**3GPP TSG-RAN WG2 Meeting #123bis** **R2-23xxxxx**

**Xiamen, China, 9th-13th October, 2023**

**Agenda item: 7.5.1**

**Source: LG Electronics Inc. (Rapporteur)**

**Title: [Post123bis][026][XR] 38.323 Running CR (LG)**

**Document for: Discussion and Decision**

# Introduction

This document collects the comments received during the following email discussion on PDCP running CR for XR.

* [POST123bis][026][XR] 38.323 Running CR (LG)

Scope:

- Review running CR

- Identify open issues

- Get inputs for subset of open issues (focus on more detailed open issues that would help with CR finalisation).

 Deadline: long

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# Discussions

Companies can provide comments and suggestions to the PDCP running CR:

|  |  |  |  |
| --- | --- | --- | --- |
| Company + Issue Number (e.g., L001) | Issue | Comments and proposed changes | Rapporteur comment |
| VF\_001 | *Definition of the discardTimerForLowImportance in 7.3 is not aligned with the description* | This timer is configured only for DRBs. The duration of the timer is configured by upper layers TS 38.331 [3]. In the transmitter, a new timer is started upon reception of an SDU belonging to a lower importance PDU Set from upper layer if *psi-BasedDiscard is configured* | It is changed in r1 as “if *psi-BasedDiscard* is configured and PSI based SDU discard is activated”. |
| APPLE\_001 | Definition of Delay-critical PDCP SDU is not clear enough | **Delay-critical PDCP SDU**: the PDCP SDU for which the remaining time value till *discardTimer* expiry is less than a [threshold]. | It is changed in r1 as “the PDCP SDU for which the remaining time till *discardTimer* expiry is less than a [threshold]”. |
| V\_001 | Functions | Timer based PDU set discard:I assume it should be “PDU set based discard”. My understanding is: in case PDU set based discard is configured, no matter one PDCP SDU is discarded based on what reason (e.g. Timer based, or PSI based), the PDU(s) in the same PDU set should be discarded. Thus, it is not just “timer based PDU set discard”, while it should be “PDU set based discard” | No changeI think “Timer based PDU Set discard” is correct.Whole PDU Set is discarded only when a SDU is discarded by the discard timer. When a SDU is discarded by the status report, only that SDU is discarded. This is aligned with the agreement, and implemented in 5.3.It is changed in r2 as “PDU Set discard”. |
| V\_002 | “- if *psi-BasedDiscard* is activated, and the PDCP SDU belongs to a lower importance PDU Set:” | Suggest to:“- if *psi-BasedDiscard* is activated, and the PDCP SDU belongs to a low~~er~~ importance PDU Set:”Otherwise, the IE should be “*discardTimerForLowerImportance*” | “lower importance” is changed to “low importance” in r1. |
| V\_003 | Data volume calculation | I assume the else part should be in brackets as it is still FFS as below:FFS what to report for the case of not PDU set discard configured[OPPO]: We share a similar view as vivo. | Bracket is added to “else” part in r1. |
| O\_001 | *Definition of the discardTimerForLowImportance* in 7.3 | Only when psi-BasedDiscard is activated, this timer would be used (to more align with the description in 5.2.1 and our MAC CE-based agreement)b) *discardTimerForLowImportance*This timer is configured only for DRBs. The duration of the timer is configured by upper layers TS 38.331 [3]. In the transmitter, a new timer is started upon reception of an SDU belonging to a lower importance PDU Set from upper layer if *psi-BasedDiscard is activated*. | See my reply to VF\_001. |
| N\_01 | Transmit Operation | The identification of lower importance set cannot be left fully up to UE implementation. There needs to be at least a pointer towards TS 26.522. | No change.The agreement is “It is up to UE implementation to determine which PSI levels will apply the discard mechanism”. There was no agreement on pointing to 26.522. Moreover, 26.522 is not listed in the References. |
| N\_02 | Second Discard Timer | The introduction of a second timer seems to contradict a previous agreement we had in RAN2: *PDU set discard is modelled using the existing PDCP discard timer for the uplink*Isn’t it possible to use one timer with two values ? This would avoid tests like “without restarting the *discardTimer* or the *discardTimerForLowImportance*”[FW]: without introducing a second timer, we have a risk that a lower importance PDU Set may be mis-characterized as a delay-critical PDU Set. | No change.That agreement is for “PDU Set discard”, which is implemented in 5.3. For “PSI based SDU discard”, we don’t have a clear agreement on introducing a new timer, but I think it is simpler and cleaner to introduce a new timer. |
