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Study Group 15
Experts Group for Video Coding and Systems in      20 January 1995
ATM and Other Network Environments

| | | |
|---|---|---|
| SOURCE | : | Stuart Dunstan, Siemens Ltd |
| TITLE | : | Proposal for H.222.1 acknowledged signalling procedures |
| PURPOSE | : | Proposal |

## 1. Introduction

In AVC-702 [1] and TD10 (Singapore) [2] it was proposed that terminal to terminal signalling using acknowledgment procedures for the set up and release of H.222.1 subchannels is appropriate. This document presents details for such procedures.

Proposed text for H.222.1, describing the protocol, is attached in Annex 1. Review is required.

## 2. H.222.1 entries

The following entries should be made in the terms and definitions section of H.222.1.

**multiplex identifier field:** the packet header field in Recommendation H.222.1 which is the basis upon which multiplexing is performed. In the Program Stream this corresponds to the stream_id field, plus extension fields. In the Transport Stream this corresponds to the PID field.

**subchannel:** a logical channel in Recommendation H.222.1 formed from packets having a unique multiplex identifier field value. A subchannel is unidirectional. There may be many subchannels within one ATM Virtual Channel.

The following entry should be made in the abbreviations section of H.222.1.

SCSE      Subchannel Signalling Entity

## 3. Subchannel Signalling Entity (SCSE)

The process that deals with the establishment and release of subchannels is referred to as the Subchannel Signalling Entity (SCSE). There is an outgoing SCSE and an incoming SCSE. Peer SCSE pairs deal with the one subchannel, which is by definition uni directional. Two way audiovisual/data communication requires two SCSE pairs, one in the forward direction and one in the reverse direction.

The SCSE is concerned only with H.222.1 peer terminal to terminal signalling and not with the transfer of user data. The SCSE simply states that audio visual and other data may only be transferred on a particular subchannel in the ESTABLISHED state.

The Service Specific Connection Oriented Protocol (SSCOP) Draft Recommendation Q.2110 [3] has been used for guidance in writing the SCSE procedures.

## 4. References

[1] AVC-702, "Terminal to terminal signalling in H.32X", ITU-T Study Group 15 Experts Group, 24 October 1994.

[2] TD10 rev. 2 (Singapore) , "Group discussion on H.32X call phases and H.222.1 signalling", ITU-T Study Group 15 Experts Group, November 1994.

[3] ITU-T Draft Recommendation Q.2110, "Service Specific Connection Oriented Protocol (SSCOP)", March 30 1994.

- end -

# ANNEX 1: PROPOSED SUBCHANNEL SIGNALLING TEXT FOR H.222.1

## 1. Subchannel signalling

Subchannel signalling is the process which establishes and releases a subchannel between peer send and receive H.222.1 entities. Subchannel signalling involves management of a unique multiplex identifier value at the send side, and transmission of this value, and information about the audio visual data to be carried within the subchannel, to the receiver. Two subchannel signalling procedures are described here, being acknowledged and unacknowledged.

## 2. Subchannel signalling unacknowledged procedures

Repeated transmission.

*{Ed: This clause will refer to H.222.0 and the method described there}.*

## 3. Subchannel signalling acknowledged procedures

Subchannel signalling using acknowledgment procedures are specified here. The procedures have the following characteristics:

- reliable set up and release of subchannels using acknowledgment procedures.

- the subchannel may only be used for audiovisual and data communication while in the ESTABLISHED state.

- procedures are specified separately for outgoing and incoming subchannel connections. Since a subchannel is defined as being unidirectional, two way audiovisual and data communication requires the procedures to be performed twice; once in the forward calling direction, and once in the backward calling direction.

  There is no connection between the incoming subchannel procedures and the outgoing subchannel procedures at one side, other than via signals to and from the higher layer signalling entity.

- BGN and END PDUs are re transmitted if no acknowledgment is received in a specified time. An error signal is generated if after a specified number of retries no acknowledgment PDU has been received.

- PDUs are coded using PSM and PSI tables in the Program Stream and Transport Stream respectively. A descriptor identifies the meaning of the tables.

- error conditions are reported.

A representation of peer H.222.1 signalling entities is shown in Figure 1.

Overview of H.222.1 Signalling Entities
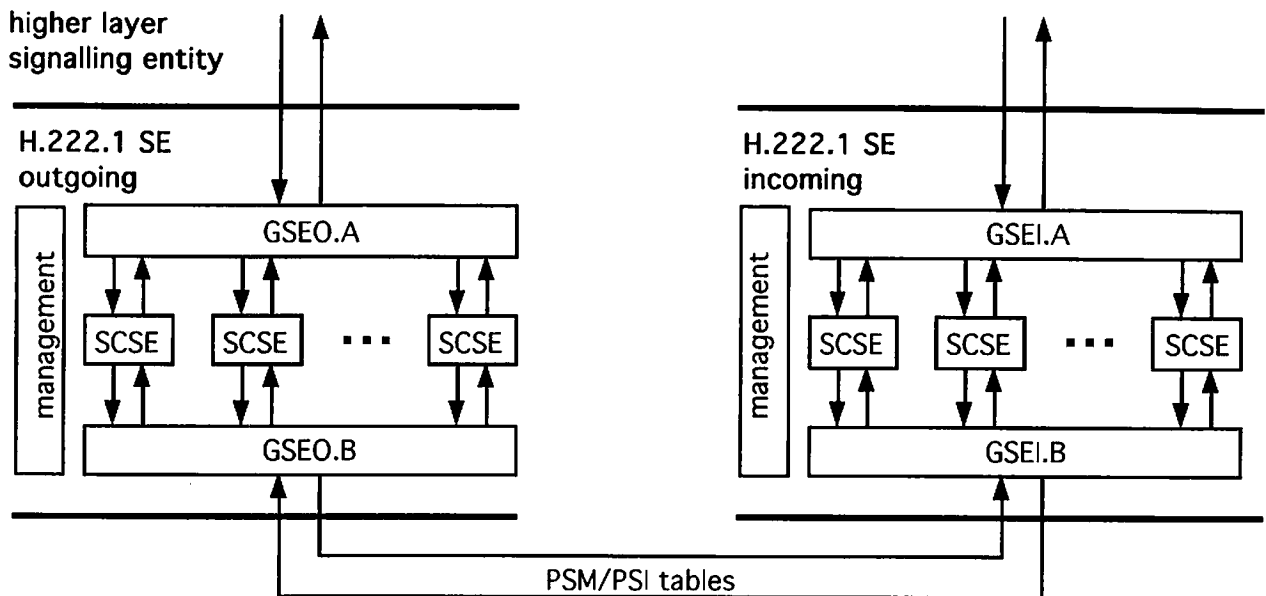


| SE: | Signalling Entity: | SCSE: | Subchannel Signalling Entity: |
|-----|--------------------|-------|-------------------------------|
| GSEO: | Global Signalling Entity Outgoing | PSM: | Program Stream Map (Program Stream) |
| GSEI: | Global Signalling Entity Incoming | PSI: | Program Specific Information (Transport Stream) |

In Figure 1 each block has the following functionality:

Global Signalling Entity Outgoing A (GSEO.A)

Upon request from the higher layer signalling entity to set up a subchannel, GSEO.A initiates an SCSE and allocates a multiplex identifier value to it. GSEO.A maps higher layer signalling entity signals for established subchannels to/from the appropriate SCSE. Upon request from the higher layer signalling entity to release a subchannel GSEO.A releases the multiplex identifier value for later reuse.

