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ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

Contents

Foreword

This European Telecommunication Standard (ETS) has been prepared by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

The content of this ETS is derived from ITU-T Recommendation I.363 [2].

This ETS constitutes one of a set of ETSs describing different Asynchronous Transfer Mode (ATM) Adaptation Layer (AAL) types.

Transposition dates	
Date of adoption of this ETS:	28 July 1995
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Introduction

The AAL type 5 enhances the service provided by the ATM layer to support functions required by the next higher layer. The AAL type 5 performs functions required by the user, control and management planes and supports the adaptation between the ATM layer and the next higher layer. The functions performed in the AAL type 5 depend upon the higher layer requirements.

The AAL supports multiple protocols (AAL types) to suit the needs of the different AAL service users. The service provided by the AAL type 5 to the higher layer and the functions performed are specified in this ETS.

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1 Scope

This European Telecommunication Standard (ETS) specifies the interactions between the Asynchronous Transfer Mode (ATM) Adaptation Layer (AAL) type 5 and the next higher layer, and the AAL type 5 and the ATM layer, as well as AAL type 5 peer-to-peer operations.

This ETS is applicable to variable bitrate sources where there exists no timing relation between the source and the destination of the data.

This ETS defines the common part of AAL type 5 and can be complemented with standards for the service specific part of the convergence sublayer.

2 Normative references

This ETS incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1] ITU-T Recommendation I.361 (1993): "B-ISDN ATM layer specification".

[2] ITU-T Recommendation I.363 (1993): "B-ISDN ATM adaptation layer specification".

3 Definitions

Illustration of the data unit naming convention used in this ETS can be found in annex A.

In addition, for the purposes of this ETS, the following definitions apply:

message mode: A Service Data Unit (SDU) is passed across the (sub)layer interface in exactly one Interface Data Unit (IDU) (see note).

streaming mode: A SDU is passed across the (sub)layer interface in one or more IDUs. The transfer of the IDUs across the (sub)layer may occur separated in time (see note).

pipelining: The sending peer entity initiates the data transfer to the receiving peer entity before the complete SDU is available (see note).

NOTE: The implementation of these concepts is not always externally visible.

4 Abbreviations

For the purposes of this ETS, the following abbreviations apply:

AAL	ATM Adaptation Layer
AAL-IDU	AAL type 5 IDU
AAL-SAP	AAL Service Access Point
AAL-SDU	AAL type 5 Service Data Unit
ATM	Asynchronous Transfer Mode
ATM-SDU	ATM Service Data Unit
AUU	ATM-layer-User to ATM-layer-User indication
CLP	Cell Loss Priority
CPCS	Common Part Convergence Sublayer
CPCS-CI	CPCS-Congestion Indication
CPCS-IDU	CPCS Interface Data Unit
CPCS-LP	CPCS-Loss Priority
CPCS-PDU	CPCS Protocol Data Unit
CPCS-SDU	CPCS Service Data Unit
CPCS-UU	CPCS-User to User indication
CPI	Common Part Indicator
CRC	Cyclic Redundancy Check
CS	Convergence Sublayer
ID	Interface Data
IDU	Interface Data Unit
LP	Loss Priority
M	More
MM	Message Mode
Pad	Padding
PICS	Protocol Implementation Conformance Statement
PT	Payload Type
QoS	Quality of Service
RS	Reception Status
SAP	Service Access Point
SAR	Segmentation And Reassembly
SAR-CI	SAR-Congestion Indication
SAR-IDU	SAR IDU
SAR-LP	SAR-Loss Priority
SAR-PDU	SAR Protocol Data Unit
SAR-SDU	SAR Service Data Unit
SDU	Service Data Unit
SDL	Specification and Description Language
SM	Streaming Mode
SSCS	Service Specific CS
SSCS-PDU	SSCS Protocol Data Unit

5 AAL type 5

5.1 Framework of AAL type 5

The Convergence Sublayer (CS) has been subdivided into the Common Part CS (CPCS) and the Service Specific CS (SSCS) as shown in figure 1 (further clarification can be found in annex C). Different SSCS protocols, to support specific AAL type 5 user services, or groups of services, may be defined. The SSCS may also be null, in the sense that it only provides for the mapping of the equivalent primitives of the AAL type 5 to CPCS and vice-versa. SSCS protocols are specified in separate ETSs.

The description contained in this ETS defines the functional behaviour of the AAL type 5 common part and does not preclude any implementation as long as the external behaviour of the implementation follows this ETS. The separation of the functionality between SAR and CPCS is arbitrary and is not visible to the outside. The allocation of functions to the two sublayers has been made in order to simplify the description.

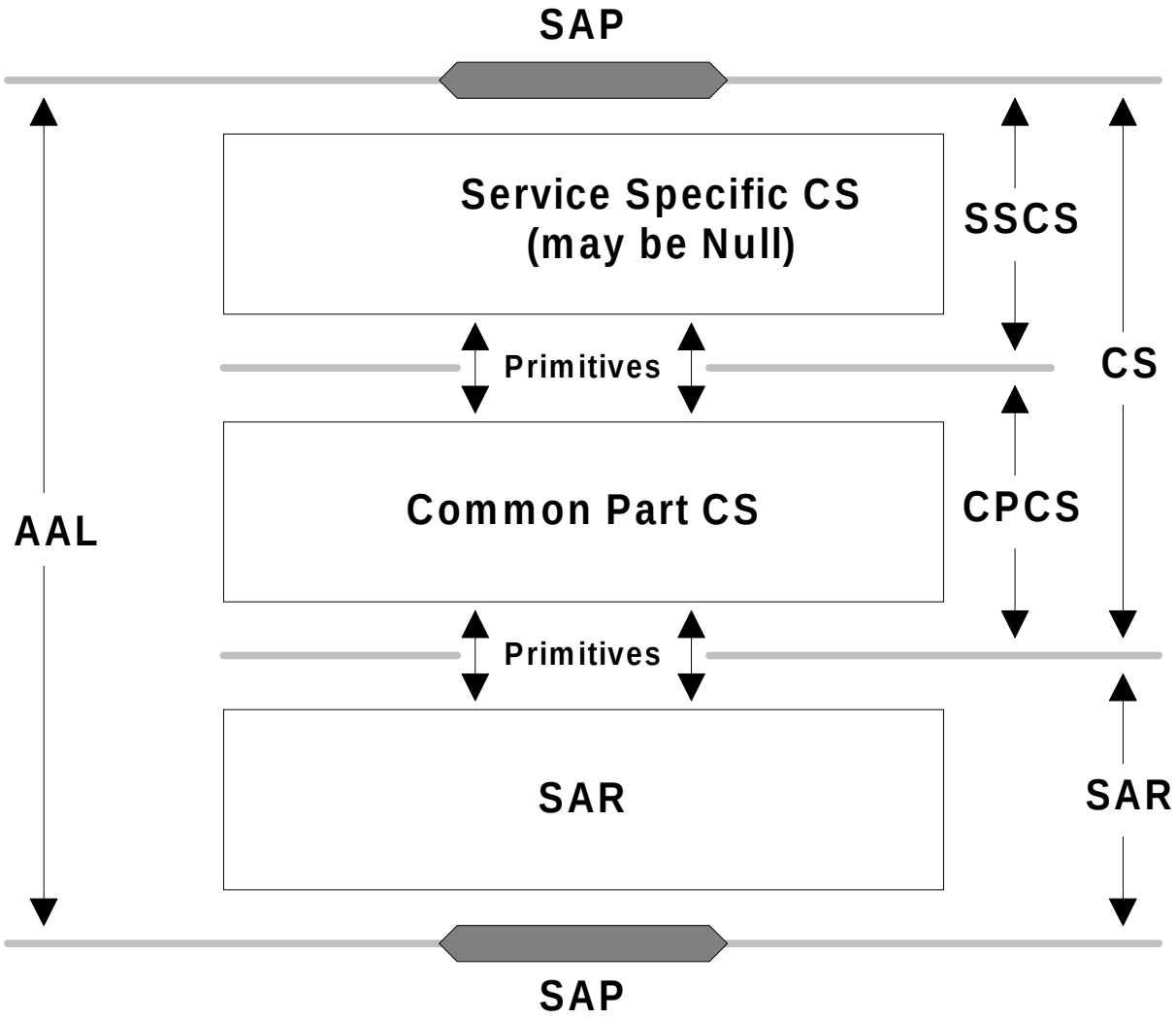


Figure 1: Structure of the AAL type 5

5.2 Information flow across the AAL-ATM boundary

The AAL type 5 makes use of the ATM layer services as defined in ITU-T Recommendation I.361 [1].

NOTE: The addition of the "Received Loss Priority" parameter in the ATM-DATA-indication primitive as agreed by CCITT SG XVIII in January 1993 is assumed.

5.3 Service provided by the AAL type 5

The AAL type 5 provides the capabilities to transfer the AAL type 5 Service Data Unit (AAL-SDU) from one AAL type 5 user to another AAL type 5 user through the ATM network. The Message Mode service, Streaming Mode service, and assured and non-assured operations as defined below for AAL type 5 are identical to those defined for AAL type 3/4 (see ETS 300 349).

Two modes of service are defined: Message and Streaming:

a) Message Mode service: the AAL-SDU is passed across the AAL type 5 interface in exactly one AAL type 5 Interface Data Unit (AAL-IDU). This service provides the transport of fixed size or variable length AAL-SDUs:

   1) in case of short fixed size AAL-SDUs an internal blocking/deblocking function in the SSCS may be applied; it provides the transport of one or more fixed size AAL-SDUs in one SSCS Protocol Data Unit (SSCS-PDU);

   2) in case of variable length AAL-SDUs an internal AAL-SDU message segmentation/reassembling function in the SSCS may be applied. In this case, a single AAL-SDU is transferred in one or more SSCS-PDUs;

   3) where the above options are not used, a single AAL-SDU is transferred in one SSCS-PDU. When the SSCS is null, the AAL-SDU is mapped to one CPCS Service Data Unit (CPCS-SDU);

b) Streaming Mode service: the AAL-SDU is passed across the AAL type 5 interface in one or more AAL-IDU. The transfer of these AAL-IDUs across the AAL type 5 interface may occur separated in time. This service provides the transport of variable length AAL-SDUs:

   1) an internal AAL-SDU message segmentation/reassembling function in the SSCS may be applied. In this case all the AAL-IDUs belonging to a single AAL-SDU are transferred in one or more SSCS-PDU;

   2) an internal pipelining function may be applied. It provides the means by which the sending AAL type 5 entity initiates the transfer to the receiving AAL type 5 entity before it has the complete AAL-SDU available;

   3) where option 1) is not used, all the AAL-IDUs belonging to a single AAL-SDU are transferred in one SSCS-PDU. When the SSCS is null, the AAL-IDUs belonging to a single AAL-SDU are mapped to one CPCS-SDU.

   The Streaming Mode service includes an abort service by which the discarding of an AAL-SDU partially transferred across the AAL type 5 interface can be requested.

Summaries of the service mode and feature options are provided in tables 1 and 2.

NOTE: An end-to-end specification of the SDU length in Message Mode with Blocking/Deblocking is needed.

Table 1: Combination of service mode and internal function

	AAL-SDU Message Segmentation/reassembly in the SSCS	AAL-SDU Message Blocking/deblocking in the SSCS	Pipelining
Message			
Option 1	O	N/A	N/A
Option 2	N/A	O	N/A
Streaming	O	N/A	O
Option 1: Long variable size SDUs		O: Optional	
Option 2: Short fixed size SDUs		N/A: Not Applicable	

Table 2: Combination of service mode at the sender and receiver side

Receiver	Sender		
	MM/Blocking	MM/Segmentation	SM
MM/Deblocking	A	N/A	N/A
MM/Reassembly	N/A	A	A
SM	N/A	A	A
MM: Message Mode		A: Applicable	
SM: Streaming Mode		N/A: Not Applicable	

Both modes of service may offer the following peer-to-peer operational procedures:

- assured operations:
  every assured AAL-SDU is delivered with exactly the data content that the user sent. The assured service is provided by retransmission of missing or corrupted SSCS-PDUs. Flow control is provided as a mandatory feature. The assured operation may be restricted to point-to-point AAL type 5 connections;

- non-assured operations:
  integral AAL-SDUs may be lost or corrupted. Lost and corrupted AAL-SDUs are not corrected by retransmission. An optional feature may be provided to allow corrupted AAL-SDUs to be delivered to the user (i.e. optional delivery of corrupted data). Flow control may be provided as an option.

5.3.1 Description of AAL type 5 connections

The AAL type 5 provides the capabilities to transfer the AAL-SDU from one AAL Service Access Point (AAL-SAP) to one other AAL-SAP through the ATM network (see figure 2). The AAL type 5 users have the capability to select a given AAL-SAP associated with the Quality of Service (QoS) required to transport that AAL-SDU (for example, delay and loss sensitive QoS).

The AAL type 5 makes use of the service provided by the underlying ATM layer (see figure 3). Multiple AAL type 5 connections may be associated with a single ATM layer connection, allowing multiplexing at the AAL type 5; however, if multiplexing is used in the AAL type 5, it occurs in the SSCS. The AAL type 5 user selects the QoS provided by the AAL type 5 through the choice of the AAL-SAP used for data transfer.

