TSG-RAN Meeting #14
Kyoto, Japan, 11 - 14 December 2001

RP-010771

Title: **Agreed CRs (Rel-4) to TS 25.322**

Source: **TSG-RAN WG2**

Agenda item: **8.2.4**

Doc-1st-	Status-	Spec	CR	Rev	Phase	Subject	Cat	Version	Versio	Workite
R2-012655	agreed	25.322	160		Rel-4	Content of retransmitted RESET ACK PDU	F	4.2.0	4.3.0	TEI4
R2-012625	agreed	25.322	166		Rel-4	Usage of UM RLC Special Length Indicator	F	4.2.0	4.3.0	TEI4
R2-012628	agreed	25.322	170		Rel-4	Indication of SDU transmission result	F	4.2.0	4.3.0	TEI4

CR-Form-v5

CHANGE REQUEST

⌘ **25.322** CR **160** ⌘rev **-** ⌘ Current version: **4.2.0** ⌘

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Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network ☐

Title: ⌘	Content of retransmitted RESET ACK PDU	
Source: ⌘	TSG-RAN WG2	
Work item code: ⌘	TEI	***Date:*** ⌘ 2001-11-29
Category: ⌘	**F**	***Release:*** ⌘ REL-4

Use <u>one</u> of the following categories:
F (correction)
A (corresponds to a correction in an earlier release)
B (addition of feature),
C (functional modification of feature)
D (editorial modification)
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use <u>one</u> of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘	If transmission of RESET ACK PDU is delayed due to lower layer scheduling, HFN will be out of synchronization after reset procedure.
Summary of change: ⌘	When the Receiver receives an old RESET PDU (RSN value is same as the previous RESET PDU), the Receiver does not reset itself (its state variables etc.) and responds with a RESET ACK PDU with the same RSN and HFNI value as the previous responded RESET ACK PDU. **The CR has isolated impact:** The RLC reset procedure is clarified. No other functionalities are affected. The CR would not affect implementations behaving like indicated in the CR, would affect implementations supporting the corrected functionality otherwise.
Consequences if not approved: ⌘	Incomplete functionality, potential failure in the RLC reset procedure.

Clauses affected: ⌘	11.4.3, 11.4.5.3

Other specs affected: ⌘	☐ Other core specifications ⌘	
	☐ Test specifications	
	☐ O&M Specifications	
Other comments: ⌘		

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downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

11.4 RLC reset procedure

11.4.1 General

The RLC reset procedure is used to reset two RLC peer entities, which are operating in acknowledged mode. Figure 11.4 below illustrates the elementary procedure for an RLC reset. During the reset procedure the hyper frame numbers (HFN) in UTRAN and UE are synchronised. Two HFNs used for ciphering needs to be synchronised, DL HFN in downlink and UL HFN in uplink. In the reset procedure, the highest UL HFN and DL HFN used by the RLC entity in the transmitting sides, i.e. the HFNs associated with PDUs of SN=VT(S)-1 if at least one data PDU had been transmitted or of SN=0 if no data PDU had been transmitted, are exchanged between UE and UTRAN.

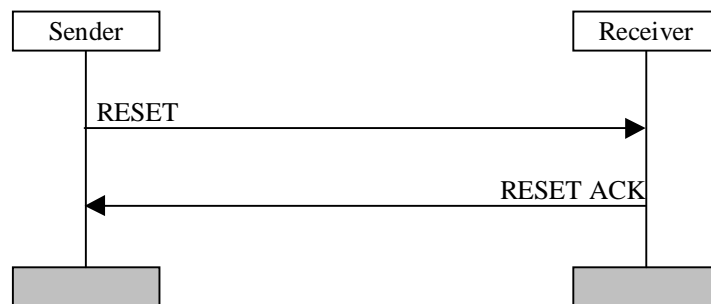The RESET PDUs and the RESET ACK PDUs have higher priority than AMD PDUs.

Figure 11.4: RLC reset procedure

11.4.2 Initiation

The Sender shall:

- if one of the following triggers is detected:

1) "No_Discard after MaxDAT number of retransmissions" is configured and VT(DAT) equals the value MaxDAT (see subclause 9.7.3.4);

2) VT(MRW) equals the value MaxMRW;

3) A STATUS PDU including "erroneous Sequence Number" is received (see clause 10);

  - submit a RESET PDU to the lower layer;

  - start the timer Timer_RST and increase VT(RST) with 1.

When a reset procedure has been initiated it can only be ended upon reception of a RESET ACK PDU with the same RSN value as in the corresponding RESET PDU, or upon request of re-establishment or release from upper layer, a reset procedure is not interrupted by the reception of a RESET PDU from the peer entity.

11.4.2.1 RESET PDU contents to set

The Sender shall:

- set the HFNI field to the currently highest used HFN (DL HFN when the RESET PDU is sent by UTRAN or UL HFN when the RESET PDU is sent by the UE);

- set the RSN field to the sequence number of the RESET PDU. This sequence number is incremented every time a new RESET PDU is transmitted, but not when a RESET PDU is retransmitted.

11.4.3 Reception of the RESET PDU by the Receiver

Upon reception of a RESET PDU, the Receiver shall:

- if the RSN value in the RESET PDU is the same as the RSN value in the last received RESET PDU:

    - only submit a RESET ACK PDU to the lower layer with the contents set exactly as in the last transmitted RESET ACK PDU (i.e., in this case the RLC entity is not reset);

- if the RESET PDU is the first RESET PDU received since the entity was (re-)established or the RSN value is different from the RSN value in the last received RESET PDU:

    - submit a RESET ACK PDU to the lower layer with the content set as specified in subclause 11.4.3.1;

    - reset the state variables described in subclause 9.4 except VT(RST) to their initial values;

    - stop all the timers described in subclause 9.5 except Timer_RST;

    - reset configurable parameters to their configured values;

    - discard all RLC PDUs in the receiving side of the AM RLC entity;

    - discard all RLC SDUs that were transmitted before the reset in the transmitting side of the AM RLC entity;

    - set the HFN (DL HFN when the RESET PDU is received in UE or UL HFN when the RESET PDU is received in UTRAN) equal to the HFNI field in the received RESET PDU;

    - increase with one the UL HFN and DL HFN, and the updated HFN values shall be used for the first transmitted and received PDUs after the reset procedure.

    /* Note to editor: Style format changed to B2 */

11.4.3.1   RESET ACK PDU contents to set

The Receiver shall:

- set the hyper frame number indicator field (HFNI) to the currently highest used HFN (DL HFN when the RESET ACK PDU is sent by UTRAN or UL HFN when the RESET ACK PDU is sent by the UE);

- set the RSN field to the same value as in the corresponding received RESET PDU.

