TSG-RAN Meeting #6
Nice, France, 13 – 15 December 1999

TSGRP#6(99)642

Title: **Agreed CRs of category "C" (Modification) and "F" (Correction) to TS 25.322**

Source: **TSG-RAN WG2**

Agenda item: **5.2.3**

Doc #	Status-	Spec	CR	Rev	Subject	Cat	Versio	Versio
R2-99k19	agreed	25.322	006	1	Editorial corrections regarding CTCH	F	3.0.0	3.1.0
R2-99i93	agreed	25.322	011		RLC Editorial Changes	F	3.0.0	3.1.0
R2-99j01	agreed	25.322	013		Editorial Modification on RLC	F	3.0.0	3.1.0
R2-99k25	agreed	25.322	015		Change to one PU in a AMD PDU	F	3.0.0	3.1.0

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Document* *(R2-99k19)
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25.322	CR	006r1	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

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Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 26.11.1999

Subject: Editoral corrections regarding CTCH

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Editoral corrections regarding CTCH in Unacknowledged Mode service are provided.

Clauses affected: 4.2.1.2, 6.1

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:

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4.2.1.2 Unacknowledged mode entities

Figure 4-3 below shows the model of two unacknowledged mode peer entities.

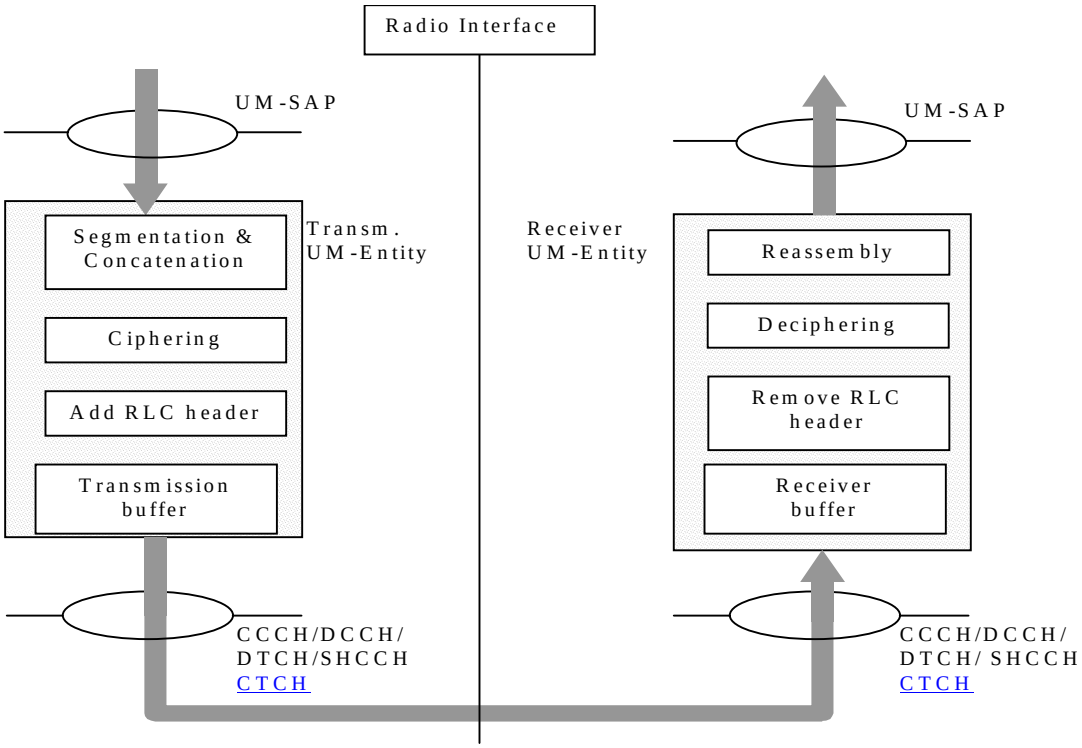

Figure 4-3: Model of two unacknowledged mode peer entities

The transmitting UM-entity receives SDUs from the higher layers. If the SDU is very large it is segmented into RLC PDUs of appropriate size. The SDU might also be concatenated with other SDUs. RLC adds a header and the PDU is placed in the transmission buffer. RLC delivers the RLC PDUs to MAC through either a DCCH, a SHCCH (downlink only), CTCH or a DTCH. The CCCH also uses unacknowledged mode, but only for the downlink. Which type of logical channel depends on if the higher layer is located in the control plane (CCCH, DCCH, SHCCH) or user plane (CTCH,DTCH).

