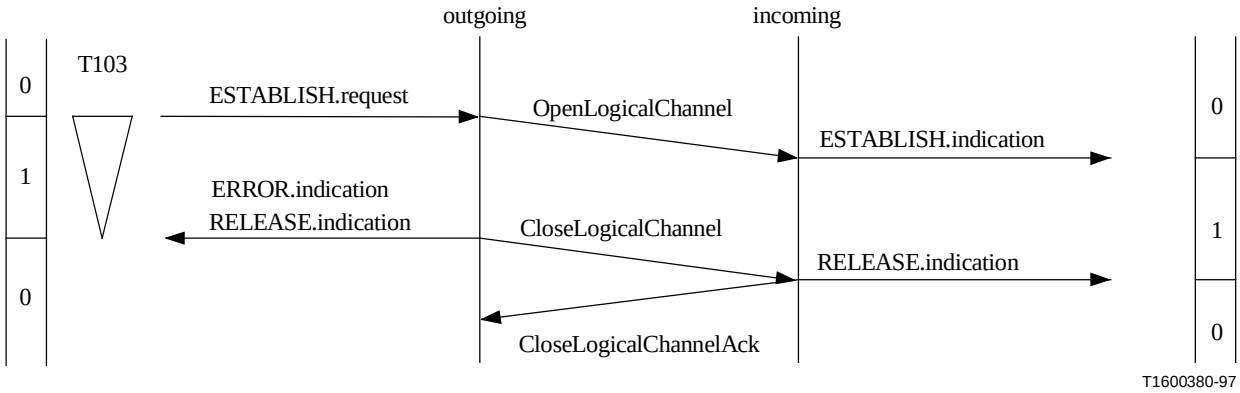


Figure II.9-5/H.245 – Bi-directional logical channel establishment request with expiry of timer T103 at the outgoing side due to slow response from peer incoming B-LCSE user

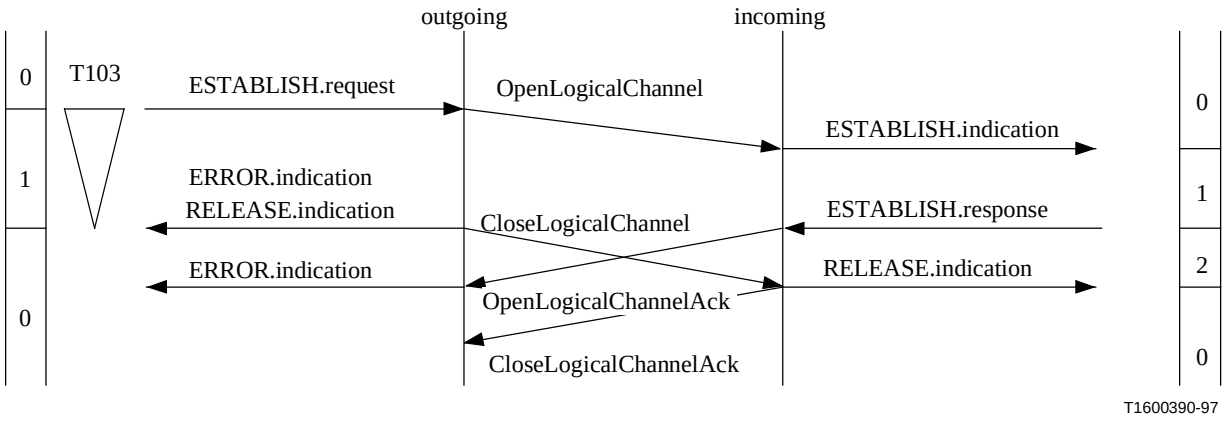


Figure II.9-6/H.245 – Bi-directional logical channel establishment request with expiry of timer T103 at the outgoing side – Timer T013 at the outgoing side has expired after transmission of the OpenLogicalChannelAck message at the incoming B-LCSE, but before reception of the OpenLogicalChannelAck message at the outgoing B-LCSE