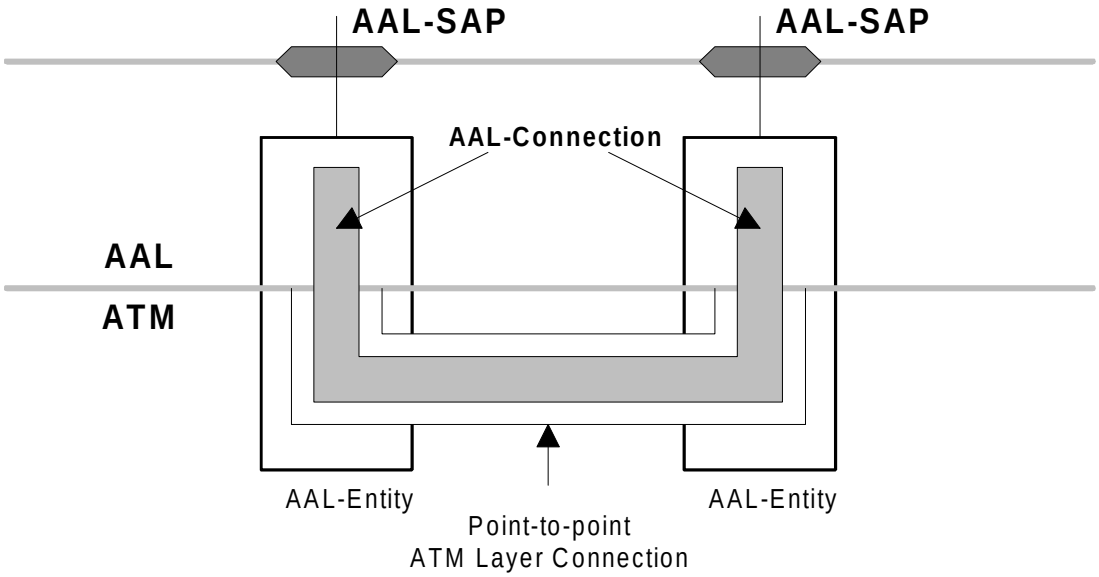
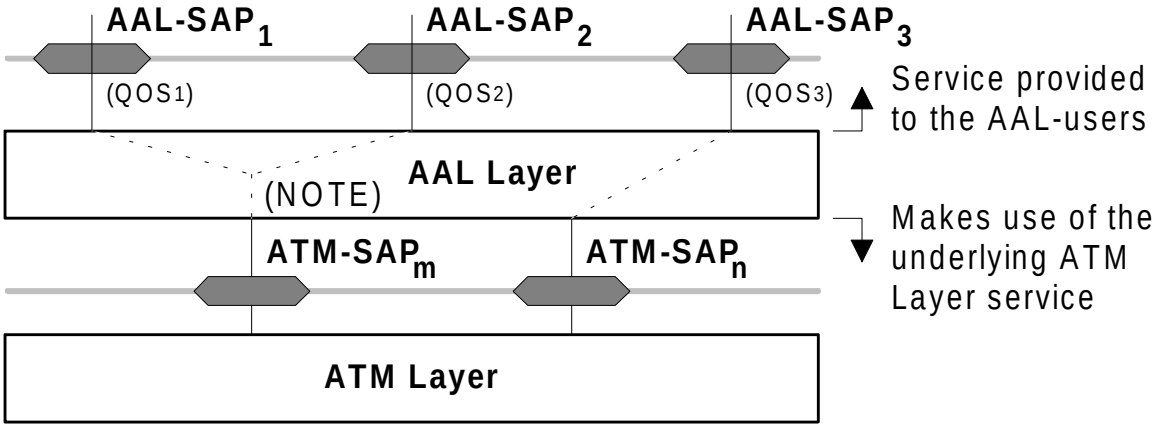


Figure 2: Point-to-Point AAL type 5 connection

5.3.2 Primitives for the AAL type 5

These primitives are service specific and are contained in separate Standards on SSCS protocols.

The SSCS may be null, in the sense that it only provides for the mapping of the equivalent primitives of the AAL type 5 to CPCS and vice-versa. In this case, the primitives for the AAL type 5 are equivalent to those for the CPCS (subclause 6.1.1.1) but identified as AAL-UNITDATA-request, AAL-UNITDATA-indication, AAL-U-Abort-request, AAL-U-Abort-indication and AAL-P-Abort-indication, consistent with the primitive naming convention at a Service Access Point (SAP).



NOTE: If multiplexing is present at the AAL type 5, it occurs in the SSCS.

Figure 3: Relation between AAL-SAP and ATM-SAP

6 The common part of the AAL type 5

6.1 Services provided by the common part of the AAL type 5

Two modes of service are defined, message and streaming:

a) Message Mode service: The CPCS Service Data Unit is passed across the CPCS interface in exactly one CPCS-IDU. This service provides the transport of fixed size or variable length CPCS-SDUs. A single CPCS-SDU is transferred in one CPCS Protocol Data Unit (CPCS-PDU);

b) Streaming Mode service: The CPCS-SDU is passed across the CPCS interface in one or more CPCS-IDUs. The transfer of these CPCS-IDUs across the CPCS interface may occur separated in time. This service provides the transport of variable length CPCS-SDUs. The Streaming Mode service includes an abort service by which the discarding of an CPCS-SDU partially transferred across the CPCS interface can be requested.

   An internal pipelining function may be applied. It provides the means by which the sending CPCS entity initiates the transfer to the receiving CPCS entity before it has the complete CPCS-SDU available.

   All the CPCS-IDUs belonging to a single CPCS-SDU are transferred in one CPCS-PDU.

   NOTE: Figures A.2.a) and A.2.d) of annex A illustrate the Message Mode and Streaming Mode services.

The following peer-to-peer operational procedure is offered:

- non-assured operations:
  integral CPCS-SDUs may be lost or corrupted. Lost and corrupted CPCS-SDUs will not be corrected by retransmission. An optional feature may be provided to allow corrupted CPCS-SDUs to be delivered to the user (i.e. optional delivery of corrupted data).

6.1.1 Primitives

The functional model for the AAL type 5 as contained in annex C shows the interrelation between the Segmentation And Reassembly (SAR) sublayer, CPCS and SSCS and the SAR and CPCS primitives.

CPCS and SAR connection establishment and release can be done via signalling, management or prearrangement. The CPCS connection and the corresponding SAR connection are established simultaneously. There is no provision for CPCS or SAR connection establishment and release in the CPCS or the SAR protocol.

6.1.1.1 Primitives for the CPCS of the AAL type 5

As there exists no SAP between the sublayers of the AAL type 5, the primitives are called "invoke" and "signal" instead of the conventional "request" and "indication" to highlight the absence of the SAP.

6.1.1.1.1 Primitives for the data transfer service

CPCS-UNITDATA-invoke and CPCS-UNITDATA-signal.

These primitives are used for the data transfer. The following parameters are defined:

- **Interface Data (ID).**

  This parameter specifies the Interface Data Unit (IDU) exchanged between the CPCS and the SSCS entity. The ID is an integral multiple of one octet. If the CPCS entity is operating in the Message Mode service, the ID represents a complete CPCS-SDU; when operating in the Streaming Mode service, the ID does not necessarily represent a complete CPCS-SDU. When the corrupted data delivery option is used, the ID parameter may be empty;

- **More (M).**

  In the Message Mode service, this parameter is not used. In the Streaming Mode service, this parameter specifies whether the ID communicated contains a beginning / continuation of a CPCS-SDU or the end of / complete CPCS-SDU;

- **CPCS Loss Priority (CPCS-LP).**

  This parameter indicates the loss priority for the associated CPCS-SDU. It can take only two values, one for high priority and the other for low priority. In Streaming Mode, this parameter is mandatory with the first invoke primitive related to a certain CPCS-SDU; otherwise, it is ignored and may be absent. At the receiving side, this parameter is only present with the last signal primitive related to a certain CPCS-SDU. This parameter is mapped to and from the SAR Loss Priority (SAR-LP) parameter. In general, this parameter has no end-to-end significance;

- **CPCS Congestion Indication (CPCS-CI).**

  This parameter indicates whether the associated CPCS-SDU has experienced congestion. In Streaming Mode, this parameter is mandatory with the first invoke primitive related to a certain CPCS-SDU; otherwise, it is not present. At the receiving side, this parameter is only present with the last signal primitive related to a certain CPCS-SDU. This parameter is mapped to and from the SAR-Congestion Indication (SAR-CI) parameter;

- **CPCS User to User indication (CPCS-UU).**

  This parameter is transparently transported by the CPCS between peer CPCS users. In Streaming Mode, this parameter is mandatory with the last invoke primitive related to a certain CPCS-SDU; otherwise, it is not present. At the receiving side, this parameter is only present with the last signal primitive related to a certain CPCS-SDU;

- **Reception Status (RS).**

  This parameter indicates whether or not the associated CPCS-SDU delivered may be corrupted. This parameter is only utilized if the corrupted data delivery option is used. In Streaming Mode, this parameter is only present with the last signal primitive related to a certain CPCS-SDU.

Depending on the service mode (Message Mode or Streaming Mode service, discarding or delivery of errored information), not all parameters are required. This is summarized in table 3.

Table 3: Parameters of the CPCS-UNITDATA

Parameter	Type	MM	SM	Comments
Interface Data (ID)	invoke signal	m m	m m	whole or partial CPCS-SDU
More (M)	invoke signal	- -	m m	M = 0: end of CPCS-SDU M = 1: not end of CPCS-SDU
CPCS-Loss priority (CPCS-LP)	invoke signal	m m	m^1 m^2	mapped to and from the ATM layer's CLP field CPCS-LP = 1: Low priority CPCS-LP = 0: High priority
CPCS-Congestion Indication (CPCS-CI)	invoke signal	m m	m^1 m^2	mapped to and from the ATM layer's Congestion Indication parameter CPCS-CI = 1: Congestion experienced CPCS-CI = 0: No congestion experienced
CPCS-User to User Indication (CPCS-UU)	invoke signal	m m	m^2 m^2	transparently transported by the CPCS
Reception Status (RS) (note)	invoke signal	- m	- m^2	indication of corrupted data

MM: Message Mode service.

SM: Streaming Mode service.

m: mandatory.

-: not present.

m^1: mandatory with the first invoke or signal primitive related to a certain CPCS-SDU, otherwise absent.

m^2: mandatory with the last invoke or signal primitive related to a certain CPCS-SDU, otherwise absent.

NOTE: Not present if the corrupted data delivery option is not used.

6.1.1.1.2 Primitives for the abort service

These primitives are used in the Streaming Mode service:

a) CPCS-U-Abort-invoke and CPCS-U-Abort-signal.

This primitive is used by the CPCS user to invoke the abort service. It is also used to signal to the CPCS user that a partially delivered CPCS-SDU is to be discarded by instruction from its peer entity. No parameters are defined.

This primitive is not used in Message Mode;

b) CPCS-P-Abort-signal.

This primitive is used by the CPCS entity to signal to its user that a partially delivered CPCS-SDU is to be discarded due to the occurrence of some error in the CPCS or below. No parameters are defined.

This primitive is not used in Message Mode.

6.1.1.2 Service provided by the SAR sublayer

Two modes of service are defined: message and streaming:

a) Message Mode service: the SAR Service Data Unit (SAR-SDU) is passed across the SAR interface in exactly one SAR-IDU. This service provides the transport of fixed size or variable length SAR-SDUs. A single SAR-SDU is transferred in one or more SAR Protocol Data Units (SAR-PDUs);

b) Streaming Mode service: the SAR-SDU is passed across the SAR interface in one or more SAR-IDUs. The transfer of these SAR-IDUs across the SAR interface may occur separated in time. This service provides the transport of variable length SAR-SDUs.

The SAR receiver always operates in Streaming Mode.

An internal pipelining function is applied. It provides the means by which the sending SAR entity initiates the transfer to the receiving SAR entity before it has the complete SAR-SDU available.

Figure A.2.d) of annex A illustrates the Streaming Mode service.

The following peer-to-peer operational procedure is offered:

- non-assured operations.

  Integral SAR-SDUs may be lost or corrupted. Lost and corrupted SAR-SDUs will not be corrected by retransmission. An optional feature may be provided to allow corrupted SAR-SDUs to be delivered to the user (i.e. optional delivery of corrupted data).

6.1.1.3 Primitives for the SAR sublayer of the AAL type 5

These primitives model the exchange of information between the SAR sublayer and the CPCS.

As there exists no SAP between the sublayers of the AAL type 5, the primitives are called "invoke" and "signal" instead of the conventional "request" and "indication" to highlight the absence of the SAP.

6.1.1.3.1 Primitives for the data transfer service

SAR-UNITDATA-invoke and SAR-UNITDATA-signal.

These primitives are used for the data transfer. The following parameters are defined:

NOTE: It is assumed that the SAR sender operates in Streaming Mode.

- **Interface Data (ID).**

  This parameter specifies the IDU exchanged between the SAR and the CPCS entity. The ID is an integral multiple of 48 octets. The ID does not necessarily represent a complete SAR-SDU;

- **More (M).**

  This parameter specifies whether the ID communicated contains the end of the SAR-SDU;

- **SAR-Loss Priority (SAR-LP).**

  This parameter indicates the loss priority for the associated SAR ID. It can take only two values, one for high priority, and the other for low priority. This parameter is mapped to the ATM layer's Submitted Loss Priority parameter and from the ATM layer's Received Loss Priority parameter;

- **SAR-Congestion Indication (SAR-CI).**

  This parameter indicates whether the associated SAR ID has experienced congestion. This parameter is mapped to and from the ATM layer's Congestion Indication parameter.

The usage of the parameters is summarized in table 4.

Table 4: Parameters of the SAR-UNITDATA

Parameter	Type		Comments
Interface Data (ID)	invoke signal	m m	whole or partial SAR-SDU
More (M)	invoke signal	m m	M = 0: end of SAR-PDU M = 1: not end of SAR-PDU
SAR-Loss Priority (SAR-LP)	invoke signal	m m	mapped to and from the ATM layer's CLP field SAR-LP = 1: Low priority SAR-LP = 0: High priority
SAR-Congestion Indication (SAR-CI)	invoke signal	m m	mapped to and from the ATM layer's Congestion Indication parameter SAR-CI = 1: Congestion experienced SAR-CI = 0: No congestion experienced
m: mandatory.			

6.2 Interaction with the management and control plane

Currently, no interactions with the management and control plane are standardized.

