

TSG-RAN Meeting #19
Birmingham, UK, 11 - 14 March 2003

RP-030101

Title: CRs (Release '99 and Rel-4/Rel-5 category A) to TS 25.322

Source: TSG-RAN WG2

Agenda item: 8.2.3

Spec	CR	Rev	Phase	Subject	Cat	Version-Current	Version-New	Doc-2nd-Level	Workitem
25.322	214	-	R99	Correction to VT(MRW) definition	F	3.13.0	3.14.0	R2-030509	TEI
25.322	215	-	Rel-4	Correction to VT(MRW) definition	A	4.7.0	4.8.0	R2-030510	TEI
25.322	216	-	Rel-5	Correction to VT(MRW) definition	A	5.3.0	5.4.0	R2-030511	TEI

CHANGE REQUEST

⌘ **25.322 CR 214** ⌘ rev - ⌘ Current version: **3.13.0** ⌘

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:	⌘ Correction to VT(MRW) definition		
Source:	⌘ TSG-RAN WG2		
Work item code:	⌘ TEI	Date:	⌘ February 2003
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:	⌘ Three state variables VT(DAT), VT(RST), and VT(MRW) are used to count the number of transmission. Among those three variables, the update method of VT(MRW) is different from that of the other two variables in that VT(MRW) is updated after the timer expires while VT(DAT) and VT(RST) are updated before transmission. The update method of VT(MRW) is well described in section 11.6 "SDU discard with explicit signalling procedure". Therefore, the definition of VT(MRW) in section 9.4 should be corrected. Also, some editorial changes are made to clean up the specification.
Summary of change:	⌘ 1. The definition and update method of VT(MRW) is corrected. 2. Editorial changes. <ul style="list-style-type: none"> - 'Initial value' sentence is line-broken as is the case for other state variables. - 'MaxDAT number of retransmission' is changed to 'MaxDAT number of transmission' in order to align with other parts. <p>Isolated Impact change analysis:</p> The CR corrects the wrong definition of RLC state variable to be aligned with the other parts of the specification. Procedural text correctly describes the usage of the RLC state variable. Since this CR corrects only the inconsistency of the specification, it has an isolated impact.
Consequences if not approved:	⌘ Inconsistencies still exist in the RLC specification. Since the update method of state variable VT(MRW) is different in 9.4 and 11.6 while 11.6 is correct, it is

possible that some implementation follow wrong method indicated in 9.4. If a UE or UTRAN follows 9.4, the number of transmission of MRW SUFI is less by 1 than expected.

Clauses affected:	⌘	9.4, 11.4.2, 11.6.2									
Other specs Affected:	⌘	<table border="1"> <thead> <tr> <th>Y</th> <th>N</th> </tr> </thead> <tbody> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> </tbody> </table>	Y	N		X		X		X	Other core specifications ⌘ Test specifications O&M Specifications
Y	N										
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Other comments:	⌘										

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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.
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- 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.

9.4 State variables

The state variables defined in this subclause are normative.

This sub-clause describes the state variables used in AM and UM in order to specify the peer-to-peer protocol. All state variables are non-negative integers. UMD and AMD PDUs are numbered by modulo integer sequence numbers (SN) cycling through the field: 0 to $212 - 1$ for AM and 0 to $27 - 1$ for UM. All arithmetic operations contained in the present document on VT(S), VT(A), VT(MS), VR(R), VR(H) and VR(MR) are affected by the AM modulus. All arithmetic operations contained in the present document on VT(US) and VR(US) are affected by the UM modulus. When performing arithmetic comparisons of state variables or Sequence number values a modulus base shall be used. This modulus base is subtracted (within the appropriate field) from all the values involved and then an absolute comparison is performed. At the Sender, VT(A) and VT(US) shall be assumed to be the modulus base in AM and UM respectively. At the Receiver, VR(R) and VR(US) shall be assumed to be the modulus base in AM and UM respectively.

The RLC shall maintain the following state variables in the Sender.

- a) VT(S) - Send state variable.

This state variable contains the "Sequence Number" of the next AMD PDU to be transmitted for the first time (i.e. excluding retransmitted PDUs). It shall be updated after the aforementioned AMD PDU is transmitted or after transmission of a MRW SUFI which includes $SN_MRW_{LENGTH} > VT(S)$ (see subclause 11.6).