Subchannel Signalling Entity (SCSE)

The SCSE is responsible for the reliable establishment and release of one subchannel. One SCSE has associated with it a unique multiplex identifier value. Peer SCSEs have the same multiplex identifier value. There is an outgoing SCSE and an incoming SCSE.

Global Signalling Entity Outgoing B (GSEO.B)

GSEO.B maps the output from many SCSEs into PSM/PSI tables. The PSM/PSI tables may be used to commonly establish/acknowledge/release many subchannels at one time.

Management

At the outgoing side some coordination amongst many SCSEs may be required. At the incoming side a management function to deal with the reporting of errors may be required.

Global Signalling Entity Incoming B (GSEI.B)

> GSEI.B performs a de multiplexing function, directing incoming PDUs to the appropriate SCSE. It also performs an error reporting function, detecting incoming PDUs with a multiplex field value for which no SCSE exists.

Global Signalling Entity Incoming A (GSEI.A)

> GSEI.A maps signals from SCSEs to the higher layer signalling entity at the receiver.

The following specifies the SCSE, for each of an outgoing and an incoming subchannel. In each case procedures are specified in terms of signals and states at the interface between the SCSE and the Global Signalling Entity A. Signalling information is transferred to the peer signalling entity via appropriate PDUs.

## 4. Communication between SCSE and its controlling entity

### 4.1. Signals between SCSE and its controlling entity

Communication between the SCSE, and the higher layer entity which controls it, is performed using the signals shown in Table 2/H.222.1 . These signals are for the purpose of defining sub channel signalling procedures and are not meant to specify or constrain implementation.

Table 2/H.222.1

Signals and parameters

| generic name | type | | | |
|---|---|---|---|---|
| | request | indication | response | confirm |
| ESTABLISH | DESC-PARAM | DESC-PARAM | - | - |
| RELEASE | - | - | not defined | - |
| STATUS | DESC-PARAM | DESC-PARAM | not defined | not defined |
| ERROR | not defined | ERRCODE | not defined | not defined |

### 4.2. Signal definition

The definition of these signals is as follows:

a)      The ESTABLISH signals are used to establish a subchannel for audiovisual and data communication

b)      The RELEASE signals are used to terminate a subchannel.

c)      The ERROR signal reports H.222.1 signalling errors and other conditions.

### 4.3. Parameter definition

The definition of the signal parameters should in Table 2/H.222.1 are as follows:

a)      The DESC-PARAM parameter is a descriptor parameter. It conveys information about the type of data carried in the subchannel. DESC-PARAM is mapped to an appropriate descriptor and carried in a BGN PDU. There may be many DESC-PARAM parameters associated with each ESTABLISH signal.

b)      The ERRCODE parameter indicates the type of SCSE error.

*{Ed: A table of error codes that agrees with the SDL error indications should be included}.*

## 4.4. State transition diagram

The allowed sequence of signals between the SCSE and its controlling entity is defined here. The allowed sequence of signals relates to states of the SCSE as viewed from the SCSE controlling entity. The sequences are specified separately for an outgoing and an incoming subchannel connection as shown in Figure 2/H.222.1.

Figure 2/H.222.1

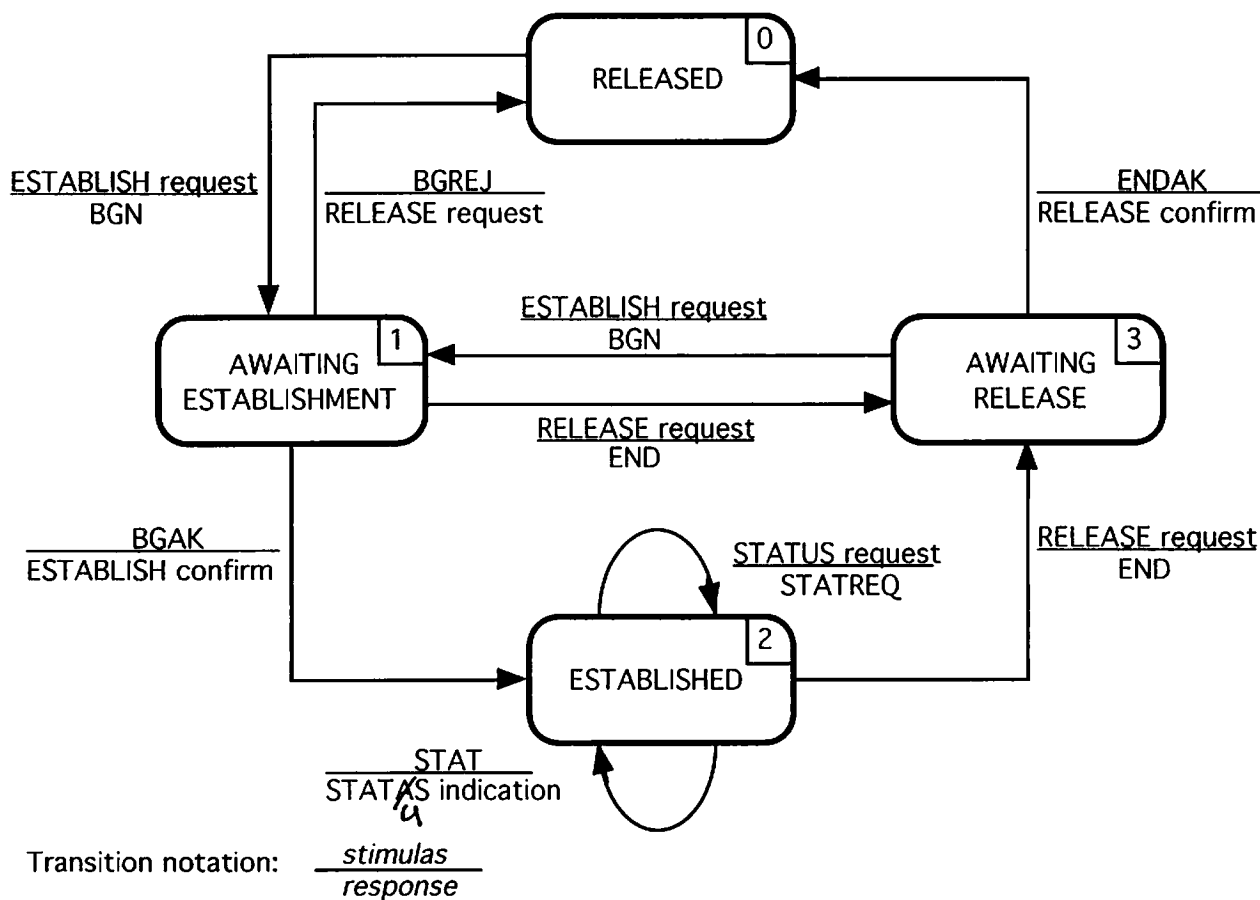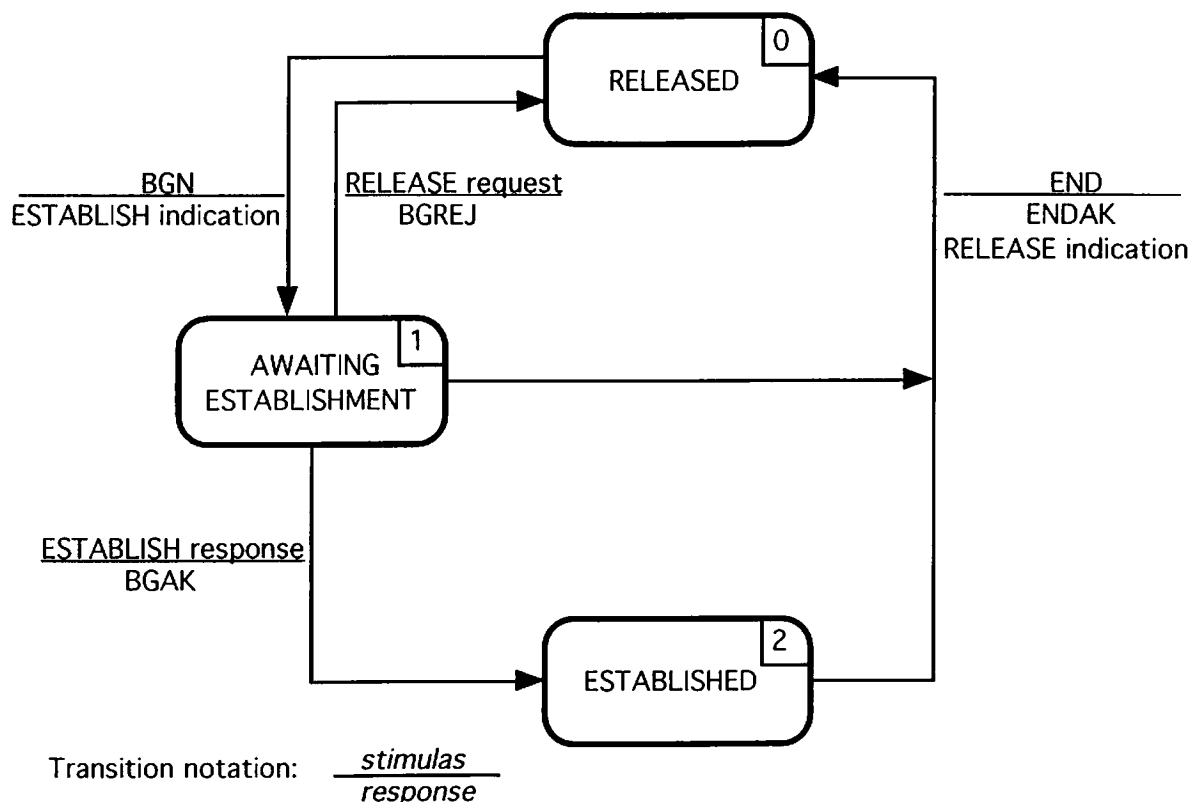a) State transition diagram for sequence of signals at SCSE outgoing