| N\_03 | Transmit Operation | With the suggested text, after the OFF-signal, for the SDUs already in buffer the new, shorter timer will still apply. This may not be desirable. In order to avoid this, we could always start the legacy timer, and ignore the expiry of the new timer if the ON-signal no longer applies. That would also justify the introduction of the 2nd timer (see N\_02).[FW]: We agree with Nokia here. The legacy timer should always be started, not just under the “else” condition. Additional reason is given in FW\_001. Furthermore, we think the following text under the SDU discard operation can satisfy “The running discard timers are not changed.”. They are just not used under the circumstance: When the *discardTimer* expires for a PDCP SDU, or when the *discardTimerForLowImportance* expires for the PDCP SDU while PSI based SDU discard is activated, the transmitting PDCP entity shall: | No change.The agreement is “The running discard timers are not changed.”.I put it on the open issue list. |
| N\_04 | Definitions | Not convinced we need the two new definitions since they are used only in one place. | No change.Without the new definitions, it is difficult to implement the agreements. I tried various ways to implement them (including what Huawei suggested in H\_005), but decided to introduce new definitions because it seems the cleanest way.Also, note that Broadcast MRB, Multicast MRB, MBS Radio Bearer, Non-split bearer are listed in definition even though they are not used in other place. |
| E\_01 | PSI and PDU Set discard dependence | PSI based discarding is a sub solution to PDU Set discarding. That has been clear from the first agreement and been the assumption in all discussions. However with current structure it seems one could activate PSI based discarding and not PDU Set discarding. Either we add a dependence that one cant activate PSI based discarding without PDU Set discarding configured or the text in 5.3 is changed to something like this:*- if pdu-SetDiscard is configured* ***or psi-BasedDiscard is activated****:**- discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs;* | No change.I don’t agree that PSI based discarding is a sub solution to PDU Set discarding. There was no agreement on the dependencies between two functions.E\_answerPDU Set Importance has been discussed as a means to discard low importance PDU Sets. If companies have different views (which seem to be the case here), we are fine to continue discussion in the next meeting and for now we just keep it open in the running CR. We can add an editor's note to highlight that this aspect is open and need discussion.RapporteurI put it on the open issue list. |
| E\_02 | Data volume calculation is ambiguous | This formulation is problematic:*the PDCP SDUs belonging to* ***the delay-critical PDU Set*** *for which no PDCP Data PDUs have been constructed;*It is ambiguous, what happen when you have multiple delay critical PDU Sets in the buffer? This is something that will occur. We could add to the above formulation explicitly stating that it is the “*shortest remaining time delay-critical PDU Set”*, however this doesn’t solve the fundamental problem.This highlights exactly the problem I tried to raise multiple times in the online session, the agreements are currently not complete. Currently we will only have one threshold to trigger the DSR and only one value as baseline (but it was not excluded that we can have more values reported, which is likely solution we need).With only one value reported and one trigger threshold for the DSR then it is unclear how to handle when we get more delay critical PDU Sets in the buffer. Should these be reported at a later time, requiring some other trigger for the DSR e.g. when the first delay critical PDU Set is finished then trigger a new DSR for the next delay critical PDU Set (potentially this create a long delay until the values for this delay critical PDU Set is reported, since the DSR is not triggered when the PDU Set becomes a delay critical PDU Set), or should the new delay critical PDU Set be included in a new DSR together with the first delay critical PDU Set (with only one delay/buffer value reported this will be misleading for the scheduler), or should it not trigger any DSR at all? (Probably a solution that will not work at all.)  | No change.You can bring a paper for the next meeting.E\_AnswerWe are fine to discuss this in the next meeting but also here it would be good to specify in an editors note that this exact problem needs further discussion. Because currently it is unclear in the TP what the behaviour is when there are multiple “delay-critical PDU Sets” in the UE buffer.RapporteurMy understanding is that the first one triggers a DSR, and at the time of DSR MAC CE construction, PDCP SDUs belonging to any of the delay-critical PDU Sets are considered in delay-critical data volume calculation.I thought the original text cover this, but it seems some companies think only a single delay-critical PDU Set is considered in data volume calculation.To avoid misunderstandings, I make it plural terms, i.e. delay-critical PDU Set**s**, in r2.  |
| E\_03 | Cover page | The cover page shall be made correct, that is add other specs affected, clause affected, and describe the summary of changes. | No change.The correct cover page will be provided in the actual CR not in the draft CR. |
| E\_04  | The added NOTE 1:NOTE 1: Identification of PDU Set importance is left up to UE implementation. | Shall have number 0, as renumbering of numbered items is “strongly deprecated” according to 21.801 Specification drafting rules.The same is true for the added “b) *discardTimerForLowImportance*” in 7.3, that is no change of numbering of what is now b) *t-Reordering*. | No change.The drafting rule in 21.801 says “Once a TS or TR is under change control, changing existing **clause, figure, table, annex**, etc. numbers is strongly deprecated, **since external documents might reference specific clauses (figures, tables, ...)** of the TS/TR.”The NOTE is not referred to by external documents, and changing the NOTE number has been allowed many times in the past.The same applies to “a), b), c)”. |
| E\_05 | Second discard timer. We agree with Nokia’s observation.  | The solution, as used for many issues in MAC spec, is to use a “helper” variable for the timer. For example, *DISCARD\_TIMER*, compare to how *HARQ-RTT-TimerDL-NTN* is used in MAC. Maybe like this - if *psi-BasedDiscard* is activated, *discardTimerForLowImportance* is configured, and the PDCP SDU belongs to a low~~er~~ importance PDU Set:- start the *DISCARD\_TIMER* associated with this PDCP SDU with the value *discardTimerForLowImportance*;- else:- start the *DISCARD\_TIMER* associated with this PDCP SDU with the value *discardTimer* (if configured).(then all actions at *discardTimer* expiry shall be at *DISCARD\_TIMER* expiry instead)The 5.3 would then be something like:When the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU. When the *DISCARD\_TIMER* expires for a PDCP SDU, the transmitting PDCP entity shall:- if *pdu-SetDiscard* is configured:- discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs;- else:- discard the PDCP SDU along with the corresponding PDCP Data PDU.And 7.3 would become (which also solves the numbering issue mentioned above)a) *DISCARD\_TIMER* This timer is configured only for DRBs. The duration of the timer is configured by upper layers TS 38.331 [3] in *discardTimer* or *discardTimerForLowImportance*. In the transmitter, a new timer is started upon reception of an SDU from upper layer, see 5.2.1 above for which timer value to use. [FW]: without introducing a second timer, we have a risk that a lower importance PDU Set may be mis-characterized as a delay-critical PDU Set. | No change.The suggest change is MAC approach, and it is not used in PDCP specification (also not in RLC specification). “lower” is changed to “low”, as replied to V\_002. |
| H\_001 | Name of the new timer “*discardTimerForLowImportance*” | We don’t have strong view on the name of new timer, but it needs to be aligned with other running CRs, in 331 it is named as “*psi-DiscardTimer*” | No change for now.I agree that the exact name of the new timer should be aligned with other specifications, but to me “discardTimerForLowImportance” is much clearer than “psi-DiscardTimer”.  |
