TSG-RAN Meeting #20 ***RP-030292***
Hämeenlinna, Finland, 03-06 June 2003

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

Source: **TSG-RAN WG2**

Agenda item: **7.2.3**

Spec	CR	Rev	Phase	Subject	Cat	Version-Current	Version-New	Doc-2nd-Level	Workitem
25.322	218	2	R99	Handling of erroneous PDUs	F	3.14.0	3.15.0	R2-031362	TEI
25.322	219	2	Rel-4	Handling of erroneous PDUs	A	4.8.0	4.9.0	R2-031363	TEI
25.322	220	2	Rel-5	Handling of erroneous PDUs	A	5.4.0	5.5.0	R2-031364	TEI
25.322	223	-	R99	Setting of the “Polling bit” in the “Every Poll_SDU SDU” function	F	3.14.0	3.15.0	R2-031455	TEI
25.322	224	-	Rel-4	Setting of the “Polling bit” in the “Every Poll_SDU SDU” function	A	4.8.0	4.9.0	R2-031456	TEI
25.322	225	-	Rel-5	Setting of the “Polling bit” in the “Every Poll_SDU SDU” function	A	5.4.0	5.5.0	R2-031457	TEI

3GPP TSG-RAN WG2 #36 ***R2-031362***
Euro Disney, France, 19th-23rd May, 2003

CR-Form-v7

CHANGE REQUEST

⌘ **25.322** **CR** **218** ⌘ **rev** **2** ⌘ Current version: **3.e.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 [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Handling of erroneous PDUs
Source:	⌘	RAN WG2
Work item code:	⌘	TEI
Date:	⌘	May 2003
Category:	⌘	**F**
Release:	⌘	R99

Use one 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 one 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:	⌘	Current standard does not mention about handling of erroneous (CRC-errored) PDUs. If the erroneous PDU is not discarded, residual bit error will be significantly increased (see details in R2-031030).
Summary of change:	⌘	A new section (10.x) is added to mandate RLC entity to discard the RLC PDU received with error indication. **Isolated Impact change analysis:** The CR has an isolated impact, since it specifies the desired RLC behaviour which has a local meaning in UE and UTRAN side, respectively. Only UE implements the CR: No IOT problem. Only residual bit error increases in UTRAN side. Only UTRAN implements the CR: No IOT problem. Only residual bit error increases in UE side.
Consequences if not approved:	⌘	Residual bit error will be increased, hence degrading the quality of service for users.

Clauses affected:	⌘	10.x (new)

Other specs Affected:	⌘	Y	N		⌘
			X	Other core specifications	
			X	Test specifications	
			X	O&M Specifications	

Other comments:	⌘	

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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.

10 Handling of unknown, unforeseen and erroneous protocol data

Errors and the handling of errors defined in this clause are normative.

10.1 Erroneous Sequence Number

A STATUS PDU or Piggybacked STATUS PDU including "erroneous Sequence Number" is a STATUS PDU or Piggybacked STATUS PDU that contains:

- a LIST, BITMAP or RLIST SUFI in which the "Sequence Number" of at least one AMD PDU that is negatively acknowledged is outside the interval VT(A)≤"Sequence Number"≤ VT(S)-1; or
- an ACK SUFI in which "LSN" is outside the interval VT(A)≤"LSN"≤ VT(S).

If an AM RLC entity receives a STATUS PDU or a Piggybacked STATUS PDU including "erroneous Sequence Number", it shall:

- discard the STATUS PDU or the Piggybacked STATUS PDU;
- initiate the RLC reset procedure (see subclause 11.4).

10.2 Inconsistent status indication

If an AM RLC entity receives a STATUS PDU or a Piggybacked STATUS PDU that indicates different status for the same AMD PDU, it shall:

- discard the STATUS PDU or the Piggybacked STATUS PDU.

10.3 Invalid PDU format

If an UM or AM RLC entity receives a RLC PDU that contains reserved or invalid values (see subclause 9.2), it shall:

- discard the RLC PDU.

10.x RLC PDU with CRC error

If an UM or AM RLC entity receives a RLC PDU with an error indication, it shall:

- discard the RLC PDU.

If a TM RLC entity receives a RLC PDU with an error indication, it shall:

- if "Delivery of Erroneous SDUs" is configured:
  - process the RLC PDU according to subclause 11.1.3;
- otherwise:
  - discard the RLC PDU.

