

TSG-RAN Meeting #17
Biarritz, France, 3 - 6 September 2002

RP-020637

Title: Agreed CRs (Release '99 and Rel-4/Rel-5 category A) to TS 25.322
Source: TSG-RAN WG2
Agenda item: 7.2.3

Doc-1st-	Status-	Spec	CR	Rev	Phase	Subject	Cat	Versio	Versio
R2-022360	agreed	25.322	202	1	R99	Corrections to RLC RESET procedure and Length Indicators	F	3.11.0	3.12.0
R2-022361	agreed	25.322	203	1	Rel-4	Corrections to RLC RESET procedure and Length Indicators	A	4.5.0	4.6.0
R2-022362	agreed	25.322	204	1	Rel-5	Corrections to RLC RESET procedure and Length Indicators	A	5.1.0	5.2.0

CHANGE REQUEST

⌘ **25.322 CR 202** ⌘ rev **1** ⌘ Current version: **3.b.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: UICC apps ME Radio Access Network Core Network

Title:	⌘ Corrections to RLC RESET procedure and length indicators		
Source:	⌘ Nokia and LG Electronics Inc.		
Work item code:	⌘ TEI	Date:	⌘ 02/09/2002
Category:	⌘ F	Release:	⌘ R99
	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) Rel-6 (Release 6)

Reason for change:	⌘ The current RLC RESET procedure causes HFN out-of-sync problem when simultaneous RESET procedure occurs. <u>With the existing font of 25.322, in 9.2.2.8 the numbers look like "126" and "125". However, the first characters are not numbers "1", but lower case letters "L". If these numbers are copied into some other text, and the font changed, the numbers look "L26" and "L25".</u>
Summary of change:	⌘ When the Sender of the RESET PDU receives another RESET PDU sent by its peer before receiving its corresponding RESET ACK PDU, the Sender, after setting the HFN equal to the HFNI field in the received RESET PDU, shall not increase the HFN values. <u>Lower case letter "L" changed to "1".</u> Impact analysis: Impact is isolated to the simultaneous RLC RESET procedure. The change is essential, but can be seen as a correction to an earlier CR producing error. If UE or UTRAN does not follow this change, the HFNs will be out-of-sync after the simultaneous RLC RESET procedure <u>The criteria when to use 7- or 15-bit Length Indicators is corrected. There should be no impact to existing implementations as it can be expected that all have interpreted the numbers correctly, ie. "L26" as "126" and "L25" as "125".</u>
Consequences if not approved:	⌘ HFN values will still be out-of-sync after the simultaneous RESET procedure. <u>Confusion about the size of Length Indicator field. The search operations on</u>

numeric values "126" and "125" would not match.

Clauses affected:	⌘	9.2.2.8, 11.4.5.3										
Other specs affected:	⌘	<table border="1"><tr><td>Y</td><td>N</td></tr><tr><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td></tr><tr><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td></tr><tr><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td></tr></table>	Y	N	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Other core specifications	⌘
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		Test specifications										
		O&M Specifications										
Other comments:	⌘											

How to create CRs using this form:

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- 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://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.

9.2.2.8 Length Indicator (LI)

A "Length Indicator" is used to indicate the last octet of each RLC SDU ending within the PDU.

Except 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 last octet 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 respectively for UMD and AMD PDUs.

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

- not be reordered 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 \leq ~~126~~¹²⁶ 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 \leq ~~125~~¹²⁵ 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 on the downlink; 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 are 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 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 in a 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 current PDU shall be padded by the Sender and ignored at the Receiver though there is no "Length Indicator" indicating the existence of Padding;
- 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 "Sequence Number" shall be incremented by 2 before it is transmitted.

If a "Length Indicator" is still awaiting transmission and there is no RLC SDU available, an RLC PDU consisting of this "Length Indicator", the appropriate padding "Length Indicator" and padding may be 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 predefined "Length Indicator" shall be used to indicate the presence of a piggybacked STATUS PDU. This "Length Indicator" replaces the padding "Length Indicator". The piggybacked STATUS PDU shall be appended immediately following the PDU data. When only part of the padding space is used, the end of the piggybacked STATUS PDU is indicated 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 AMD 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.