| H\_002 | Transmit Operation | Regarding to the following changes:“if *psi-BasedDiscard* is activated, and the PDCP SDU belongs to a lower importance PDU Set:- start the *discardTimerForLowImportance* associated with this PDCP SDU (if configured);”If we understand correctly, the “psi-BasedDiscard” is the indicator to indicate wheter a DRB is configured with PDU set discarding for congestion alleviation. If so, the above text misses the other condition, that is the network has indicated the congestion happens by activating the newly defined discard timer.So we would suggest to revise the above text either to add something like “and the XXX timer is activated” or directly replace “psi-BasedDiscard” with “*discardTimerForLowImportance*”(or other name for the newly defined timer) | Agree. It is changed in r1 as “if *psi-BasedDiscard* is configured and PSI based SDU discard is activated” |
| H\_003 | NOTE1 in 5.2.1 | Should we use “NOTE 0” to avoid renumbering all of the following NOTEs? | No change. See my reply to E\_04. |
| H\_004 | Remaining time calculation | We also need to consider how to indicate the remaining time of the delay critical PDCP data volume to the lower layers. | No change. I think it is sufficient to specify the remaining time in the MAC specification. |
| H\_005 | “delay-critical PDU set” and “delay-critical PDCP SDUs” in 5.6 | Although there is a corresponding definition in 3.1, not sure it is a normal way to specify something. We think it would be more appropriate and clear if there was some text somewhere in the main part of specs, something like: “The UE shall consider PDCP SDU for which the remaining *discardTimer* value is less than a [threshold] as a delay-critical PDCP SDU”. | No change.See my reply to N\_04. |
| H\_006 | Description of *discardTimerForLowImportance* | The current text “In the transmitter, a new timer is started upon reception of an SDU belonging to a lower importance PDU Set from upper layer.” should add “and the *discardTimerForLowImportance* is activated” | See my reply to VF\_001. |
| NEC\_01 | Functions | “PSI based PDU set discard” should be “PSI based SDU discard”.PDU set discard and SDU discard are two independent functions. PDU set discard is to handle whether UE discards all packets in PDU set when one PDU is discarded based on PDU-set discard indication. | Agree. The name is changed to “PSI based SDU discard”. |
| NEC\_02 | 5.2.1 NOTE 1:  | Suggest changing to “NOTE 1: Identification of low importance PDU Set ~~importance~~ is left up to UE implementation.” since RAN2#123bis agreement was “It is up to UE implementation to determine which PSI levels will apply the discard mechanism” | Agree. |
| Xiaomi-1 | Definition of discardTimerForLowImportance | Do we need to introduce another new timer or reuse the legacy timer with a shorter value for PDCP SDU belongs to a lower importance PDU Set? That need to be discussed further.[FW]: without introducing a second timer, we have a risk that a lower importance PDU Set may be mis-characterized as a delay-critical PDU Set. | See my reply to N\_02. |
| Xiaomi-2 | Comment on 5.6 Data volume calculationWe do not need to add new definition of “delay-critical PDCP SDUs” and “Delay-critical PDU Set”.And for PDU set, it only considers SDU, not the consider corresponding PDCP Data PDUs.Delay-critical PDU Set: the PDU Set to which the delay-critical PDCP SDU belongs. | We prefer the original way in last post email discussing that people proposed. Then we do not need to add new definition of “delay-critical PDCP SDUs”.A suggestion is as following:For the purpose of MAC delay status reporting, the transmitting PDCP entity shall consider the following as delay-critical PDCP data volume:- the PDCP SDUs for which no PDCP Data PDUs have been constructed for which the remaining discardTimer values are less than a [threshold];- the PDCP Data PDUs that have not been submitted to lower layers and for which the remaining discardTimer values are less than a [threshold];- for AM DRBs, the PDCP SDUs to be retransmitted according to clause 5.1.2 and clause 5.13 and for which the remaining discardTimer values are less than a [threshold];- for AM DRBs, the PDCP Data PDUs to be retransmitted according to clause 5.5 and for which the remaining discardTimer values are less than a [threshold].And to reflect the agreement “The data volume calculation to be reported in the DSR will consider the at size of the full remaining PDUs in the PDU set (if any PDU within the PDU set is with remaining time below the threshold), if the PDU set discard is configured.” Then to add a sentence would be enough.Then we do not need to define “Delay-critical PDU Set”If pdu-SetDiscard is configured, When the remaining discardTimer value is less than a [threshold] for a PDCP SDU, the transmitting PDCP entity shall take all PDCP SDUs belonging to the PDU Set along with the corresponding PDCP Data PDUs into consideration when calculation delay-critical PDCP data volume. | See my reply to N\_04.My first attempt was similar to what you suggested, but I found that it is difficult to implement “full **remaining** PDUs”. Your last sentence is not correct because only the SDUs not constructed and PDUs not submitted should be considered in delay-critical data volume calculation.This is the reason why I introduce two new definitions. |