Transition notation: $\dfrac{stimulas}{response}$

Figure 2/H.222.1

b) State transition diagram for sequence of signals at SCSE incoming



Transition notation:     $\dfrac{stimulas}{response}$

## 5.    Peer to peer SCSE communication

### 5.1.    Protocol Data Units

Table 3/H.222.1 shows the SCSE PDUs and their function.

Table 3/H.222.1

SCSE PDU names

| function | PDU name | direction | description |
|---|---|---|---|
| establishment | BGN | O -> I | connection request |
| | BGAK | O <- I | connection acknowledgment |
| | BGREJ | O <- I | connection rejection |
| release | END | O -> I | disconnection request |
| | ENDAK | O <- I | disconnection acknowledgment |
| status | STATREQ | O -> I | status request |
| | STAT | O <- I | status |

Key:  O - outgoing, I - incoming.

The SCSE PDUs have the following definition:

a)     BGN (begin)

The BGN PDU is used to establish a subchannel connection between an outgoing SCSE and a peer incoming SCSE.

b)    BGAK (begin acknowledgment)

The BGAK PDU acknowledges the acceptance of the subchannel connection request from the peer SCSE.

c)    BGREJ (begin reject)

The BGREJ PDU is used to reject the subchannel connection request from the peer SCSE.

d)    END (end)

The END PDU is used by the outgoing SCSE to release a subchannel connection between two peer SCSEs.

e)    ENDAK (end acknowledge)

The ENDAK PDU is used to confirm the release of a subchannel connection.

f)    STATREQ (status request)

The STATREQ PDU is used by the outgoing SCSE to request status information from the peer incoming SCSE.

g)    STAT (status)

The STAT PDU conveys status information about the incoming SCSE to the peer outgoing SCSE.

## 5.2.  Coding of Protocol Data Units

The SCSE PDUs are implemented using H.222.0 syntax elements.  In the case of the Program Stream SCSE PDUs are formed using the Program Stream Map.  In the case of the Transport Stream, SCSE PDUs are formed using PSI tables.  The pdu_type_descriptor in the PSM/PSI tables indicates the type of SCSE PDU.  The type of PDU indicates how the PSM/PSI tables are to be interpreted.  Absence of this descriptor indicates that unacknowledged signalling procedures are being used, and the meaning of the PSM or PSI tables is as given in H.222.0.

The SCSE relates to the establishment and release of one subchannel.  However the coding of SCSE PDUs using H.222.0 syntax elements allows one or more subchannels to be established, or released, at one time.  Typically at the start of a call many subchannels are established.  In the Program Stream/Transport Stream this corresponds to the PSM/PSI tables respectively describing the complete program to be established.  The presence of the pdu_type_descriptor at the program level indicates a BGN PDU.  At the end of the call all subchannels may be released using the PSM/PSI tables, with the pdu_type_descriptor, included at the program level, indicating the END PDU.  Apart from the pdu_type_descriptor, no program or elementary stream descriptors are coded in the END PDU.  Between this time individual subchannels may be established or released using the PSM/PSI tables.  In this case the PSM/PSI tables state explicitly to which subchannel the PDU refers to.

Table 4/H.222.1 indicates the PSM/PSI coding requirements for each SCSE PDU type.

Table 4/H.222.1

SCSE PDUs and PSM/PSI coding requirements

| PDU name | pdu_type descriptor | program descriptors[1] | at least one elementary stream[2] | elementary stream descriptors |
|----------|---------------------|------------------------|-----------------------------------|-------------------------------|
| BGN | M | O | M | O |
| BGNAK | M | - | M | - |
| BGREJ | M | - | M | - |
| END | M | - | O[3] | - |
| ENDAK | M | - | O[3] | - |
| STATREQ | M | - | - | - |
| STATUS[4] | M | M | M | M |

Key:  M - mandatory, O - optional, "-" - not coded.

Notes:

1)    Some PDUs include no program descriptors.  An exception is the pdu_type_descriptor which may be included at the program level.

2)    This column indicates the requirement for explicit reference to at least one elementary stream in the PDU.

3)    Reference to one or more elementary streams is optional here.  If no elementary stream is specified then the PDU refers to all established subchannels.  If one or more elementary streams are listed then the PDU refers only to those listed.

4)    The STATUS PDU returns a complete listing of all established subchannels i.e. the PSM/PSI tables list information on all elementary streams.

The syntax and semantics of the PSM/PSI tables apply as defined in H.222.0, with the exception of the syntax elements listed in Table 5/H.222.1.