The receiving UM-entity receives PDUs through one of the logical channels from the MAC sublayer. RLC removes header from the PDUs and reassembles the PDUs (if segmentation has been performed) into RLC SDUs. After that the SDUs are delivered to the higher layer.

6.1 Mapping of services/functions onto logical channels

...

Table 6-2: RLC modes and functions in UE downlink side

Service	Functions	SCCH	BCCH	PCCH	SHCCH	CCCH	DCCH	DTCH	CTCH
Transparent Service	Applicability	+	+	+	+	-	-	+	+-
	Reassembly	+	+	+	-	-	-	+	-
Unacknowledged Service	Applicability	-	-	-	+	+	+	+	+
	Reassembly	-	-	-	+	+	+	+	+
	Deciphering	-	-	-	-	-	+	+	-
	Sequence number check	-	-	-	+	+	+	+	+
Acknowledged Service	Applicability	-	-	-	-	-	+	+	-
	Reassembly	-	-	-	-	-	+	+	-
	Error correction	-	-	-	-	-	+	+	-
	Flow Control	-	-	-	-	-	+	+	-
	In sequence delivery	-	-	-	-	-	+	+	-
	Duplicate detection	-	-	-	-	-	+	+	-
	Protocol error correction & recovery	-	-	-	-	-	+	+	-
	Deciphering	-	-	-	-	-	+	+	-

Table 6-3: RLC modes and functions in UTRAN downlink side

Service	Functions	SCCH	BCCH	PCCH	CCCH	SHCCH	DCCH	DTCH	CTCH
Transparent Service	Applicability	+	+	+	-	+	-	+	+-
	Segmentation	+	+	+	-	-	-	+	-
	Transfer of user data	+	+	+	-	+	-	+	+-
Unacknowledged Service	Applicability	-	-	-	+	+	+	+	+
	Segmentation	-	-	-	+	+	+	+	+
	Concatenation	-	-	-	+	+	+	+	+
	Padding	-	-	-	+	+	+	+	+
	Ciphering	-	-	-	-	-	+	+	-
Acknowledged Service	Applicability	-	-	-	-	-	+	+	-
	Segmentation	-	-	-	-	-	+	+	-
	Concatenation	-	-	-	-	-	+	+	-
	Padding	-	-	-	-	-	+	+	-
	Transfer of user data	-	-	-	-	-	+	+	-
	Flow Control	-	-	-	-	-	+	+	-
	Error Correction	-	-	-	-	-	+	+	-
	Protocol error correction & recovery	-	-	-	-	-	+	+	-
	Ciphering	-	-	-	-	-	+	+	-

11.2 Unacknowledged mode data transfer procedure

11.2.1 Purpose

The unacknowledged mode data transfer procedure is used for transferring data between two RLC peer entities, which are operating in unacknowledged mode. Figure 11-2 below illustrates the elementary procedure for unacknowledged mode data transfer. The sender can be either the UE or the network and the receiver is either the network or the UE.

Figure 11-2: Unacknowledged mode data transfer procedure

11.2.2 Initiation

The sender initiates this procedure upon a request of unacknowledged mode data transfer from higher layer.

When the sender is in data transfer ready state it shall segment the data received from the higher layer into PDUs.

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

The VT(US) state variable shall be updated for each UMD PDU that is transmitted.

11.2.2.1 UMD PDU contents to set

The Sequence Number field shall be set equal to VT(US).

The Extension bit shall be set to 1 if the next field is a length indicator field, otherwise it shall be set to zero.

One length indicator field shall be included for each end of a SDU that the PDU includes. The length indicator shall be set equal to the number octets between the end of the header fields and the end of the segment. If padding is needed another length indicator shall be added. If the PDU is exactly filled with the last segment of a SDU and there is no room for a length indicator field a length indicator field set to only 0's shall be included in the next PDU.