11.4.4   Reception of the RESET ACK PDU by the Sender

Upon reception of a RESET ACK PDU, the Sender shall:

- if the Sender has already transmitted a RESET PDU which has not been yet acknowledged by a RESET ACK PDU:

    - if the received RSN value is the same as the one in the corresponding RESET PDU:

        - set the HFN value (DL HFN when the RESET ACK PDU is received in UE or UL HFN when the RESET ACK PDU is received in UTRAN) to the HFNI field of the received RESET ACK PDU;

        - reset the state variables described in subclause 9.4 to their initial values;

        - stop all the timers described in subclause 9.5;

        - reset configurable parameters to their configured values;

        - discard all RLC PDUs in the receiving side of the AM RLC entity;

        - discard all RLC SDUs that were transmitted before the reset in the transmitting side of the AM RLC entity;

        - increase with one the UL HFN and DL HFN, and the updated HFN values shall be used for the first transmitted and received PDUs after the reset procedure;

    - otherwise (if the received RSN value is not the same as the one in the corresponding RESET PDU):

        - discard the RESET ACK PDU;

- otherwise (if the Sender has not transmitted a RESET PDU which has not been yet acknowledged by a RESET ACK PDU):

    - discard the RESET ACK PDU.

11.4.5   Abnormal cases

11.4.5.1   Timer_RST timeout

If Timer_RST expires before the reset procedure is terminated, the Sender shall:

- if VT(RST)<MaxRST-1:

    - set the RESET PDU as previously transmitted (even if additional SDUs were discarded in the mean-time);

    - transmit RESET PDU;

- increment VT(RST) by one;

- restart Timer_RST.

11.4.5.2   Unrecoverable error (VT(RST) ≥ MaxRST)

The Sender shall:

- if VT(RST) becomes larger than or equal to MaxRST:

    - indicate unrecoverable error to upper layer.

11.4.5.3   Reception of the RESET PDU by the Sender

Upon reception of a RESET PDU, the Sender shall:

- submit a RESET ACK PDU to the lower layer with the content set as specified in subclause 11.4.3.1;

    - reset the state variables described in subclause 9.4 except VT(RST) to their initial values;

    - stop all the timers described in subclause 9.5 except Timer_RST;

    - reset configurable parameters to their configured values;

    - discard all RLC PDUs in the receiving side of the   AM RLC entity;

    - discard all RLC SDUs that were transmitted before the reset in the transmitting side of the AM RLC entity;

    - set the HFN (DL HFN when the RESET PDU is received in UE or UL HFN when the RESET PDU is received in UTRAN) equal to the HFNI field in the received RESET PDU;

    - increase with one the UL HFN and DL HFN, and the updated HFN values shall be used for the first transmitted and received PDUs after the reset procedure.

CR-Form-v4

CHANGE REQUEST

| ⌘ | **25.322** CR **166** | ⌘ .rev | **-** | ⌘ | Current version: | **4.2.0** | ⌘ |

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Proposed change affects: ⌘   (U)SIM ☐   ME/UE **X**   Radio Access Network **X**   Core Network ☐

Title: ⌘	Usage of UM RLC Special Length Indicator	
Source: ⌘	Nortel Networks	
Work item code: ⌘	TEI4	***Date:*** ⌘ 26 November 01
Category: ⌘ **F**		***Release:*** ⌘ REL-4

Use <u>one</u> of the following categories:
  F *(correction)*
  A *(corresponds to a correction in an earlier release)*
  B *(addition of feature),*
  C *(functional modification of feature)*
  D *(editorial modification)*
Detailed explanations of the above categories can
be found in 3GPP <u>TR 21.900</u>.

Use <u>one</u> of the following releases:
  2   (GSM Phase 2)
  R96   (Release 1996)
  R97   (Release 1997)
  R98   (Release 1998)
  R99   (Release 1999)
  REL-4 (Release 4)
  REL-5 (Release 5)

Reason for change: ⌘	As explained in R2-012504, because of the way the concatenation is signalled in UM, if the Special LI is not used and if a RLC UM PDU is lost, then the following correctly received SDU can be discarded by the receiving entity.
Summary of change: ⌘	The usage of the Special LI is extended: - It is no more configured by RRC - RLC shall use it when appropiate (see subclause 9.2.2.8)
Consequences if not approved: ⌘	Unefficiant behaviour as described in R2-012504.

Clauses affected: ⌘	8.1, 8.2, 9.2.2.8
Other specs affected: ⌘	**X** Other core specifications ⌘ 25.331 ☐ Test specifications ☐ O&M Specifications
Other comments: ⌘	

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8.1   Primitives between RLC and upper layers

The primitives between RLC and upper layers are shown in Table 8.1.

Table 8.1: Primitives between RLC and upper layers

Generic Name	Parameters			
	Req.	**Ind.**	**Resp.**	**Conf.**
RLC-AM-DATA	Data, CNF, MUI	Data, DiscardInfo	Not Defined	MUI
RLC-UM-DATA	Data, ~~Use special LI~~	Data	Not Defined	Not Defined
RLC-TM-DATA	Data	Data	Not Defined	Not Defined
CRLC-CONFIG	E/R, Stop, Continue, Ciphering Elements (UM/AM only), TM_parameters (TM only), UM_parameters (UM only), AM_parameters (AM only)	Not Defined	Not Defined	Not Defined
CRLC-SUSPEND (UM/AM only)	N	Not Defined	Not Defined	VT(US) (UM only), VT(S) (AM only)
CRLC-RESUME (UM/AM only)	No Parameter	Not Defined	Not Defined	Not Defined
CRLC-STATUS	Not Defined	EVC	Not Defined	Not Defined

Each Primitive is defined as follows:

RLC-AM-DATA-Req/Ind/Conf

- RLC-AM-DATA-Req is used by upper layers to request transmission of an RLC SDU in acknowledged mode.

- RLC-AM-DATA-Ind is used by the AM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in acknowledged mode and to indicate to upper layers of the discarded RLC SDU in the peer RLC AM entity.

- RLC-AM-DATA-Conf is used by the AM RLC entity to confirm to upper layers the reception of an RLC SDU by the peer-RLC AM entity.

RLC-UM-DATA-Req/Ind

- RLC-UM-DATA-Req is used by upper layers to request transmission of an RLC SDU in unacknowledged mode.

- RLC-UM-DATA-Ind is used by the UM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in unacknowledged mode.

RLC-TM-DATA-Req/Ind

- RLC-TM-DATA-Req is used by upper layers to request transmission of an RLC SDU in transparent mode.

- RLC-TM-DATA-Ind is used by the TM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in transparent mode.

CRLC-CONFIG-Req

This primitive is used by upper layers to establish, re-establish, release, stop, continue or modify the RLC. Ciphering elements are included for UM and AM operation.

