**3GPP TSG RAN WG1 #104-e R1-21xxxxx**

**e-Meeting, January 25th – February 5th, 2021**

**Agenda item:** 8.4

**Source:** Moderator (Qualcomm)

**Title:** Summary of discussion/approval of the reply LS to R1-2100014

**Document for:** Discussion/Decision

# Introduction

In RAN1 104e, SA2 sent to RAN1 and RAN2 a LS on the QoS requirements when satellite access is used. The LS include two questions about AN-PDB and PER related to 5QI Table 5.7.4-1 in TS 23.501. A reply LS was prepared by Thales in R1-2100832.

As guided by the Chairman, in this document the summary of the discussions and outcomes of the email discussion will be provided.

[104-e-NR-NTN-05] Email discussion/approval of the reply LS to R1-2100014 until Feb-01 – Xiaofeng (Qualcomm)

# Discussions

The first question from SA2 is about AN-PDB:

***Question 1: SA2 would like to ask RAN1, and RAN2 to indicate what is the expected “lower” and “higher” AN-PDB values when the different RAT types for satellite access is used?***

The question is about packet delay from the UE to the UPF that terminates the N6 interface and better to be answered by RAN2. From RAN1 point of view, the maximal RTD of different RAT types for satellite access can be provided.

Based on the above, the proposed reply from RAN1 is

*The round-trip delay (RTD) between the UE and the NTN gateway can be up to [600] ms for GEO satellites and [20 to 30] ms for LEO satellites. The RTD for HAPS is similar to that in TN.*

**Question 1: ~~Is the above proposed reply to Question 1 acceptable? If not, please provide comment~~ (Please see updated reply and answer Question 1a).**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| QC | Yes |  |
| ZTE | Yes with modification | Additional clarification below can be added to give the whole picture on the latency:  In existing discussion, the case where gNB is co-located at the NTN-GW is prioritized, in which the propagation delay between NTN-GW and the gNB can be ignored. |
| Intel | Yes | If more accurate RTD value is needed, we can refer to Table 7.1-1 of TR38.821 as it is stated in our tdoc R1-2101719 |
| LG | Yes |  |
| Ericsson | Yes with modification | * The [20 to 30] ms is applicable for LEO satellites at around 600 km height. So, either spelling out the altitude or, as suggested by Intel, referring to Table 7.1-1 of TR38.821. * The packet transmission delay depends on how many (re)transmissions occur in radio access network. To avoid misinterpreting RTD as PDB, it is preferred to mention the impact of retransmission.   In line of above comments, the reply can be revised as follows:  *The round-trip delay (RTD) between the UE and the NTN gateway can be up to [600] ms for GEO satellites and [20 to 30] ms for LEO satellites at 600 km height. The RTD for HAPS is similar to that in TN. (Re)transmissions may lead to a delay of multiple RTDs.* |
| Nokia, Nokia shanghai Bell | Yes with modification | This response is only delivering part of the story, as it only relates to the round trip delay between NTN gateway and UE. The response does not consider any additional mechanism that is needed for ensuring reliable transmission (related to the PER in second question).  In general, the response here should also highlight that in order to deliver needed PER target, we would need to rely on HARQ and RLC recovery which would potentially increase the needed time. This aspect/disclaimer should be mentioned in the LS reply and potentially we should notify our RAN2 colleagues that such considerations need to be included in their answer (which should also include SR/BSR delays for UL transmissions). |
| APT | Agree with changes | LEO satellites may have different orbits, e.g., 350km, 500km, 600km, or 1200km. It is better to point out the minimum satellite altitude is 600 km for the LEO case. |
| CATT | Yes with modification | Ericsson’s modification is more accurate, and can be acceptable. |
|  |  |  |

**Moderator’s summary and proposal on Question 1**

Since the prioritization of the case where gNB and GTW are collocated is not RAN1’s decision, it should not be included in RAN1’s reply. Based on the comments, the reply to Question 1 is revised as below:

*The round-trip delay (RTD) between the UE and the NTN gateway can be up to 541.46 ms for GEO satellites and 25.77 ms for LEO satellites at 600 km height. The RTD for HAPS is similar to that in TN. Retransmissions may lead to a delay of multiple RTDs.*