The initial value of this variable is 0. ([*NOTE : moved to next line](#))

- b) VT(A) - Acknowledge state variable.

This state variable contains the "Sequence Number" following the "Sequence Number" of the last in-sequence acknowledged AMD PDU. This forms the lower edge of the transmission window of acceptable acknowledgements. VT(A) shall be updated based on the receipt of a STATUS PDU including an ACK (see subclause 9.2.2.11.2) and/or an MRW_ACK SUFI (see subclause 11.6).

The initial value of this variable is 0. For the purpose of initialising the protocol, this value shall be assumed to be the first "Sequence Number" following the last in-sequence acknowledged AMD PDU.

- c) VT(DAT).

This state variable counts the number of times a AMD PDU has been scheduled to be transmitted. There shall be one VT(DAT) for each PDU and each shall be incremented every time the corresponding AMD PDU is scheduled to be transmitted.

The initial value of this variable is 0.

- d) VT(MS) - Maximum Send state variable.

This state variable contains the "Sequence Number" of the first AMD PDU that can be rejected by the peer Receiver, $VT(MS) = VT(A) + VT(WS)$. This value represents the upper edge of the transmission window. The transmitter shall not transmit AMD PDUs with "Sequence Number" $\geq VT(MS)$ unless $VT(S) \geq VT(MS)$. In that case, the AMD PDU with "Sequence Number" = $VT(S) - 1$ can also be transmitted. VT(MS) shall be updated when VT(A) or VT(WS) is updated.

The initial value of this variable is Configured_Tx_Window_size.

- e) VT(US) – UM data state variable.

This state variable contains the "Sequence Number" of the next UMD PDU to be transmitted. It shall be incremented by 1 each time a UMD PDU is transmitted.

The initial value of this variable is 0.

NOTE: For the UTRAN side, the initial value of this variable can be different from 0.

- f) VT(PDU).

This state variable is used when the "poll every Poll_PDU PDU" polling trigger is configured. It shall be incremented by 1 for each AMD PDU that is transmitted including both new and retransmitted AMD PDUs. When it becomes equal to the value Poll_PDU, a new poll shall be transmitted and the state variable shall be set to zero.

The initial value of this variable is 0.

g) VT(SDU).

This state variable is used when the "poll every Poll_SDU SDU" polling trigger is configured. It shall be incremented by 1 for a given SDU when all the AMD PDUs carrying a part of this SDU have been transmitted at least once. When it becomes equal to the value Poll_SDU a new poll shall be transmitted and the state variable shall be set to zero. The "Polling bit" shall be set to "1" in the first transmission of the AMD PDU that contains the last segment of the SDU.

The initial value of this variable is 0.

h) VT(RST) - Reset state variable.

This state variable is used to count the number of times a RESET PDU is scheduled to be transmitted before the reset procedure is completed. VT(RST) shall be incremented by 1 each time a RESET PDU is scheduled to be transmitted. VT(RST) shall only be reset upon the reception of a RESET ACK PDU, i.e. VT(RST) shall not be reset when an RLC reset initiated by the peer RLC entity occurs.

The initial value of this variable is 0.

i) VT(MRW) – MRW command send state variable.

This state variable is used to count the number of times a MRW command is ~~scheduled to be~~ transmitted. VT(MRW) is incremented by 1 each time a timer Timer_MRW expires~~an MRW SUFI is scheduled to be transmitted~~. VT(MRW) shall be reset when the SDU discard with explicit signalling procedure is terminated.

The initial value of this variable is 0. (*NOTE : moved to next line)

j) VT(WS) – Transmission window size state variable.

This state variable contains the size that shall be used for the transmission window. VT(WS) shall be set equal to the WSN field when the transmitter receives a STATUS PDU including a WINDOW SUFI.

The initial value of this variable is Configured_Tx_Window_size.

The RLC shall maintain the following state variables in the Receiver:

a) VR(R) - Receive state variable.

This state variable contains the "Sequence Number" following that of the last in-sequence AMD PDU received. It shall be updated upon the receipt of the AMD PDU with "Sequence Number" equal to VR(R).

The initial value of this variable is 0. For the purpose of initialising the protocol, this value shall be assumed to be the first "Sequence Number" following the last in-sequence received AMD PDU.

b) VR(H) - Highest expected state variable.