CRLC-SUSPEND-Req/Conf

- CRLC-SUSPEND-Req is used by upper layers to suspend the UM or AM RLC entity.

- CRLC-SUSPEND-Conf is used by the UM or AM RLC entity to confirm that the entity is suspended.

CRLC-RESUME-Req

This primitive is used by upper layers to resume the UM or AM RLC entity after the UM or AM RLC entity has been suspended.

CRLC-STATUS-Ind

It is used by an RLC entity to send status information to upper layers.

8.2   Primitive parameters

Following parameters are used in the primitives:

1) The parameter Data is the RLC SDU that is mapped onto the Data field in RLC PDUs. When AM or UM RLC entities are used, the length of the Data parameter is a multiple of 8 bits, otherwise (TM RLC entity) the length of Data parameter is a bit-string whose length may not be a multiple of 8 bits.

2) The parameter Confirmation Request (CNF) indicates whether the transmitting side of the AM RLC entity needs to confirm the reception of the RLC SDU by the peer-RLC AM entity. If required, once all AMD PDUs that make up the RLC SDU are positively acknowledged by the receiving AM RLC entity, the transmitting AM RLC entity notifies upper layers.

3) The parameter Message Unit Identifier (MUI) is an identity of the RLC SDU, which is used to indicate which RLC SDU that is confirmed with the RLC-AM-DATA-Conf. primitive.

4) The parameter E/R indicates establishment, re-establishment, release or modification of an RLC entity, where re-establishment is applicable to AM and UM RLC entities only. If re-establishment is requested, the state variables and configurable parameters are initialised according to subclause 9.7.7. If release is requested, all protocol parameters, variables and timers are released and the RLC entity enters the NULL state. If modification is requested, the protocol parameters indicated by upper layers (e.g. ciphering parameters) are only modified, while keeping the other protocol parameters, such as the protocol variables, protocol timers and protocol state unchanged. AM RLC entities are always re-established if the AMD PDU size is changed. The modification of other protocol parameters does not require a re-establishment.

5) The parameter Event Code (EVC) indicates the reason for the CRLC-STATUS-Ind (e.g., unrecoverable errors such as data link layer loss or recoverable status events such as reset.).

6) The parameter Ciphering Elements are only applicable for UM and AM operations. These parameters are Ciphering Mode, Ciphering Key, Transmitting Activation Time (SN to activate a new ciphering configuration at the Sender), Receiving Activation Time (SN to activate a new ciphering configuration at the Receiver) and HFN (Hyper Frame Number).

7) The AM_parameters are only applicable for AM operation. These parameters are AMD PDU size, In-sequence Delivery Indication (indicating that RLC SDUs are delivered to upper layers in sequence or out of sequence), Timer values (see subclause 9.5), Protocol parameter values (see subclause 9.6), Polling triggers (see subclause 9.7.1), Status triggers (see subclause 9.7.2), Periodical Status blocking configuration (see subclause 9.7.2), SDU discard mode (see subclause 9.7.3), Minimum WSN (see subclause 9.2.2.11.3), and Send MRW. The Minimum WSN is always greater than or equal to the number of transport blocks in the smallest transport block set. The Send MRW indicates that the information of each discarded RLC SDU is sent to the Receiver, and the MRW SUFI is sent to the Receiver even if no segments of the RLC SDU to be discarded were submitted to a lower layer.

8) The parameter DiscardInfo indicates to upper layer the discarded RLC SDU in the peer-RLC AM entity. It is applicable only when in-sequence delivery is configured and it is to be used when upper layers require the reliable data transfer.

9) The Stop parameter indicates to the RLC entity to (see subclause 9.7.6):

    - discard all RLC PDUs received from the lower layer.

    - not submit to lower layer any RLC PDUs.

10) The Continue parameter indicates to the RLC entity to continue transmission and reception of RLC PDUs.

11) The parameter Use special LI indicates that the LI indicating that an RLC SDU begins in the beginning of an RLC PDU is to be used (see subclause 9.2.2.8).

1~~1~~2) The UM_parameters are only applicable for UM operation. It contains Timer_Discard value (see subclause 9.5) and largest UMD PDU size (see subclause 9.2.2.8).

1~~2~~3) The TM_parameters are only applicable for TM operation. It contains e.g. segmentation indication (see subclauses 9.2.2.9 and 11.1.2.1), Timer_Discard value (see subclause 9.5) and delivery of erroneous SDU indication (see subclause 11.1.3).

1~~3~~4) The N parameter indicates that an RLC entity will not send a PDU with SN>=VT(S)+N for AM and SN>=VT(US)+N for UM, where N is a non-negative integer.

1~~4~~5) The VT(S) parameter indicates the value of the Send State Variable for the case of the AM.

1~~5~~6) The VT(US) parameter indicates the value of the UM Data State Variable, for the case of the UM.

9.2.2.8　　　Length Indicator (LI)

The "Length Indicator" is used to indicate, each time, the end of an RLC SDU occurs in the PDU.

Unless for the predefined values reserved for special purposes and listed in the tables below, the "Length Indicator" shall:

- be set to the number of octets between the end of the RLC header and up to and including the octet at the end of an RLC SDU segment;

- be included in the PDUs that they refer to.

The size of the "Length Indicator" may be either 7bits or 15 bits. The value of a "Length Indicator" shall not exceed the values specified in subclauses 11.2.4.2 and 11.3.4.5.

The "Length Indicators", which refer to the same PDU shall:

- not be reordered nor removed in case of retransmission;

- be in the same order as the RLC SDUs that they refer to.

For AM:

- if the "AMD PDU size" is ≤ l26 octets:

  - 7-bit "Length Indicators" shall be used.

- else:

  - 15-bit "Length Indicators" shall be used;

- the size of the "Length Indicator" is always the same for all AMD PDUs, for one RLC entity.

For UM:

- if the "largest UMD PDU size" is ≤ l25 octets:

  - 7-bit "Length Indicators" shall be used.

- else:

  - 15-bit "Length Indicators" shall be used;

- between modifications of the "largest UMD PDU size", the size of the "Length Indicator" is the same for all UMD PDUs;

- if the parameter Use special LI is configured; and

- if the RLC SDU begins in the beginning of the RLC PDU; and

- if the "Length Indicators" indicating that a RLC SDU ended exactly in the end or one octet short (only when 15-bit "Length Indicators" is used) of the previous RLC PDU is not present:

    - if 7-bit "Length Indicator" is used:

        - the "Length Indicator" with value "111 1100" shall be used;

    - if 15-bit "Length Indicator" is used:

        - the "Length Indicator" with value "111 1111 1111 1100" shall be used.