3GPP TSG-RAN WG2 #36 ***R2-031363***
Euro Disney, France, 19th-23rd May, 2003

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CHANGE REQUEST

⌘ **25.322** **CR** **219** ⌘ **rev** **2** ⌘ Current version: **4.8.0** ⌘

*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 [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Handling of erroneous PDUs
Source:	⌘	RAN WG2
Work item code:	⌘	TEI
Date:	⌘	May 2003
Category:	⌘	**A**
Release:	⌘	Rel-4

Use one 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)*
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Use one of the following releases:

2	*(GSM Phase 2)*
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R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change:	⌘	Current standard does not mention about handling of erroneous (CRC-errored) PDUs. If the erroneous PDU is not discarded, residual bit error will be significantly increased (see details in R2-031030).
Summary of change:	⌘	A new section (10.x) is added to mandate RLC entity to discard the RLC PDU received with error indication. **Isolated Impact change analysis:** The CR has an isolated impact, since it specifies the desired RLC behaviour which has a local meaning in UE and UTRAN side, respectively. Only UE implements the CR: No IOT problem. Only residual bit error increases in UTRAN side. Only UTRAN implements the CR: No IOT problem. Only residual bit error increases in UE side.
Consequences if not approved:	⌘	Residual bit error will be increased, hence degrading the quality of service for users.

Clauses affected:	⌘	10.x (new)

Other specs Affected: ⌘	Y	N		
		X	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	

Other comments: ⌘

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- an ACK SUFI in which "LSN" is outside the interval VT(A)≤"LSN"≤ VT(S).

If an AM RLC entity receives a STATUS PDU or a Piggybacked STATUS PDU including "erroneous Sequence Number", it shall:

- discard the STATUS PDU or the Piggybacked STATUS PDU;
- initiate the RLC reset procedure (see subclause 11.4).

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If a TM RLC entity receives a RLC PDU with an error indication, it shall:

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- otherwise:
  - discard the RLC PDU.

3GPP TSG-RAN WG2 #36 ***R2-031364***
Euro Disney, France, 19th-23rd May, 2003

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CHANGE REQUEST

⌘ **25.322** **CR** **220** ⌘ **rev** **2** ⌘ Current version: **5.4.0** ⌘

*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 [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Handling of erroneous PDUs
Source:	⌘	RAN WG2
Work item code:	⌘	TEI
Date:	⌘	May 2003
Category:	⌘	**A**
Release:	⌘	Rel-5

Use one 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 one 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:	⌘	Current standard does not mention about handling of erroneous (CRC-errored) PDUs. If the erroneous PDU is not discarded, residual bit error will be significantly increased (see details in R2-031030).
Summary of change:	⌘	A new section (10.x) is added to mandate RLC entity to discard the RLC PDU received with error indication. **Isolated Impact change analysis:** The CR has an isolated impact, since it specifies the desired RLC behaviour which has a local meaning in UE and UTRAN side, respectively. Only UE implements the CR: No IOT problem. Only residual bit error increases in UTRAN side. Only UTRAN implements the CR: No IOT problem. Only residual bit error increases in UE side.
Consequences if not approved:	⌘	Residual bit error will be increased, hence degrading the quality of service for users.

Clauses affected:	⌘	10.x (new)

Other specs Affected: ⌘	Y	N		
		X	Other core specifications	⌘
		X	Test specifications	
		X	O&M Specifications	

Other comments: ⌘

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- otherwise:
  - discard the RLC PDU.

3GPP TSG-RAN2 Meeting #36
Paris, France, 19th-23st May 2003

Tdoc R2-031455

CR-Form-v7

CHANGE REQUEST

⌘ **25.322** **CR** **223** ⌘ **rev** **-** ⌘ Current version: **3.e.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 [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Setting of the "Polling bit" in the "Every Poll_SDU SDU" function
Source:	⌘	RAN WG2
Work item code:	⌘	TEI
Date:	⌘	7 April 2003
Category:	⌘	**F**
Release:	⌘	R99

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
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R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*

Reason for change: ⌘

In case "Every Poll_SDU SDU" is configured, when the last block of an SDU falls exactly on the RLC payload maximum size and another RLC PDU is needed to send the "Length Indicator" (LI = 0) that indicates the end of the SDU, the specification is unfortunately formulate in saying that the Transmitting side of an AM RLC entity is expected to set the "Polling bit" to "1" in the PDU that contains the last segment of that SDU.