This state variable contains the "Sequence Number" following the highest "Sequence Number" of any received AMD PDU. When a AMD PDU is received with "Sequence Number" x such that $VR(H) \leq x < VR(MR)$, this state variable shall be set equal to x+1.

The initial value of this variable is 0.

c) VR(MR) - Maximum acceptable Receive state variable.

This state variable contains the "Sequence Number" of the first AMD PDU that shall be rejected by the Receiver, $VR(MR) = VR(R) + \text{Configured_Rx_Window_Size}$.

d) VR(US) - Receiver Send Sequence state variable.

This state variable contains the "Sequence Number" following that of the last UMD PDU received. When a UMD PDU with "Sequence Number" equal to x is received, the state variable shall set equal to $x + 1$.

The initial value of this variable is 0.

e) VR(EP) - Estimated PDU Counter state variable.

This state variable contains the number of AMD PDUs whose re-transmission is still expected as a consequence of the transmission of the latest status report. At the end of each TTI it is decremented by the total number of AMD PDUs that were received during that time.

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.

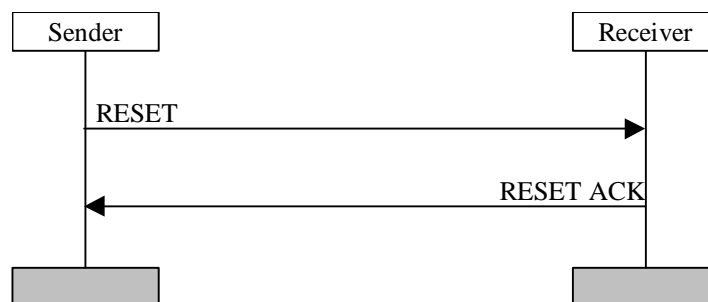


Figure 11.4: RLC reset procedure

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 $VT(RST) = MaxRST$:
 - the Sender may submit to the lower layer a RESET PDU;
 - 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.

11.6 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 reception window. Figure 11.6 below illustrates the elementary procedure for SDU discard with explicit signalling.

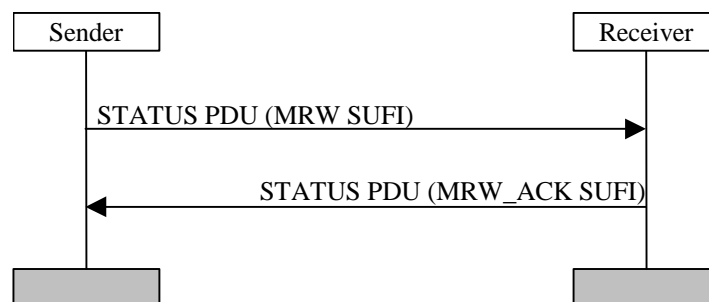


Figure 11.6: SDU discard with explicit signalling

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

- discard all SDUs that have segments in AMD PDUs with "Sequence Number" SN inside the interval $VT(A) \leq SN \leq X$, where X is the value of the "Sequence Number" of the AMD PDU with $VT(DAT) \geq MaxDAT$.
- if requested:
 - inform the upper layers of the discarded SDUs
- discard all AMD PDUs including segments of the discarded SDUs, unless they also carry a segment of a SDU whose timer has not expired;
- if more than 15 discarded SDUs are to be informed to the Receiver (see subclause 11.6.2.2):
 - if "Send MRW" is not configured:
 - assemble an MRW SUFI with the discard information of the SDUs.
 - otherwise ("Send MRW" is configured):
 - assemble an MRW SUFI with the discard information of the first 15 SDUs; and
 - include the discard information of the rest SDUs 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.
- schedule and submit to lower layer a STATUS PDU/piggybacked STATUS PDU containing the MRW SUFI;
- 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.

CHANGE REQUEST

⌘ **25.322 CR 215** ⌘ rev - ⌘ Current version: **4.7.0** ⌘

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

Title:	⌘ Correction to VT(MRW) definition		
Source:	⌘ TSG-RAN WG2		
Work item code:	⌘ TEI	Date:	⌘ February 2003
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:	⌘ Three state variables VT(DAT), VT(RST), and VT(MRW) are used to count the number of transmission. Among those three variables, the update method of VT(MRW) is different from that of the other two variables in that VT(MRW) is updated after the timer expires while VT(DAT) and VT(RST) are updated before transmission. The update method of VT(MRW) is well described in section 11.6 "SDU discard with explicit signalling procedure". Therefore, the definition of VT(MRW) in section 9.4 should be corrected. Also, some editorial changes are made to clean up the specification.
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9.4 State variables

The state variables defined in this subclause are normative.