11.2.3 Reception of UMD PDU

Upon reception of a UMD PDU the receiver shall update VR(US) state variable according to the received PDU(s).

The PDUs are reassembled into RLC SDUs. If a PDU with sequence number < VR(US) is missing then all SDUs that have segments in this PDU shall be discarded. RLC delivers the RLC SDUs to the higher layer through the UM-SAP.

11.2.4 Abnormal cases

11.2.4.1 Length Indicator value 1111110

Upon reception of an UMD PDU that contains Length Indicator value 1111110 or 111111111111110 ("piggybacked STATUS PDU", in case 7bit or 15 bit Length Indicator field is used, respectively) the receiver shall discard that UMD PDU. This Length Indicator value is not used in unacknowledged mode data transfer.

11.2.4.2 Invalid length indicator value

If the length indicator of a PDU has a value that is larger than the PDU size, the PDU shall be discarded and treated as a missing PDU.

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***Document* (R2-99i93)**
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25.322	**CR**	**011**	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-RAN#6	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio	X	Core Network	

Source: TSG-RAN WG2 **Date:** 1999-11-29

Subject: RLC Editorial changes

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: Correction of the inconsistent description on the timer “Timer_discard” and the function “Timer based discard without explicit signalling”.

Clauses affected: 9,5, 9.7.3.2, 11.3.2, 11.3.4.3.2

Other specs affected:

Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:


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9.5 Timers

d) Timer_Discard

This timer is used for the SDU discard function. In the transmitter, the timer is activated upon reception of a SDU from higher layer. If the SDU has not been acknowledged and/or transmitted when the timer expires, the SDU is discarded. ~~and~~ Following which, if the SDU discard function uses explicit signalling, a Move Receiving Window request is sent to the receiver. ~~If the SDU discard function does not use the Move Receiving Window request, the timer is also used in the receiver, where it is activated once a PDU is detected as outstanding, i.e. there is a gap between sequence numbers of received PDUs.~~ The value of the timer is signalled by RRC.

9.7.3 SDU discard function

9.7.3.2 Timer based discard, without explicit signalling

This alternative uses the same timer based trigger for SDU discard (Timer_Discard) as the one described in the section 9.7.3.1. The difference is that this discard method does not use any peer-to-peer signalling. ~~For~~ This function is applied only for unacknowledged mode RLC and peer-to-peer signalling is never needed. The SDUs are simply discarded in the transmitter, once the transmission time is exceeded. ~~For acknowledged mode RLC, peer-to-peer signalling can be avoided as long as SDU discard is always performed in the transmitter before it is performed in the receiver. As long as the corresponding SDU is eventually discarded in the receiver too, possible retransmission requests of PDU of discarded SDUs can be ignored by the transmitter. The bigger the time difference is between the triggering of the discard condition at the transmitter and the receiver, the bigger the unnecessary buffering need is at the receiver and the more bandwidth is lost on the reverse link due to unnecessary retransmission requests. On the other hand, forward link bandwidth is saved, as no explicit SDU discard signalling is needed.~~

11.3 Acknowledged mode data transfer procedure

11.3.2 Initiation

If timer based SDU discard is used the timer Timer_Discard shall be started when ~~the first segment of~~ the RLC entity receives a SDU from higher layer~~is transmitted~~.

11.3.4.3 Timer_Discard timeout

11.3.4.3.2 SDU discard without explicit signalling

Upon expiry of the Timer_Discard on the sender side the sender shall discard all PDU~~PU~~s that contain~~s a~~ segments of the associated SDU. If the concatenation function is active, PDUs carrying segments of other SDUs that have not timed out shall not be discarded. The state variable ~~variables~~ VT(US)~~VT(A) and VT(MS)~~ shall be updated.

