3GPP TSG RAN WG2 #121 R2-2302009

Athens, GR, 26th Feb– 3rd Mar, 2023

**Agenda item: 8.5.1**

**Source: CMCC**

**Title: Summary of [AT121][204][XR] Reply LS to SA2 on PSER usage (CMCC)**

**Document for: Decision, Discussion**

# 1 Introduction

This document captures the following discussion:

 **[AT121][204][XR] Reply LS to SA2 on PSER usage (CMCC)**

Scope: Discuss whether there is a need to send reply LS to SA2 [R2-2300071](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121/Docs/R2-2300071.zip). Try to provide proposal on what could be replied to SA2.

Intended outcome: Discussion summary in [R2-2302009](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_121/Docs/R2-230xxxx.zip) (including draft LS text).

Deadline: Thursday XR session

In SA2’s LS to RAN2[1], the following information about PSER is provided:

|  |
| --- |
| *The PDU Set Error Rate (PSER) defines an upper bound for the rate of PDU Sets that have been processed by the sender of a link layer protocol (e.g. RLC in RAN of a 3GPP access) but that are not successfully delivered by the corresponding receiver to the upper layer (e.g. PDCP in RAN of a 3GPP access). Thus, the PSER defines an upper bound for a rate of non-congestion related packet losses. The purpose of the PSER is to allow for appropriate link layer protocol configurations (e.g. RLC and HARQ in RAN of a 3GPP access).* |

Furthermore, in the SA2’s CR on support of PDU Set based handling [2], a clarification on the usage of PSER and PER is also provided:

|  |
| --- |
| 5.7.X.3 PDU Set Error Rate The PDU Set Error Rate (PSER) defines an upper bound for the rate of PDU Sets that have been processed by the sender of a link layer protocol (e.g. RLC in RAN of a 3GPP access) but that are not successfully delivered by the corresponding receiver to the upper layer (e.g. PDCP in RAN of a 3GPP access). Thus, the PSER defines an upper bound for a rate of non-congestion related PDU Set losses. The purpose of the PSER is to allow for appropriate link layer protocol configurations (e.g. RLC and HARQ in RAN of a 3GPP access).  NOTE1: In this release, a PDU Set is considered as successfully delivered only when all PDUs of a PDU Set are delivered successfully.  A QoS Flow is associated with only one PDU Set Error Rate. If the PSER is available, the usage of PSER supersedes the usage of PER. The value of the PDU Set Error Rate is the same in UL and DL.  Editor's Note: The PSER definition may be subject to change if RAN2 provides any feedback on that. |

# Contact information

|  |  |
| --- | --- |
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| Futurewei | Yunsong Yang (yyang1@futurewei.com) |
| vivo | Chenli (chenli5g@vivo.com) |

# Discussion

## 2.1 The definition of PSER from RAN2 side

Since SA2 defined a new QoS parameter PDU Set Error Rate (PSER) with a Editor’s note, i.e., The PSER definition may be subject to change if RAN2 provides any feedback on that.

The rapporteur in principle agrees with SA2’s definition, and thinks that from RAN2 perspective, **the PSER can be defined as an upper bound for the error probability of PDU set that successfully transmitting data packet from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point of the radio interface within required delay budget.**