6.3 Functions, structure, and coding of the AAL type 5

6.3.1 Segmentation And Reassembly (SAR) sublayer

6.3.1.1 Functions of the SAR sublayer

The SAR sublayer functions are performed on a SAR-PDU basis. The SAR sublayer accepts variable length SAR-SDUs which are integral multiples of 48 octets from the CPCS and generates SAR-PDUs containing 48 octets of SAR-SDU data.

a) Preservation of SAR-SDU.

This function preserves the SAR-SDU by providing for an "end of SAR-SDU" indication.

b) Handling of congestion information.

This function provides for the passing of congestion information between the layers above the SAR sublayer and the one below in both directions.

c) Handling of loss priority information.

This function provides for the passing of cell loss priority information between the layers above the SAR sublayer and the one below in both directions.

d) SAR-SDU sequence integrity.

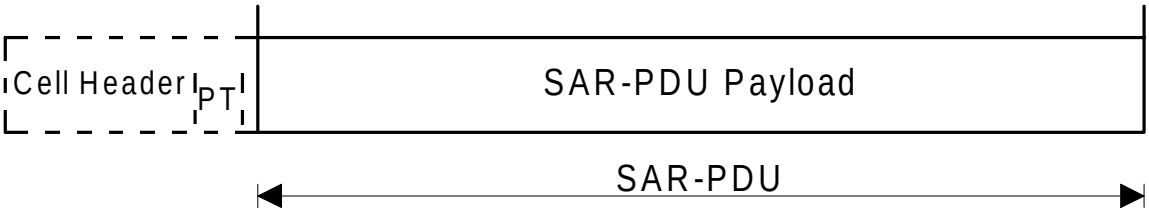
This function assures that the sequence of SAR-SDUs is maintained within one SAR connection.

e) Mapping between SAR connections and ATM connections.

This function provides for the one-to-one mapping between SAR connections and ATM connections. Neither SAR connection multiplexing nor splitting is provided.

6.3.1.2 SAR-PDU structure and coding

The SAR sublayer functions utilize the ATM-layer-user to ATM-layer-user indication (AUU) parameter of the ATM layer primitives to indicate that a SAR-PDU contains the end of a SAR-SDU. A SAR-PDU where the value of the AUU parameter is "1" indicates the end of a SAR-SDU; the value of "0" indicates the beginning or continuation of a SAR-SDU. The structure of the SAR-PDU is illustrated in figure 4.



PT: Payload Type

NOTE: The Payload Type field belongs to the ATM header. It conveys the value of the AUU parameter end-to-end.

Figure 4: SAR-PDU format for the AAL type 5

6.3.2 Convergence Sublayer (CS)

6.3.2.1 Functions, structure, and coding for the CPCS

The CPCS has the following service characteristics:

- non-assured data transfer of user data frames with any length measured in octets from 1 to 65 535 octets. In addition, an independent octet of user to user information per frame is transferred;
- the CPCS connection is established by management or by the control plane;
- error detection and indication (bit error and cell loss or gain);
- CPCS-SDU sequence integrity on each CPCS connection.

6.3.2.1.1 Functions of the CPCS

The CPCS functions are performed per CPCS-PDU. The CPCS provides several functions in support of the CPCS service user. The functions provided depend on whether the CPCS service user is operating in Message Mode or Streaming Mode:

a) Message Mode service: the CPCS-SDU is passed across the CPCS interface in exactly one CPCS-IDU. This service provides the transport of a single CPCS-SDU in one CPCS-PDU;

b) Streaming Mode service: the CPCS-SDU is passed across the CPCS interface in one or more CPCS-IDUs. The transfer of these CPCS-IDUs across the CPCS interface may occur separated in time.

   - **General description:** This service provides the transport of all the CPCS-IDUs belonging to a single CPCS-SDU within one CPCS-PDU.
   - **Pipelining function:** An internal pipelining function in the CPCS may be applied which provides the means by which the sending CPCS entity initiates the transfer to the receiving CPCS entity before it has the complete CPCS-SDU available.
   - **Abort service:** The Streaming Mode service includes an abort service by which the discarding of a CPCS-SDU partially transferred across the interface can be requested.

   NOTE: At the sending side, parts of the CPCS-PDU may have to be buffered if the restriction (i.e. that SAR ID are a multiple of 48 octets, see subclause 6.3.1.1) cannot be satisfied.

The functions implemented by the CPCS include:

1) preservation of CPCS-SDU.

   This function provides for the delineation and transparency of CPCS-SDUs;

2) preservation of CPCS user to user information.

   This function provides for the transparent transfer of CPCS user to user information;

3) error detection and handling.

   This function provides for the detection and handling of CPCS-PDU corruption. By default, corrupted CPCS-SDUs are discarded. A CPCS receiver may provide the local option to deliver corrupted CPCS-SDU to the SSCS (i.e. optional delivery of corrupted data). When the corrupted data delivery option is used, an error status indication is associated with the delivery. Even if the errored delivery service is used, CPCS-SDUs may be lost without notice.

   Examples of detected errors include: received length and CPCS-PDU Length field mismatch including buffer overflow, and CPCS Cyclic Redundancy Check (CRC) errors;

4) abort.

   This function provides for the means to abort a partially transmitted CPCS-SDU. This function is indicated in the Length field;

5) padding.

   This function provides for the padding of the CPCS-PDUs to an integral multiple of 48 octets and for the location of the CPCS-PDU trailer in the last 8 octets of the CPCS-PDU;

6) handling of congestion information.

   This function provides for the passing of congestion information between the layers above the CPCS and the one below in both directions;

7) handling of loss priority information.

   This function provides for the passing of cell loss priority information between the layers above the CPCS and the one below in both directions;

8) CPCS-SDU sequence integrity.

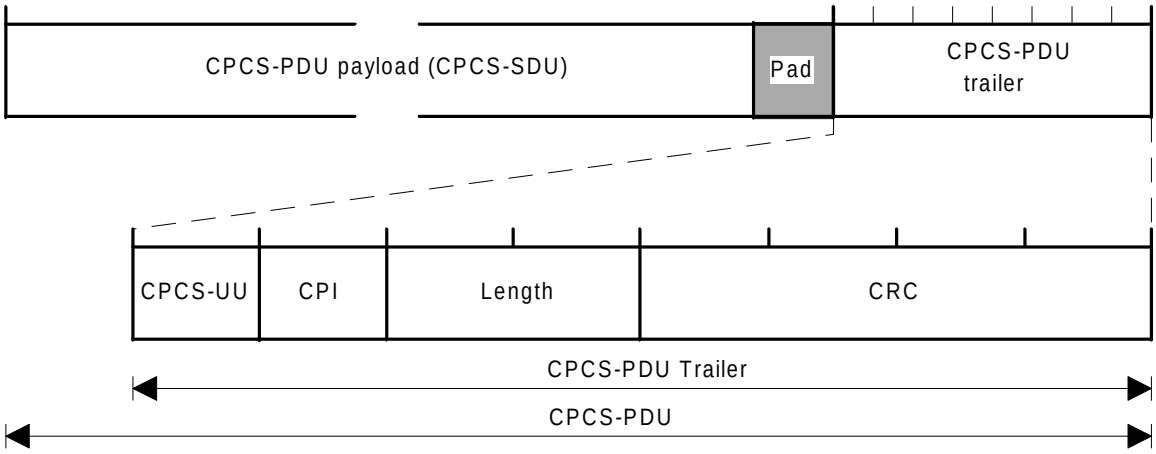
   This function assures that the sequence of CPCS-SDUs is maintained within one CPCS connection;

9) mapping between CPCS connections and SAR connections.

   This function provides for the one-to-one mapping between CPCS connections and SAR connections. Neither CPCS connection multiplexing nor splitting is provided.

6.3.2.1.2 CPCS structure and coding

The CPCS functions require an 8 octet CPCS-PDU Trailer. The CPCS-PDU Trailer is always located in the last 8 octets of the last SAR-PDU of the CPCS-PDU. Therefore, a padding field provides for a 48 octet alignment of the CPCS-PDU. The CPCS-PDU Trailer together with the padding field and the CPCS-PDU payload comprise the CPCS-PDU. The sizes and positions of fields for the CPCS-PDU structure are given in figure 5.



Pad:	Padding	(0 ... 47 octets)
CPCS-UU:	CPCS User-to-User Indication	(1 octet)
CPI:	Common Part Indicator	(1 octet)
Length:	Length of CPCS-SDU	(2 octets)
CRC:	Cyclic Redundancy Check	(4 octets)

Figure 5: CPCS-PDU format for the AAL type 5

The coding of the CPCS-PDU conforms to the coding conventions specified in ITU-T Recommendation I.361 [1], § 2.1:

a) CPCS-PDU payload.

The CPCS-PDU payload is the CPCS-SDU. The field can be from 1 to 65535 octets in length;

b) Padding (Pad) field.

Between the end of the CPCS-PDU payload and the CPCS-PDU trailer, there are from 0 to 47 unused octets. These unused octets are called the Padding (Pad) field; they are strictly used as filler octets and do not convey any information. Any coding is acceptable. This padding field complements the CPCS-PDU (including CPCS-PDU payload, Padding field, and CPCS-PDU Trailer) to an integral multiple of 48 octets.

The function of the Pad field is shown in figure 6.

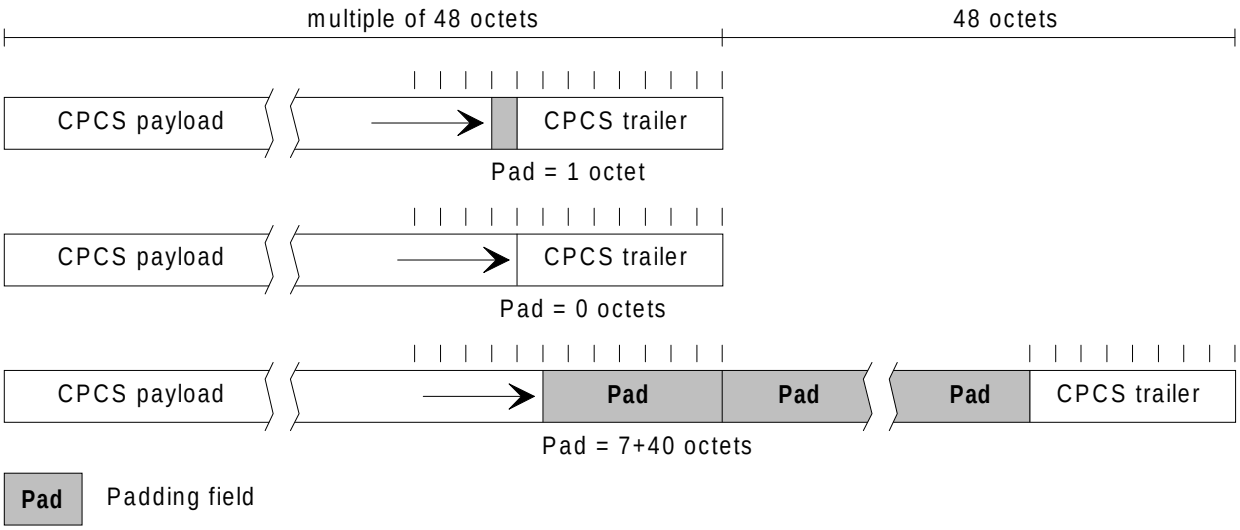


Figure 6: Examples of the Pad field function

c) CPCS-UU field.

The CPCS-UU field is used to transparently transfer CPCS user to user information;

d) Common Part Indicator (CPI) field.

The value CPI="0" indicates that the field is only used to align the length of the CPCS-PDU trailer to 64 bits. Possible additional functions and corresponding codings may include identification of layer management messages;

e) Length field.

The Length field is used to encode the length of the CPCS-PDU payload field. The Length field value is also used by the receiver to detect the loss or gain of information.

The length is binary encoded as number of octets.

A Length field coded as zero is used for the abort function;

f) CRC field.

The CRC-32 is used to detect bit errors in the CPCS-PDU.

The CRC field is filled with the value of a CRC calculation which is performed over the entire contents of the CPCS-PDU, including the CPCS-PDU payload, the Pad field, and the first 4 octets of the CPCS-PDU Trailer. The CRC field shall contain the ones complement of the sum (modulo 2) of:

1) the remainder of x^k ($x^{31} + x^{30} + ... + x + 1$) divided (modulo 2) by the generator polynomial, where k is the number of bits of the information over which the CRC is calculated; and

2) the remainder of the division (modulo 2) by the generator polynomial of the product of x^{32} by the information over which the CRC is calculated.

The CRC-32 generator polynomial is:

$$G(x) = x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$$

The result of the CRC calculation is placed with the least significant bit right justified in the CRC field.

As a typical implementation at the transmitter, the initial content of the register of the device computing the remainder of the division is pre-set to all "1's" and is then modified by division by the generator polynomial (as described above) of the information over which the CRC is to be calculated; the ones complement of the resulting remainder is put into the CRC field.

As a typical implementation at the receiver, the initial content of the register of the device computing the remainder of the division is pre-set to all "1's". The final remainder, after multiplication by x^{32} and then division (modulo 2) by the generator polynomial of the serial incoming CPCS-PDU, will be (in the absence of errors):

$$C(x) = x^{31}+x^{30}+x^{26}+x^{25}+x^{24}+x^{18}+x^{15}+x^{14}+x^{12}+x^{11}+x^{10}+x^{8}+x^{6}+x^{5}+x^{4}+x^{3}+x+1$$

An example of the CRC calculation is given in annex E.

6.4 Procedures

No procedures describing the delivery of errored information are standardized.

6.4.1 Procedures of the SAR sublayer

The structure and coding of the SAR-PDU is defined in subclause 6.3.1.2.

6.4.1.1 State variables of the SAR sublayer at the sender side

The SAR sender maintains no state variables.

6.4.1.2 Procedures of the SAR sublayer at the sender side

The state machine of the SAR sender is shown in figure 7.

Figure 7: State transition diagram for the SAR Sender

Table 5 defines the state for the SAR sender.