~~Upon expiry of the Timer_Discard on the receiver side the receiver shall discard all PUs that contains a segment of the associated SDU. If the concatenation function is active, PDUs carrying segments of other SDUs that have not timed out shall not be discarded. The state variable variables VR(R), VR(H) and VR(MR) shall be updated.~~

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25.322	CR	013	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

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Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio	X	Core Network	

Source:	TSG-RAN WG2		**Date:**	1999-11-29	
Subject:	Editorial modification on RLC specification				
Work item:					

Category: *(only one category shall be marked with an X)*			**Release:**	
F	Correction	X	Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature		Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	X
			Release 00	

Reason for change:

- Since currently the parameter Widow_Size is defined only for the transmitter window, it is necessary to define Widow_size for the receiver window.
- Correction of the description on ACK SUFI.

Clauses affected: 9.2.2.12.2, 9.2.2.12.3, 9.4, 9.6

Other specs affected:			
Other 3G core specifications		→ List of CRs:	
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:


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9.2.2 Parameters

9.2.2.12.2 The Acknowledgement super-field

The 'Acknowledgement' super-field consists of a type identifier field (ACK) and a sequence number (LSN) as shown in figure 9-10 below. The acknowledgement super-field is also indicating the end of the data part of a STATUS PDU. Thus, no 'NO_MORE' super-field is needed in the STATUS PDU when the 'ACK' super-field is present. The ACK SUFI shall always be placed as the last SUFI if it is included in a STATUS PDU. All data after this SUFI shall be regarded as padding and shall be neglected.

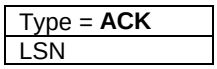

Figure 9-10: The ACK fields in a STATUS PDU

LSN

Length: 12 bits

Acknowledges the reception of all PUs with sequence numbers < LSN (Last Sequence Number) that are *not* indicated to be erroneous in earlier parts of the STATUS PDU. The LSN should not be set to a value ≥> VR(H). This means that if the LSN is set to a different value than VR(R) all erroneous PUs must be included in the same STATUS PDU and if the LSN is set to VR(R) the erroneous PUs are split into several STATUS PDUs. At the receiver, if the value of the LSN =< the value of the first error indicated in the STATUS PDU VT(A) will be updated according to the LSN, otherwise VT(A) will be updated according to the first error indicated in the STATUS PDU.

9.2.2.12.3 The Window Size super-field

The 'Window Size' super-field consists of a type identifier (WINDOW) and a window size number (WSN) as shown in figure 9-11 below. The receiver is always allowed to change the window size during a connection.

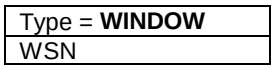

Figure 9-11: The WINDOW fields in a STATUS PDU

WSN

Length: 12 bits

The allowed window size to be used by the transmitter. The range of the window size is [0, 2^{12}-1]. The Tx_Window_Size parameter is set equal to WSN.

9.4 State variables

This sub-clause describes the state variables used in the specification of the peer-to-peer protocol. PUs are sequentially and independently numbered and may have the value 0 through n minus 1 (where n is the modulus of the sequence numbers). The modulus equals 2^{12} for AM and 2^{7} for UM; the sequence numbers cycle through the entire range: 0 through 2^{12} – 1 for AM and 0 through 2^{7} – 1 for UM. All arithmetic operations on the following state variables and

sequence numbers contained in this specification are affected by the modulus: VT(S), VT(A), VT(MS), VR(R), VR(H), VR(MR), VT(US) and VR(US). When performing arithmetic comparisons of transmitter variables, VT(A) is assumed to be the base. When performing arithmetic comparisons of receiver variables, VR(R) is assumed to be the base.

The RLC maintains the following state variables at the transmitter.

a) VT(S) - Send state variable

The sequence number of the next PU to be transmitted for the first time (i.e. excluding retransmission). It is updated after transmission of a PDU which includes not earlier transmitted PUs. The initial value of this variable is 0.

b) VT(A) - Acknowledge state variable

The sequence number of the next in-sequence PU expected to be acknowledged, which forms the lower edge of the window of acceptable acknowledgments. VT(A) is updated based on receipt of a STATUS PDU including an ACK super-field. The initial value of this variable is 0.

c) VT(DAT)

This state variable counts the number of times a PU has been transmitted. There is one VT(DAT) for each PU and it is incremented each time the PU is transmitted. The initial value of this variable is 0.