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 AMD PDUs of "Sequence Number"= $VT(S)-1$ if at least one AMD PDU had been transmitted or of "Sequence Number"=0 if no AMD PDU had been transmitted, are exchanged between UE and UTRAN.

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

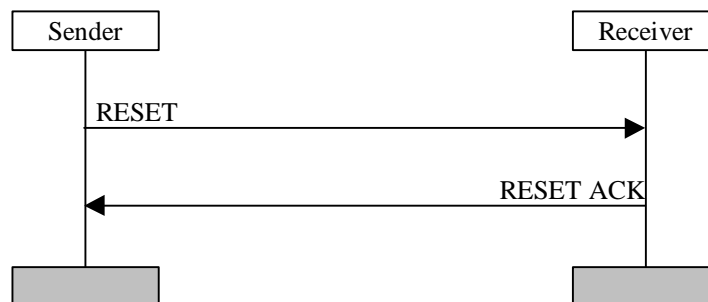


Figure 11.4: RLC reset procedure

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);
 - stop transmitting any AMD PDU or STATUS PDU;
 - increment $VT(RST)$ by 1;
 - if $VT(RST) = MaxRST$:
 - perform the actions specified in subclause 11.4.4a.
 - else (if $VT(RST) < MaxRST$):
 - submit a RESET PDU to the lower layer;
 - start the timer Timer_RST.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC reset procedure until the end of the next TTI.

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. The sequence number of the first RESET PDU after the AM entity is established or re-established shall be "0". 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 AMD PDUs after the reset procedure.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side of the AM RLC entity until the end of the next TTI.

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 AMD 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.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side until the end of the next TTI.

11.4.4a Reached maximum number of attempts

If $VT(RST) = MaxRST$, the Sender shall:

- terminate the ongoing RLC RESET procedure;
- stop the timer `Timer_RST` if it was started;
- indicate unrecoverable error to upper layer.

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:

- increment $VT(RST)$ by one;
- if $VT(RST) < MaxRST$:
 - set the RESET PDU as previously transmitted (even if additional SDUs were discarded in the mean-time);
 - transmit the RESET PDU;
 - restart `Timer_RST`.
- else (if $VT(RST) = MaxRST$):
 - perform the actions specified in subclause 11.4.4a.

11.4.5.2 Void

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 AMD PDUs after the reset procedure.~~

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side until the end of the next TTI.

CHANGE REQUEST

⌘ **25.322 CR 203** ⌘ rev **1** ⌘ Current version: **4.5.0** ⌘

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Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ Corrections to RLC RESET procedure and Length Indicators		
Source:	⌘ Nokia and LG Electronics Inc.		
Work item code:	⌘ TEI	Date:	⌘ 02/09/2002
Category:	⌘ A	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) Rel-6 (Release 6)

Reason for change:	⌘ The current RLC RESET procedure causes HFN out-of-sync problem when simultaneous RESET procedure occurs. <u>With the existing font of 25.322, in 9.2.2.8 the numbers look like "126" and "125". However, the first characters are not numbers "1", but lower case letters "L". If these numbers are copied into some other text, and the font changed, the numbers look "L26" and "L25".</u>
Summary of change:	⌘ When the Sender of the RESET PDU receives another RESET PDU sent by its peer before receiving its corresponding RESET ACK PDU, the Sender, after setting the HFN equal to the HFNI field in the received RESET PDU, shall not increase the HFN values. <u>Lower case letter "L" changed to "1".</u> Impact analysis: Impact is isolated to the simultaneous RLC RESET procedure. The change is essential, but can be seen as a correction to an earlier CR producing error. If UE or UTRAN does not follow this change, the HFNs will be out-of-sync after the simultaneous RLC RESET procedure <u>The criteria when to use 7- or 15-bit Length Indicators is corrected. There should be no impact to existing implementations as it can be expected that all have interpreted the numbers correctly, ie. "L26" as "126" and "L25" as "125".</u>
Consequences if not approved:	⌘ HFN values will still be out-of-sync after the simultaneous RESET procedure. <u>Confusion about the size of Length Indicator field. The search operations on numeric values "126" and "125" would not match.</u>

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9.2.2.8 Length Indicator (LI)

A "Length Indicator" is used to indicate the last octet of each RLC SDU ending within the PDU.