Table 5: State definition for the SAR sender

State	Definition
IDLE	Waiting to begin or continue to transmit a SAR-SDU

1) Upon receiving a SAR-UNITDATA-invoke primitive from the CPCS, the SAR sender shall start the segmenting process. If the ID has a length of more than 48 octets, the SAR sender generates more than one SAR-PDU. In all SAR-PDUs, the SAR-PDU payload field shall be filled with 48 octets of CPCS-PDU information.

2) If the More parameter in the SAR-UNITDATA-invoke primitive has the value "0", the SAR sender shall set the AUU parameter in the ATM-DATA-request primitive for the last SAR-PDU generated from the ID to "1"; in all other cases (i.e. the More parameter has the value "1" or the ATM-DATA-request primitive does not contain the last data generated from the ID), it shall set the AUU parameter to "0".

3) In all ATM-DATA-request primitives, the Submitted CLP and Congestion Indication parameters shall be set to the same value as the SAR-LP and SAR-CI parameters, respectively, in the received SAR-UNITDATA-invoke primitive.

6.4.1.3 State variables of the SAR sublayer at the receiver side

The SAR receiver maintains no state variables.

6.4.1.4 Procedures of the SAR sublayer at the receiver side

The state machine of the SAR receiver is shown in figure 8.

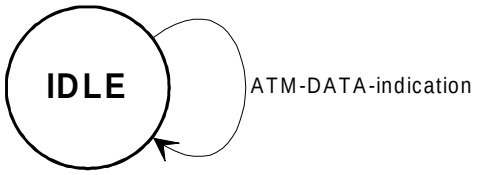


Figure 8: State transition diagram for the SAR receiver

Table 6 defines the state for the SAR receiver.

Table 6: State definition for the SAR receiver

State	Definition
IDLE	Waiting to begin or continue to receive a SAR-SDU

1) Upon receipt of an ATM-DATA-indication primitive, the 48 octet SAR-PDU payload is sent to the CPCS. If the AUU parameter in the ATM-DATA-indication primitive is set to "1", the More parameter is set to "0"; otherwise, the More parameter is set to "1".

2) In all SAR-UNITDATA-signal primitives, the SAR-CI and the SAR-LP parameters shall be set to the same value as the Congestion Indication and the Received Loss Priority parameters, respectively, in the received ATM-DATA-indication primitive.

6.4.2 Procedures of the CPCS for the Message Mode service

No procedures for the CPCS operating in Streaming Mode are standardized.

The structure and coding of the CPCS-PDU is defined in subclause 6.3.2.1.2.

6.4.2.1 State variables of the CPCS at the sender side

The CPCS sender maintains no state variables.

6.4.2.2 Procedures of the CPCS at the sender side

The state machine of the CPCS sender is shown in figure 9.

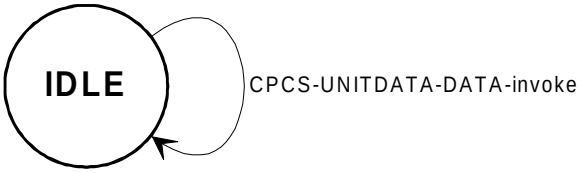


Figure 9: State transition diagram for the CPCS sender

Table 7 defines the state for the CPCS sender.

Table 7: State definition for the CPCS sender

State	Definition
IDLE	Waiting to transmit a new CPCS-PDU

Upon reception of a CPCS-UNITDATA-invoke primitive, the CPCS-PDU is constructed as described in subclause 6.3.2.1.2, and the CPCS-PDU is passed to the SAR sublayer in a SAR-UNITDATA-invoke primitive with the More parameter set to "0". The SAR-LP and the SAR-CI parameters are set to the value of the CPCS-LP and the CPCS-CI parameters, respectively, of the CPCS-UNITDATA-invoke primitive. The CPCS-UU field is assigned the value of the CPCS-UU parameter.

6.4.2.3 State variables of the CPCS at the receiver side

The CPCS receiver maintains the following state variable:

rcv_LP.

The rcv_LP variable is initially set to "0" and reinitialized at the beginning of the handling of a CPCS-PDU. If any SAR-LP parameter is set to "1", this variable is set to "1". It is used to set the CPCS-LP parameter in the CPCS-UNITDATA-signal primitive.

6.4.2.4 Procedures of the CPCS at the receiver side

The following procedures are specified for a CPCS receiver that does not deliver errored data to the receiving CPCS user.

The CPCS receiver maintains the following parameter:

Max_SDU_Deliver_Length.

This parameter indicates the maximum size SDU (in octets) that may be delivered to a CPCS user. At a receiver, the value of this parameter is compared to the length of each CPCS-SDU before it is delivered. Any CPCS-SDU that has a length greater than Max_SDU_Deliver_Length is discarded and the event is reported to layer management. This parameter can take on any integer value from 1 to 65'535 and is set by the management plane.

The state machine of the CPCS receiver is shown in figure 10.

Figure 10: State transition diagram for the CPCS receiver

Table 8 defines the state for the CPCS receiver.

Table 8: State definition for the CPCS receiver

State	Definition
IDLE	Waiting to begin or continue to reassemble a CPCS-PDU

NOTE: This procedure description may copy up to 47 octets of the Pad field into the reassembly buffer before processing the CPCS-PDU trailer.

1) When the CPCS receiver receives a SAR-UNITDATA-signal primitive from the SAR sublayer, it shall copy the ID to the reassembly buffer. If the SAR-LP parameter is set to "1", the variable rcv_LP is also set to "1".

2) If the More parameter of the SAR-UNITDATA-signal primitive is "1" and the received number of octets in the reassembly buffer of the CPCS-SDU is greater than the value of the parameter Max_SDU_Deliver_Length + 7, the CPCS receiver shall discard any information in the reassembly buffer.

3) If the More parameter of the SAR-UNITDATA-signal primitive is "0", the last 8 octets of the ID represent the CPCS-PDU trailer. If the CRC calculation performed on the complete CPCS-PDU as specified in subclause 6.3.2.1.2 and the value in the CRC field indicate the presence of errors, any information in the reassembly buffer shall be discarded.

4) If the value in the CPI field is not valid, any information in the reassembly buffer shall be discarded.

5) If the Length field of the CPCS-PDU trailer is coded as "0", any information in the reassembly buffer shall be discarded.

6) The Length field of the CPCS-PDU trailer is used to determine the length of the Pad field (length of received CPCS-PDU minus eight and minus the content of the Length field). If the Pad field is longer than 47 octets or not enough data has been received, any information in the reassembly buffer shall be discarded.

7) If the CPCS-SDU is longer than Max_SDU_Deliver_Length, any information in the reassembly buffer shall be discarded.

8) After the receipt of a SAR-UNITDATA-signal primitive with the More parameter set to "0" and the data has not been discarded, any CPCS-SDU data in the reassembly buffer shall be delivered to the CPCS user via a CPCS-UNITDATA-signal primitive. The CPCS-LP parameter shall be set to the value of the variable rcv_LP. The CPCS-CI parameter shall be set to the value of the SAR-CI parameter received with the last SAR-UNITDATA-signal primitive. The CPCS-UU parameter shall be set to the value of the CPCS-UU field of the CPCS-PDU trailer. Data that is delivered is removed from the reassembly buffer.

9) Whenever information from the reassembly buffer is delivered or discarded, the variable rcv_LP is reset to "0".

A CPCS receiver may optionally implement a reassembly timer. If a reassembly timer is supported, the following procedures apply:

10) When the CPCS receiver receives a SAR-UNITDATA-signal primitive from the SAR sublayer with the More parameter set to "1", the reassembly timer shall be (re-)started.

11) When the CPCS receiver receives a SAR-UNITDATA-signal primitive from the SAR sublayer with the More parameter set to "0", the reassembly timer shall be stopped.

12) If the timer expires, the CPCS receiver shall discard any information in the reassembly buffer.

NOTE: The initialization value of a reassembly timer is not indicated to the corresponding CPCS sender(s). Neither an initialization value for the reassembly timer nor a formula to determine it from, e.g., ATM layer connection characteristics and/or AAL type 5 user requirements is standardized.

6.4.3 Summary of parameters and values for an AAL type 5 connection

The information in table 9 shall be known at AAL type 5 connection establishment.

Table 9: Parameters and options for the AAL type 5

Significance	Option/Parameter	Legal values
peer-to-peer	Max_SDU_Deliver_Length	1 to 65'535 octets
local (receiver)	corrupted SDU delivery	no / yes
	use and value of reassembly timer	no / yes and value

Annex A (informative): Details of the data unit naming convention

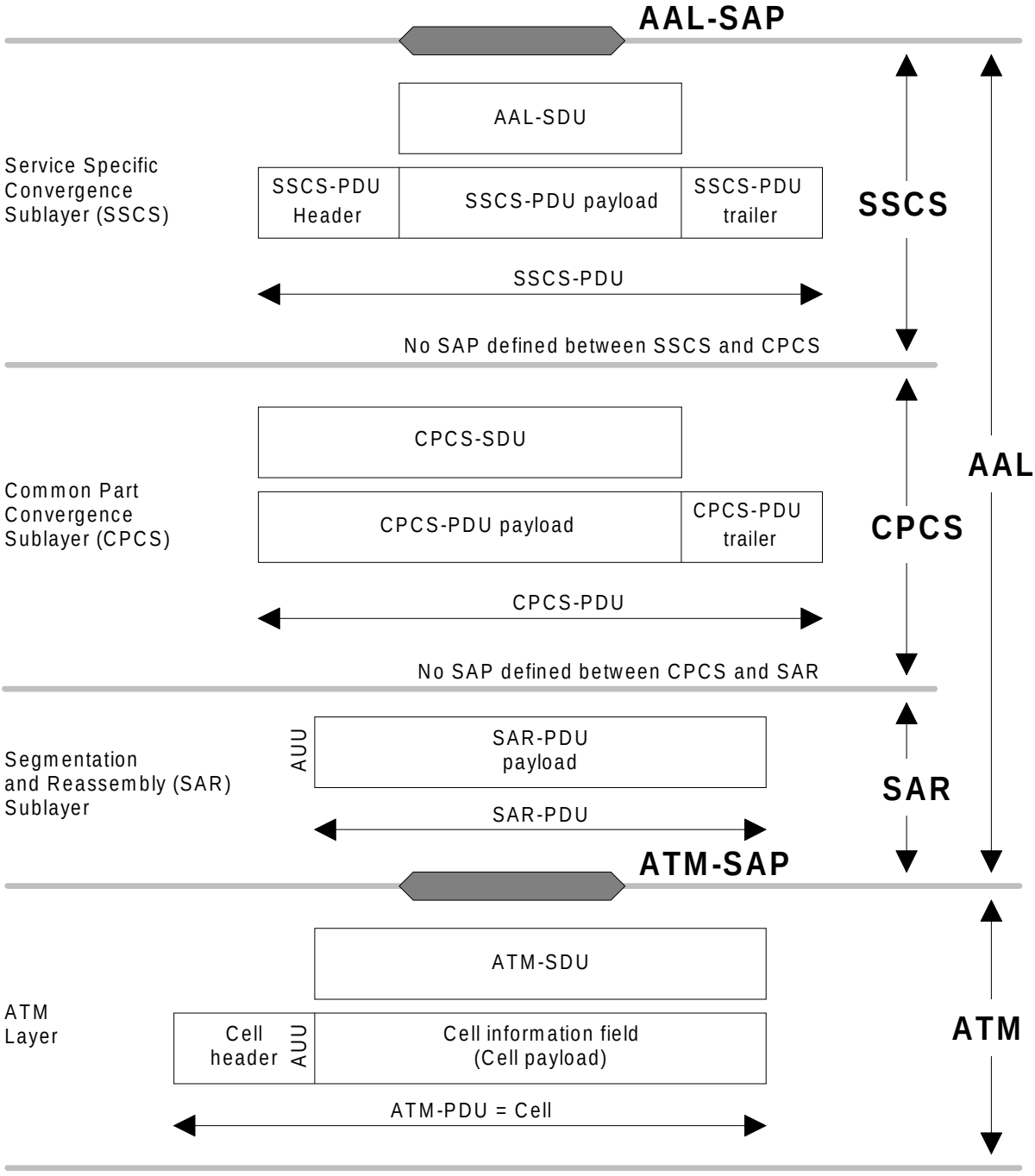
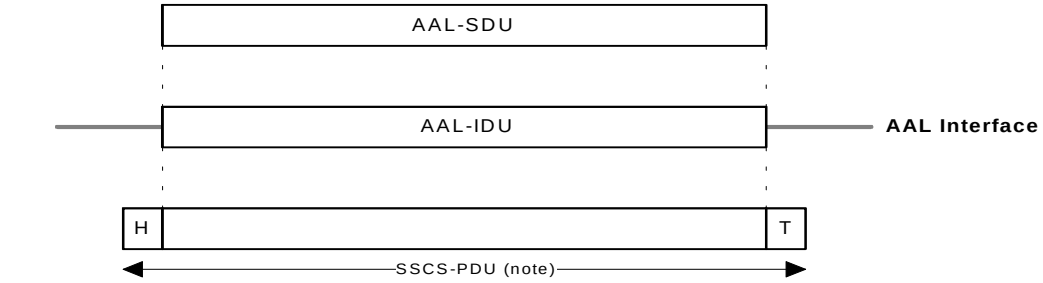
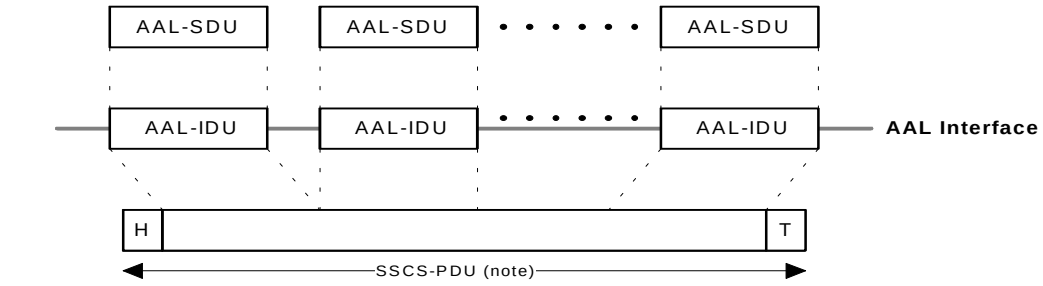