d) VT(MS) - Maximum Send state variable

The sequence number of the first PU not allowed by the peer receiver [i.e. the receiver will allow up to VT(MS) – 1], VT(MS) = VT(A) + Tx_Window_Size. This value represents the upper edge of the transmit window. The transmitter shall not transmit a new PU if VT(S) ≥ VT(MS). VT(MS) is updated based on receipt of a STATUS PDU including an ACK and/or a WINDOW super-field.

e) VT(US) – UM data state variable

This state variable gives the sequence number of the next UMD PDU to be transmitted. It is updated each time a UMD PDU is transmitted. The initial value of this variable is 0.

f) VT(PU)

This state variable is used when the poll every Poll_PU PU function is used. It is incremented with 1 for each PU that is transmitted. It should be incremented for both new and retransmitted PUs. When it reaches Poll_PU a new poll is transmitted and the state variable is 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 function is used. It is incremented with 1 for each SDU that is transmitted. When it reaches Poll_SDU a new poll is transmitted and the state variable is set to zero. The poll bit should be set in the PU that contains the last segment of the SDU. The initial value of this variable is 0.

h) VT(RST) - Reset state variable

It is used to count the number of times a RESET PDU is transmitted. VT(RST) is incremented with 1 each time a RESET PDU is transmitted. VT(RST) is reset upon the reception of a RESET ACK PDU. The initial value of this variable is 0.

The RLC maintains the following state variables at the receiver:

a) VR(R) - Receive state variable

The sequence number of the next in-sequence PU expected to be received. It is updated upon receipt of the next in-sequence PU. The initial value of this variable is 0.

b) VR(H) - Highest expected state variable

The sequence number of the highest expected PU. This state variable is updated when a new PU is received with SN≥VR(H). The initial value of this variable is 0.

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

The sequence number of the first PU not allowed by the receiver [i.e. the receiver will allow up to VR(MR) – 1], VR(MR) = VR(R) + Rx_Window_Size. The receiver shall discard PUs with SN ≥ VR(MR), (in one case, such a PU may cause the transmission of an unsolicited STATUS PDU).

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

The sequence number of the next PDU to be received. It shall set equal to SN + 1 upon reception of a PDU. The initial value of this variable is 0.

e) VR(EP) – Estimated PDU Counter state variable

The number of PUs that should be received yet as a consequence of the transmission of the latest STATUS PDU. In acknowledged mode, this state variable is updated at the end of each transmission time interval. It is decremented by the number of PUs that should have been received during the transmission time interval. If VR(EP) is equal to zero, then check if all PUs requested for retransmission in the latest STATUS PDU have been received.

9.6 Protocol Parameters

a) MaxDAT

It is the maximum value for the number of retransmissions of a PU. This parameter is an upper limit of counter VT(DAT). When the value of VT(DAT) comes to MaxDAT, error recovery procedure will be performed.

b) Poll_PU

This parameter indicates how often the transmitter should poll the receiver in case of polling every Poll_PU PU. This is an upper limit for the VT(PU) state variable, when VT(PU) reaches Poll_PU a poll is transmitted to the peer entity.

c) Poll_SDU

This parameter indicates how often the transmitter should poll the receiver in case of polling every Poll_SDU SDU. This is an upper limit for the VT(SDU) state variable, when VT(SDU) reaches Poll_SDU a poll is transmitted to the peer entity.

d) Poll_Window

This parameter indicates when the transmitter should poll the receiver in case of performing window based polling. A poll is transmitted when:

~~$1 - \frac{(Window\_Size + VT(MS) - VT(S)) \bmod Window\_Size}{Window\_Size} > Poll\_Window$.~~

$$\left[1 - \frac{(Tx\_Window\_Size + \mathrm{VT(S)} - \mathrm{VT(MS)}) \bmod Tx\_Window\_Size}{Tx\_Window\_Size} \right] * 100 > Poll\_Window$$

e) MaxRST

It is the maximum value for the number of retransmission of RESET PDU. This parameter is an upper limit of counter VT(RST). When the value of VT(RST) comes to MaxRST, the higher layer (RRC) is notified.

f) Tx_Window_Size

The maximum allowed transmitter window size.

g) Rx_Window_Size

The maximum allowed receiver window size.