**Q1: What’s your view on the definition of PSER？**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or no** | **Comments** |
| Xiaomi | - | PSER is the error rate not the “**success probability”.**  Lets keep SA2’s definition as it is.  It should be in SA2’s scope. |
| Apple |  | The rapporteur seems to define PSER as the upper bound of successful delivery probability of PDU Sets. However, it should be the upper bound of probability of delivery failure. We also agree with Xiaomi that SA2 definition is sufficient.  The definition from the rapporteur should be updated as following:  **the PSER can be defined as an upper bound for the ~~success~~ probability of PDU set that are not successfully delivered ~~transmitting data packet~~ from the radio protocol layer 2/3 SDU ingress point to the radio protocol layer 2/3 SDU egress point of the radio interface within required delay budget** |
| Nokia | - | The SA2 definition is too convoluted and refers to protocol layers outside of SA2 scope. It is not entirely correct either (the wording is inaccurate from RAN2 perspective). It might be better to just say “*the PSER defines an upper bound for a rate of non-congestion related PDU Set losses*”. |
| Huawei, HiSilicon |  | We think the current PSER definition is OK from RAN2 perspective. Perhaps some simplifications can be discussed directly in SA2. |
| CATT |  | We agree with Xiaomi: let’s just keep the SA2 definition as is, to start with. Specifically, the Rapporteur adds the delay component assuming PDU Sets that exceed the delay budget are discarded, which may not always be the case. |
| Ericsson |  | Keep SA2 definition as it is. |
| LG | - | Keep the definition of PSER agreed in SA2. |
| ITRI |  | We think SA2’s PSER definition is ok from RAN2 perspective. |
| MediaTek |  | No need to change SA2’s definition |
| OPPO | - | In principle, we understand that PSER is an upper bound for the rate of PDU Sets that are not successfully delivered. We would like to keep the definition provided by SA2. |
| InterDigital |  | We can keep the SA2 definition. |
| Qualcomm |  | SA2’s definition is fine only under the assumption that “a PDU Set is considered as successfully delivered only when all PDUs of a PDU Set are delivered successfully”. If PSIHI is not set for a QoS flow, the success criterion for a PDU Set is different, i.e. enough number of PDUs in a PDU Set required for its decoding have been successfully delivered to upper layer. The definition of PSER hence should be adjusted to reflect that, e.g. “The PDU Set Error Rate (PSER) defines an upper bound for the rate of PDU Sets that have been processed by the sender of a link layer protocol (e.g. RLC in RAN of a 3GPP access) but ~~that are not~~ but do not have enough number of PDUs required by their decoding at the application successfully delivered by the corresponding receiver to the upper layer (e.g. PDCP in RAN of a 3GPP access) . |
| NEC |  | We’d like to follow SA2’s definition, but we also suggest to emphasize that the PDU Set should be delivered as a whole. See below,   |  | | --- | | The Packet Set Error Rate (PSER) defines an upper bound for the rate of PDU Sets that have been processed by the sender of a link layer protocol (e.g. RLC in RAN of a 3GPP access) but that are not successfully delivered as a whole (or, not all PDUs of the PDU Set are successfully delivered) by the corresponding receiver to the upper layer (e.g. PDCP in RAN of a 3GPP access). Thus, the PSER defines an upper bound for a rate of non-congestion related PDU Set losses. | |
| Samsung |  | No need to change SA2 definition. It should be up to SA2. |
| Spreadtrum |  | Ok to keep SA2 PSER definition. |
| Intel |  | We also support keeping SA2 definition. |
| Futurewei |  | Agree that PSER is about the error probability not the “success probability”.  From the new definition (or interpretation) provided by the rapporteur, it is unclear whether congestion related loss (i.e., discard) is counted or not, while the SA2’s definition focuses on non-congestion related loss.  Agree with other companies on no need to change SA2’s definition. |
| vivo |  | We also think this should be defined in SA2, and let’s keep the definition in SA2. |
| Lenovo |  | Keep SA2 definition as it is. |

***Summary:***

*Out of 20 responding companies, the following table presents a summary of responses to the above question:*

|  |  |
| --- | --- |
| *Keep the SA2 definition* | *Improve the SA2 definition* |
| *17* | *3* |

*Based on near consensus support, keeping the SA2 definition seems in general acceptable.*

***Proposal 1: RAN2 confirms the SA2’s definition of PSER. (17/20)***

## 2.2 Whether PSER is beneficial for RAN

SA2 has calcified that the usage of PSER supersedes the usage of PER if PSER is available. And it seems that there is an agreement that PSER is useful or beneficial for RAN and is going to use PSER.