| Xiaomi-3 | Comments on 5.2.1 | Logical mistake.If NW does not configure a discard timer for low importance, in this case the legacy timer will be used.Suggest to modify:At reception of a PDCP SDU from upper layers, the transmitting PDCP entity shall:- if psi-BasedDiscard is activated, and the PDCP SDU belongs to a lower importance PDU Set and if NW configures a discard timer for low importance:- start the discardTimerForLowImportance associated with this PDCP SDU;- else:- start the discardTimer associated with this PDCP SDU (if configured). | See my reply to VF\_001. |
| C\_001 | PDCP SDUs already in the buffer cannot be discarded immediately. This can be solved by always running both timers concurrently but the discard based on the new timer is only enabled when *psi-BasedDiscard* is activated. | At reception of a PDCP SDU from upper layers, the transmitting PDCP entity shall:- if  *discardTimerForLowImportance*is configured and the PDCP SDU belongs to a lower importance PDU Set:- start the *discardTimerForLowImportance* associated with this PDCP SDU;- start the *discardTimer* associated with this PDCP SDU (if configured).[…]The transmitting PDCP entity shall:- if the *discardTimer* expires for a PDCP SDU; or - if the *discardTimerForLowImportance* expires for a PDCP SDU while *psi-basedDiscard* is activated: - if *pdu-SetDiscard* is configured: - discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs; - else: - discard the PDCP SDU along with the corresponding PDCP Data PDU. | I put it on the open issue list. |
| C\_002 | PDU Sets could be overlapped in a received burst so that more than one PDU Sets could be involved in a DSR. | - if *pdu-SetDiscard* is configured:- the PDCP SDUs belonging to the delay-critical PDU Set(s) for which no PDCP Data PDUs have been constructed;- the PDCP Data PDUs that contain the PDCP SDUs belonging to the delay-critical PDU Set(s) and have not been submitted to lower layers; | See my reply to E\_02.To avoid misunderstandings, I make it plural terms, i.e. delay-critical PDU Set**s**, in r2.   |
| FW\_001 | Transmit Operation | The legacy discardTimer should always be started, i.e., not just under the “else” condition, to track the true remaining time for delay-critical determination. | I put it on the open issue list. |
| Can\_001 | Data volume calculation shall not be restricted to a single PDU Set.Agree with E\_02 and C\_002 | There are no agreements to restrict one PDU set per DRB.Proposed change:- the PDCP SDUs belonging to ~~the~~ all delay-critical PDU Sets for which no PDCP Data PDUs have been constructed;- the PDCP Data PDUs that contain the PDCP SDUs belonging to ~~the~~ all delay-critical PDU Sets and have not been submitted to lower layers; | See my reply to E\_02 and C\_002. |
| FJ\_001 | DefinitionsPDU Set | Suggest adding one sentence after the current definition of PDU Set to link application level PDU with PDCP SDU:A PDU in the PDU Set corresponds to a PDCP SDU. | Included in r2. |
| FJ\_002 | Functions | We want to echo V\_001:Timer based PDU set discard:I assume it should be “PDU set based discard”. FJ: We also think it is better to use “PDU set based discard” to reduce confusion. Now every discard is timer based. Current “Timer based PDU set discard” will bring confusing with the current “PSI based SDU discard”, which actually uses a timer-based mechanism. In timer-based PDU set discard, we want to emphasize “PDU set based”, rather than “timer based”. | It is changed in r2 as “PDU Set discard”.I think “PDU Set based discard” is not correct. What is discarded is PDU set. |
| FJ\_003 | Transmit operation | NOTE 1: need to mention PSI somehow since it is called PSI based discard. There are actually two steps: first identify PSI, and then decide whether it is considered low importance by some rules. Suggested change:NOTE1: Identification of PSI of a PDU Set and determination of low importance PDU Set are left up to UE implementation. | Included in r2. |