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Document* *(R2-99k25)
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25.322	CR	015	Current Version:	3.0.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-RAN#6	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: *(at least one should be marked with an X)* (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 29/11 1999

Subject: Change to one PU in a AMD PDU

Work item:

Category: *(only one category shall be marked with an X)*

F	Correction	X	**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature			Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change:

1) Correction and clarification of the specification
2) R99 will support only one PU in a PDU

Clauses affected: 9.2.1.3, 9.2.2.7, 9.2.2.7.1, 9.2.2.8, 9.7.5

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:
Other GSM core specifications	[ ]	→ List of CRs:
MS test specifications	[ ]	→ List of CRs:
BSS test specifications	[ ]	→ List of CRs:
O&M specifications	[ ]	→ List of CRs:

Other comments:


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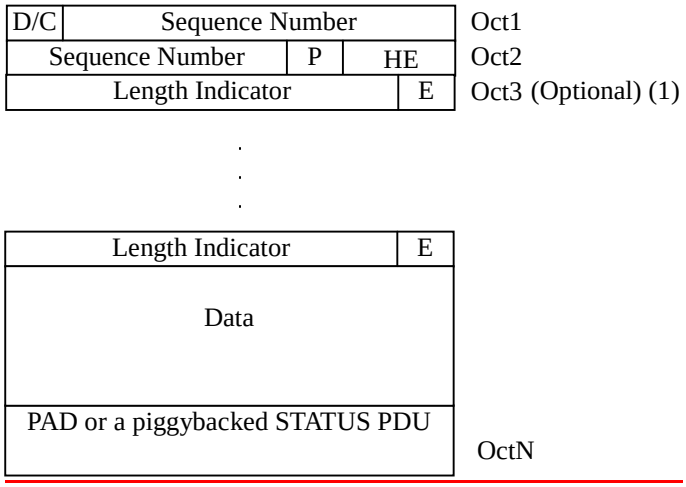
9.2.1.3 AMD PDU

The AMD PDU transfers user data and piggybacked status information and requests status report by setting Poll bit when RLC is operating in acknowledged mode.



NOTE (1): The Length Indicator may be 15bits.

Figure 9-3: AMD PDU

9.2.2.7 Header Extension Type (HE)

Length: 2 bits

This two-bit field indicates the format of the extended header.

Value	Description
00	The succeeding octet contains data
01	The succeeding octet contains a 7bit length indicator and E bit
10	The succeeding octet contains a 15bit length indicator and E bit~~The succeeding octet contains an extended header field~~
11	~~The succeeding octet contains a 15bit length indicator and E bit~~ Reserved *(PDUs with this coding will be discarded by this version of the protocol).*

~~9.2.2.7.1 AMD PDU Extended Header (EH)~~

~~The Extended Header is used when additional sequence numbers are needed to indicate PUs that are not in sequence with respect to the first PU in a PDU. Extended Headers must be used for all PUs, excluding the first PU, in a PDU or not at all. An appropriate RLC PDU size must be chosen from a set of possible PDU sizes to allow space for Extended Headers and the required number of PUs. Padding in the PDU may be required where the Extended Headers, Length Indicators and PUs do not completely fill a PDU. This padding must be put at the end of the PDU.~~

~~First, all the Extended Headers are listed, in the same order of the PUs they refer to. The n^{th} sequence number in the PDU indicates the sequence number of the n^{th} PU in the PDU. Extended Headers must always precede any Length Indicators. The decision to use an Extended Header is made by the transmitting RLC.~~

~~The R field is reserved and filled with zeros, otherwise the PDU is considered invalid by this version of the protocol~~

Sequence Number			Oct1
Sequence Number	HE	R	Oct2

~~Figure 9-7: Format of the extended header~~

9.2.2.8 Length Indicator (LI)

The Length Indicator is used to indicate, each time, the end of an SDU occurs in the PU. The Length Indicator points out the number of octets between the end of the last Length Indicator field and up to and including the octet at the end of an SDU segment. Length Indicators ~~always take space from~~are included in the PUs that they refer to. The size of the Length Indicator may be either 7bits or 15bits. The maximum value of a Length Indicator will be no greater than the RLC PDU size – AMD PDU Header – PADDING.