Except 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 last octet of an RLC SDU segment;
- be included in the PDUs that they refer to.

The size of the "Length Indicator" may be either 7 bits 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 respectively for UMD and AMD PDUs.

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

- not be reordered 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 $\leq \underline{126}$ ~~126~~ 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 $\leq \underline{125}$ ~~125~~ 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 RLC SDU begins in the beginning of the RLC PDU; and
- if the RLC PDU is transmitted in uplink; 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 are 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 downlink:
 - if 7-bit "Length Indicator" is used:
 - the Receiver shall be prepared to receive the "Length Indicator" with value "111 1100";

- the Receiver shall follow the discard rules in subclause 11.2.3 both when the "Length Indicator" with value "111 1100" is present and when it is absent.
- if 15-bit "Length Indicator" is used:
 - the Receiver shall be prepared to receive the "Length Indicator" with value "111 1111 1111 1100";
 - the Receiver shall follow the discard rules in subclause 11.2.3 both when the "Length Indicator" with value "111 1111 1111 1100" is present and when it is absent.

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 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 in a 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 current PDU shall be padded by the Sender and ignored at the Receiver though there is no "Length Indicator" indicating the existence of Padding;
- 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 "Sequence Number" shall be incremented by 2 before it is transmitted.

For UM and AM RLC:

- if a 7 bit "Length Indicator" is used in a RLC PDU and one or more padding octets are present in the RLC PDU after the end of the last RLC SDU:
 - indicate the presence of padding by including a "Length Indicator" with value "1111111" as the last "Length Indicator" in the PDU.
- if a 15 bit "Length Indicator" is used in a RLC PDU and two or more padding octets are present in the RLC PDU after the end of the last RLC SDU:
 - indicate the presence of padding by including a "Length Indicator" with value "111 1111 1111 1111" as the last "Length Indicator" in the PDU.

NOTE: After the "Length Indicator" indicating the presence of padding has been included in the RLC PDU, the length of the padding may be zero.

If a "Length Indicator" is still awaiting transmission and there is no RLC SDU available, an RLC PDU consisting of this "Length Indicator", the appropriate padding "Length Indicator" and padding may be 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 predefined "Length Indicator" shall be used to indicate the presence of a piggybacked STATUS PDU. This "Length Indicator" replaces the padding "Length Indicator". The piggybacked STATUS PDU shall be appended immediately following the PDU data. When only part of the padding space is used, the end of the piggybacked STATUS PDU is indicated 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 AMD 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.

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 AMD PDUs of "Sequence Number"= $VT(S)-1$ if at least one AMD PDU had been transmitted or of "Sequence Number"=0 if no AMD PDU had been transmitted, are exchanged between UE and UTRAN.

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

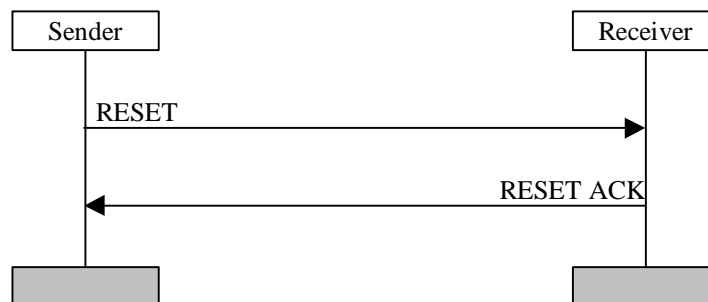


Figure 11.4: RLC reset procedure

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);
 - stop transmitting any AMD PDU or STATUS PDU;
 - increment $VT(RST)$ by 1;
 - if $VT(RST) = MaxRST$:
 - perform the actions specified in subclause 11.4.4a.
 - else (if $VT(RST) < MaxRST$):
 - submit a RESET PDU to the lower layer;
 - start the timer Timer_RST.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC reset procedure until the end of the next TTI.

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. The sequence number of the first RESET PDU after the AM entity is established or re-established shall be "0". 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 AMD PDUs after the reset procedure.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side of the AM RLC entity until the end of the next TTI.