In the case where the end of the last segment of an RLC SDU exactly ends at the end of a PDU and there is no "Length Indicator" that indicates the end of the RLC SDU:

- if 7-bit "Length Indicator" is used:

    - a "Length Indicator" with value "000 0000" shall be placed as the first "Length Indicator" in the following PDU;

- if 15-bit "Length Indicator" is used:

    - a "Length Indicator" with value "000 0000 0000 0000" shall be placed as the first "Length Indicator" in the following PDU.

In case this RLC SDU was the last one to be transmitted, an RLC PDU may be transmitted. This RLC PDU consists of:

- an RLC Header;

- if 7-bit "Length Indicator" is used:

    - a "Length Indicator" with value "000 0000";

- if 15-bit "Length Indicator" is used:

    - a "Length Indicator" with value "000 0000 0000 0000";

- a padding "Length Indicator"; and

- padding.

In the case where a PDU contains a 15-bit "Length Indicator" indicating that an RLC SDU ends with one octet left in the PDU, the last octet of this PDU shall:

- be padded by the Sender and ignored by the Receiver though there is no "Length Indicator" indicating the existence of Padding; and

- not be filled with the first octet of the next RLC SDU data.

In the case where 15-bit "Length Indicators" are used for the previous PDU and the last segment of an RLC SDU is one octet short of exactly filling the PDU:

- if a 15-bit "Length Indicator" is used for the following PDU:

    - the "Length Indicator" with value "111 1111 1111 1011" shall be placed as the first "Length Indicator" in the following PDU;

    - the remaining one octet in the previous PDU shall be padded by the Sender and ignored at the Receiver though there is no "Length Indicator" indicating the existence of Padding;

    - in case this SDU was the last one to be transmitted:

        - a RLC PDU consisting of an RLC Header with "Length Indicator" "111 1111 1111 1011" followed by a padding "Length Indicator" and padding may be transmitted;

- if a 7-bit "Length Indicator" is used for the following PDU:

- if RLC is configured for UM mode:

  - the "Length Indicator" with value "000 0000" shall be placed as the first "Length indicator" in the following PDU and its SN shall be incremented by 2 before it is transmitted.

Predefined values of the "Length Indicator" are used to indicate padding. The values that are reserved for special purposes are listed in the tables below depending on the size of the "Length Indicator". Only predefined "Length Indicator" values can refer to the padding space. These values shall only be placed after all other "Length Indicators" for a PDU.

STATUS PDUs can be piggybacked on the AMD PDU by using part or all of the padding space. A "Length Indicator" shall be used to indicate the piggybacked STATUS PDU. This "Length Indicator" takes space from the padding space or piggybacked STATUS PDU and not the PDU data and will always be the last Length Indicator. Where only part of the padding space is used by a piggybacked STATUS PDU, the end of the piggybacked STATUS PDU is determined by one of the SUFI fields NO_MORE or ACK, thus no additional "Length Indicator" is required to show that there is still padding in the PDU. The padding/piggybacked STATUS PDU predefined "Length Indicators" shall be added after the very last "Length Indicator" that indicates the end of the last RLC SDU segment in the PDU.

If "SDU discard with explicit signalling" is configured:

- an AMD PDU can contain a maximum number of 15 "Length Indicators" indicating the end of 15 corresponding SDUs; and

- the rest of the AMD PDU space shall be used as padding or as piggybacked STATUS PDU.

Length: 7 bits

Bit	Description
0000000	The previous RLC PDU was exactly filled with the last segment of an RLC SDU and there is no "Length Indicator" that indicates the end of the RLC SDU in the previous RLC PDU.
1111100	UMD PDU: The first data octet in this RLC PDU is the first octet of an RLC SDU. AMD PDU: Reserved (PDUs with this coding will be discarded by this version of the protocol).
1111101	Reserved (PDUs with this coding will be discarded by this version of the protocol).
1111110	AMD PDU: The rest of the RLC PDU includes a piggybacked STATUS PDU. UMD PDU: Reserved (PDUs with this coding will be discarded by this version of the protocol).
1111111	The rest of the RLC PDU is padding. The padding length can be zero.

Length: 15bits

Bit	Description
000000000000000	The previous RLC PDU was exactly filled with the last segment of an RLC SDU and there is no "Length Indicator" that indicates the end of the RLC SDU in the previous RLC PDU.
111111111111011	The last segment of an RLC SDU was one octet short of exactly filling the previous RLC PDU and there is no "Length Indicator" that indicates the end of the RLC SDU in the previous RLC PDU. The remaining one octet in the previous RLC PDU is ignored.
111111111111100	UMD PDU: The first data octet in this RLC PDU is the first octet of an RLC SDU. AMD PDU: Reserved (PDUs with this coding will be discarded by this version of the protocol).
111111111111101	Reserved (PDUs with this coding will be discarded by this version of the protocol).
111111111111110	AMD PDU: The rest of the RLC PDU includes a piggybacked STATUS PDU. UMD PDU: Reserved (PDUs with this coding will be discarded by this version of the protocol).
111111111111111	The rest of the RLC PDU is padding. The padding length can be zero.

CR-Form-v5

CHANGE REQUEST

⌘ **25.322** CR **170** ⌘rev **-** ⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: ⌘ (U)SIM ☐ ME/UE **X** Radio Access Network **X** Core Network ☐

Title: ⌘	Indication of SDU transmission result	
Source: ⌘	TSG-RAN WG2	
Work item code: ⌘	TEI4	***Date:*** ⌘ 29 November 2001

Category: ⌘ **F**

Use <u>one</u> of the following categories:
F (correction)
A (corresponds to a correction in an earlier release)
B (addition of feature),
C (functional modification of feature)
D (editorial modification)
Detailed explanations of the above categories can
be found in 3GPP TR 21.900.

Release: ⌘ REL-4

Use <u>one</u> of the following releases:
2 (GSM Phase 2)
R96 (Release 1996)
R97 (Release 1997)
R98 (Release 1998)
R99 (Release 1999)
REL-4 (Release 4)
REL-5 (Release 5)

Reason for change: ⌘	As explained in R2-012539, the indication of SDU discarded or successfully transmitted result should be used to improve efficiency.
Summary of change: ⌘	To indicate a discarded SDU to upper layer, "DiscardReq" parameter and "Status" parameter are added. Indication of a discarded SDU is used. (See subclause 11.1.4.2, 11.2.4.3, and 11.6.2) Indication of a successfully transmitted result is used. (See subclause 11.5.3)
Consequences if not approved: ⌘	Inefficient behavior

Clauses affected: ⌘	8.1, 8.2, 11.1.4.2, 11.2.4.3, 11.5.3, 11.6.2

Other specs affected: ⌘	**X** Other core specifications ⌘ 25.323
	☐ Test specifications
	☐ O&M Specifications

Other comments: ⌘	

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

8   Elements for layer-to-layer communication

The interaction between the RLC sublayer and other layers are described in terms of primitives where the primitives represent the logical exchange of information and control between the RLC sublayer and other layers. The primitives shall not specify or constrain the implementation.