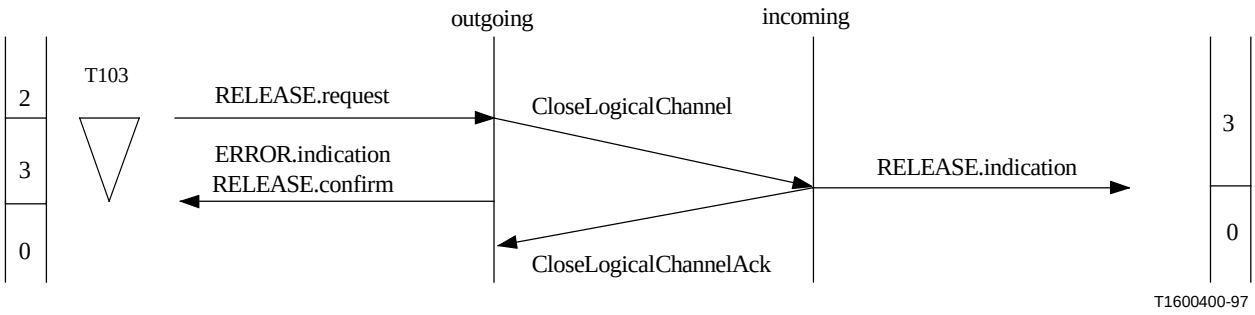


Figure II.9-7/H.245 – Bi-directional logical channel release request with expiry of timer T103 at the outgoing side

APPENDIX III

Summary of procedure timers and counters

This appendix provides a list of the timers and counters specified in clause 8.

This Recommendation does not define the values loaded into these timers. The values may be defined in other Recommendations such as H.310, H.323 and H.324.

III.1 Timers

Table III.1 shows the timers specified in this Recommendation.

Table III.1/H.245 – Procedure timers

Timer	Procedure	Definition
T106	Master Slave Determination	This timer is used in the OUTGOING AWAITING RESPONSE state and during the INCOMING AWAITING RESPONSE state. It specifies the maximum time during which no acknowledgement message may be received.
T101	Capability Exchange	This timer is used in the AWAITING RESPONSE state. It specifies the maximum time during which no TerminalCapabilitySetAck or TerminalCapabilitySetReject message may be received.
T103	Uni-directional and bi-directional Logical Channel Signalling	This timer is used in the AWAITING ESTABLISHMENT and AWAITING RELEASE states. It specifies the maximum time during which no OpenLogicalChannelAck or OpenLogicalChannelReject or CloseLogicalChannelAck message may be received.
T108	SEND Logical Channel	This timer is used in the AWAITING RESPONSE state. It specifies the maximum time during which no RequestMultiplexEntryAck or RequestMultiplexEntryReject message may be received.

Table III.1/H.245 – Procedure timers (*concluded*)

Timer	Procedure	Definition
T104	H.223 Multiplex Table	This timer is used in the AWAITING RESPONSE state. It specifies the maximum time during which no MultiplexEntrySendAck or MultiplexEntrySendReject message may be received.
T109	Mode Request	This timer is used in the AWAITING RESPONSE state. It specifies the maximum time during which no RequestModeAck or RequestModeReject message may be received.
T105	Round Trip Delay	This timer is used in the AWAITING RESPONSE state. It specifies the maximum time during which no RoundTripDelayResponse message may be received.
T107	Request Multiplex Entry	This timer is used during the AWAITING RESPONSE state. It specifies the maximum time during which no RequestMultiplexEntryAck or RequestMultiplexEntryReject message may be received.
T102	Maintenance Loop	This timer is used during the AWAITING RESPONSE state. It specifies the maximum allowed time during which no MaintenanceLoopAck or MaintenanceLoopReject message may be received.

III.2 Counters

Table III.2 shows the counters specified in this Recommendation.

Table III.2/H.245 – Procedure counters

Timer	Procedure	Definition
N100	Master slave determination	This counter specifies the maximum number of times that MasterSlaveDetermination messages will be sent during the OUTGOING AWAITING RESPONSE state.

APPENDIX IV

Recommendation H.245 extension procedure

This Recommendation is a "living document" used by a number of systems Recommendations including H.310, H.323, H.324, and V.70, which is expected to be extended, in a backward compatible way, likely at each meeting of ITU-T Study Group 16. This appendix explains the procedure that should be used to add extensions to this Recommendation.

At a given point in time there is only one H.245 syntax in force. No other ITU-T Recommendation should include other variants of H.245 syntax in their Recommendations in a normative manner.

Requests for extensions to this Recommendation should be submitted as a White Contribution or formal liaison to Study Group 16, with a copy sent as early as possible to the Rapporteur and editor of this Recommendation. Such requests should include:

1) functional requirements for syntax to be drafted by the H.245 editor or proposed syntax based on the current approved version; and

2) proposed semantics for clause 7; and

3) proposed procedures for clause 8 if new procedures are requested.

All extensions to this Recommendation must be backwards compatible with all its previous versions. Pre-existing syntax, semantics, and procedures cannot be changed. The meaning of pre-existing syntax cannot be changed.