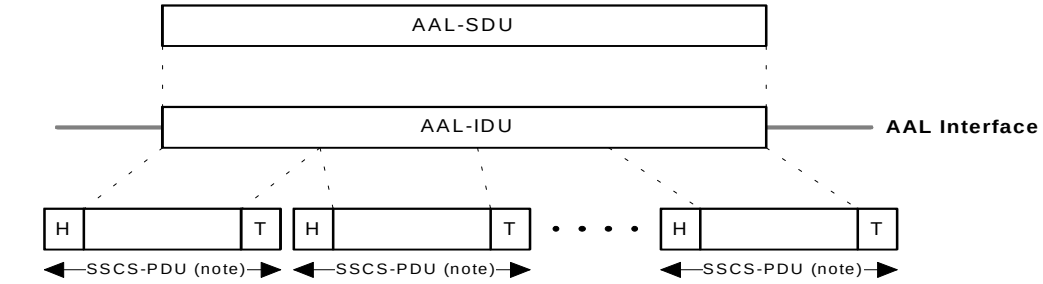
Figure A.1: Data unit naming conventions for the AAL type 5



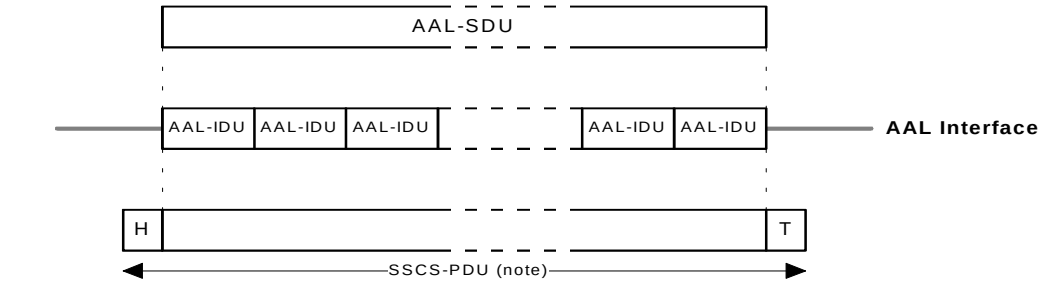
a) Message mode service



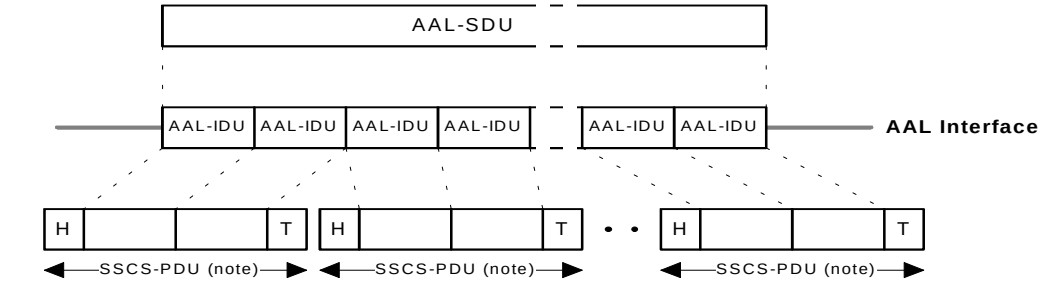
b) Message mode service plus blocking/deblocking internal function



c) Message Mode service plus segmentation/reassembly internal function



d) Streaming Mode service



e) Streaming Mode service plus segmentation/reassembly internal function

NOTE: The structure of the SSCS-PDU is for further study.

Figure A.2: Message Mode and Streaming Mode of service at the AAL type 5 interface combined with blocking/deblocking or segmentation/reassembly internal function

Annex B (informative): General framework of the AAL type 5

This annex provides a description of the general framework of the AAL type 5 including SAR and CPCS PDU formats.

B.1 Message segmentation and reassembly

Figure B.1 provides a generic interpretation of the segmenting of a SAR-SDU (message) into SAR-PDUs where the AUU bit in the header of the associated ATM Service Data Unit (ATM-SDU) is set to "0" and the last SAR-PDU where the AUU bit is set to "1".

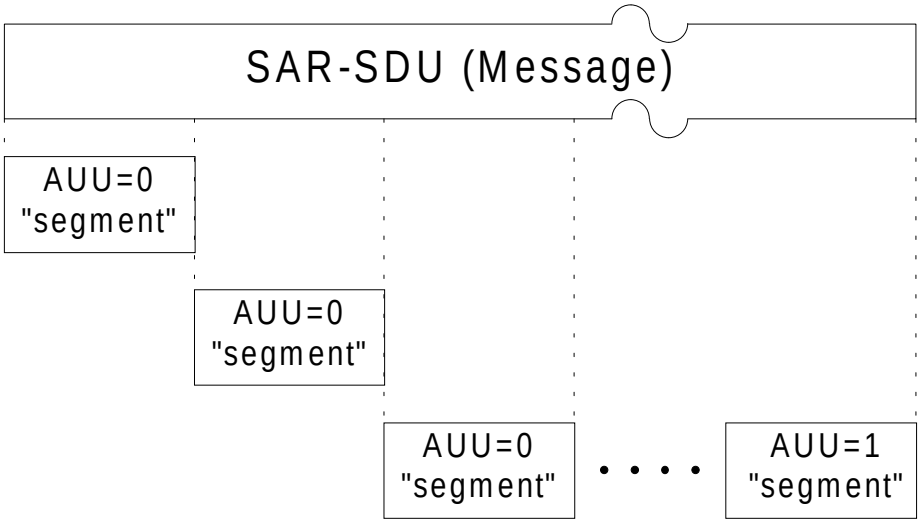


Figure B.1: Message segmentation and reassembly

B.2 PDU Headers, trailers and terminology

Figure B.2 builds on the generic view of message segmentation of figure A.1 to incorporate the relevant PDU headers and trailers and appropriate terminology on the basis of the AUU bit being set to "0" or "1".

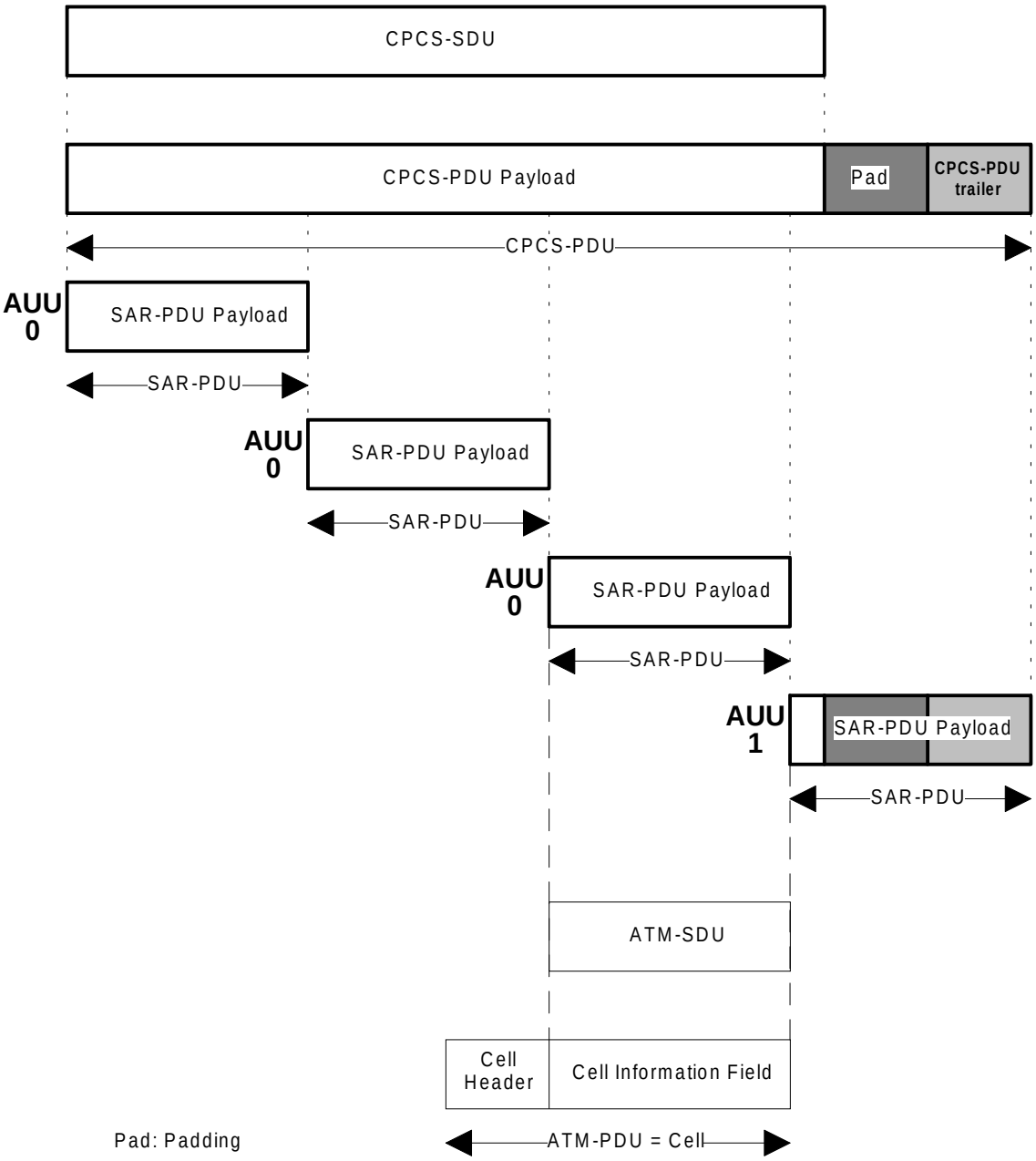


Figure B.2: PDU headers, trailers and terminology

B.3 Examples of the segmentation and reassembly process

Figure B.3 shows schematically a successful segmentation and reassembly of a CPCS user PDU in Message Mode.

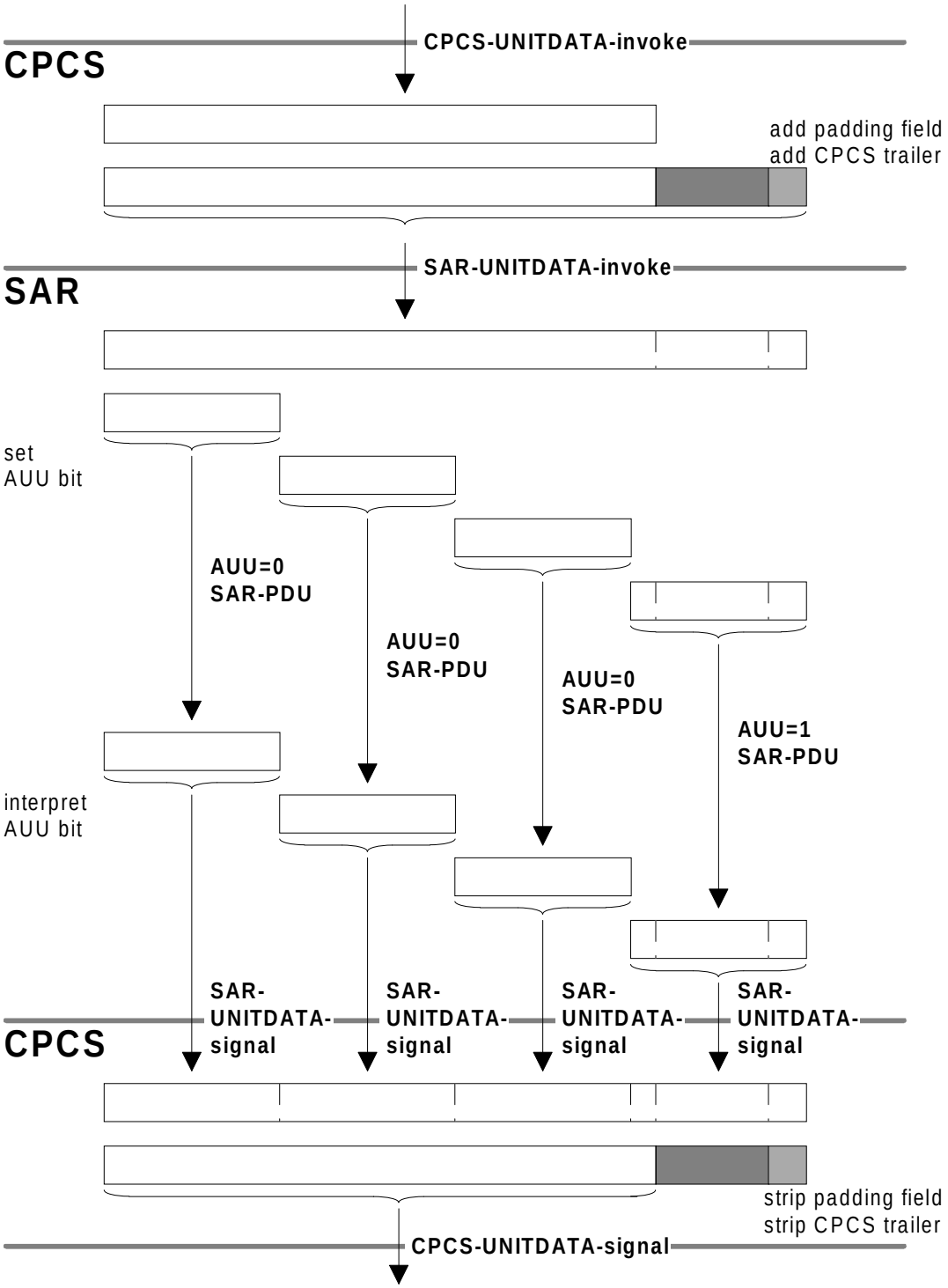


Figure B.3: Successful segmentation and reassembly of a CPCS user PDU

Annex C (informative): Functional model for the AAL type 5

For the AAL type 5, the functionality of the SSCS may provide only for the mapping of the equivalent primitives of the AAL type 5 to the CPCS an vice versa. On the other hand, the SSCS may implement functions such as assured data transfer. Such functions, however, are not shown in the following figures.