8.1   Primitives between RLC and upper layers

The primitives between RLC and upper layers are shown in Table 8.1.

Table 8.1: Primitives between RLC and upper layers

Generic Name	Parameters			
	Req.	**Ind.**	**Resp.**	**Conf.**
RLC-AM-DATA	Data, CNF, ~~DiscardReq,~~ MUI	Data, DiscardInfo	Not Defined	Status, MUI
RLC-UM-DATA	Data, Use special LI, ~~CNF~~~~DisardReq,~~ MUI	Data	Not Defined	MUI~~Not Defined~~
RLC-TM-DATA	Data, ~~CNF~~~~DiscardReq,~~ MUI	Data	Not Defined	MUI~~Not Defined~~
CRLC-CONFIG	E/R, Stop, Continue, Ciphering Elements (UM/AM only), TM_parameters (TM only), UM_parameters (UM only), AM_parameters (AM only)	Not Defined	Not Defined	Not Defined
CRLC-SUSPEND (UM/AM only)	N	Not Defined	Not Defined	VT(US) (UM only), VT(S) (AM only)
CRLC-RESUME (UM/AM only)	No Parameter	Not Defined	Not Defined	Not Defined
CRLC-STATUS	Not Defined	EVC	Not Defined	Not Defined

Each Primitive is defined as follows:

RLC-AM-DATA-Req/Ind/Conf

- RLC-AM-DATA-Req is used by upper layers to request transmission of an RLC SDU in acknowledged mode.

- RLC-AM-DATA-Ind is used by the AM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in acknowledged mode and to indicate to upper layers of the discarded RLC SDU in the peer RLC AM entity.

- RLC-AM-DATA-Conf is used by the AM RLC entity to confirm to upper layers the reception of an RLC SDU by the peer-RLC AM entity or to inform the upper layers of a discarded SDU.

RLC-UM-DATA-Req/Ind/Conf

- RLC-UM-DATA-Req is used by upper layers to request transmission of an RLC SDU in unacknowledged mode.

- RLC-UM-DATA-Ind is used by the UM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in unacknowledged mode.

- RLC-UM-DATA-Conf is used by the UM RLC entity to inform the upper layers of a discarded SDU.

RLC-TM-DATA-Req/Ind/Conf

- RLC-TM-DATA-Req is used by upper layers to request transmission of an RLC SDU in transparent mode.

- RLC-TM-DATA-Ind is used by the TM RLC entity to deliver to upper layers an RLC SDU that has been transmitted in transparent mode.

- RLC-TM-DATA-Conf is used by the TM RLC entity to inform the upper layers of a discarded SDU.

CRLC-CONFIG-Req

This primitive is used by upper layers to establish, re-establish, release, stop, continue or modify the RLC. Ciphering elements are included for UM and AM operation.

CRLC-SUSPEND-Req/Conf

- CRLC-SUSPEND-Req is used by upper layers to suspend the UM or AM RLC entity.

- CRLC-SUSPEND-Conf is used by the UM or AM RLC entity to confirm that the entity is suspended.

CRLC-RESUME-Req

This primitive is used by upper layers to resume the UM or AM RLC entity after the UM or AM RLC entity has been suspended.

CRLC-STATUS-Ind

It is used by an RLC entity to send status information to upper layers.

8.2   Primitive parameters

Following parameters are used in the primitives:

1) The parameter Data is the RLC SDU that is mapped onto the Data field in RLC PDUs. When AM or UM RLC entities are used, the length of the Data parameter is a multiple of 8 bits, otherwise (TM RLC entity) the length of Data parameter is a bit-string whose length may not be a multiple of 8 bits.

2) The parameter Confirmation Request (CNF) indicates whether the transmitting side of the AM RLC entity needs to confirm the reception of the RLC SDU by the peer-RLC AM-entity (AM only) or to inform the upper layers of the discarded RLC SDU (AM/UM/TM). If required, the transmitting RLC entity notifies upper layers when once all AMD PDUs that make up the RLC SDU are positively acknowledged by the receiving AM peer-RLC entity (AM only) or when the SDU is discarded (AM/UM/TM)., the transmitting AM RLC entity notifies upper layers.

X) The parameter DiscardReq indicates whether the transmitting RLC entity needs to inform the upper layers of the discarded RLC SDU. If required, the transmitting RLC entity notifies upper layers when the SDU is discarded.

3) The parameter Message Unit Identifier (MUI) is an identity of the RLC SDU, which is used to indicate which RLC SDU that is confirmed with the RLC-AM/UM/TM-DATA-Conf. Primitive. or discarded with the RLC-AM/UM/TM-DATA-Conf. Primitive.

4) The parameter E/R indicates establishment, re-establishment, release or modification of an RLC entity, where re-establishment is applicable to AM and UM RLC entities only. If re-establishment is requested, the state variables and configurable parameters are initialised according to subclause 9.7.7. If release is requested, all protocol parameters, variables and timers are released and the RLC entity enters the NULL state. If modification is requested, the protocol parameters indicated by upper layers (e.g. ciphering parameters) are only modified, while keeping the other protocol parameters, such as the protocol variables, protocol timers and protocol state unchanged. AM RLC entities are always re-established if the AMD PDU size is changed. The modification of other protocol parameters does not require a re-establishment.

5) The parameter Event Code (EVC) indicates the reason for the CRLC-STATUS-Ind (e.g., unrecoverable errors such as data link layer loss or recoverable status events such as reset.).

6) The parameter Ciphering Elements are only applicable for UM and AM operations. These parameters are Ciphering Mode, Ciphering Key, Transmitting Activation Time (SN to activate a new ciphering configuration at the Sender), Receiving Activation Time (SN to activate a new ciphering configuration at the Receiver) and HFN (Hyper Frame Number).

7) The AM_parameters are only applicable for AM operation. These parameters are AMD PDU size, In-sequence Delivery Indication (indicating that RLC SDUs are delivered to upper layers in sequence or out of sequence),

Timer values (see subclause 9.5), Protocol parameter values (see subclause 9.6), Polling triggers (see subclause 9.7.1), Status triggers (see subclause 9.7.2), Periodical Status blocking configuration (see subclause 9.7.2), SDU discard mode (see subclause 9.7.3), Minimum WSN (see subclause 9.2.2.11.3), and Send MRW. The Minimum WSN is always greater than or equal to the number of transport blocks in the smallest transport block set. The Send MRW indicates that the information of each discarded RLC SDU is sent to the Receiver, and the MRW SUFI is sent to the Receiver even if no segments of the RLC SDU to be discarded were submitted to a lower layer.