Table 5/H.222.1

H.222.0 coding exceptions

| H.222.0 table | syntax element | coding |
|---------------|----------------|--------|
| program_stream_map() | current_next_indicator | don't care |
| | program_stream_map_version | don't care |
| TS_program_map_section() | version_number | don't care |
| | current_next_indicator | don't care |

## 5.3. PDU type descriptor

The pdu_type_descriptor indicates the PDU type for the specified elementary stream with which it is associated. If the pdu_type_descriptor is included at the elementary stream level then it applies just to that elementary stream. If the pdu_type_descriptor is included at the program level then it applies to all the elementary streams included in that program. The coding of the pdu_type_descriptor is shown in Table 6/H.222.1

Table 6/H.222.1

Coding of the PDU type descriptor

| Syntax | No. of bits | Identifier |
|---|---|---|
| pdu_type_descriptor() {<br>    descriptor_tag<br>    descriptor_length<br>    pdu_type<br>    for (i = 0; i < N ; i++ ){<br>        parameter<br>    }<br>} | <br>8<br>8<br>8<br><br>8 | <br>uimsbf<br>uimsbf<br>uimsbf<br><br>bslbf |

The pdu_type field and the parameter field are coded as shown in Table 7/H.222.1.

Table 7/H.222.1

Coding of pdu_type and parameter fields

| PDU | pdu_type coding | number of parameters | parameter |
|---|---|---|---|
| BGN | 0000 0000 | 1 | N(SQ) |
| BGNAK | 0000 0001 | none | - |
| BGREJ | 0000 0010 | 1 ??? | N(CAUSE) ??? |
| END | 0000 0011 | none | - |
| ENDAK | 0000 0100 | none | - |
| STATREQ | 0000 0101 | none | - |
| STATUS | 0000 0110 | none | - |

## 5.4. SCSE states

The following states are used to specify the allowed sequence of signals between the SCSE and the SCSE controlling entity, and the exchange of peer-to-peer PDUs. The states are conceptual and are not meant to constrain implementation. The states are specified separately for each of an outgoing SCSE and an incoming SCSE. The states for an outgoing SCSE are:

State 0: RELEASED

The subchannel is released. The subchannel can not be used to send outgoing elementary stream data.

State 1: AWAITING ESTABLISHMENT

The SCSE is waiting to establish a subchannel with a peer incoming SCSE. An ESTABLISH request signal has been received from the SCSE controlling entity. A BGN PDU has been sent and a BGNAK PDU is awaited. The subchannel can not be used to send outgoing elementary stream data.

State 2: ESTABLISHED

An SCSE peer-to-peer subchannel connection has been established. A BGAK PDU was received from the peer incoming SCSE and an ESTABLISH confirm signal was sent to the SCSE controlling entity. The subchannel may be used to send outgoing elementary stream data.

State 3: AWAITING RELEASE

The SCSE is waiting to release a subchannel with the peer incoming SCSE. A RELEASE request was received from the SCSE controlling entity and an END PDU was sent to the peer SCSE. The subchannel can not be used to send outgoing elementary stream data.

The states for an incoming SCSE are:

State 0: RELEASED

The subchannel is released. The subchannel can not be used to receive incoming elementary stream data.

State 1: AWAITING ESTABLISHMENT

The SCSE is waiting to establish a subchannel with a peer outgoing SCSE. An BGN PDU was received and an ESTABLISH indication signal has sent to the SCSE controlling entity. The subchannel can not be used to receive incoming elementary stream data.

State 2: ESTABLISHED

An SCSE peer-to-peer subchannel connection has been established. An ESTABLISH response signal was received from the SCSE controlling entity and a BGAK PDU was sent to the peer outgoing SCSE. The subchannel may be used to receive incoming elementary stream data.

## 5.5. SCSE state variables

The following state variables are defined at the outgoing SCSE:

VT(RPT)

This state variable counts the number of times a BGN or an END PDU is transmitted in the AWAITING ESTABLISHMENT or AWAITING RELEASE states respectively. The variable is set to zero upon entry to these states. It is incremented by 1 for each BGN or END PDU that is transmitted.

VT(SQ)

This state variable is used to identify retransmitted BGN PDUs. It is set to 0 when the SCSE process begins and is incremented and mapped to the N(SQ) field before initial transmission of a BGN PDU[1].

Note 1: Since the PSM/PSI tables may transmit BGN PDUs from many SCSEs, at the same time, coordination of VT(SQ) state variables among many SCSEs may be required, if the PDU type descriptor is included at the program level in the PSM/PSI tables.

The following state variable is defined at the incoming SCSE:

VR(SQ)

This state variable is used to detect retransmitted BGN PDUs. Upon reception of a BGN PDU it is compared to the value of N(SQ). If the values are different, the PDU is processed and VR(SQ) is set to the value of N(SQ). If they are the same, the PDU is identified as a retransmission.

## 5.6. SCSE timers

The following timer is specified for the outgoing SCSE:

timer_RPT

This timer is used during the AWAITING ESTABLISHMENT and AWAITING RELEASE states. It specifies the time before repeated transmission of a BGN or an END PDU respectively, during which no BGAK or ENDAK PDU has been received.

## 5.7. SCSE parameters

The following parameters are defined for the outgoing SCSE:

max_RPT

The maximum value of VT(RPT), which is the maximum number of times a BGN or END PDU may be transmitted in the AWAITING ESTABLISHMENT and AWAITING RELEASE states.