This sub-clause describes the state variables used in AM and UM in order to specify the peer-to-peer protocol. All state variables are non-negative integers. UMD and AMD PDUs are numbered by modulo integer sequence numbers (SN) cycling through the field: 0 to $212 - 1$ for AM and 0 to $27 - 1$ for UM. All arithmetic operations contained in the present document on VT(S), VT(A), VT(MS), VR(R), VR(H) and VR(MR) are affected by the AM modulus. All arithmetic operations contained in the present document on VT(US) and VR(US) are affected by the UM modulus. When performing arithmetic comparisons of state variables or Sequence number values a modulus base shall be used. This modulus base is subtracted (within the appropriate field) from all the values involved and then an absolute comparison is performed. At the Sender, VT(A) and VT(US) shall be assumed to be the modulus base in AM and UM respectively. At the Receiver, VR(R) and VR(US) shall be assumed to be the modulus base in AM and UM respectively.

The RLC shall maintain the following state variables in the Sender.

- a) VT(S) - Send state variable.

This state variable contains the "Sequence Number" of the next AMD PDU to be transmitted for the first time (i.e. excluding retransmitted PDUs). It shall be updated after the aforementioned AMD PDU is transmitted or after transmission of a MRW SUFI which includes $SN_MRW_{LENGTH} > VT(S)$ (see subclause 11.6).

The initial value of this variable is 0. ([*NOTE : moved to next line](#))

- b) VT(A) - Acknowledge state variable.

This state variable contains the "Sequence Number" following the "Sequence Number" of the last in-sequence acknowledged AMD PDU. This forms the lower edge of the transmission window of acceptable acknowledgements. VT(A) shall be updated based on the receipt of a STATUS PDU including an ACK (see subclause 9.2.2.11.2) and/or an MRW_ACK SUFI (see subclause 11.6).

The initial value of this variable is 0. For the purpose of initialising the protocol, this value shall be assumed to be the first "Sequence Number" following the last in-sequence acknowledged AMD PDU.

- c) VT(DAT).

This state variable counts the number of times a AMD PDU has been scheduled to be transmitted. There shall be one VT(DAT) for each PDU and each shall be incremented every time the corresponding AMD PDU is scheduled to be transmitted.

The initial value of this variable is 0.

- d) VT(MS) - Maximum Send state variable.

This state variable contains the "Sequence Number" of the first AMD PDU that can be rejected by the peer Receiver, $VT(MS) = VT(A) + VT(WS)$. This value represents the upper edge of the transmission window. The transmitter shall not transmit AMD PDUs with "Sequence Number" $\geq VT(MS)$ unless $VT(S) \geq VT(MS)$. In that case, the AMD PDU with "Sequence Number" = $VT(S) - 1$ can also be transmitted. VT(MS) shall be updated when VT(A) or VT(WS) is updated.

The initial value of this variable is Configured_Tx_Window_size.

- e) VT(US) – UM data state variable.

This state variable contains the "Sequence Number" of the next UMD PDU to be transmitted. It shall be incremented by 1 each time a UMD PDU is transmitted.

The initial value of this variable is 0.

NOTE: For the UTRAN side, the initial value of this variable can be different from 0.

- f) VT(PDU).

This state variable is used when the "poll every Poll_PDU PDU" polling trigger is configured. It shall be incremented by 1 for each AMD PDU that is transmitted including both new and retransmitted AMD PDUs. When it becomes equal to the value Poll_PDU, a new poll shall be transmitted and the state variable shall be set to zero.

The initial value of this variable is 0.

g) VT(SDU).

This state variable is used when the "poll every Poll_SDU SDU" polling trigger is configured. It shall be incremented by 1 for a given SDU when all the AMD PDUs carrying a part of this SDU have been transmitted at least once. When it becomes equal to the value Poll_SDU a new poll shall be transmitted and the state variable shall be set to zero. The "Polling bit" shall be set to "1" in the first transmission of the AMD PDU that contains the last segment of the SDU.

The initial value of this variable is 0.

h) VT(RST) - Reset state variable.