The functional model of the AAL type 5 at the sender side is shown in figure C.1. The model consists of several blocks that co-operate to provide the AAL type 5 service. The SAR and CPCS blocks that are paired represent the segmentation state machine.

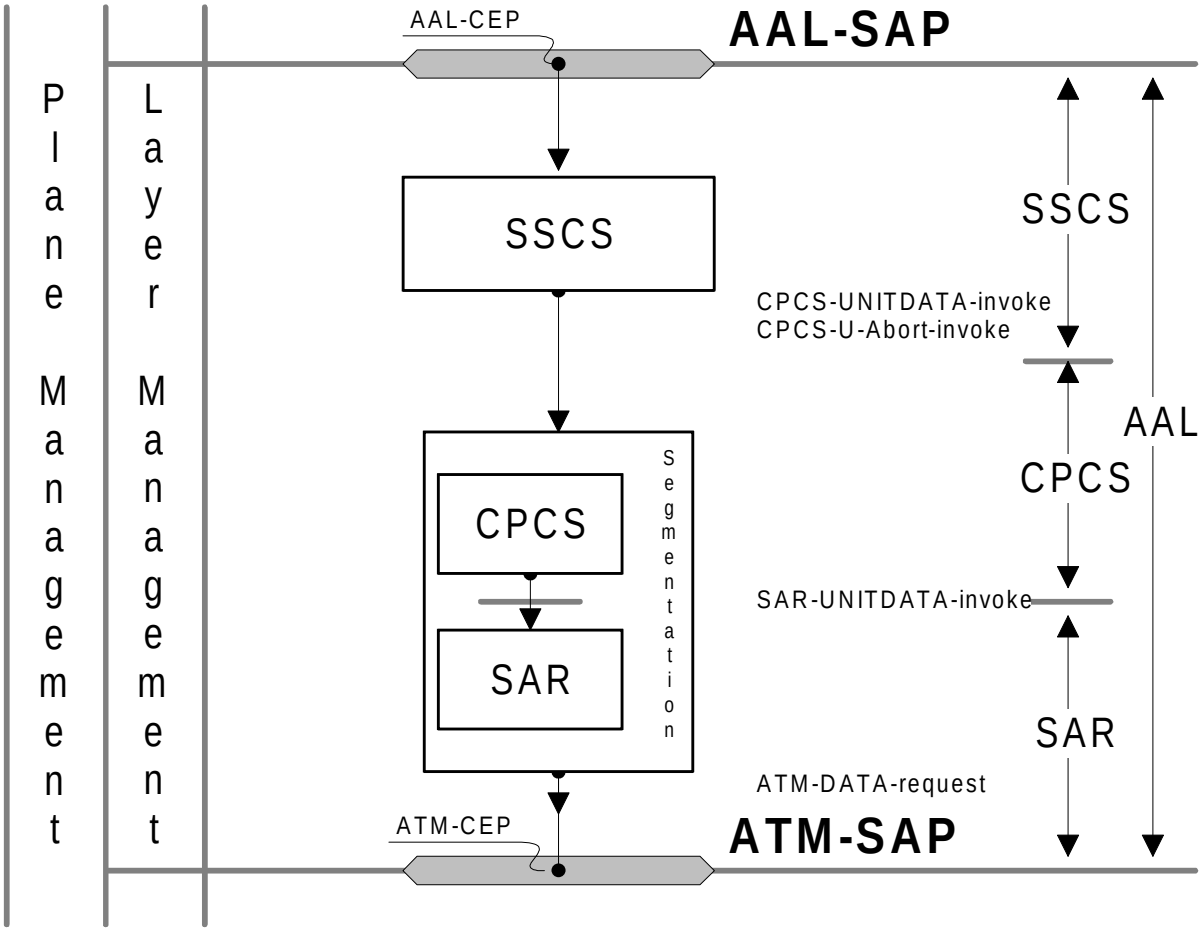


Figure C.1: Functional model for the AAL type 5 (sender side)

The functional model of the AAL type 5 at the receiver side is shown in figure C.2. The model consists of several blocks that co-operate to provide the AAL type 5 services. The SAR and CPCS blocks that are paired represent the reassembly state machine.

NOTE 1: Layer management interactions require further study.

NOTE 2: Concerning the SSCS, the functional model is an example only. Possible functions in the SSCS (i.e. multiplexing) are not shown. The SSCS is specified in other standards and Recommendations.

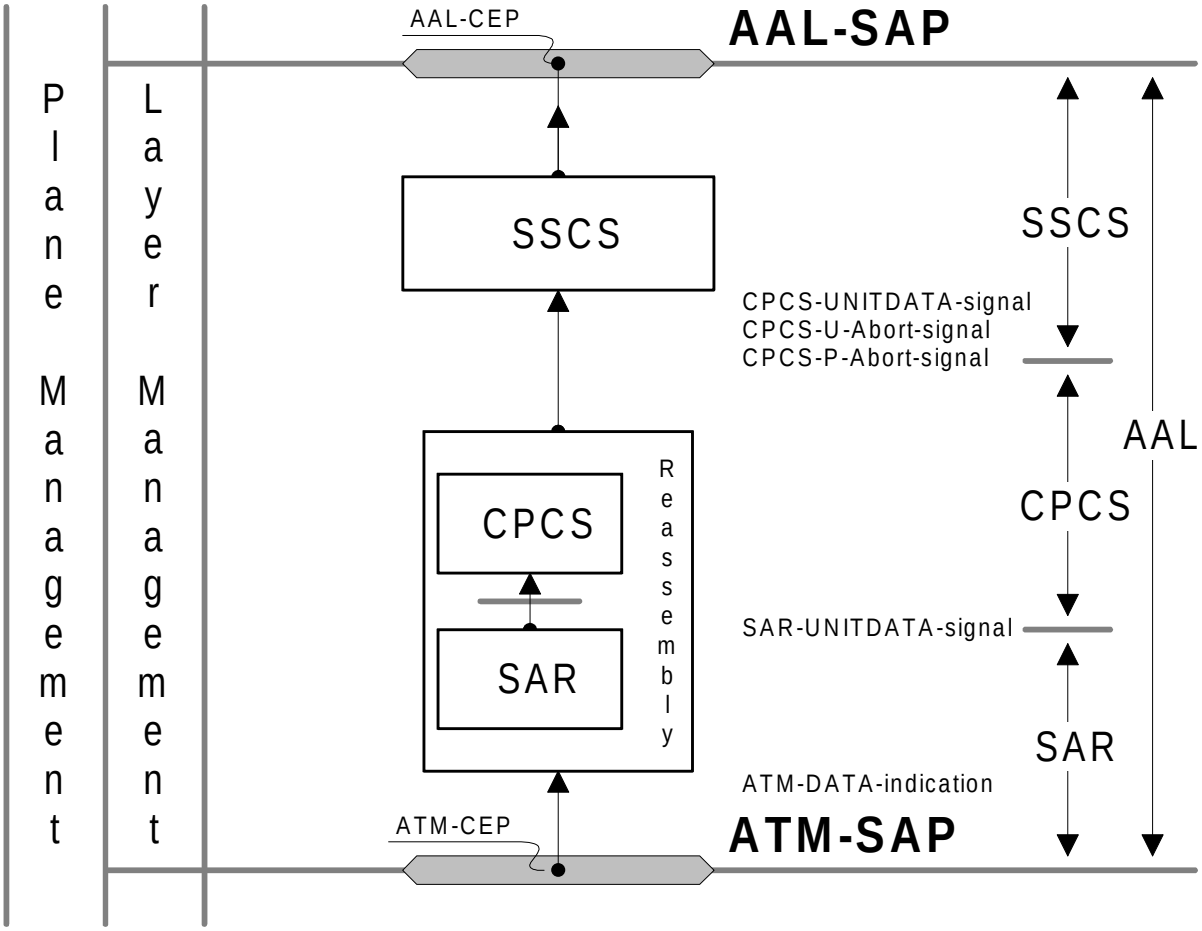


Figure C.2: Functional model for the AAL type 5 (receiver side)

Annex D (informative): Specification and Description Language (SDL) diagrams for the SAR and the CPCS of the AAL type 5

D.1 SDL for the SAR sublayer

The purpose of this clause is to provide one example of an SDL representation of the SAR procedures, to assist in the understanding of this ETS. The SDL representation does not constrain implementations from exploiting the full potential inherent in this highly parallel and fast environment. The text description of the procedures in the main body of this ETS is definitive.

D.1.1 The SAR sender

The SAR sender makes use of two variables:

a) ptrPDU.

This is a temporary variable that points into the (partial) CPCS-PDU received via the SAR-UNITDATA-invoke primitive. As successive parts of the CPCS-PDU are filled into SAR-PDU payloads, this pointer keeps pointing at the first octet within the CPCS-PDU that has not yet been sent within a SAR-PDU;

b) count.

This temporary variable keeps track of the number of octets still awaiting segmentation and transmission within a SAR-PDU.

NOTE: No interactions with layer management are shown; these interactions require further study.

Process SAR sender **1(1)**

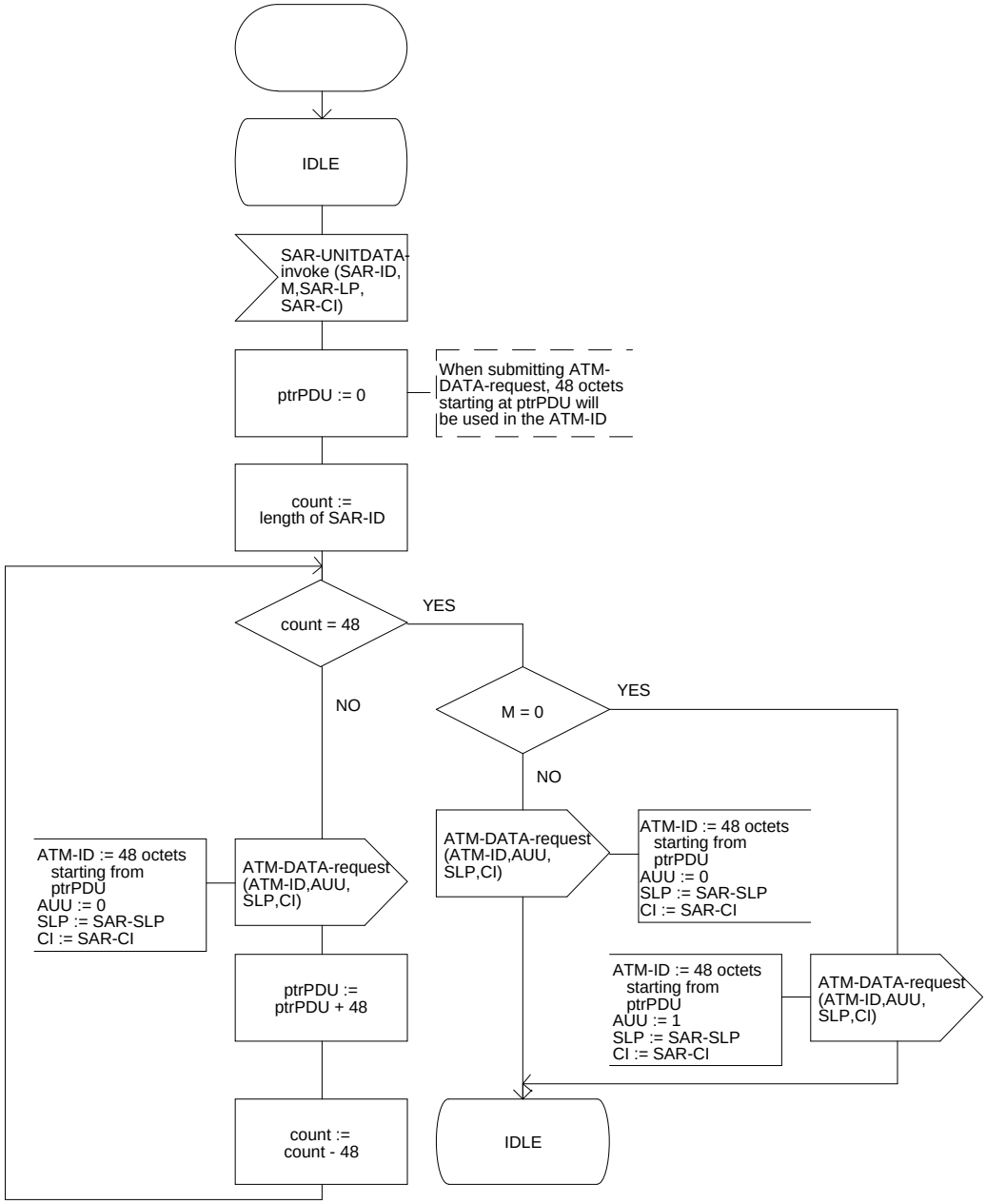


Figure D.1: SDL diagram for the SAR sender

D.1.2 The SAR receiver

The SAR receiver maintains no variables.

NOTE: No interactions with layer management are shown; these interactions require further study.