**Q2: Do you agree that PSER is beneficial or useful for RAN and RAN plans to use it？**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or no** | **Comments** |
| CMCC | Yea | PSER is beneficial for RAN to performing appropriate L2 UP configuration and/or data scheduling. |
| Xiaomi | Yes | How to use it should be NW’s implementation. |
| Apple | Yes |  |
| Nokia | Yes | Without PSER, the handling of PDU Sets becomes problematic, especially when PSIHI is set. |
| Huawei, HiSilicon | Yes | We have already concluded this in the online session. |
| CATT | Yes, if PER is not provided | Considering the clarification by SA2 that if the PSER is available, the usage of PSER supersedes the usage of PER, we agree that if RAN is not provided with a PER target, RAN needs something else to maintain the target reliability of the Uu link for a QoS flow, which can be the PSER. However, RAN can live with the legacy PER, if provided, and does not specifically needs PSER. In other words, the motivation for introducing PSER is only if SA2 finds it more convenient and appropriate to define a reliability requirement for a given XR video QoS flow. |
| Ericsson | Yes | PSER is only a guidance but can be useful and usage is implementation specific. |
| LG | Yes | PSER would be used to appropriately configure the L2 configuration as stated in the SA2 CR. |
| ITRI | Yes | We share the view with Nokia. |
| MediaTek | No | We do not see how this can be enforced, and no explanation has been provided in the discussions so far. Therefore we cannot see how RAN2 can claim that it is beneficial.  The only thing we can state is that enforcement of PSER can be left to gNB implementation (not that PSER itself is beneficial). |
| OPPO | Yes, if PSER is provided/available | Not sure whether PSER is beneficial for RAN, but if PSER is provided/available, how to use PSER can depend on the network implementation. |
| InterDigital | Yes | Agree with Nokia, it can be useful to the RAN. |
| Qualcomm | Yes |  |
| NEC | Maybe | How to use PSER is up to network implementation. |
| Samsung | Maybe no | Based on the discussion, it is transparent whether RLC PDU or MAC PDU is associated to a PDU set or a PDU (i.e., legacy one) at RLC layer and MAC layer. We do not see a difference between PSER and PER at AS perspective. We somewhat share the view that gNB may use PSER not PER if it is provided but it is unclear whether it is beneficial or useful. |
| Spreadtrum | Yes | It is beneficial to RAN and how to use PSER belongs to implementation. |
| Intel | No | Share the same view as MediaTek |
| Futurewei | Yes | How to use it for the DL is up to NW implementation and how the UE uses it for the UL should be under the NW’s control. |
| vivo | Yes | Similar as PER, it could be used to define the satisfied rate, which should be up to NW implementation, e.g. may impact RAN link adaptation. |
| Lenovo | Yes | PSER as new QoS requirement is beneficial or useful for RAN. How to ensure the PSER is left to the RAN implementation. |

***Summary:***

*Out of 15 responding companies, the following table presents a summary of responses to the above question:*

|  |  |
| --- | --- |
| *PSER is useful for RAN, and how to use PSER is up to network implementation* | *Not sure whether PSER is useful for RAN, how to use PSER is up to network implementation* |
| *15* | *5* |

*Based on company input, most companies seem to think that PSER is useful for RAN, and how to use PSER is up to network implementation. Hence, rapporteur suggests as follow:*

***Proposal 2: RAN2 will reply to the SA2 that PSER is useful for RAN, and how to use PSER is up to network implementation (15/20).***

## 2.3 Link layer protocol configuration (RLC/HARQ)

In F2F discussion, it seems that the majority view is that there will be no RLC/HARQ changes and PSER enforcement can be left for network vendor’s implementation.

**Q3: Do you agree to reply to SA2 that there will be no impact on RLC/HARQ specification of PSER？**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or no** | **Comments** |
| CMCC | No | there will be no impact on RLC/HARQ specification. We prefer to correct their spec. |
| Xiaomi | NO | The sentence of “The purpose of the PSER is to allow for appropriate link layer protocol configurations (e.g. RLC and HARQ in RAN of a 3GPP access). “ is copy and paste from the definition of PER. It is true that PER or PSER is used for link layer protocol configurations. So we do not see huge problem for this. Even we agreed that RLC and HARQ will not treat packets on packet set basis. We do not think SA2 need to be informed of that.  So keep SA2’s definition as it is. |
| Apple | No | We are not sure why SA2 need to know the impacts to RAN2 specifications. |
| Nokia | No | The point is that it does not matter as it is handled by gNB implementation. SA2 should not have to bother with this. |
| Huawei, HiSilicon | No | SA2 did not ask us about impact on our specifications. |
| CATT | Yes/No | We agree PSER has no impact on RLC/HARQ specification. We don’t agree we need to reply it to SA2. |
| Ericsson | No | Do not write anything about impacts as SA2 didn’t ask about that and usage is implementation specific. |
| LG | No | No impact for PDCP/RLC/MAC specification. |
| ITRI | No | We think how PSER is enforced is up to network implementation. There is no need to reply to SA2 that there will be no impact on RLC/HARQ specification of PSER. |
| MediaTek | Yes | We should respond to SA2 that PSER enforcement is left to NW implementation. However given that SA2 have explicitly referenced HARQ and RLC, we should correct SA2’s understanding in their incoming LS, i.e. HARQ and RLC has not been modified to deal with PDU sets. Not saying anything about it seems disingenuous. |
| OPPO | No | No impact on RLC/HARQ specification and L2 measurement. |
| InterDigital | No strong view | Can reply to clarify but RLC/HARQ is up to RAN. |
| Qualcomm |  | RAN2 should reply to SA2 that PSER has no foreseen impact on RLC/HARQ protocols. |
| NEC | No | As other companies already commented, PSER has no impact on RLC/HARQ specification. But it is in our scope, no need to reply to SA2. |
| Samsung | Yes | We think that we should reply to SA2 that there is no impact on ARQ/HARQ operations for handling PDU set. |
| Spreadtrum | No | It is RAN impact and do not need to inform SA2. |
| Intel |  | It might be good to suggest SA2 not to capture the following sentence in TS 23.501 “*The purpose of the PSER is to allow for appropriate link layer protocol configurations (e.g. RLC and HARQ in RAN of a 3GPP access)”*. |
| Futurewei |  | Agree with Qualcomm. |
| vivo | No | No impact on RLC/HARQ specification. |
| Lenovo | No | There will be no impact on RLC/HARQ specification of PSER. |