## 6. SCSE procedures
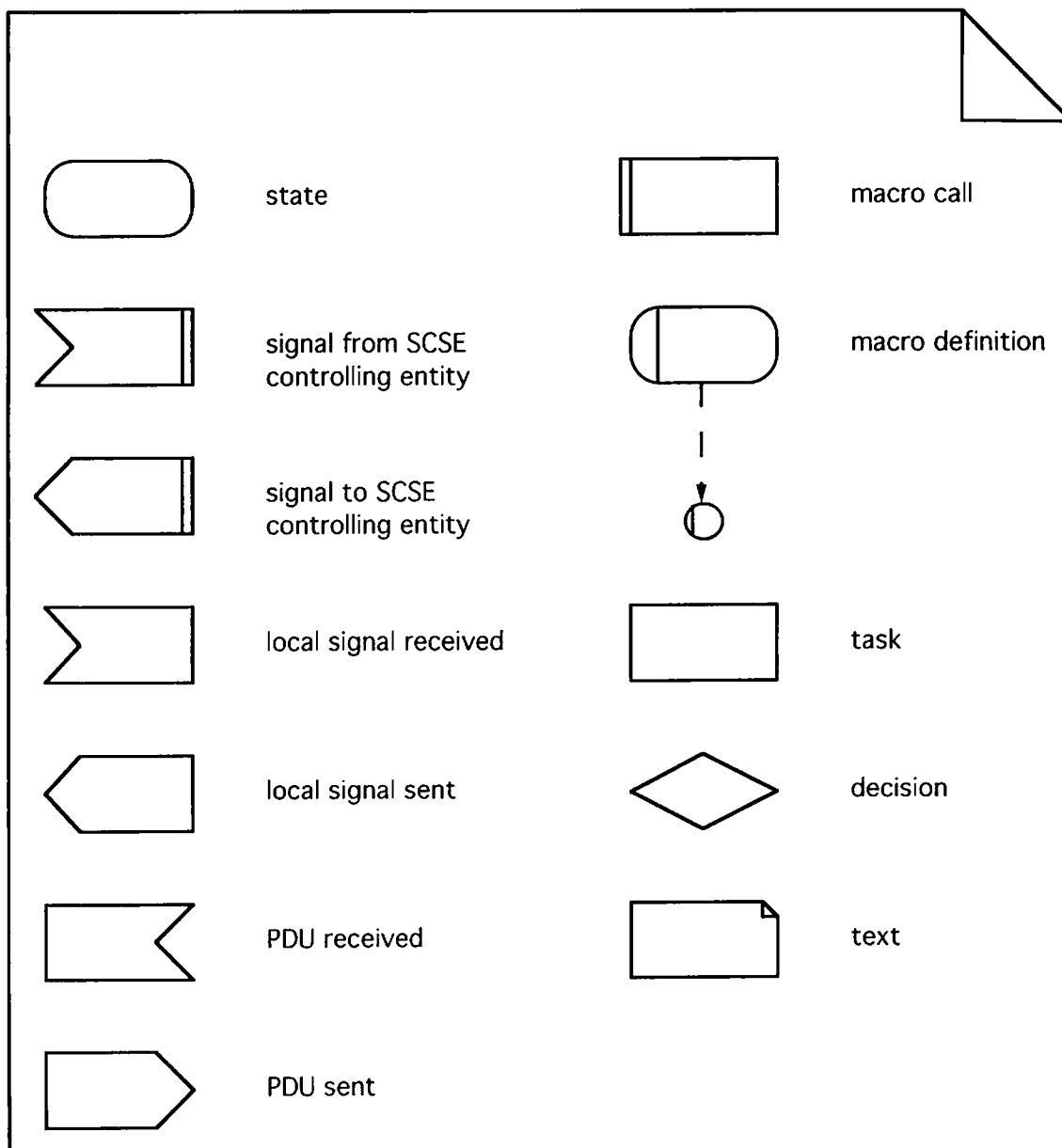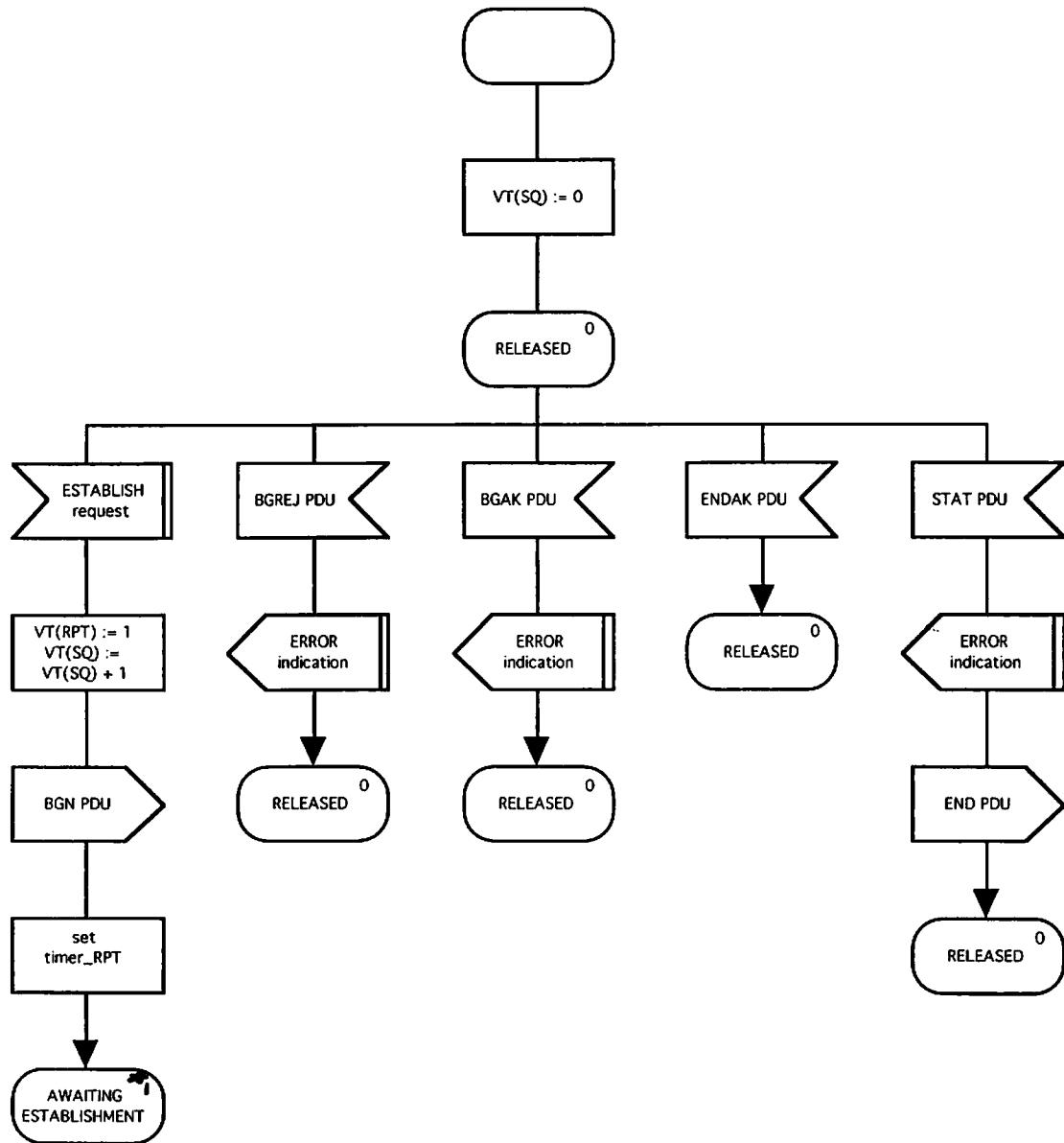
SDL key



| | | | |
|---|---|---|---|
| ⬭ | state | ▯ | macro call |
| ⊳ | signal from SCSE controlling entity | ⬭ | macro definition |
| ⊲ | signal to SCSE controlling entity | ○ | |
| ⊳ | local signal received | ▭ | task |
| ⊲ | local signal sent | ◇ | decision |
| ⊏ | PDU received | ▭ | text |
| ⊐ | PDU sent | | |

Outgoing

Outgoing

Outgoing

ESTABLISHED $^2$

| | | | | | |
|---|---|---|---|---|---|
| RELEASE request | BGAK PDU | BGREJ PDU | ENDAK PDU | STAT PDU | STATUS request |