8) The parameter DiscardInfo indicates to upper layer the discarded RLC SDU in the peer-RLC AM entity. It is applicable only when in-sequence delivery is configured and it is to be used when upper layers require the reliable data transfer.

9) The Stop parameter indicates to the RLC entity to (see subclause 9.7.6):

- discard all RLC PDUs received from the lower layer.

- not submit to lower layer any RLC PDUs.

10) The Continue parameter indicates to the RLC entity to continue transmission and reception of RLC PDUs.

11) The parameter Use special LI indicates that the LI indicating that an RLC SDU begins in the beginning of an RLC PDU is to be used (see subclause 9.2.2.8).

12) The UM_parameters are only applicable for UM operation. It contains Timer_Discard value (see subclause 9.5) and largest UMD PDU size (see subclause 9.2.2.8).

13) The TM_parameters are only applicable for TM operation. It contains e.g. segmentation indication (see subclauses 9.2.2.9 and 11.1.2.1), Timer_Discard value (see subclause 9.5) and delivery of erroneous SDU indication (see subclause 11.1.3).

14) The N parameter indicates that an RLC entity will not send a PDU with SN>=VT(S)+N for AM and SN>=VT(US)+N for UM, where N is a non-negative integer.

15) The VT(S) parameter indicates the value of the Send State Variable for the case of the AM.

16) The VT(US) parameter indicates the value of the UM Data State Variable, for the case of the UM.

XX) The parameter Status is only applicable for AM operation. This parameter indicates whether a RLC SDU is successfully transmitted or discarded.

11 Elementary procedures

Procedures defined in this clause are normative.

This description assumes elementary procedures. Interactions between procedures are not described.

11.1 Transparent mode data transfer procedure

11.1.1 General

The transparent mode data transfer procedure is used for transferring data between two RLC peer entities, which are operating in transparent mode. Data is transferred from Sender to Receiver. This procedure should only apply to entities in DATA_TRANSFER_READY state. Figure 11.1 below illustrates the elementary procedure for transparent mode data transfer.

Channels that can be used are DTCH, CCCH (uplink only), SHCCH (uplink only), BCCH and PCCH. The type of logical channel depends on if the RLC entity is located in the user plane (DTCH) or in the control plane (CCCH/BCCH/SHCCH/PCCH).

Figure 11.1: Transparent mode data transfer procedure

11.1.2 Transmission of TMD PDU

Upon a request of transparent mode data transfer from upper layer, the Sender shall:

- if no SDU discard configuration has been made by upper layers:

    - discard SDUs received in previous TTIs upon reception of new SDUs from upper layers (see subclause 9.7.3.5);

- otherwise (if "Timer Based SDU Discard without explicit signalling" is configured):

    - start a timer Timer_Discard for each SDU received from upper layers (see subclause 9.7.3);

- schedule the RLC SDUs that have been received from upper layer for transmission;

- if one or more RLC SDUs have been scheduled for transmission:

    - notify the lower layer of reception of data from upper layers;

    - perform the actions specified in subclause 11.1.2.2.

11.1.2.1 TMD PDU contents to set

The Sender shall set the data field of the TMD PDU to all or a subset of the data contained in the SDU as described in subclause 11.1.2.2.

11.1.2.2 Submission of TMD PDUs to the lower layer

If one or more RLC SDUs have been scheduled for transmission, according to Subclause 11.1.2, the Sender shall:

- if it is configured for segmented operation:

    - inform the lower layer of the size of the next SDU to be sent;

    - segment the SDU according to the PDU size indicated by the lower layer.

- otherwise (the Sender is configured for non-segmented operation):

    - inform the lower layer of the number and size of SDUs available for transmission;

- submit to the lower layer, the requested number of TMD PDUs;

- buffer the SDUs that are not submitted to the lower layer according to the discard configuration (see subclause 9.7.3).

11.1.3   Reception of TMD PDU

Upon delivery by the lower layer of a set of TMD PDUs (received within one TTI), the Receiver shall:

- if it is configured for segmented operation:

    - reassemble the TMD PDUs received in one TTI into one RLC SDU.

- otherwise (it is configured for non-segmented operation):

    - treat each received TMD PDU as a SDU;

- if "Delivery of Erroneous SDUs" is configured as "no":

    - submit only the RLC SDUs received without error to upper layers through the TM-SAP.

- else if "Delivery of Erroneous SDUs" is configured as "yes":

    - submit all RLC SDUs to upper layers through the TM-SAP;

    - provide an error indication for each SDU received in error.

- otherwise if "Delivery of Erroneous SDUs" is configured as "No detect":

    - submit all RLC SDUs to upper layers through the TM-SAP.

If segmentation is performed in transparent mode RLC, an SDU is erroneous if one or more of the TMD PDUs received in a TTI contains an error. If segmentation is not performed, an SDU is erroneous if the corresponding TMD PDU is erroneous.

11.1.4   Abnormal cases

11.1.4.1   Void

11.1.4.2   SDU discard without explicit signalling

Upon expiry of the timer Timer_Discard in the Sender, the Sender shall:

- discard the associated SDU;

- if requested, inform the upper layers of the discarded SDU.

In the case where the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the UE may wait until after it provides MAC with the requested set of PDUs before discarding the afore-mentioned SDU.

11.2 Unacknowledged mode data transfer procedure

11.2.1 General

The unacknowledged mode data transfer procedure is used for transferring data between two RLC peer entities, which are operating in unacknowledged mode. Data is transferred from Sender to Receiver. This procedure should only apply to RLC entities in DATA_TRANSFER_READY state or LOCAL_SUSPEND state. Figure 11.2 below illustrates the elementary procedure for unacknowledged mode data transfer.

Channels that can be used are DTCH, DCCH, CCCH (downlink only), CTCH, SHCCH (downlink only). The type of logical channel depends on if the RLC entity is located in the user plane (DTCH, CTCH) or in the control plane (DCCH/CCCH(downlink only)/SHCCH(downlink only)). One or several PDUs may be transmitted in each transmission time interval (TTI). For each TTI, MAC decides which PDU size shall be used and how many PDUs shall be transmitted.

Figure 11.2: Unacknowledged mode data transfer procedure

11.2.2 Transmission of UMD PDU

Upon a request of unacknowledged mode data transfer from upper layer, the Sender shall:

- if no SDU discard configuration has been made by upper layers:

    - only discard SDUs when the Transmission buffer is full (see subclause 9.7.3);

- if "Timer based SDU Discard without explicit signalling" is configured:

    - start a timer Timer_Discard for each SDU received from upper layer (see subclause 9.7.3);

- schedule the RLC SDUs received from upper layer for transmission;

- if one or more RLC SDUs have been scheduled for transmission:

    - notify the lower layer of reception of data from upper layers;

    - perform the actions specified in subclause 11.2.2.2.