**Question 1a: Is the above proposed reply to Question 1 from SA2 acceptable? If not, please provide comment.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| Intel | Yes |  |
| MediaTek | Yes |  |
| LG | Yes |  |
| Samsung | Yes with modification | The last sentence (*(Re)transmissions may lead to a delay of multiple RTDs.*) is not okay. Due to the feature of HARQ-ACK feedback enabling/disabling, (Re)transmissions may or may not lead to a delay of multiple RTDs. In this regards, the last sentence needs to be removed. |
| Nokia, Nokia Shanghai Bell | Yes | If we remove that sentence as proposed by Samsung, we have a high risk of conveying the wrong message. The AN-PDB and PER are coupled to a service, and if we disable HARQ-ACK, we may not be able to fulfil the PER for the given service unless we rely on higher layer recovery. Hence, we would prefer to keep the last sentence. |
| Ericsson | Yes | Similar to Nokia’s comment, we should keep the last sentence so that SA2 is informed that there may be retransmissions at radio access network that lead to longer latency than pure one-time RTD. This would help SA2 set proper service requirement accordingly. Otherwise, if SA2 only considers one-time RTD, this would pose significant requirement on radio access network that must deliver the packet within one-time RTD. |
| APT | Yes | Blind retransmission for HARQ-ACK disabling is not yet supported. Better not to rely on HARQ-ACK disabling to guarantee SA2 certain PDB and PER. |
| Huawei | Yes | In our contribution, we have analysed more factors that would have impact to the AN-PDB. However, there may be no need to consider other factors in the LS given that they are much smaller than the RTD for GEO case. The expected AN-PDB for LEO case may well be covered by the current 5QIs. Hence it would be okay to report the RTD values as suggested. We also think the last sentence should be kept. |

The second question is on the upper bound of PER:

***Question 2: SA2 would like to ask RAN1, and RAN2 to indicate what is the expected upper bound of PER when the different RAT types for satellite access is used?***

On this question, one version of the reply is proposed in R1-2100832:

*RAN1 assumes that the current upper bound of PER defined as 10-2 also applies for NTN.*

**~~Question 2: Is the above proposed reply to Question 2 from SA2 acceptable? If not, please provide comment~~( Please see updated reply and answer Question 2a).**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| QC | No | The 10-2 upper bound mentioned in the LS is defined for upper-layer packet (e.g., IP packet). It’s preferred to provide RAN1’s view on physical layer as below:  *RAN1 is not expected to consider higher PER for NTN.* |
| ZTE | Yes with modification | Regarding the PER, although there have been agreements made in RAN1 and RAN2 on disabling HARQ feedback for downlink, the HARQ retransmission and RLC ARQ would still be supported in NTN to ensure the reliability. Meanwhile, it clear that PER is mainly defined for certain service, if supported in NTN, same value as TN is preferred. So, following updated version can be considered:  *From RAN1 perspective, same PER including the upper bound is applied for NTN.* |
| Intel | Yes with modification | We don’t see big difference between wording from R1-2100832, QC and ZTE. We slightly prefer wording provided by ZTE. |
| LG | Yes | We are also fine with wording from ZTE. |
| Ericsson | Yes with modification | SA2 is asking about upper bound of PER. It’s preferred not to generalize to PER in general. In line of this, the reply can go as follows (revised from QC’s wording)  *RAN1 is not expected to consider higher PER upper bound for NTN.* |
| Nokia, Nokia Shanghai Bell | Yes with modification | The response might need a clarification that from PHY layer perspective we do not expect to have any change to the PER requirements. |
| APT | Yes | PER can be achieved by MCS and HARQ retransmissions  *From RAN1 perspective, same PER including the upper bound is applied for NTN.* |
| CATT | No | Slightly agree QC view. In NTN case, re-transmission may cause larger latency, so BLER target of NTN can be stricter than that of TN. Then we can support lower PER target in NTN. |

**Moderator’s summary and proposal on Question 2**

RAN1 has not agreed to consider the same PER range. In addition, only the upper bound is asked by SA2. Including a statement about the PER range without an agreement introduces additional risk of inaccuracy without benefit. Based on the comments, the reply to Question 2 is revised as below:

*RAN1 is not expected to consider higher PER upper bound for NTN.*

**Question 2a: Is the above proposed reply to Question 2 acceptable? If not, please provide comment.**

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| --- | --- | --- |
| Company | Yes/No | Comment |
| Intel | Yes |  |
| MediaTek | Yes |  |
| LG | Yes |  |
| Samsung | Yes |  |
| Nokia, Nokia Shanghai Bell | Yes |  |
| Ericsson | Yes |  |
| APT | Yes |  |
| Huawei | Yes with slight modification | *RAN1 is not expected to consider higher PER upper bound in ~~NTN~~ different RAT types for satellite access.*  According to SA2’s question, it seems that SA2 was asking whether different PER target will be applied in different RAT types for satellite access. |