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 AMD 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.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side until the end of the next TTI.

11.4.4a Reached maximum number of attempts

If $VT(RST) = MaxRST$, the Sender shall:

- terminate the ongoing RLC RESET procedure;
- stop the timer `Timer_RST` if it was started;
- indicate unrecoverable error to upper layer.

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:

- increment $VT(RST)$ by one;
- if $VT(RST) < MaxRST$:
 - set the RESET PDU as previously transmitted (even if additional SDUs were discarded in the mean-time);
 - transmit the RESET PDU;
 - restart `Timer_RST`.
- else (if $VT(RST) = MaxRST$):
 - perform the actions specified in subclause 11.4.4a.

11.4.5.2 Void

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 AMD PDUs after the reset procedure.~~

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side until the end of the next TTI.

CHANGE REQUEST

⌘ **25.322 CR 204** ⌘ rev **1** ⌘ Current version: **5.1.0** ⌘

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

Proposed change affects: UICC apps ME Radio Access Network Core Network

Title:	⌘ Corrections to RLC RESET procedure and Length Indicators		
Source:	⌘ Nokia and LG Electronics		
Work item code:	⌘ TEI	Date:	⌘ 02/09/2002
Category:	⌘ A	Release:	⌘ Rel-5
	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) Rel-6 (Release 6)

Reason for change:	⌘ The current RLC RESET procedure causes HFN out-of-sync problem when simultaneous RESET procedure occurs. <u>With the existing font of 25.322, in 9.2.2.8 the numbers look like "126" and "125". However, the first characters are not numbers "1", but lower case letters "L". If these numbers are copied into some other text, and the font changed, the numbers look "L26" and "L25".</u>
Summary of change:	⌘ When the Sender of the RESET PDU receives another RESET PDU sent by its peer before receiving its corresponding RESET ACK PDU, the Sender, after setting the HFN equal to the HFNI field in the received RESET PDU, shall not increase the HFN values. <u>Lower case letter "L" changed to "1".</u> Impact analysis: Impact is isolated to the simultaneous RLC RESET procedure. The change is essential, but can be seen as a correction to an earlier CR producing error. If UE or UTRAN does not follow this change, the HFNs will be out-of-sync after the simultaneous RLC RESET procedure <u>The criteria when to use 7- or 15-bit Length Indicators is corrected. There should be no impact to existing implementations as it can be expected that all have interpreted the numbers correctly, ie. "L26" as "126" and "L25" as "125".</u>
Consequences if not approved:	⌘ HFN values will still be out-of-sync after the simultaneous RESET procedure. <u>Confusion about the size of Length Indicator field. The search operations on numeric values "126" and "125" would not match.</u>

Clauses affected:	⌘	9.2.2.8, 11.4.5.3										
Other specs affected:	⌘	<table border="1"><tr><td>Y</td><td>N</td></tr><tr><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td></tr><tr><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td></tr><tr><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td></tr></table>	Y	N	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Other core specifications	⌘
		Y	N									
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<input type="checkbox"/>	<input checked="" type="checkbox"/>											
<input type="checkbox"/>	<input checked="" type="checkbox"/>											
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/specs/CR.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://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.

9.2.2.8 Length Indicator (LI)

A "Length Indicator" is used to indicate the last octet of each RLC SDU ending within the PDU.

Except 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 last octet of an RLC SDU segment;
- be included in the PDUs that they refer to.

The size of the "Length Indicator" may be either 7 bits 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 respectively for UMD and AMD PDUs.

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

- not be reordered 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 \leq ~~126~~¹²⁶ 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 \leq ~~125~~¹²⁵ 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 RLC SDU begins in the beginning of the RLC PDU; and
- if the RLC PDU is transmitted in uplink; 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 are 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 downlink:
 - if 7-bit "Length Indicator" is used:
 - the Receiver shall be prepared to receive the "Length Indicator" with value "111 1100";

- the Receiver shall follow the discard rules in subclause 11.2.3 both when the "Length Indicator" with value "111 1100" is present and when it is absent.
- if 15-bit "Length Indicator" is used:
 - the Receiver shall be prepared to receive the "Length Indicator" with value "111 1111 1111 1100";
 - the Receiver shall follow the discard rules in subclause 11.2.3 both when the "Length Indicator" with value "111 1111 1111 1100" is present and when it is absent.