A UMD PDU shall be considered to be a padding PDU if it consists only of an RLC Header with one length indicator (indicating that the rest of the PDU is padding) and padding.

11.2.2.1 UMD PDU contents to set

The Sender shall:

- set the field "Sequence Number" equal to VT(US);

- set a "Length Indicator" field for each SDU that ends in the UMD PDU according to subclause 9.2.2.8.

For each "Extension bit" field in the RLC header, the Sender shall:

- if the next field in the UMD PDU is a "Length Indicator":

    - set the "Extension bit" to "1";

- otherwise if the next field in the UMD PDU is data:

- set the "Extension bit" to "0".

11.2.2.2 Submission of UMD PDUs to the lower layer

If one or more SDUs have been scheduled for transmission according to subclause 11.2.2, the Sender shall:

- inform the lower layer of the number and size of SDUs scheduled for transmission;

- segment, and if possible concatenate the SDUs according to the PDU sizes indicated by the lower layer;

- submit to the lower layer, the requested number of UMD PDUs;

- update VT(US) for each UMD PDU submitted to the lower layer (see subclause 9.4);

- buffer the SDUs that are not submitted to the lower layer according to the discard configuration (see subclause 9.7.3).

11.2.3 Reception of UMD PDU

Upon delivery of a set of UMD PDUs from the lower layer, the Receiver shall:

- update VR(US) according to each received UMD PDU (see subclause 9.4);

- if the updating step of VR(US) is not equal to one (i.e. one or more UMD PDUs are missing):

  - discard the SDUs that have segments in the missing UMD PDUs;

- reassemble the received UMD PDUs into RLC SDUs;

- submit the RLC SDUs to upper layers through the UM-SAP.

11.2.4 Abnormal cases

11.2.4.1 Length Indicator value reserved for UMD PDU

Upon delivery by the lower layer of an UMD PDU that contains a "Length Indicator" value specified to be reserved for UMD PDUs in this version of the protocol, the Receiver shall:

- discard that UMD PDU and treat the UMD PDU as missing.

11.2.4.2 Invalid length indicator value

If the "Length Indicator" of an UMD PDU has a value that is larger than the PDU size – RLC header size and is not one of the predefined values listed in the table of subclause 9.2.2.8, the Receiver shall:

- discard the UMD PDU; and

- treat the UMD PDU as missing.

11.2.4.3 SDU discard without explicit signalling

Upon expiry of the timer Timer_Discard in the Sender, the Sender shall:

- discard the associated SDU;

- if requested, inform the upper layers of the discarded SDU;

- for the first UMD PDU to be transmitted after the discard operation, the Sender shall:

  - increment VT(US) so that the "Sequence Number" field in this UMD PDU is incremented with two compared with the previous UMD PDU;

  - fill the first data octet in this UMD PDU with the first octet of an RLC SDU;

- set the first "Length Indicator" in this UMD PDU to indicate that the previous RLC PDU was exactly filled with the last segment of an RLC SDU (to avoid that the Receiver unnecessarily discards an extra SDU).

In the case where the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the UE may wait until after it provides MAC with the requested set of PDUs before discarding the afore-mentioned SDU.

11.5   STATUS report transfer procedure

11.5.1   General

The status report transfer procedure is used for transferring of status information between two RLC peer entities, which are operating in acknowledged mode. Figure 11.5 below illustrates the elementary procedure for status report transfer. A status report consists of one or several STATUS PDUs.

In case two logical channels are configured in the uplink, control PDUs are transmitted on the second logical channel. In case two logical channels are configured in the downlink, control PDUs can be transmitted on any of the two logical channels.

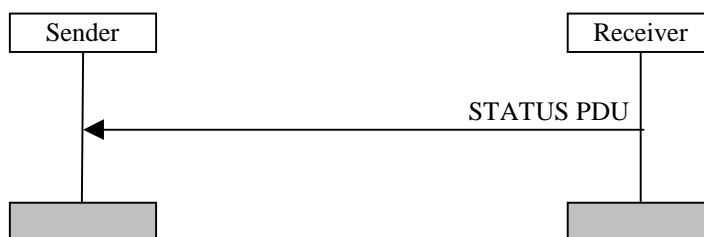The STATUS PDUs have higher priority than AMD PDUs.

Figure 11.5: Status report transfer procedure

11.5.2   Initiation

The Receiver shall:

-    if one of the following triggers is detected:

1)   The "Polling bit" in a received AMD PDU is set to "1";

2)   "Missing PDU Indicator" is configured and a missing AMD PDU is detected;

3)   The "Timer based STATUS transfer" is configured and the timer Timer_Status_Periodic has expired:

-    act on the trigger as specified in subclause 9.7.2.

11.5.2.1   Piggybacked STATUS PDU

The Receiver may:

-    if STATUS PDU(s) to be sent fit into padding octets in AMD PDU(s) to be sent:

-    piggyback a STATUS PDU on the AMD PDU to be sent.

Submission of a piggybacked STATUS PDU in an AMD PDU to the lower layer follows the same rules as an ordinary STATUS PDU.

11.5.2.2   STATUS PDU contents to set

On triggering of a status report, the Receiver shall:

-    if neither the "STATUS prohibit" nor "EPC mechanism" are active:

-    include negative acknowledgements for all AMD PDUs detected as missing;

-    include acknowledgements for all AMD PDUs received up to at least VR(R);

-    if "SDU discard with explicit signalling" procedure has been initiated since the last status report was sent:

- optionally include one MRW SUFI as specified in subclause 11.6.2.2;

- if the MRW SUFI was received in the last status report received:

  - include one MRW_ACK SUFI as specified in subclause 11.6.3.2;

- if the Sender's transmission window is to be updated:

  - include the WINDOW SUFI;

- if all SUFIs can be accommodated in one STATUS PDU:

  - construct the status report using one STATUS PDU, using one of the allowed PDU sizes;

  - if the SUFIs included do not fill the entire STATUS PDU:

    - terminate the STATUS PDU with the ACK or NO_MORE SUFI;

    - use padding in the remainder of the STATUS PDU;

  - otherwise (SUFIs included fill the entire STATUS PDU):

    - ACK or NO_MORE SUFIs need not be included in that STATUS PDU;

- otherwise (the status report is segmented):

  - construct STATUS PDUs including only complete SUFIs using one of the allowed PDU sizes. The set of STATUS PDUs shall accommodate all the SUFIs to form the complete status report. Indication of the same AMD PDU shall not be given in more than one STATUS PDU of a status report, but the ACK SUFI can be present in more than one STATUS PDU of a status report;

  - if any STATUS PDU constructed is not entirely filled with SUFIs:

    - terminate that STATUS PDU with the ACK or NO_MORE SUFI;

    - use padding in the remainder of that STATUS PDU.