VT(RPT) := 1

ESTABLISHED $^2$

ERROR indication

ERROR indication

STATUS indication

STATREQ PDU

END PDU

RELEASED $^0$

RELEASED $^0$

ESTABLISHED $^2$
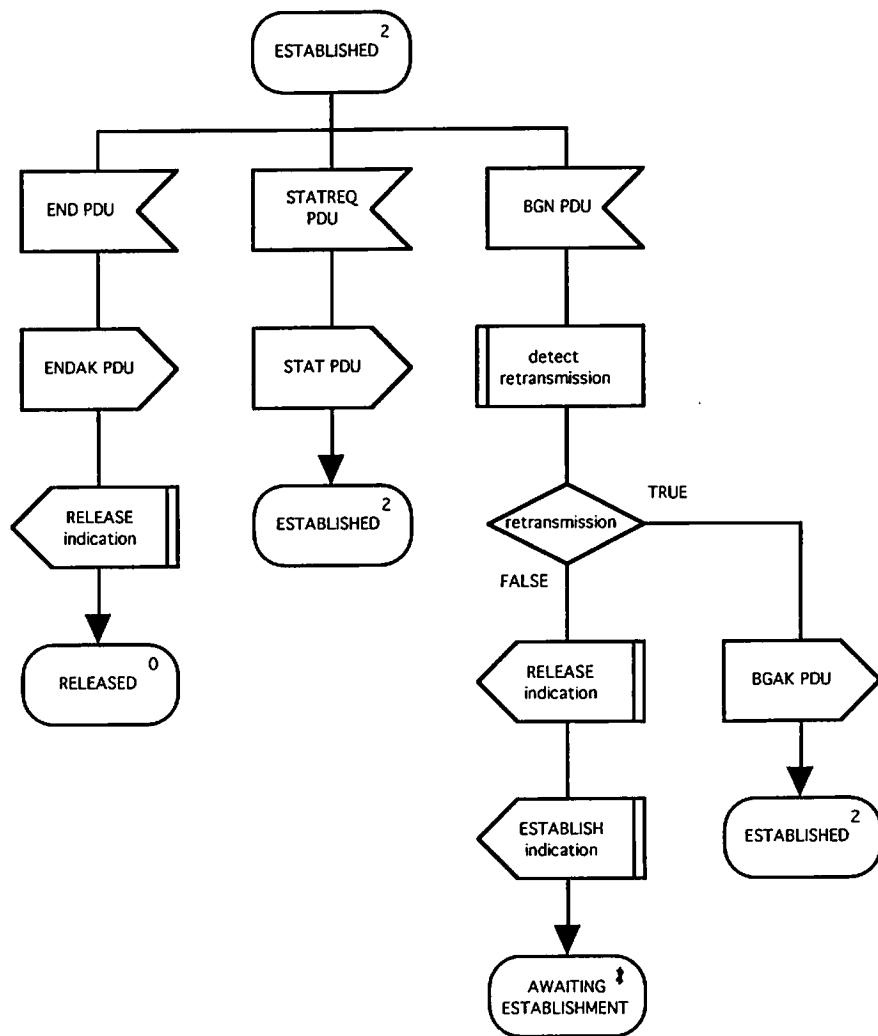