The desired behaviour is to set the "Polling bit" to "1" in the PDU that enables the peer AM RLC entity to reconstruct the SDU (i.e. the AMD PDU that contains the "Length Indicator" that indicates the end of this SDU). Without this change the poll_SDU mechanism would not be not reliable.

The section describing the updating of the state variable VT(SDU) is incorrect. It would result in sending a poll every poll_SDU+1 SDUs instead of every poll_SDU. The expectec behavior is well known, and well described in the semantics section (9.6) as well as in the tests (34.123, section 7.2.3.18).

Summary of change: ⌘

The unfortunate formulation has been modified. It is now clearly said that the Polling bit shall be set to "1" in the first transmission of the AMD PDU that contains the "Length Indicator" indicating the end of the SDU, i.e. the PDU that enables the peer AM RLC entity to reconstruct the SDU.

The description of the updating of VT(SDU) is corrected to align it with the semantics description.

Isolated impact:

This change clarifies the UE behaviour when poll every poll_SDU SDUs is configured. It

		clearly mandates a behaviour for a case that was not covered and it aligns two contradicting parts of the specs. A UE that is not implemented according to the first change in the CR would not send polls in the last PDU when the length indicator of the SDU at which a poll would be triggered, leading to reduced performance. A UE that is not implemented according to the second change in the CR would send polls sever poll_SDU+1 SDUs instead of every poll_SDUs thus leading to reduced performance.
Consequences if not approved:	⌘	**If the CR is not implemented in the UE or the UTRAN:** The poll_SDU mechanism is not reliable as the poll bit may not be set to 1 in the PDU that would enable the peer AM RLC entity to reconstruct the SDU.

Clauses affected:	⌘	9.4, 9.7.1			
Other specs affected:	⌘	**Y**	**N**		⌘
			X	Other core specifications	
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

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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 $2^{12} - 1$ for AM and 0 to $2^7 - 1$ 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.

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 PDU~~s~~ carrying ~~a part~~the first segment of this SDU ~~orthe "Length Indicator" indicating the end of this SDU have been transmitted~~is scheduled to be transmitted for the first time.~~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 "Length Indicator" indicating the end of the SDU.~~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 transmitted. VT(MRW) is incremented by 1 each time a timer Timer_MRW expires. VT(MRW) shall be reset when the SDU discard with explicit signalling procedure is terminated.

The initial value of this variable is 0.

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)≤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.

9.7.1 Polling function for acknowledged mode

The Polling function is used by the Sender to request the peer RLC entity for a status report. The "Polling bit" in the AMD PDU indicates the poll request. There are several triggers for initiating the Polling function. Which of the triggers shall be used is configured by upper layers for each RLC entity. The following triggers can be configured:

1) Last PDU in buffer.

When an AMD PDU to be transmitted for the first time is submitted to lower layer, the Sender shall:

- if the AMD PDU is the last AMD PDU scheduled for transmission according to subclause 11.3.2 (i.e. no data received from upper layer remains to be segmented into AMD PDUs); or
- if the AMD PDU is the last AMD PDU that is allowed to transmit according to subclause 11.3.2.2:
  - trigger a poll for this AMD PDU.

2) Last PDU in Retransmission buffer.

When a retransmitted AMD PDU is submitted to lower layer, the Sender shall:

- if the AMD PDU is the last AMD PDU scheduled for retransmission according to subclause 11.3.2; or
- if the AMD PDU is the last of the AMD PDUs scheduled for retransmission that are allowed to transmit according to subclause 11.3.2.2:
  - trigger a poll for this AMD PDU.

3) Poll timer.

The timer Timer_Poll is started and stopped according to subclause 9.5 a). When the timer Timer_Poll expires the Sender triggers the Polling function.

4) Every Poll_PDU PDU.

The Sender triggers the Polling function for every Poll_PDU PDU. Both retransmitted and new AMD PDUs shall be counted.

5) Every Poll_SDU SDU.

The Sender triggers the Polling function for every Poll_SDU SDU. The poll shall be triggered for the first transmission of the ~~last~~ AMD PDU that contains the "Length Indicator" indicating the end of the SDU.~~segments of the RLC SDU.~~

6) Window based.

The Sender triggers the Polling function when the condition described in subclause 9.6 d) ("Poll_Window") is fulfilled.

7) Timer based.

The Sender triggers the Polling function periodically.

UTRAN should configure RLC to avoid deadlock situations.