This state variable is used to count the number of times a RESET PDU is scheduled to be transmitted before the reset procedure is completed. VT(RST) shall be incremented by 1 each time a RESET PDU is scheduled to be transmitted. VT(RST) shall only be reset upon the reception of a RESET ACK PDU, i.e. VT(RST) shall not be reset when an RLC reset initiated by the peer RLC entity occurs.

The initial value of this variable is 0.

i) VT(MRW) – MRW command send state variable.

This state variable is used to count the number of times a MRW command is ~~scheduled to be~~ transmitted. VT(MRW) is incremented by 1 each time ~~a timer Timer_MRW expires~~ ~~an MRW-SUFI is scheduled to be~~ ~~transmitted~~. VT(MRW) shall be reset when the SDU discard with explicit signalling procedure is terminated.

The initial value of this variable is 0. (*NOTE : moved to next line)

j) VT(WS) – Transmission window size state variable.

This state variable contains the size that shall be used for the transmission window. VT(WS) shall be set equal to the WSN field when the transmitter receives a STATUS PDU including a WINDOW SUFI.

The initial value of this variable is Configured_Tx_Window_size.

The RLC shall maintain the following state variables in the Receiver:

a) VR(R) - Receive state variable.

This state variable contains the "Sequence Number" following that of the last in-sequence AMD PDU received. It shall be updated upon the receipt of the AMD PDU with "Sequence Number" equal to VR(R).

The initial value of this variable is 0. For the purpose of initialising the protocol, this value shall be assumed to be the first "Sequence Number" following the last in-sequence received AMD PDU.

b) VR(H) - Highest expected state variable.

This state variable contains the "Sequence Number" following the highest "Sequence Number" of any received AMD PDU. When a AMD PDU is received with "Sequence Number" x such that $VR(H) \leq x < VR(MR)$, this state variable shall be set equal to x+1.

The initial value of this variable is 0.

c) VR(MR) - Maximum acceptable Receive state variable.

This state variable contains the "Sequence Number" of the first AMD PDU that shall be rejected by the Receiver, $VR(MR) = VR(R) + Configured_Rx_Window_Size$.

d) VR(US) - Receiver Send Sequence state variable.

This state variable contains the "Sequence Number" following that of the last UMD PDU received. When a UMD PDU with "Sequence Number" equal to x is received, the state variable shall set equal to $x + 1$.

The initial value of this variable is 0.

e) VR(EP) - Estimated PDU Counter state variable.

This state variable contains the number of AMD PDUs whose re-transmission is still expected as a consequence of the transmission of the latest status report. At the end of each TTI it is decremented by the total number of AMD PDUs that were received during that time.

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.

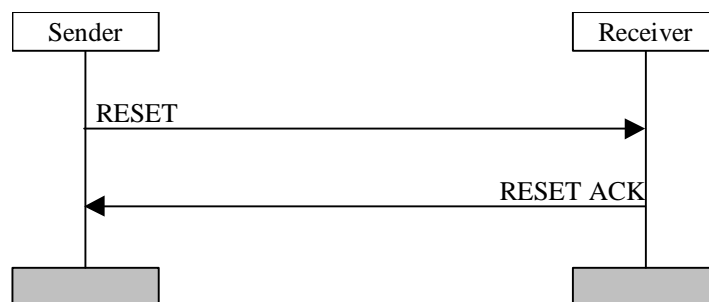


Figure 11.4: RLC reset procedure

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.

11.6 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 reception window. Figure 11.6 below illustrates the elementary procedure for SDU discard with explicit signalling.

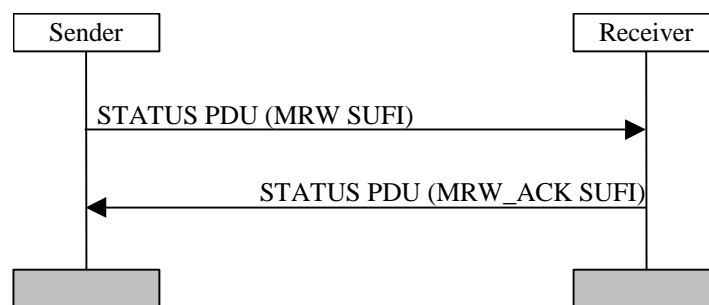


Figure 11.6: SDU discard with explicit signalling

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 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.
- if "SDU discard after MaxDAT number of retransmissions" is configured:
 - discard all SDUs that have segments in AMD PDUs with "Sequence Number" SN inside the interval $VT(A) \leq SN \leq X$, where X is the value of the "Sequence Number" of the AMD PDU with $VT(DAT) \geq MaxDAT$.