ESTABLISHED $^2$

set timer_RPT

AWAITING RELEASE $^3$
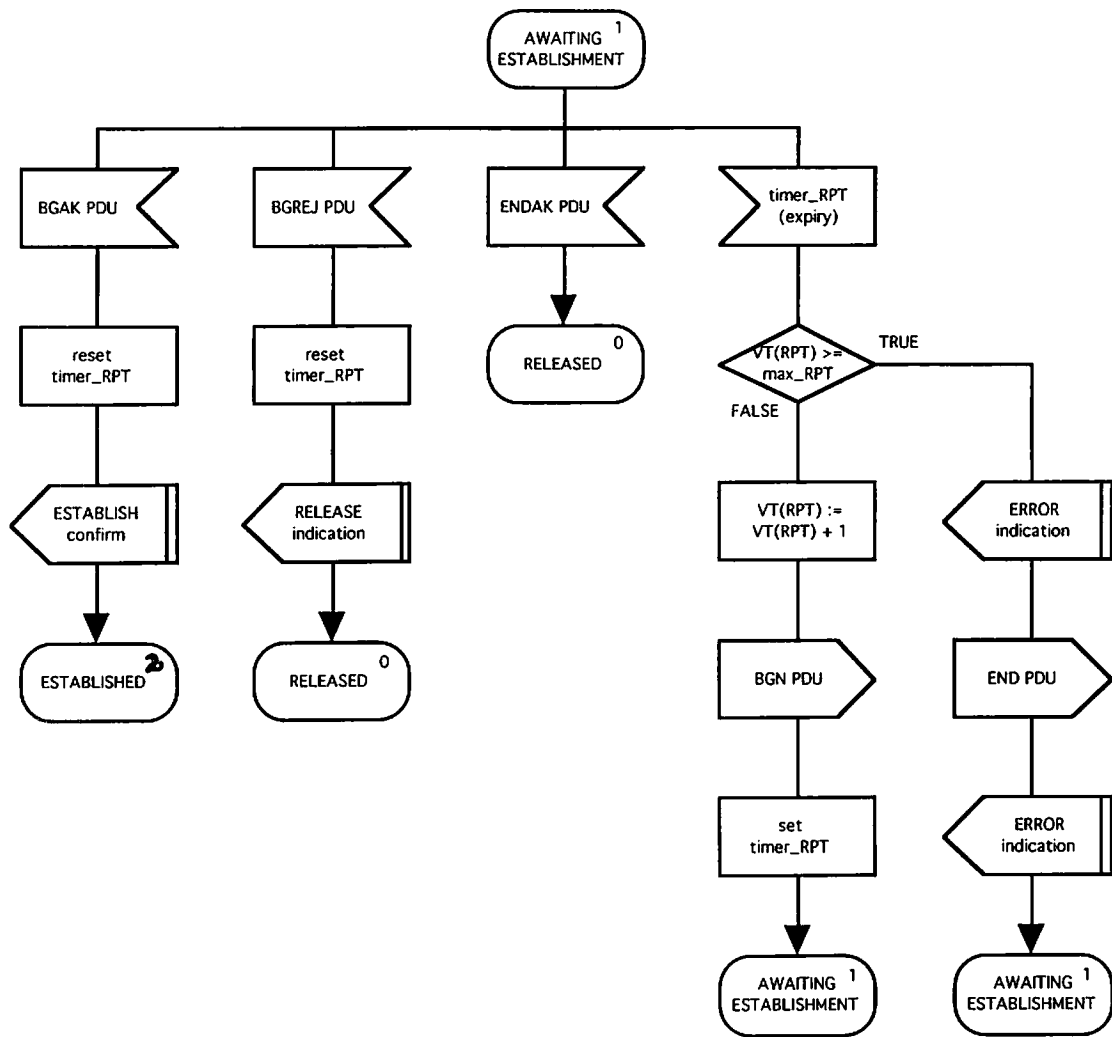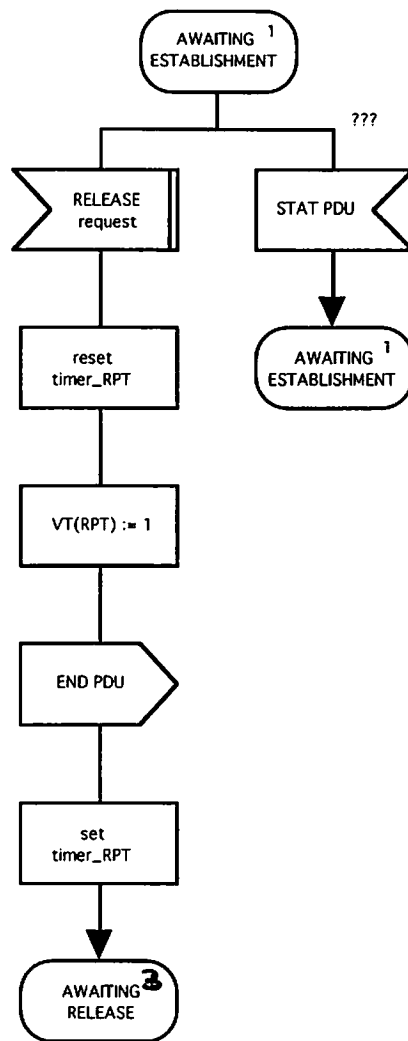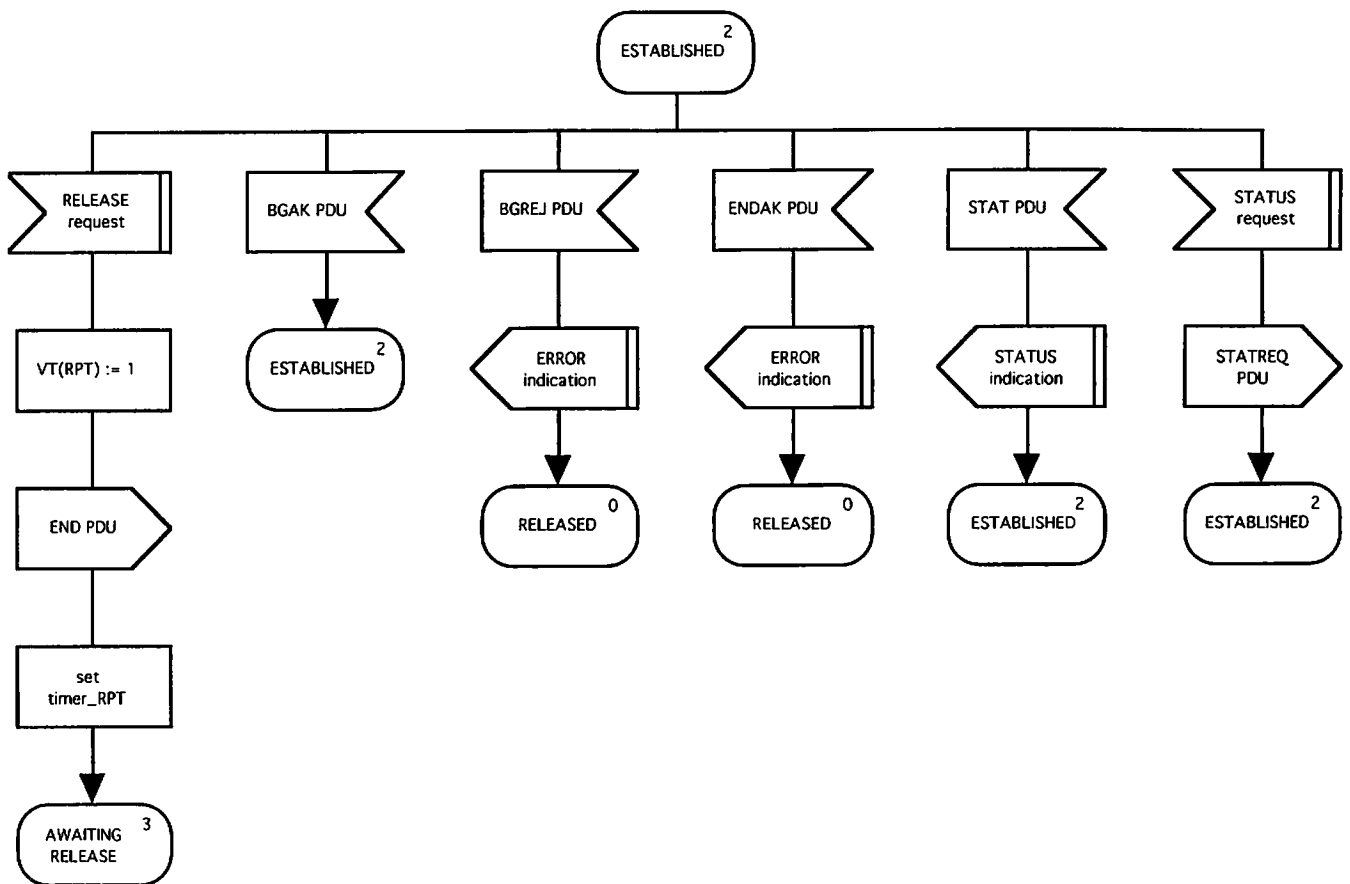