The Poll Prohibit function is used by the Sender to delay the initiation of the Polling function. Usage of the Poll Prohibit function is configured by upper layers. The Poll Prohibit function consists of starting the timer Timer_Poll_Prohibit according to subclause 9.5 b) and delaying the Polling function according to the following rules:

When the Polling function is triggered, the Sender shall:

- if polling is not prohibited (see subclause 9.5 b)); and
- if there is one or more AMD PDUs to be transmitted or there are AMD PDUs not acknowledged by the Receiver:
  - initiate the Polling function by setting the polling bit according to subclause 11.3.2.1.1.
- otherwise (if there is no PDU to be transmitted and all PDUs have already been acknowledged):
  - not initiate the Polling function.

Upon expiry of the timer Timer_Poll_Prohibit, the Sender shall:

- if the Polling function was triggered at least once while the timer Timer_Poll_Prohibit was active; and
- if there is one or more AMD PDUs to be transmitted or there are AMD PDUs not acknowledged by the Receiver:
  - initiate the Polling function once by setting the polling bit according to subclause 11.3.2.1.1.
- otherwise (if there is no PDU to be transmitted and all PDUs have already been acknowledged):
  - not initiate the Polling function.

3GPP TSG-RAN2 Meeting #36
Paris, France, 19th-23st May 2003

Tdoc R2-031456

CR-Form-v7

CHANGE REQUEST

⌘ **25.322** **CR** **224** ⌘ **rev** **-** ⌘ Current version: **4.8.0** ⌘

*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:	⌘	Setting of the "Polling bit" in the "Every Poll_SDU SDU" function
Source:	⌘	RAN WG2
Work item code:	⌘	TEI
Date:	⌘	7 April 2003
Category:	⌘	**A**
Release:	⌘	Rel-4

Use one 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 one 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:	⌘	In case "Every Poll_SDU SDU" is configured, when the last block of an SDU falls exactly on the RLC payload maximum size and another RLC PDU is needed to send the "Length Indicator" (LI = 0) that indicates the end of the SDU, the specification is unfortunately formulate in saying that the Transmitting side of an AM RLC entity is expected to set the "Polling bit" to "1" in the PDU that contains the last segment of that SDU. The desired behaviour is to set the "Polling bit" to "1" in the PDU that enables the peer AM RLC entity to reconstruct the SDU (i.e. the AMD PDU that contains the "Length Indicator" that indicates the end of this SDU). Without this change the poll_SDU mechanism would not be not reliable. The section describing the updating of the state variable VT(SDU) is incorrect. It would result in sending a poll every poll_SDU+1 SDUs instead of every poll_SDU. The expectec behavior is well known, and well described in the semantics section (9.6) as well as in the tests (34.123, section 7.2.3.18).
Summary of change:	⌘	The unfortunate formulation has been modified. It is now clearly said that the Polling bit shall be set to "1" in the first transmission of the AMD PDU that contains the "Length Indicator" indicating the end of the SDU, i.e. the PDU that enables the peer AM RLC entity to reconstruct the SDU. The description of the updating of VT(SDU) is corrected to align it with the semantics description.
Consequences if not approved:	⌘	**If the CR is not implemented in the UE or the UTRAN:** The poll_SDU mechanism is not reliable as the poll bit may not be set to 1 in the PDU that would enable the peer AM RLC entity to reconstruct the SDU.

Clauses affected:	⌘	9.4, 9.7.1			
Other specs affected:	⌘	**Y**	**N**		
			X	Other core specifications	⌘
			X	Test specifications	
			X	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.

9.4 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 $2^{12} - 1$ for AM and 0 to $2^7 - 1$ 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.

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 PDU~~s~~ carrying ~~a part~~the first segment of this SDU ~~orthe "Length Indicator" indicating the end of this SDU have been transmitted~~is scheduled to be transmitted for the first time.~~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 "Length Indicator" indicating the end of the SDU.~~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 transmitted. VT(MRW) is incremented by 1 each time a timer Timer_MRW expires. VT(MRW) shall be reset when the SDU discard with explicit signalling procedure is terminated.

The initial value of this variable is 0.

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)≤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.

9.7.1 Polling function for acknowledged mode

The Polling function is used by the Sender to request the peer RLC entity for a status report. The "Polling bit" in the AMD PDU indicates the poll request. There are several triggers for initiating the Polling function. Which of the triggers shall be used is configured by upper layers for each RLC entity. The following triggers can be configured:

1) Last PDU in buffer.