***Summary:***

*Out of 15 responding companies, the following table presents a summary of responses to the above question:*

|  |  |
| --- | --- |
| *No impact on RLC/HARQ specification of PSER* | *Maybe impact on RLC/HARQ specification of PSER* |
| *15* | *0* |

|  |  |  |
| --- | --- | --- |
| *Notify to SA2* | *NO* | *Not mention this point* |
| *5* | *11* | *4* |

*Based on company input, ALL companies agree there is No impact on RLC/HARQ specification of PSER, and 11 companies explicitly expressed that SA2 doesn't need to be informed. Hence, rapporteur suggests that we do not reply to SA2 on this point,*

***Proposal 3: RAN2 will not inform SA2 there is No impact on RLC/HARQ specification of PSER.***

## 2.4 The need to send a reply LS to SA2

Since SA2 defined a new QoS parameter PDU Set Error Rate (PSER) and kindly asks RAN2 to provide feedback on this new QoS parameter in relation to its intended purpose i.e., appropriate link layer protocol configurations.

The rapporteur thinks that from RAN2 perspective, it’s better to provide feedback to SA2 on PSER.

**Q1: Do you agree to send a reply LS to SA2 on PSER？**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or no** | **Comments** |
| CMCC | Yes |  |
| Xiaomi | Yes | The LS only needs to capture that RAN2 thinks it is beneficial and the following agreement:   * RAN2 thinks that how PSER is enforced is up to network implementation. |
| Apple | No strong view | We don’t see a strong need, but okay to follow majority. |
| Nokia | Maybe | If it is only to echo the agreements, then no. But if there is an agreement to ask them to simplify their definition, then yes. |
| Huawei, HiSilicon | Do not see the need | We do not see much value of the reply LS, but if companies want it, we should simply reply that there is no issue with PSER from RAN2 point of view. The current draft LS reply may be simplified. |
| CATT | Yes | We think it could be good to clarify that RAN can live with legacy PER also with XR QoS flows, and the motivation for introducing PSER is only if SA2 finds it more convenient and appropriate to define a reliability requirement for a given XR video QoS flow. In which case RAN could also make use of it, which is left to gNB implementation. |
| Ericsson | Yes | Ok to reply that PSER is useful. |
| LG | No | We do not see a need of sending LS. |
| ITRI | Yes | We think SA2 is waiting for our feedback on this. |
| MediaTek | Yes | SA2 is waiting on our feedback. |
| OPPO | - | No strong view, but if majorities prefer to send it, we prefer to simplify the reply and just mention what RAN2 has agreed on PSER. |
| InterDigital | No strong view | Link layer protocol config would be up to RAN. We see no downside either way. |
| Qualcomm | Yes | SA2 has asked for a reply. Then RAN2 should respond, regardless of what agreement RAN2 may reach on SA2’s question. |
| NEC | Follow majority view | We see the LS from SA2 clearly ask for a RAN2 feedback. However, seems majority view is that it is no need to reply impact on RLC/HARQ specification, we are not sure whether the LS is useful. |
| Samsung | Yes |  |
| Spreadtrum | Yes |  |
| Intel | Yes | We support CATT views that RAN can live with legacy PER considering that PDU sets of different importance are mapped to the same XR QoS flow in Rel-18 with the assumption that those PDU set have the same value of PSER. |
| Futurewei | Yes |  |
| Vivo | No strong view | If our reply is to confirm SA2 definition on PSER, then, there is no need, as SA2 will anyway remove the EN in TR in the final version.  Editor's Note: The PSER definition may be subject to change if RAN2 provides any feedback on that.  If we want to inform other things or ask questions, we are fine to reply LS to SA2. |
| Lenovo | Yes | RAN2 can reply PSER is beneficial or useful for RAN, how to ensure the PSER is left to the RAN implementation. |