Outgoing
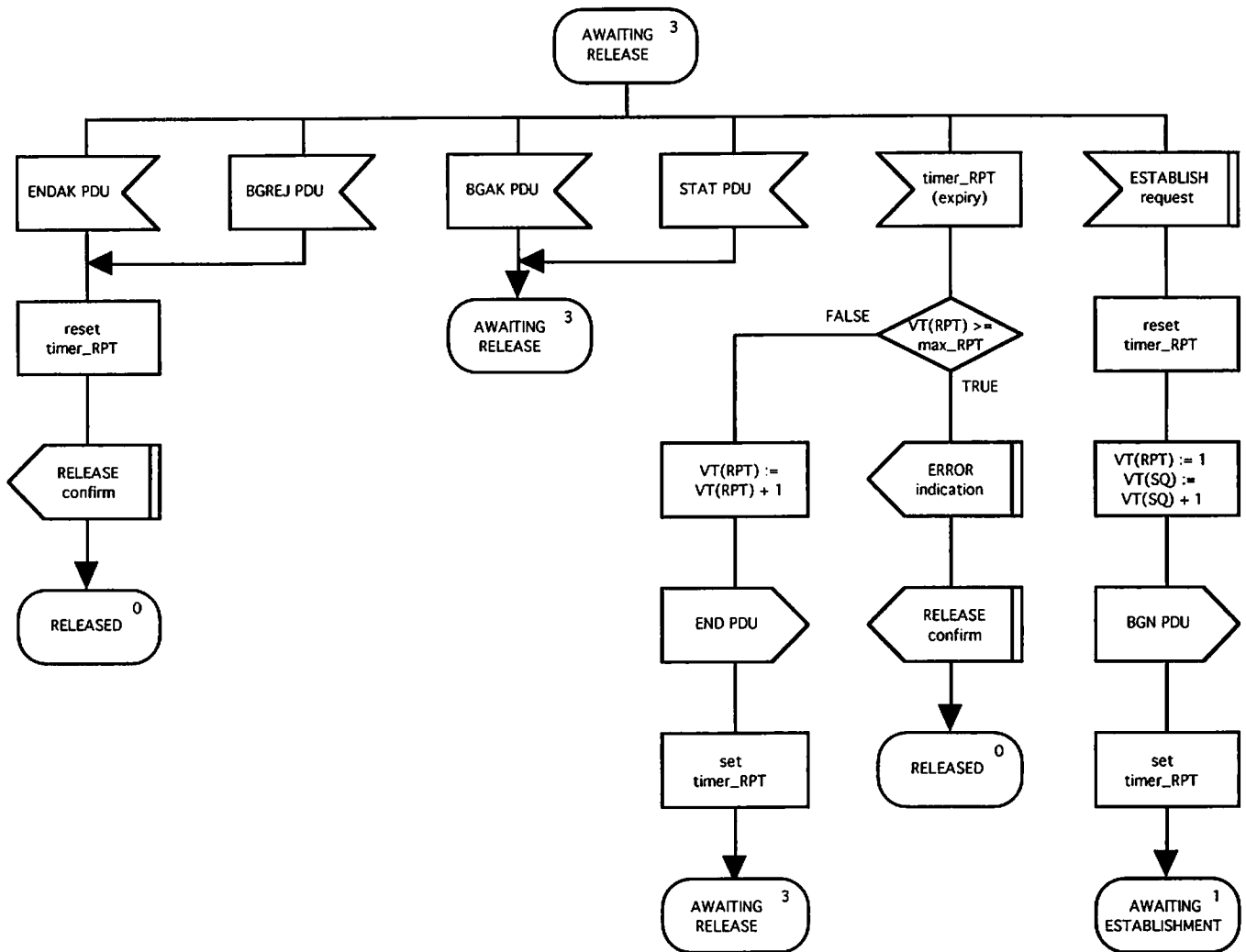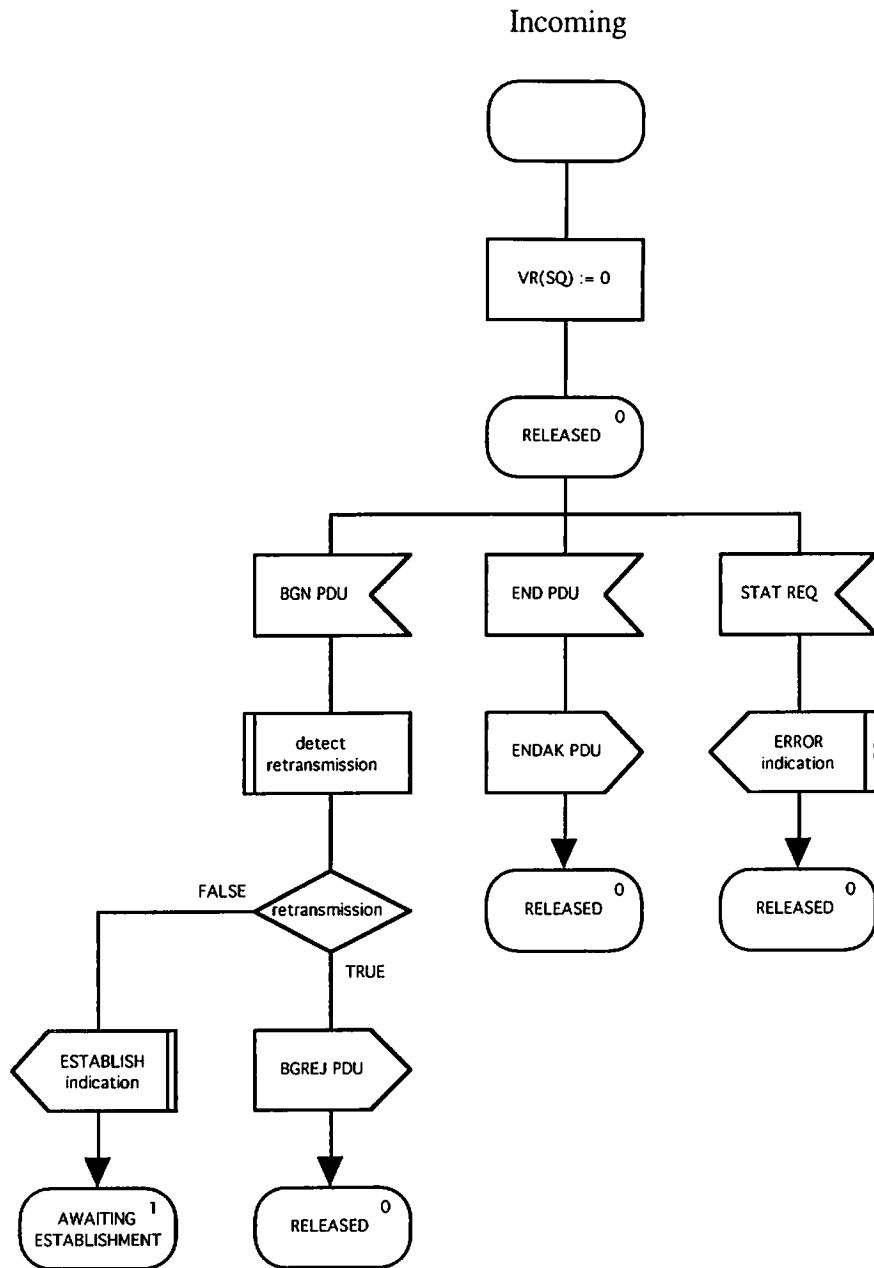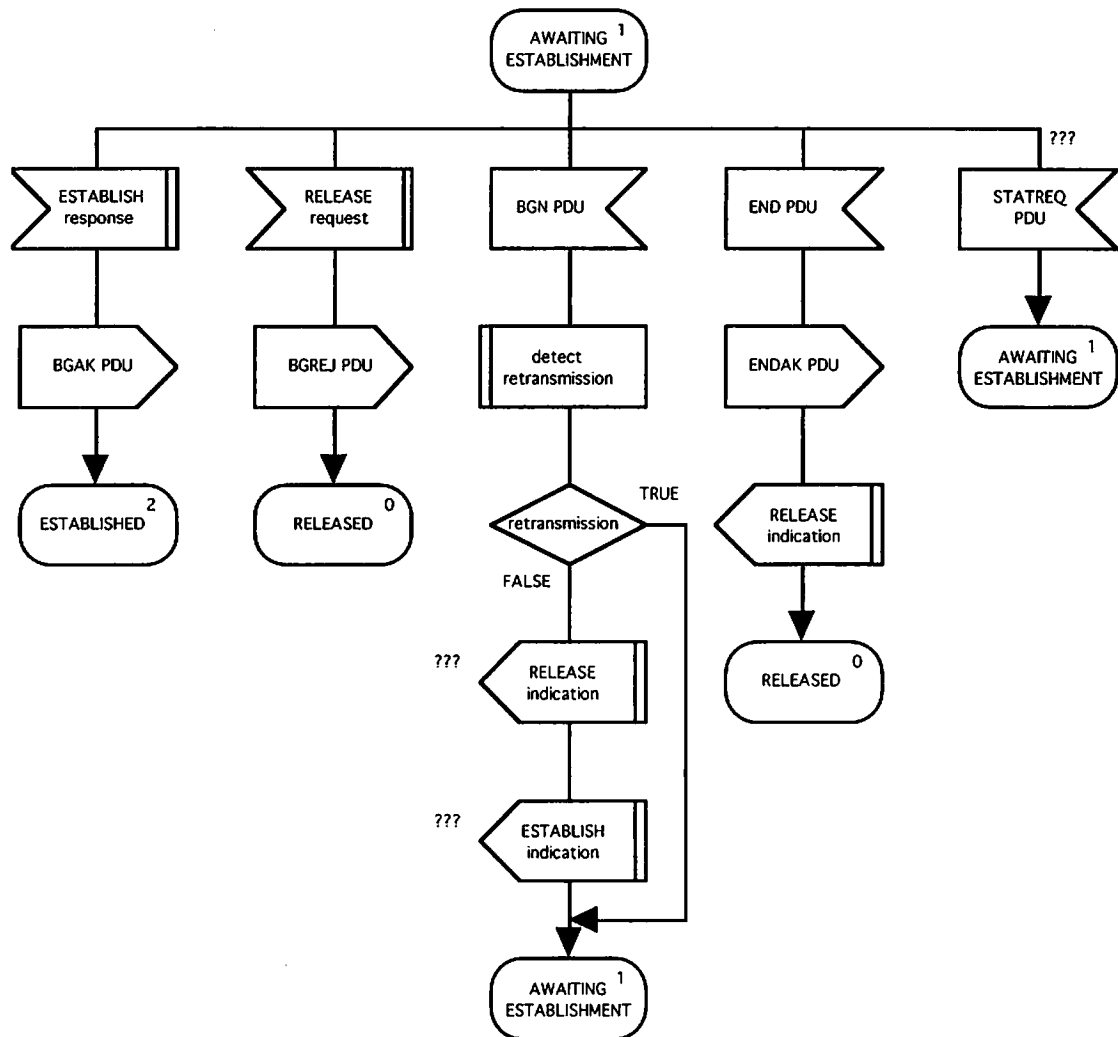
Incoming

Incoming

Figure 5/H.222.1 (sheet 3 of 4)

Incoming