- if requested:
 - inform the upper layers of the discarded SDUs.
- discard all AMD PDUs including segments of the discarded SDUs, unless they also carry a segment of a SDU whose timer has not expired;
- if more than 15 discarded SDUs are to be informed to the Receiver (see subclause 11.6.2.2):
 - if "Send MRW" is not configured:
 - assemble an MRW SUFI with the discard information of the SDUs.
 - otherwise ("Send MRW" is configured):
 - assemble an MRW SUFI with the discard information of the first 15 SDUs; and
 - include the discard information of the rest SDUs 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.
- schedule and submit to lower layer a STATUS PDU/piggybacked STATUS PDU containing the MRW SUFI;
- 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.

CHANGE REQUEST

⌘ **25.322 CR 216** ⌘ rev - ⌘ Current version: **5.3.0** ⌘

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:	⌘ Correction to VT(MRW) definition		
Source:	⌘ TSG-RAN WG2		
Work item code:	⌘ TEI	Date:	⌘ February 2003
Category:	⌘ A	Release:	⌘ Rel-5
	Use <u>one</u> of the following categories: <i>F</i> (correction) <i>A</i> (corresponds to a correction in an earlier release) <i>B</i> (addition of feature), <i>C</i> (functional modification of feature) <i>D</i> (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:	⌘ Three state variables VT(DAT), VT(RST), and VT(MRW) are used to count the number of transmission. Among those three variables, the update method of VT(MRW) is different from that of the other two variables in that VT(MRW) is updated after the timer expires while VT(DAT) and VT(RST) are updated before transmission. The update method of VT(MRW) is well described in section 11.6 "SDU discard with explicit signalling procedure". Therefore, the definition of VT(MRW) in section 9.4 should be corrected. Also, some editorial changes are made to clean up the specification.
Summary of change:	⌘ <ol style="list-style-type: none"> 1. The definition and update method of VT(MRW) is corrected. 2. Editorial changes. <ul style="list-style-type: none"> - 'Initial value' sentence is line-broken as is the case for other state variables. - 'MaxDAT number of retransmission' is changed to 'MaxDAT number of transmission' in order to align with other parts. <p>Isolated Impact change analysis:</p> <p>The CR corrects the wrong definition of RLC state variable to be aligned with the other parts of the specification. Procedural text correctly describes the usage of the RLC state variable. Since this CR corrects only the inconsistency of the specification, it has an isolated impact.</p>
Consequences if not approved:	⌘ Inconsistencies still exist in the RLC specification. Since the update method of state variable VT(MRW) is different in 9.4 and 11.6 while 11.6 is correct, it is

possible that some implementation follow wrong method indicated in 9.4. If a UE or UTRAN follows 9.4, the number of transmission of MRW SUFI is less by 1 than expected.

Clauses affected:	⌘	9.4, 11.4.2, 11.6.2									
Other specs Affected:	⌘	<table border="1"> <thead> <tr> <th>Y</th> <th>N</th> </tr> </thead> <tbody> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> <tr> <td></td> <td>X</td> </tr> </tbody> </table>	Y	N		X		X		X	Other core specifications ⌘ Test specifications O&M Specifications
Y	N										
	X										
	X										
	X										
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.

9.4 State variables

The state variables defined in this subclause are normative.

This sub-clause describes the state variables used in AM and UM in order to specify the peer-to-peer protocol. All state variables are non-negative integers. UMD and AMD PDUs are numbered by modulo integer sequence numbers (SN) cycling through the field: 0 to $212 - 1$ for AM and 0 to $27 - 1$ for UM. All arithmetic operations contained in the present document on VT(S), VT(A), VT(MS), VR(R), VR(H) and VR(MR) are affected by the AM modulus. All arithmetic operations contained in the present document on VT(US) and VR(US) are affected by the UM modulus. When performing arithmetic comparisons of state variables or Sequence number values a modulus base shall be used. This modulus base is subtracted (within the appropriate field) from all the values involved and then an absolute comparison is performed. At the Sender, VT(A) and VT(US) shall be assumed to be the modulus base in AM and UM respectively. At the Receiver, VR(R) and VR(US) shall be assumed to be the modulus base in AM and UM respectively.