***Summary:***

*Out of 20 responding companies, the following table presents a summary of responses to the above question:*

|  |  |  |
| --- | --- | --- |
| *Send a reply LS to SA2 on PSER usage?* | | |
| *Proponent* | *No strong view* | *opponent* |
| *12* | *6* | *2* |

*Based on consensus support, the above proposal seems acceptable.*

***Proposal 4: RAN2 will send a reply LS to SA2 on PSER usage with the information that RAN2 thinks that PSER is useful for RAN, and how to use PSER is up to network implementation .***

# 4 Reply LS to SA2 on PSER usage

**1. Overall Description:**

RAN2 would like to thank SA2 for their LS SA2 on PSER usage. RAN2 has discussed the questions and concluded that:

* **RAN2 confirms SA2’s definition on PSER, and RAN2 thinks that PSER is useful for RAN, and how to use PSER is up to network implementation.**

**2. Actions:**

**To SA2:**

**ACTION:**  RAN2 kindly asks SA2 to take the above into account.

# 5 Summary

*Out of 20 responding companies, the following table presents a summary of responses to the above question:*

|  |  |
| --- | --- |
| *Keep the SA2 definition* | *Improve the SA2 definition* |
| *17* | *3* |

*Based on near consensus support, keeping the SA2 definition seems in general acceptable.*

***Proposal 1: RAN2 confirms the SA2’s definition of PSER. (17/20)***

*Out of 15 responding companies, the following table presents a summary of responses to the above question:*

|  |  |
| --- | --- |
| *PSER is useful for RAN, and how to use PSER is up to network implementation* | *Not sure whether PSER is useful for RAN, how to use PSER is up to network implementation* |
| *15* | *5* |

*Based on company input, most companies seem to think that PSER is useful for RAN, and how to use PSER is up to network implementation. Hence, rapporteur suggests as follow:*

***Proposal 2: RAN2 will reply to the SA2 that PSER is useful for RAN, and how to use PSER is up to network implementation (15/20).***

*Out of 15 responding companies, the following table presents a summary of responses to the above question:*

|  |  |
| --- | --- |
| *No impact on RLC/HARQ specification of PSER* | *Maybe impact on RLC/HARQ specification of PSER* |
| *15* | *0* |

|  |  |  |
| --- | --- | --- |
| *Notify to SA2* | *NO* | *Not mention this point* |
| *5* | *11* | *4* |

*Based on company input, ALL companies agree there is No impact on RLC/HARQ specification of PSER, and 11 companies explicitly expressed that SA2 doesn't need to be informed. Hence, rapporteur suggests that we do not reply to SA2 on this point,*

***Proposal 3: RAN2 will not inform SA2 there is No impact on RLC/HARQ specification of PSER.***

*Out of 20 responding companies, the following table presents a summary of responses to the above question:*

|  |  |  |
| --- | --- | --- |
| *Send a reply LS to SA2 on PSER usage?* | | |
| *Proponent* | *No strong view* | *opponent* |
| *12* | *6* | *2* |

*Based on consensus support, the above proposal seems acceptable.*

***Proposal 4: RAN2 will send a reply LS to SA2 on PSER usage with the information that RAN2 thinks that PSER is useful for RAN, and how to use PSER is up to network implementation .***

# 6 Conclusion

***Proposal 1: RAN2 confirms the SA2’s definition of PSER. (17/20)***

***Proposal 2: RAN2 will reply to the SA2 that PSER is useful for RAN, and how to use PSER is up to network implementation (15-Proponent, 5- Not sure).***

***Proposal 3: RAN2 will not inform SA2 there is No impact on RLC/HARQ specification of PSER(11-No need; 5- Need; 4-No view) .***

***Proposal 4: RAN2 will send a reply LS to SA2 on PSER usage with the information that RAN2 thinks that PSER is useful for RAN, and how to use PSER is up to network implementation(12-Proponent; 6- Neutral; 2-Opponent) .***

# 7 References

1. S2-2301378, Reply LS on PDU Set Handling, SA2(Tencent)
2. S2-2303841, Support of PDU Set based handling, SA2(Huawei, HiSilicon)