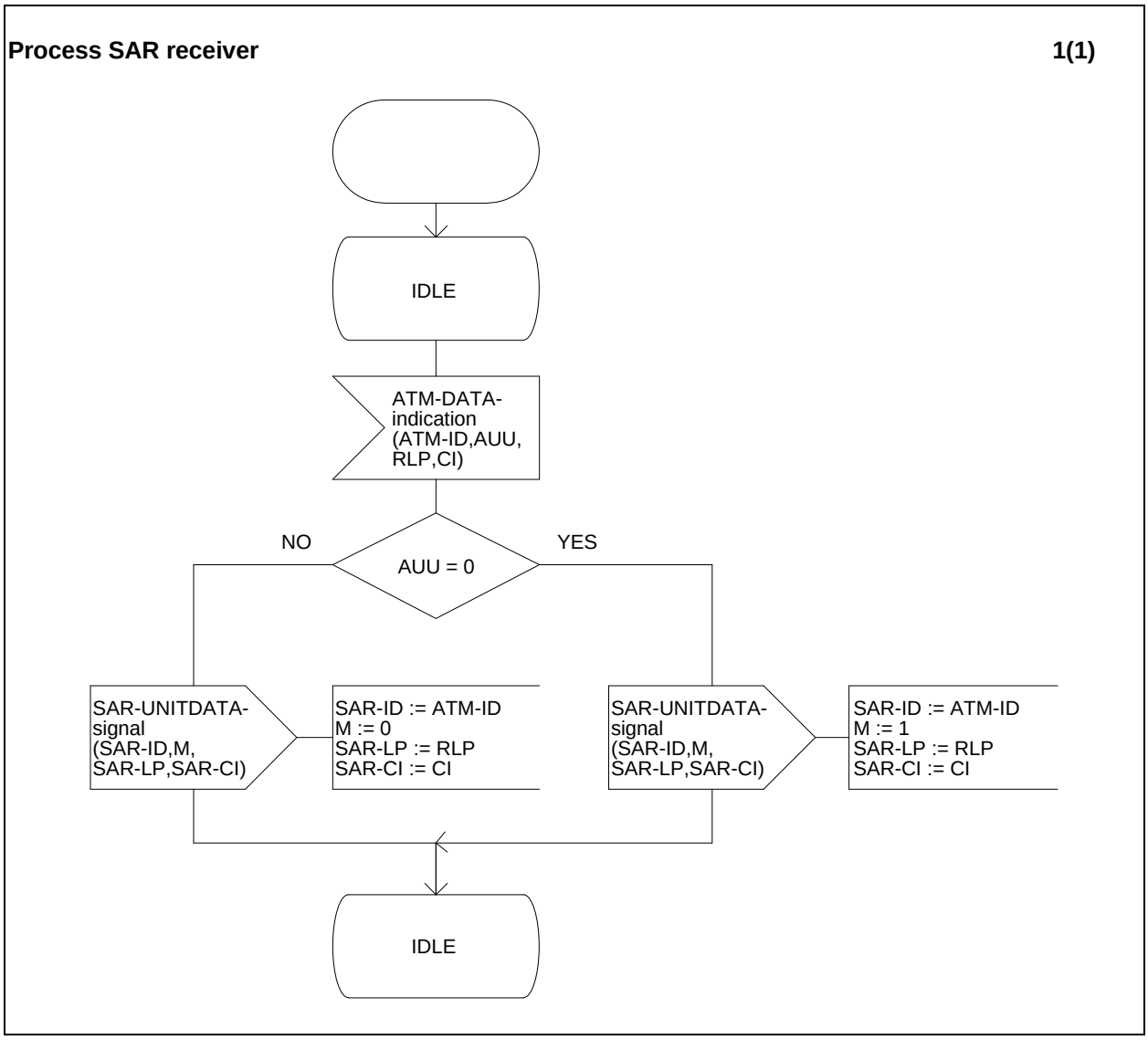


Figure D.2: SDL diagram for the SAR receiver

D.2 SDL for the CPCS procedures

The purpose of this section of annex D is to provide one example of an SDL representation of the CPCS procedures, to assist in the understanding of this ETS. Neither delivery of errored data nor Streaming Mode procedures are included. The SDL representation does not constrain implementations from exploiting the full potential inherent in this highly parallel and fast environment. The text description of the procedures in the main body of this ETS is definitive.

D.2.1 The CPCS sender

The CPCS sender maintains no variables.

NOTE: No interactions with layer management are shown; these interactions require further study.

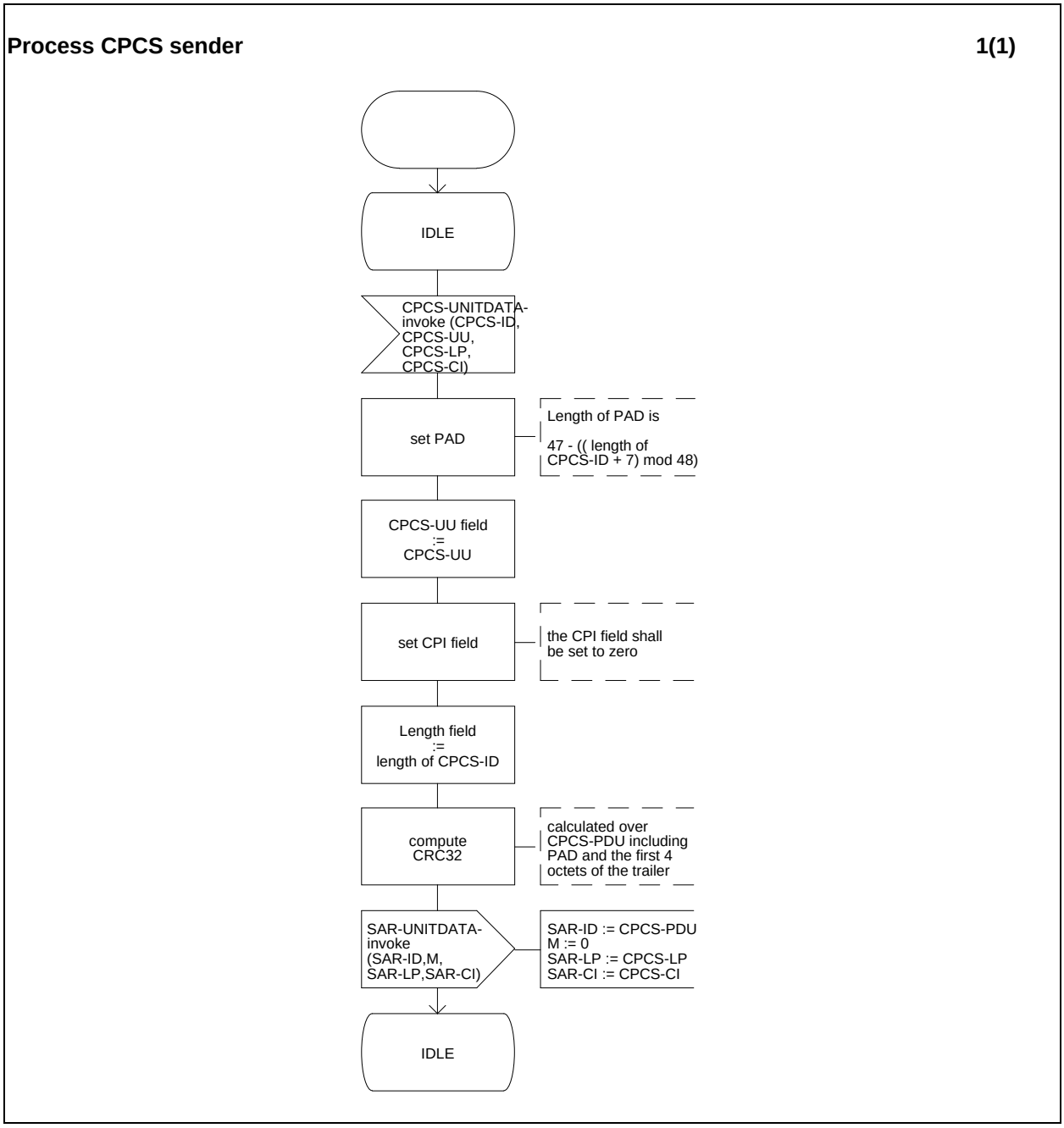


Figure D.3: SDL diagram for the CPCS sender

D.2.2 The CPCS receiver

The CPCS receiver makes use of the state variable rcv_LP (as defined in subclause 6.4.2.3). In addition the CPCS receiver utilizes one variable:

- **reassembly buffer.**

  The reassembly buffer is allocated while processing the CPCS-PDU and freed once the reassembly of a CPCS-PDU is complete (or abandoned due to errors).

  NOTE: No interactions with layer management are shown; these interactions require further study.

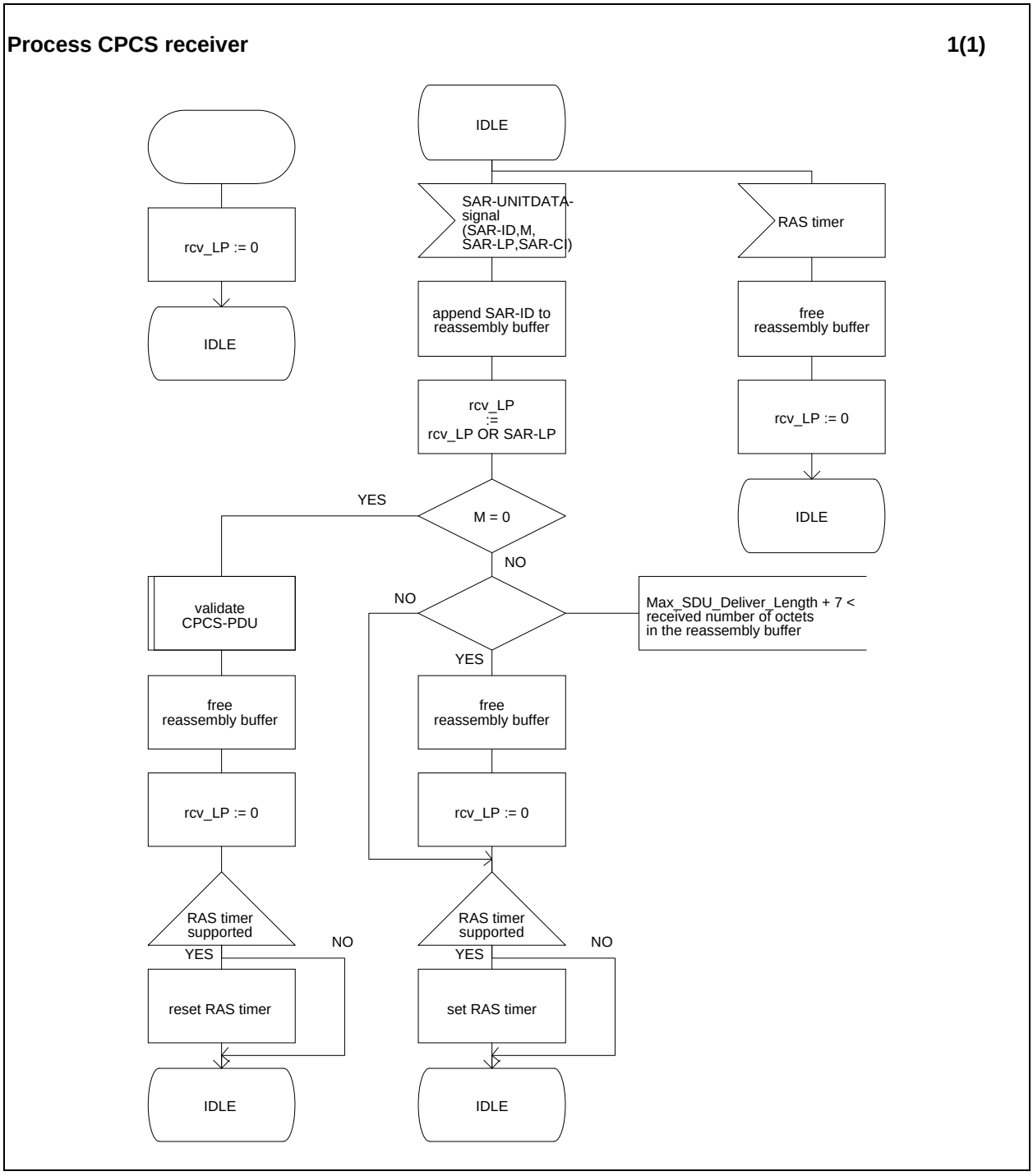


Figure D.4: SDL diagram for the CPCS receiver

Procedure Validate CPCS-PDU **1(1)**

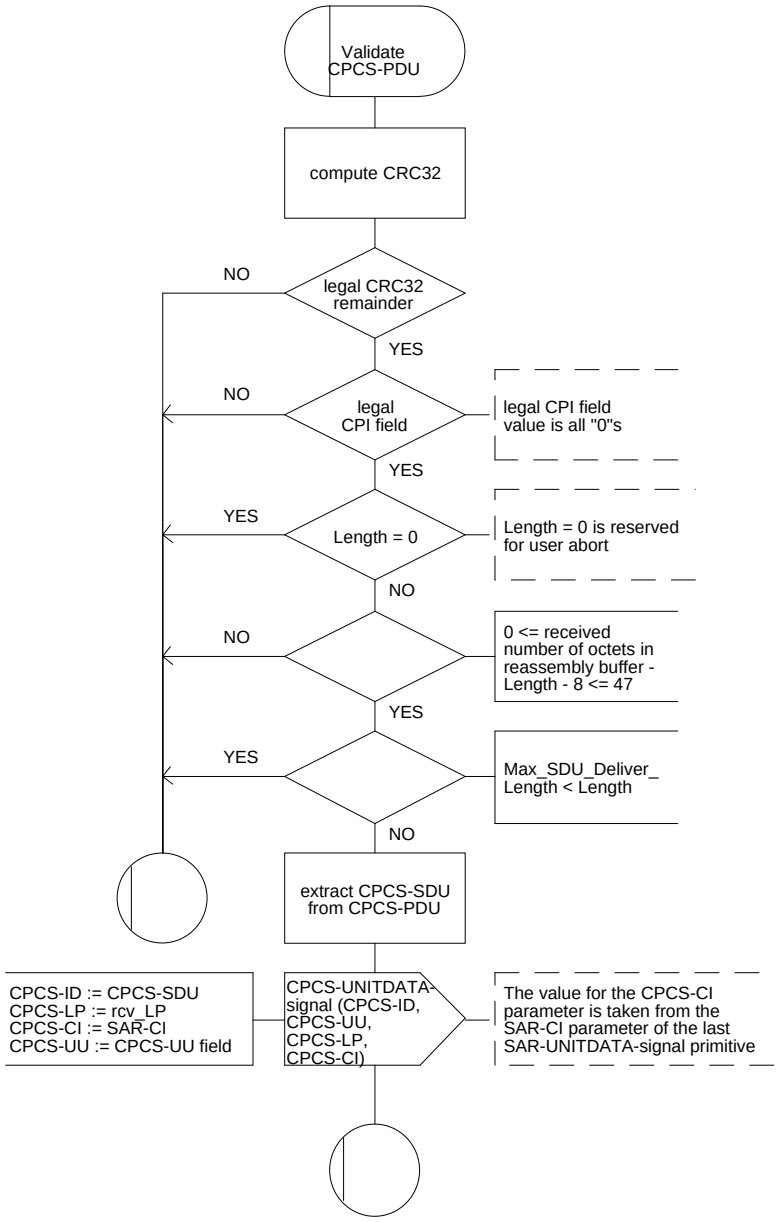


Figure D.5: SDL diagram for Validate CPCS-PDU procedure

Annex E (informative): Example CPCS-PDUs for the AAL type 5

The values in the examples are in hexadecimal notation.