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 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 in a 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 current PDU shall be padded by the Sender and ignored at the Receiver though there is no "Length Indicator" indicating the existence of Padding;
- 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 "Sequence Number" shall be incremented by 2 before it is transmitted.

For UM and AM RLC:

- if a 7 bit "Length Indicator" is used in a RLC PDU and one or more padding octets are present in the RLC PDU after the end of the last RLC SDU:
 - indicate the presence of padding by including a "Length Indicator" with value "1111111" as the last "Length Indicator" in the PDU.
- if a 15 bit "Length Indicator" is used in a RLC PDU and two or more padding octets are present in the RLC PDU after the end of the last RLC SDU:
 - indicate the presence of padding by including a "Length Indicator" with value "111 1111 1111 1111" as the last "Length Indicator" in the PDU.

NOTE: After the "Length Indicator" indicating the presence of padding has been included in the RLC PDU, the length of the padding may be zero.

If a "Length Indicator" is still awaiting transmission and there is no RLC SDU available, an RLC PDU consisting of this "Length Indicator", the appropriate padding "Length Indicator" and padding may be 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 predefined "Length Indicator" shall be used to indicate the presence of a piggybacked STATUS PDU. This "Length Indicator" replaces the padding "Length Indicator". The piggybacked STATUS PDU shall be appended immediately following the PDU data. When only part of the padding space is used, the end of the piggybacked STATUS PDU is indicated 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 AMD 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.

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 AMD PDUs of "Sequence Number"= $VT(S)-1$ if at least one AMD PDU had been transmitted or of "Sequence Number"=0 if no AMD PDU had been transmitted, are exchanged between UE and UTRAN.

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

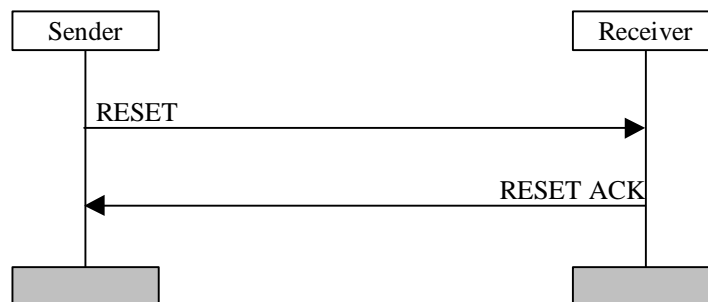


Figure 11.4: RLC reset procedure

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);
 - stop transmitting any AMD PDU or STATUS PDU;
 - increment $VT(RST)$ by 1;
 - if $VT(RST) = MaxRST$:
 - perform the actions specified in subclause 11.4.4a.
 - else (if $VT(RST) < MaxRST$):
 - submit a RESET PDU to the lower layer;
 - start the timer Timer_RST.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC reset procedure until the end of the next TTI.

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. The sequence number of the first RESET PDU after the AM entity is established or re-established shall be "0". 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 AMD PDUs after the reset procedure.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side of the AM RLC entity until the end of the next TTI.

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 AMD 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.

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side until the end of the next TTI.

11.4.4a Reached maximum number of attempts

If $VT(RST) = MaxRST$, the Sender shall:

- terminate the ongoing RLC RESET procedure;
- stop the timer `Timer_RST` if it was started;
- indicate unrecoverable error to upper layer.

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:

- increment $VT(RST)$ by one;
- if $VT(RST) < MaxRST$:
 - set the RESET PDU as previously transmitted (even if additional SDUs were discarded in the mean-time);
 - transmit the RESET PDU;
 - restart `Timer_RST`.
- else (if $VT(RST) = MaxRST$):
 - perform the actions specified in subclause 11.4.4a.

11.4.5.2 Void

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 AMD PDUs after the reset procedure.~~

NOTE: If the TFC selection exchange has been initiated by sending the RLC Entity Info parameter to MAC, the RLC entity may delay the RLC SDUs discard in the transmitting side until the end of the next TTI.