When an AMD PDU to be transmitted for the first time is submitted to lower layer, the Sender shall:

- if the AMD PDU is the last AMD PDU scheduled for transmission according to subclause 11.3.2 (i.e. no data received from upper layer remains to be segmented into AMD PDUs); or
- if the AMD PDU is the last AMD PDU that is allowed to transmit according to subclause 11.3.2.2:
  - trigger a poll for this AMD PDU.

2) Last PDU in Retransmission buffer.

When a retransmitted AMD PDU is submitted to lower layer, the Sender shall:

- if the AMD PDU is the last AMD PDU scheduled for retransmission according to subclause 11.3.2; or
- if the AMD PDU is the last of the AMD PDUs scheduled for retransmission that are allowed to transmit according to subclause 11.3.2.2:
  - trigger a poll for this AMD PDU.

3) Poll timer.

The timer Timer_Poll is started and stopped according to subclause 9.5 a). When the timer Timer_Poll expires the Sender triggers the Polling function.

4) Every Poll_PDU PDU.

The Sender triggers the Polling function for every Poll_PDU PDU. Both retransmitted and new AMD PDUs shall be counted.

5) Every Poll_SDU SDU.

The Sender triggers the Polling function for every Poll_SDU SDU. The poll shall be triggered for the first transmission of the ~~last~~ AMD PDU that contains the "Length Indicator" indicating the end of the SDU.~~segments of the RLC SDU.~~

6) Window based.

The Sender triggers the Polling function when the condition described in subclause 9.6 d) ("Poll_Window") is fulfilled.

7) Timer based.

The Sender triggers the Polling function periodically.

UTRAN should configure RLC to avoid deadlock situations.

The Poll Prohibit function is used by the Sender to delay the initiation of the Polling function. Usage of the Poll Prohibit function is configured by upper layers. The Poll Prohibit function consists of starting the timer Timer_Poll_Prohibit according to subclause 9.5 b) and delaying the Polling function according to the following rules:

When the Polling function is triggered, the Sender shall:

- if polling is not prohibited (see subclause 9.5 b)); and
- if there is one or more AMD PDUs to be transmitted or there are AMD PDUs not acknowledged by the Receiver:
  - initiate the Polling function by setting the polling bit according to subclause 11.3.2.1.1.
- otherwise (if there is no PDU to be transmitted and all PDUs have already been acknowledged):
  - not initiate the Polling function.

Upon expiry of the timer Timer_Poll_Prohibit, the Sender shall:

- if the Polling function was triggered at least once while the timer Timer_Poll_Prohibit was active; and
- if there is one or more AMD PDUs to be transmitted or there are AMD PDUs not acknowledged by the Receiver:
  - initiate the Polling function once by setting the polling bit according to subclause 11.3.2.1.1.
- otherwise (if there is no PDU to be transmitted and all PDUs have already been acknowledged):
  - not initiate the Polling function.

3GPP TSG-RAN2 Meeting #36
Paris, France, 19th-23st May 2003

Tdoc R2-031457

CR-Form-v7

CHANGE REQUEST

⌘ **25.322** **CR** **225** ⌘ **rev** **-** ⌘ Current version: **5.4.0** ⌘

*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 [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Setting of the "Polling bit" in the "Every Poll_SDU SDU" function
Source:	⌘	RAN WG2
Work item code:	⌘	TEI
Date:	⌘	7 April 2003
Category:	⌘	**A**
Release:	⌘	Rel-5

Use one 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 one 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:	⌘	In case "Every Poll_SDU SDU" is configured, when the last block of an SDU falls exactly on the RLC payload maximum size and another RLC PDU is needed to send the "Length Indicator" (LI = 0) that indicates the end of the SDU, the specification is unfortunately formulate in saying that the Transmitting side of an AM RLC entity is expected to set the "Polling bit" to "1" in the PDU that contains the last segment of that SDU. The desired behaviour is to set the "Polling bit" to "1" in the PDU that enables the peer AM RLC entity to reconstruct the SDU (i.e. the AMD PDU that contains the "Length Indicator" that indicates the end of this SDU). Without this change the poll_SDU mechanism would not be not reliable. The section describing the updating of the state variable VT(SDU) is incorrect. It would result in sending a poll every poll_SDU+1 SDUs instead of every poll_SDU. The expectec behavior is well known, and well described in the semantics section (9.6) as well as in the tests (34.123, section 7.2.3.18).
Summary of change:	⌘	The unfortunate formulation has been modified. It is now clearly said that the Polling bit shall be set to "1" in the first transmission of the AMD PDU that contains the "Length Indicator" indicating the end of the SDU, i.e. the PDU that enables the peer AM RLC entity to reconstruct the SDU. The description of the updating of VT(SDU) is corrected to align it with the semantics description.
Consequences if not approved:	⌘	**If the CR is not implemented in the UE or the UTRAN:** The poll_SDU mechanism is not reliable as the poll bit may not be set to 1 in the PDU that would enable the peer AM RLC entity to reconstruct the SDU.