EXAMPLE 1: 40 octets filled with "0"

CPCS-UU field=0
CPI Field=0
Length=40 octets
CRC-32=864d7f99

00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00	00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00	00 00 00 28 86 4d 7f 99

EXAMPLE 2: 40 octets filled with "1"

CPCS-UU field=0
CPI Field=0
Length=40 octets
CRC-32=c55e457a

ff ff ff ff ff ff ff ff	ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff	ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff	00 00 00 28 c5 5e 45 7a

EXAMPLE 3: 40 octets counting: 1 to 40

CPCS-UU field=0
CPI Field=0
Length=40 octets
CRC-32=bf671ed0

01 02 03 04 05 06 07 08	09 0a 0b 0c 0d 0e 0f 10
11 12 13 14 15 16 17 18	19 1a 1b 1c 1d 1e 1f 20
21 22 23 24 25 26 27 28	00 00 00 28 bf 67 1e d0

Annex F (normative): Protocol Implementation Conformance Statement (PICS) proforma

F.1 Identification of the implementation

1) Identification:

   a) implementation identification;

   b) system identification:

      - hardware;
      - software.

2) Supplier identification and/or test laboratory client identification.

3) Contact person for the PICS.

4) Date and place of statement.

5) Relationship between the PICS and the System Conformance Statement for the system.

   NOTE: The information requested above is required for a complete PICS.

F.2 Identification of the protocol

This PICS proforma may be applied to the SAR and CPCS protocol as specified in ETS 300 428 (1994).

F.3 Global statement of conformance

"Are all mandatory capabilities implemented? Yes/No"

NOTE: Answering "No" to this question indicates non-conformance to the protocol specification. Non-supported mandatory capabilities are to be identified in the PICS, with an explanation of why the implementation is non-conforming.

F.4 Capabilities

F.4.1 Initiator/responder capability

Not applicable. The establishment of the communication is out of the scope of this PICS.

F.4.2 Major capabilities

Major capabilities implemented				
Item No	Major Capability	Reference	Status	Support
0	CPCS-SDU transmission	5.3	o.1	
1	CPCS-SDU receipt	5.3	o.1	

o.1: At least one of these capabilities shall be implemented.

F.4.2.1 Transmission capabilities

The transmission capabilities apply IF (F.4.2/0).

Transmission capabilities implemented				
Item No.	Capability	Reference	Status	Support
0	CPCS-SDU transmission/ SAR-SDU transmission	6.3.2.1/ 6.3.1.1	m	
1	CPCS-SDU transmission sequence preservation/ SAR-SDU transmission sequence preservation	6.3.2.1/ 6.3.1.1.d	m	
2	CPCS-SDU delineation and transparency preservation/ SAR-SDU delineation and transparency preservation	6.3.2.1.1 1)/ 6.3.1.1 a)	m	
3	CPCS-User to User Information transmission and transparency preservation	6.3.2.1/ 6.3.2.1.1 2)	m	
4	CPCS-SDU bit error and information loss or gain protection	6.3.2.1.1 3)	m	
5	Message Mode	6.3.2.1.1 a)	m	
6	CPCS-SDU transmission streaming/ CPCS-SDU transmission pipelining/ CPCS Abort transmission/ SAR-SDU transmission streaming/ SAR-SDU transmission pipelining	6.3.2.1.1 b)/ 6.1 b)/ 6.3.2.1.1 b)/ 6.1.1.2 b)/ 6.1.1.2 b)	o	
7	CPCS-SDU padding	6.3.2.1.1 5)	m	
8	CPCS handling of congestion information/ SAR handling of congestion information	6.3.2.1.1 6)/ 6.3.1.1 b)	m	
9	CPCS handling of loss priority/ SAR handling of loss priority	6.3.2.1.1 7)/ 6.3.1.1 c)	m	

F.4.2.1.1 Protocol parameters for transmission

Protocol parameters implemented						
Item No.	Timer/Protocol parameter	Reference	Status	Support	Values	
					allowed	supported
0	max. CPCS-SDU length	6.3.2.1	m		o:∈ [1..65535]	

F.4.2.1.2 PDUs for transmission

PDUs implemented				
Item No.	PDU type	Reference	Status	Support
0	Data CPCS-PDU	6.3.2.1.2	m	
1	AUU-0 Data SAR-PDU	6.3.1.2	m	
2	AUU-1 Data SAR-PDU	6.3.1.2	m	
3	Abort CPCS-PDU	6.3.2.1.2 e)	c1	

c1: IF(F.4.2.1/6) THEN m.

F.4.2.1.2.1 Data CPCS-PDU parameters for transmission

Implemented transmission parameters of Data CPCS-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	CPCS-PDU Payload	6.3.2.1.2 a)	m		m: 1..F.4.2.1.1/0b octets		m: all possible values	
1	Padding	6.3.2.1.2 b)	m		m: 0..47 octets		o2: all possible values	
2	CPCS user to user information	6.3.2.1.2 c)	m		m: 1 octet		m: all possible values	
3	Common Part Indicator	6.3.2.1.2 d)	m		m: 1 octet		m: 0	
4	Length	6.3.2.1.2 e)	m		m: 2 octets		m: 1..F.4.2.1.1/0b	
5	CRC	6.3.2.1.2 f)	m		m: 4 octets		m: all possible values	

o2: any non empty subset may be selected.

F.4.2.1.2.2 Abort CPCS-PDU parameters for transmission

Implemented transmission parameters of Abort CPCS-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	CPCS-PDU Payload	6.3.2.1.2 a)	m		m: 1..F.4.2.1.1/0b octets		m: all possible values	
1	Padding	6.3.2.1.2 b)	m		m: 0..47 octets		o3: all possible values	
2	CPCS user to user information	6.3.2.1.2 c)	m		m: 1 octet		m: all possible values	
3	Common Part Indicator	6.3.2.1.2 d)	m		m: 1 octet		m: 0	
4	Length	6.3.2.1.2 e)	m		m: 2 octets		m: 0 (note)	
5	CRC	6.3.2.1.2 f)	m		m: 4 octets		m: all possible values	
NOTE: As the Length field is coded to "0", the CPCS-PDU payload field cannot be separated from the padding field.								

o3: any non empty subset may be selected.

F.4.2.1.2.3 AUU-0 SAR-PDU parameters for transmission

Implemented transmission parameters of AUU 0 SAR-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	AUU	6.3.1.2	m		m: 1 bit		m: 0	
1	SAR-PDU payload	6.3.1.2	m		m: 48 octets		m: all possible values	

F.4.2.1.2.4 AUU-1 SAR-PDU parameters for transmission

Implemented transmission parameters of AUU 1 SAR-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	AUU	6.3.1.2	m		m: 1 bit		m: 1	
1	SAR-PDU payload	6.3.1.2	m		m: 48 octets		m: all possible values	

F.4.2.2 Receipt capabilities

The receipt capabilities apply IF(F.4.2/1).

Receipt capabilities implemented				
Item No.	Capability	Reference	Status	Support
0	CPCS-SDU receipt/ SAR-SDU receipt/ SAR-SDU receipt streaming/ CPCS-Abort receipt	6.3.2.1/ 6.3.1.1/ 6.1.1.2 b)/ 6.3.2.1.1 b)	m	
1	CPCS-SDU receipt streaming/ CPCS Abort indication	6.3.2.1.1 b)/ 6.3.2.1.1 b)	o	
2	CPCS-SDU receipt sequence preservation/ SAR-SDU receipt sequence preservation	6.3.2.1 c)/ 6.3.1.1 d)	m	
3	CPCS-SDU delineation preservation/ SAR-SDU delineation preservation	6.3.2.1.1 1)/ 6.3.1.1 a)	m	
4	CPCS User to User information receipt	6.3.2.1/ 6.3.2.1.1 2)	m	
5	CPCS-SDU bit error and information loss or gain detection handling	6.3.2.1.1 3)	m	
6	CPCS handling of congestion information/ SAR handling of congestion information	6.3.2.1.1 6)/ 6.3.1.1 b)	m	
7	CPCS handling of loss priority information/ SAR handling of loss priority information	6.3.2.1.1 7)/ 6.3.1.1 c)	m	

F.4.2.2.1 Receipt timers/ protocol parameters for reception

Protocol parameters implemented						
Item No.	Protocol parameter	Reference	Status	Support	Values	
					allowed	supported
0	max. CPCS-SDU length	6.3.2.1	m		o:∈ [1..65535]	
1	CPCS Reassembly timer	6.4.2.4	o		o: unspecified	

F.4.2.2.2 Support of PDUs received

PDUs supported				
Item No.	PDU type	Reference	Status	Support
0	Data CPCS-PDU	6.3.2.1.2	m	
1	AUU 0 SAR-PDU	6.3.1.2	m	
2	AUU 1 SAR-PDU	6.3.1.2	m	
3	Abort CPCS-PDU	6.3.2.1.2 e)	m	

F.4.2.2.2.1 Data CPCS-PDU parameters at receipt

Supported parameters of received Data CPCS-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	CPCS-PDU Payload	6.3.2.1.2 a)	m		m: 1..F.4.2.2.1/0b		m: all possible values	
1	Padding	6.3.2.1.2 b)	m		m: 0..47 octets		m: all possible values	
2	CPCS user to user information	6.3.2.1.2 c)	m		m: 1 octet		m: all possible values	
3	Common Part Indicator	6.3.2.1.2 d)	m		m: 1 octet		m: 0	
4	Length	6.3.2.1.2 e)	m		m: 2 octets		m: 1..F.4.2.2.1/0b	
5	CRC	6.3.2.1.2 f)	m		m: 4 octets		m: all possible values	

F.4.2.2.2.2 Abort CPCS-PDU parameters at receipt

Supported parameters of received Abort CPCS-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	CPCS-PDU Payload	6.3.2.1.2 a)	m		m: 0..F.4.2.2.1/0b		m: all possible values	
1	Padding	6.3.2.1.2 b)	m		m: 0..47 octets		m: all possible values	
2	CPCS user to user information	6.3.2.1.2 c)	m		m: 1 octet		m: all possible values	
3	Common Part Indicator	6.3.2.1.2 d)	m		m: 1 octet		m: 0	
4	Length	6.3.2.1.2 e)	m		m: 2 octets		m: 0 (note)	
5	CRC	6.3.2.1.2 f)	m		m: 4 octets		m: all possible values	
NOTE: As the Length field is coded to "0", the CPCS-PDU payload field cannot be separated from the padding field.								

F.4.2.2.2.3 AUU 0 SAR-PDU parameters at receipt

Supported parameters of received AUU 0 SAR-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	AUU	6.3.1.2	m		m: 1 bit		m: 0	
1	SAR-PDU payload	6.3.1.2	m		m: 48 octets		m: all possible values	

F.4.2.2.2.4 AUU 1 SAR-PDU parameters at receipt

Supported parameters of received AUU 1 SAR-PDU								
Item No.	Parameter type	Reference	Status	Support	Values			
					Length		Range	
					allowed	supported	allowed	supported
0	AUU	6.3.1.2	m		m: 1 bit		m: 1	
1	SAR-PDU payload	6.3.1.2	m		m: 48 octets		m: all possible values	

F.4.2.3 Protocol error handling

Error handling implemented				
Item No.	Type of error handling	Reference	Status	Support
0	Discard of invalid CPCS-SDUs	6.3.2.1.1 3)	m	
1	Annotated delivery of invalid CPCS-SDUs	6.3.2.1.1 3)	o	

F.4.3 Negotiation capabilities

Not applicable. Any negotiation capabilities influencing the protocols concerned need to be provided by signalling or other means of pre-arrangement and are therefore out of the scope of this PICS.

F.4.4 Multi-layer dependencies

The AAL type 5 makes use of the ATM layer services as defined in ITU-T Recommendation I.361 [1].

NOTE: The addition of the "Received Loss Priority" parameter in the ATM-DATA-indication primitive as agreed by CCITT SG XVIII in January 1993 is assumed.

F.4.5 Other conditions

No relationship between options beyond those listed above have been identified.

Annex G (informative): Bibliography

The following references are given for informative purposes.

1) ITU-T Recommendation I.362 (1993): "B-ISDN ATM adaptation layer (AAL) functional description".

2) CCITT Recommendation X.200 (1988): "Reference Model for Open Systems Interconnection for CCITT Applications".

3) CCITT Recommendation X.210 (1988): "Open Systems Interconnection (OSI) Layer Service Definition Conventions".

4) ITU-T Recommendation Z.100: "Specification and description language (SDL)".

5) ETS 300 349: "Broadband Integrated Services Digital Network (B-ISDN); Asynchronous Transfer Mode (ATM) Adaptation Layer (AAL) specification - type 3/4".

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