The RLC shall maintain the following state variables in the Sender.

- a) VT(S) - Send state variable.

This state variable contains the "Sequence Number" of the next AMD PDU to be transmitted for the first time (i.e. excluding retransmitted PDUs). It shall be updated after the aforementioned AMD PDU is transmitted or after transmission of a MRW SUFI which includes $SN_MRW_{LENGTH} > VT(S)$ (see subclause 11.6).

The initial value of this variable is 0. ([*NOTE : moved to next line](#))

- b) VT(A) - Acknowledge state variable.

This state variable contains the "Sequence Number" following the "Sequence Number" of the last in-sequence acknowledged AMD PDU. This forms the lower edge of the transmission window of acceptable acknowledgements. VT(A) shall be updated based on the receipt of a STATUS PDU including an ACK (see subclause 9.2.2.11.2) and/or an MRW_ACK SUFI (see subclause 11.6).

The initial value of this variable is 0. For the purpose of initialising the protocol, this value shall be assumed to be the first "Sequence Number" following the last in-sequence acknowledged AMD PDU.

- c) VT(DAT).

This state variable counts the number of times a AMD PDU has been scheduled to be transmitted. There shall be one VT(DAT) for each PDU and each shall be incremented every time the corresponding AMD PDU is scheduled to be transmitted.

The initial value of this variable is 0.

- d) VT(MS) - Maximum Send state variable.

This state variable contains the "Sequence Number" of the first AMD PDU that can be rejected by the peer Receiver, $VT(MS) = VT(A) + VT(WS)$. This value represents the upper edge of the transmission window. The transmitter shall not transmit AMD PDUs with "Sequence Number" $\geq VT(MS)$ unless $VT(S) \geq VT(MS)$. In that case, the AMD PDU with "Sequence Number" = $VT(S) - 1$ can also be transmitted. VT(MS) shall be updated when VT(A) or VT(WS) is updated.

The initial value of this variable is Configured_Tx_Window_size.

- e) VT(US) – UM data state variable.

This state variable contains the "Sequence Number" of the next UMD PDU to be transmitted. It shall be incremented by 1 each time a UMD PDU is transmitted.

The initial value of this variable is 0.

NOTE: For the UTRAN side, the initial value of this variable can be different from 0.

- f) VT(PDU).

This state variable is used when the "poll every Poll_PDU PDU" polling trigger is configured. It shall be incremented by 1 for each AMD PDU that is transmitted including both new and retransmitted AMD PDUs. When it becomes equal to the value Poll_PDU, a new poll shall be transmitted and the state variable shall be set to zero.

The initial value of this variable is 0.

g) VT(SDU).

This state variable is used when the "poll every Poll_SDU SDU" polling trigger is configured. It shall be incremented by 1 for a given SDU when all the AMD PDUs carrying a part of this SDU have been transmitted at least once. When it becomes equal to the value Poll_SDU a new poll shall be transmitted and the state variable shall be set to zero. The "Polling bit" shall be set to "1" in the first transmission of the AMD PDU that contains the last segment of the SDU.

The initial value of this variable is 0.

h) VT(RST) - Reset state variable.

This state variable is used to count the number of times a RESET PDU is scheduled to be transmitted before the reset procedure is completed. VT(RST) shall be incremented by 1 each time a RESET PDU is scheduled to be transmitted. VT(RST) shall only be reset upon the reception of a RESET ACK PDU, i.e. VT(RST) shall not be reset when an RLC reset initiated by the peer RLC entity occurs.

The initial value of this variable is 0.

i) VT(MRW) – MRW command send state variable.

This state variable is used to count the number of times a MRW command is ~~scheduled to be~~ transmitted. VT(MRW) is incremented by 1 each time a timer Timer_MRW expires~~an MRW SUFI is scheduled to be transmitted~~. VT(MRW) shall be reset when the SDU discard with explicit signalling procedure is terminated.

The initial value of this variable is 0. (*NOTE : moved to next line)

j) VT(WS) – Transmission window size state variable.

This state variable contains the size that shall be used for the transmission window. VT(WS) shall be set equal to the WSN field when the transmitter receives a STATUS PDU including a WINDOW SUFI.