Clauses affected:	⌘	9.4, 9.7.1			
Other specs affected:	⌘	**Y**	**N**		
			X	Other core specifications	⌘
			X	Test specifications	
			X	O&M Specifications	
Other comments:	⌘				

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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 $2^{12} - 1$ for AM and 0 to $2^7 - 1$ 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.

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 PDU~~s~~ carrying ~~a part~~the first segment of this SDU ~~orthe "Length Indicator" indicating the end of this SDU have been transmitted~~is scheduled to be transmitted for the first time.~~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 "Length Indicator" indicating the end of the SDU.~~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 transmitted. VT(MRW) is incremented by 1 each time a timer Timer_MRW expires. VT(MRW) shall be reset when the SDU discard with explicit signalling procedure is terminated.

The initial value of this variable is 0.

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)≤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.

9.7.1 Polling function for acknowledged mode

The Polling function is used by the Sender to request the peer RLC entity for a status report. The "Polling bit" in the AMD PDU indicates the poll request. There are several triggers for initiating the Polling function. Which of the triggers shall be used is configured by upper layers for each RLC entity. The following triggers can be configured:

1) Last PDU in buffer.

When an AMD PDU to be transmitted for the first time is submitted to lower layer, the Sender shall:

- if the AMD PDU is the last AMD PDU scheduled for transmission according to subclause 11.3.2 (i.e. no data received from upper layer remains to be segmented into AMD PDUs); or
- if the AMD PDU is the last AMD PDU that is allowed to transmit according to subclause 11.3.2.2:
  - trigger a poll for this AMD PDU.

2) Last PDU in Retransmission buffer.

When a retransmitted AMD PDU is submitted to lower layer, the Sender shall:

- if the AMD PDU is the last AMD PDU scheduled for retransmission according to subclause 11.3.2; or
- if the AMD PDU is the last of the AMD PDUs scheduled for retransmission that are allowed to transmit according to subclause 11.3.2.2:
  - trigger a poll for this AMD PDU.

3) Poll timer.

The timer Timer_Poll is started and stopped according to subclause 9.5 a). When the timer Timer_Poll expires the Sender triggers the Polling function.

4) Every Poll_PDU PDU.

The Sender triggers the Polling function for every Poll_PDU PDU. Both retransmitted and new AMD PDUs shall be counted.

5) Every Poll_SDU SDU.

The Sender triggers the Polling function for every Poll_SDU SDU. The poll shall be triggered for the first transmission of the ~~last~~ AMD PDU that contains the "Length Indicator" indicating the end of the SDU.~~segments of the RLC SDU.~~

6) Window based.

The Sender triggers the Polling function when the condition described in subclause 9.6 d) ("Poll_Window") is fulfilled.

7) Timer based.

The Sender triggers the Polling function periodically.

UTRAN should configure RLC to avoid deadlock situations.

The Poll Prohibit function is used by the Sender to delay the initiation of the Polling function. Usage of the Poll Prohibit function is configured by upper layers. The Poll Prohibit function consists of starting the timer Timer_Poll_Prohibit according to subclause 9.5 b) and delaying the Polling function according to the following rules:

When the Polling function is triggered, the Sender shall:

- if polling is not prohibited (see subclause 9.5 b)); and
- if there is one or more AMD PDUs to be transmitted or there are AMD PDUs not acknowledged by the Receiver:
  - initiate the Polling function by setting the polling bit according to subclause 11.3.2.1.1.
- otherwise (if there is no PDU to be transmitted and all PDUs have already been acknowledged):
  - not initiate the Polling function.

Upon expiry of the timer Timer_Poll_Prohibit, the Sender shall:

- if the Polling function was triggered at least once while the timer Timer_Poll_Prohibit was active; and
- if there is one or more AMD PDUs to be transmitted or there are AMD PDUs not acknowledged by the Receiver:
  - initiate the Polling function once by setting the polling bit according to subclause 11.3.2.1.1.
- otherwise (if there is no PDU to be transmitted and all PDUs have already been acknowledged):
  - not initiate the Polling function.