  - otherwise (SUFIs included fill the entire STATUS PDU):

    - ACK or NO_MORE SUFIs should not be included in that STATUS PDU.

Which SUFI fields to use is implementation dependent. Bitmap SUFI is used to indicate both received and/or missing AMD PDUs. List SUFI and/or Relative List SUFI are used to indicate missing AMD PDUs only. Acknowledgement SUFI is used to indicate the received AMD PDUs. (For SUFI details see 9.2.2.11.) No information shall be given for AMD PDUs with $SN \geq VR(H)$, i.e. AMD PDUs that have not yet reached the Receiver.

11.5.2.3 Submission of STATUS PDUs to the lower layer

The Receiver shall:

- inform the lower layer of the STATUS PDUs scheduled for transmission;

- submit to the lower layer, the requested number of PDUs (STATUS PDUs, piggybacked AMD / STATUS PDUs and optionally AMD PDUs, see also subclause 11.3.2.2);

- if "Timer based STATUS transfer" is configured and the timer Timer_Status_Periodic has expired:

  - restart the timer Timer_Status_Periodic according to subclause 9.5 f);

- if the "EPC mechanism" is configured:

  - start the timer Timer_EPC according to subclause 9.5 c), and set VR(EP) equal to the number of AMD PDUs requested to be retransmitted;

- if the STATUS PDU includes the MRW SUFI:

  - start the timer Timer_MRW according to subclause 9.5 i).

11.5.3 Reception of the STATUS PDU by the Sender

Upon reception of the STATUS PDU/piggybacked STATUS PDU, the Sender shall:

- if a RLC SDU is positively acknowledged by the STATUS PDU:

    - ~~delete the corresponding AMD PDU(s) from the Retransmission buffer. AMD PDUs carrying segments of not positively acknowledged SDUs shall not be deleted;~~

    - if requested, inform the upper layers of the reception of the RLC SDU by the peer AM RLC entity;

- update the state variables VT(A) and VT(MS) according to the received STATUS PDU/piggybacked STATUS PDU;

- if the STATUS PDU includes negatively acknowledged AMD PDUs:

    - initiate the acknowledged data transfer procedure; and

    - retransmit these AMD PDUs. Retransmitted AMD PDUs shall have higher priority than AMD PDUs to be transmitted for the first time;

    - if an AMD PDU is negatively acknowledged more than once in a STATUS PDU:

        - retransmit the AMD PDU only once;

- if the STATUS PDU includes the MRW SUFI:

    - take the actions specified in subclause 11.6.3;

- if the STATUS PDU includes the MRW_ACK SUFI:

    - take the actions specified in subclause 11.6.4;

- if the STATUS PDU includes the WINDOW SUFI:

- update the current transmitter window size, VT(WS).

11.6   SDU discard with explicit signalling procedure

11.6.1   General

The SDU discard with explicit signalling procedure is used for discarding SDUs and transferring the discard information between two peer entities, which are operating in acknowledged mode. The Sender shall discard an SDU that has not been successfully transmitted for a period of time or for a number of transmissions, and send a Move Receiving Window (MRW) SUFI to the Receiver. According to the MRW SUFI, the Receiver shall discard AMD PDUs carrying that SDU and update the receiving window. Figure 11.6 below illustrates the elementary procedure for SDU discard with explicit signalling.
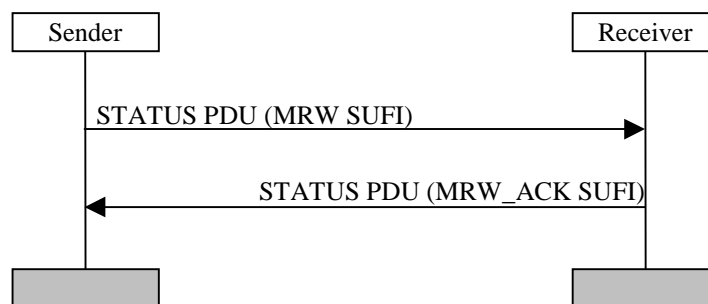

Figure 11.6: SDU discard with explicit signalling

11.6.2   Initiation

The Sender shall initiate the SDU discard with explicit signalling procedure if one of the following triggers is detected:

- "Timer based SDU discard with explicit signalling" is configured, Timer_Discard expires for an SDU, and one or more segments of the SDU have been submitted to a lower layer;

- "Timer based SDU discard with explicit signalling" is configured, Timer_Discard expires for an SDU, and Send MRW is configured;

- "SDU discard after MaxDAT number of transmissions" is configured, and MaxDAT number of transmissions is reached (i.e. $VT(DAT) \geq MaxDAT$) for an AMD PDU.

Upon initiation of the SDU discard with explicit signalling procedure, the Sender shall:

- if "Timer based SDU discard with explicit signalling" is configured:

    - discard all SDUs up to and including the SDU for which the timer Timer_Discard expired;

    - not discard AMD PDUs carrying segments of other SDUs whose timers have not expired;

- if "SDU discard after MaxDAT number of retransmissions" is configured:

    - discard all SDUs that have segments in AMD PDUs with SN inside the interval $VT(A) \leq SN \leq X$, where X is the value of the SN of the AMD PDU with $VT(DAT) \geq MaxDAT$;

- if requested, inform the upper layers of the discarded SDUs;

- if more than 15 discarded SDUs are to be informed to the Receiver:

    - assemble an MRW SUFI with the discard information of the first 15 SDUs. The discard information of the rest SDUs shall be included in another MRW SUFI which shall be sent by the next SDU discard with explicit signalling procedure (after the current SDU discard with explicit signalling procedure is terminated);

- otherwise (less than or equal to 15 discarded SDUs are to be informed to the Receiver):

    - assemble an MRW SUFI with the discard information of the SDUs;

- include the MRW SUFI in the next STATUS PDU/piggybacked STATUS PDU to be transmitted, according to subclause 11.5.2;

- if SN_MRW_{LENGTH} in the MRW SUFI $>VT(S)$:

  - update $VT(S)$ to SN_MRW_{LENGTH};

- start a timer Timer_MRW according to subclause 9.5.

If a new SDU discard with explicit signalling procedure is triggered when the timer Timer_MRW is active, no new MRW SUFIs shall be sent before the current SDU discard with explicit signalling procedure is terminated by one of the termination criteria specified in subclause 11.6.4.