A Length Indicator group is a set of Length Indicators that refer to a PU. Length Indicators that are part of a Length Indicator group must never be reordered within the Length Indicator group or removed from the Length Indicator group.

If there can be more than one Length Indicator, each specifying the end of an SDU in a PU, the order of these Length Indicators must be in the same order as the SDUs that they refer to.

In the case where the end of last segment of an SDU exactly ~~occupies the last PU~~ends at the end of ~~in a~~ a PDU, the next Length Indicator, shall be placed as the first Length Indicator in the next PU and have value LI=0.

In the case where the last segment of an RLC SDU is one octet short of exactly filling the last RLC PU, and 15-bit Length Indicators are used, the next Length Indicator shall be placed as the first Length Indicator in the next PU and have value LI=111 1111 1111 1011.

A PU that has unused space, to be referred to as padding, must use a Length Indicator to indicate that this space is used as padding. A padding Length Indicator must be placed after any Length Indicators for a PU.

All unused space in a PU must be located at the end of the PDU, be a homogeneous space and is referred to as padding. Predefined values of the Length Indicator are used to indicate this. The values that are reserved for special purposes are listed in the tables below depending on the size of the Length Indicator. Only predefined Length Indicator values can refer to the padding space.

STATUS PDUs can be piggybacked on the AMD PDU by using part or all of the padding space~~. If the last Length Indicator for all PUs indicates padding in the PU then this can be replaced with a padding Length Indicator that indicates padding for the rest of the PDU. Otherwise, aAn additional~~ Length Indicator must be used to indicate the piggybacked STATUS PDU. This Length Indicator takes space from the padding space or piggybacked STATUS PDU and not the PDU data and will always be the last Length Indicator. Where only part of the padding space is used by a piggybacked STATUS PDU then the end of the piggybacked STATUS PDU is determined by the SUFI field, NO_MORE, thus no additional Length Indicator is required to show that there is still padding in the PDU. The padding/piggybacked STATUS PDU predefined Length Indicators shall be added after the very last (i.e. there could be more than one SDU that end within a PDU) Length Indicator that indicates the end of the last SDU segment in the PU.

If RLC PDUs always carry only one PU, 7bit indicators are used in a particular RLC PDU if the address space is sufficient to indicate all SDU segment borders. Otherwise 15bit Length Indicators are applied.

~~If RLC PDUs carry more than one PU, then t~~The length of the Length Indicator only depends on the size of the largest RLC PDU. The ~~size~~ length of the Length Indicator is always the same for all PUs, for one RLC entity.

For Release 99, there is one PU in a AMD PDU.

Length: 7bit

Bit	Description
0000000	The previous RLC ~~PU~~ PDU was exactly filled with the last segment of a RLC SDU.
1111100	~~The rest of the RLC PU includes a piggybacked STATUS PDU.~~Reserved *(PDUs with this coding will be discarded by this version of the protocol).*
1111110	The rest of the RLC PDU includes a piggybacked STATUS PDU.
1111101	~~The rest of the RLC PU is padding.~~Reserved *(PDUs with this coding will be discarded by this version of the protocol).*
1111111	The rest of the RLC PDU is padding.

Length: 15bit

Bit	Description
000000000000000	The previous RLC ~~PU~~ PDU was exactly filled with the last segment of a RLC SDU.
111111111111011	The last segment of an RLC SDU was one octet short of exactly filling the last RLC PDU.
111111111111100	Reserved *(PDUs with this coding will be discarded by this version of the protocol).* ~~The rest of the RLC PU includes a piggybacked STATUS PDU.~~
111111111111110	The rest of the RLC PDU includes a piggybacked STATUS PDU.
111111111111101	Reserved *(PDUs with this coding will be discarded by this version of the protocol).*~~The rest of the RLC PU is padding.~~
111111111111111	The rest of the RLC PDU is padding.