The initial value of this variable is Configured_Tx_Window_size.

The RLC shall maintain the following state variables in the Receiver:

a) VR(R) - Receive state variable.

This state variable contains the "Sequence Number" following that of the last in-sequence AMD PDU received. It shall be updated upon the receipt of the AMD PDU with "Sequence Number" equal to VR(R).

The initial value of this variable is 0. For the purpose of initialising the protocol, this value shall be assumed to be the first "Sequence Number" following the last in-sequence received AMD PDU.

b) VR(H) - Highest expected state variable.

This state variable contains the "Sequence Number" following the highest "Sequence Number" of any received AMD PDU. When a AMD PDU is received with "Sequence Number" x such that $VR(H) \leq x < VR(MR)$, this state variable shall be set equal to x+1.

The initial value of this variable is 0.

c) VR(MR) - Maximum acceptable Receive state variable.

This state variable contains the "Sequence Number" of the first AMD PDU that shall be rejected by the Receiver, $VR(MR) = VR(R) + \text{Configured_Rx_Window_Size}$.

d) VR(US) - Receiver Send Sequence state variable.

This state variable contains the "Sequence Number" following that of the last UMD PDU received. When a UMD PDU with "Sequence Number" equal to x is received, the state variable shall set equal to $x + 1$.

The initial value of this variable is 0.

e) VR(EP) - Estimated PDU Counter state variable.

This state variable contains the number of AMD PDUs whose re-transmission is still expected as a consequence of the transmission of the latest status report. At the end of each TTI it is decremented by the total number of AMD PDUs that were received during that time.

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.

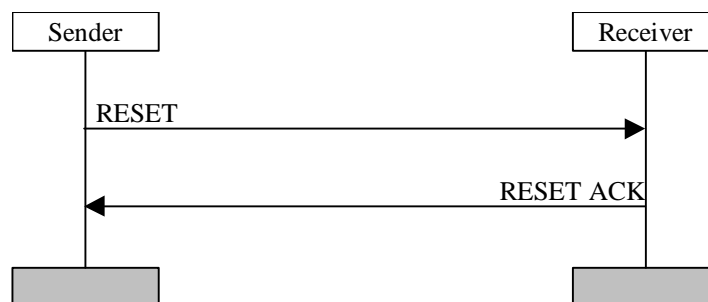


Figure 11.4: RLC reset procedure

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 $VT(RST) = MaxRST$:
 - the Sender may submit to the lower layer a RESET PDU;
 - 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.

11.6 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 reception window. Figure 11.6 below illustrates the elementary procedure for SDU discard with explicit signalling.

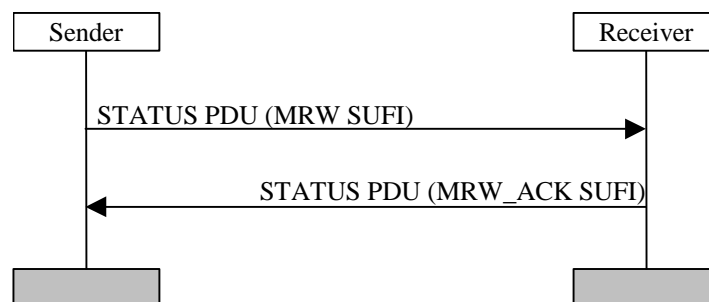


Figure 11.6: SDU discard with explicit signalling

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

- discard all SDUs that have segments in AMD PDUs with "Sequence Number" SN inside the interval $VT(A) \leq SN \leq X$, where X is the value of the "Sequence Number" of the AMD PDU with $VT(DAT) \geq MaxDAT$.
- if requested:
 - inform the upper layers of the discarded SDUs
- discard all AMD PDUs including segments of the discarded SDUs, unless they also carry a segment of a SDU whose timer has not expired;
- if more than 15 discarded SDUs are to be informed to the Receiver (see subclause 11.6.2.2):
 - if "Send MRW" is not configured:
 - assemble an MRW SUFI with the discard information of the SDUs.
 - otherwise ("Send MRW" is configured):
 - assemble an MRW SUFI with the discard information of the first 15 SDUs; and
 - include the discard information of the rest SDUs 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.
- schedule and submit to lower layer a STATUS PDU/piggybacked STATUS PDU containing the MRW SUFI;
- 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.