| I\_001 | UE discard behaviour if *pdu-SetDiscard* is not configured | During meeting, it clarified that TS 38.323 does not captures anything explicitly about the *discardTimer* associated to a successful delivery of a PDCP SDU which gets discarded in transmitter after being configured. Current TP adds a clear else condition in which UE may not perform discard, i.e. expiry of a discardTimer associated for a successful delivery of a PDCP SDU. Therefore, we suggest to clarify that this discard might not always be possible, i.e. only when is still available in transmitter. Suggest the following TP:“When the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU.When the *discardTimer* or *discardTimerForLowImportance* expires for a PDCP SDU, the transmitting PDCP entity shall:- if *pdu-SetDiscard* is configured:- discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs;- else:- discard the PDCP SDU along with the corresponding PDCP Data PDU, if available. | No change.It is obvious that discard is performed only when it is available.Not only “discard” but all the UE behaviors are performed only when it is available or applicable.This is the reason why the PDCP specification does not specify “if available” at all. |
| I\_002 | PDU Set Discard when PDUs of a PDU Set arrive at different instance of time | TS 38.323 captures that data in Tx is discarded when its delivery is successfully (i.e., “*When the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU*”), however it does not states anything on what happens with its associated *discardTimer*. It was explained during the meeting that this means that UE shall keep it running and therefore even if the *discardTimer* expires for a successful delivery of a PDCP SDU, it could trigger the discard of the other PDUs belonging to the same PDU Set. This is a new expected behaviour in UE side that it does not seem as obvious in our understanding from current TP. We suggest further clarifying this new/expected behaviour in TS 38.323 in the procedural text or at least as a note. Some possible options may be e.g.,**Option 1)** Procedural text is updated to add UE expected behaviour.“When the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU and if *pdu-SetDiscard* is configured, its associated *discardTimer* is kept running. When the *discardTimer* or *discardTimerForLowImportance* expires for a PDCP SDU, the transmitting PDCP entity shall:- if *pdu-SetDiscard* is configured:- discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs;- else:- discard the PDCP SDU along with the corresponding PDCP Data PDU.”**Option 2)** A note clarifies UE expected behaviour.“When the successful delivery of a PDCP SDU is confirmed by PDCP status report, the transmitting PDCP entity shall discard the PDCP SDU along with the corresponding PDCP Data PDU.When the *discardTimer* or *discardTimerForLowImportance* expires for a PDCP SDU, the transmitting PDCP entity shall:- if *pdu-SetDiscard* is configured:- discard all PDCP SDUs belonging to the PDU Set to which the PDCP SDU belongs along with the corresponding PDCP Data PDUs;- else:- discard the PDCP SDU along with the corresponding PDCP Data PDU.NOTE: If *pdu-SetDiscard* is configured, the *discardTimer* associated to a successful delivery of a PDCP SDU is kept running to allow UE to perform PDU Set based discard. “ | I put it on the open issue list. |
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# Conclusion

Following open issues are identified during the e-mail discussion.

1. Dependencies between PDU Set discard and PSI based SDU discard

Option A: Independent functions

Option B: PSI based SDU discard can be activated only when PDU Set discard is configured

1. Concurrent running of discardTimer and discardTimerForLowImportance when PSI based SDU discard is activated

Option A: only one timer is running

Option B: two timers can be running concurrently when PSI based SDU discard is activated

1. Handling of discardTimer when a PDCP SDU is discarded by ACK in PDCP status report if PDU Set discard is configured.

Option A: discardTimer is stopped (and disabled because PDCP SDU is discarded) same as legacy

Option B: discardTimer is kept running until expiry.

Following open issues are also identified by the rapprteur during CR implementation.

1. Whether the following should be considered in delay-critical PDCP data volume
	1. PDCP Control PDUs
	2. PDCP SDUs to be retransmitted for AM DRBs
	3. PDCP Data PDUs to be retransmitted for AM DRBs