Requests should be submitted as early as possible to allow time for review of extensions by H.245 experts in Study Group 16. It must be understood that the exact requested syntax may be modified because of:

1) verification of correct ASN.1 syntax;

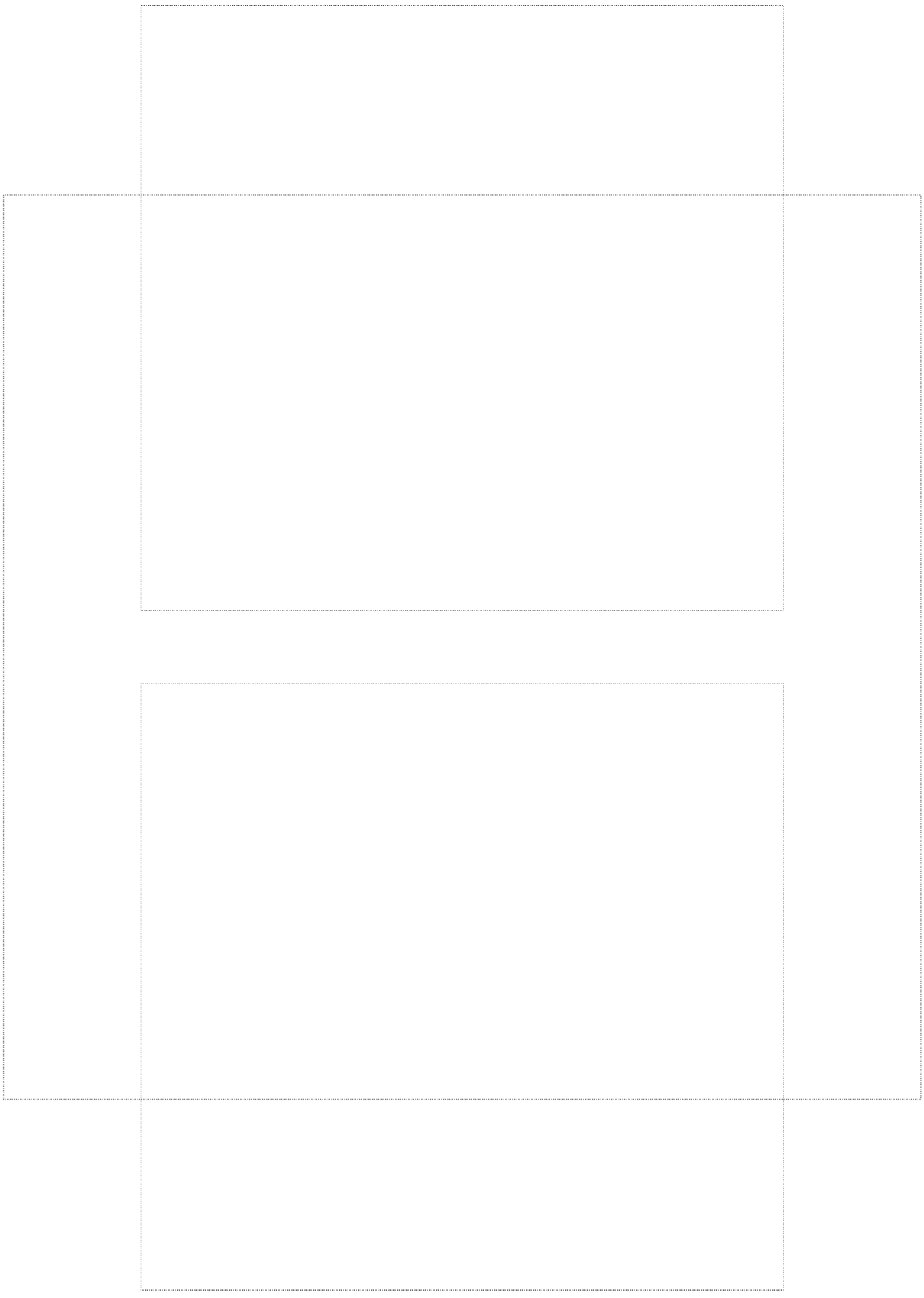
2) harmonization with other, conflicting, requests for extensions of this Recommendation;

3) backward compatibility with pre-existing versions of of this Recommendation;

4) expert review of placement of new functions relative to the existing H.245 structure.

The editor of this Recommendation will review all extension requests and propose final text for its extended versions for Study Group 16 approval by the Resolution 1 process. Upon Study Group approval of each new version of this Recommendation, its version number in **protocolIdentifier** will be incremented to identify the new version.

Please note that it is the intention of Study Group 16 to accept only harmonized H.245 extensions originating from the H.245 editor.



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