3GPP RAN WG2 Meeting #113e R2-2102043

eMeeting January 25th – February 5th, 2021

Agenda Item: 8.10.2.2

Source: InterDigital (email discussion rapporteur)

Title: [DRAFT] [AT113-e][103][NTN] HARQ aspects Phase 2

Document for: Discussion, Decision

# Introduction

This discussion document is intended to enable continuation of user plane discussions from RAN2#113e, specifically relating to HARQ-related aspects as per the offline description below:

* [AT113-e][103][NTN] HARQ aspects (InterDigital)

Updated scope: Continue the discussion on p5, p7, p8 and discuss p4a, p4b and p4c from R2-2102013

Updated intended outcome: Summary of the offline discussion with e.g.:

* List of proposals for agreement

The following deadlines have been provided by the session chair:

Deadline (for companies' feedback): **Wednesday 2021-02-03 18:00 UTC**

Deadline (for rapporteur's summary in R2-2102042): **Wednesday 2021-02-03 22:00 UTC**

# UL HARQ Retransmission

## ‘Enabling/disabling’ HARQ UL retransmission (P4a, 4b, 4c)

Based on comments from several companies in Phase 1 email discussion [1], there was a desire to further clarify what the actual definition of “disabled” HARQ UL retransmission. The following was agreed the previous meeting [2]:

*From RAN2 perspective, for dynamic grant, one possibility for "enabling"/"disabling" HARQ uplink retransmission at UE transmitter is without introducing an additional mechanism (i.e. gNB can send grant with NDI not toggled/toggled without waiting for decoding result of previous PUSCH transmission). FFS on the handling of RTT timers. Other solutions for enabling/disabling HARQ UL reTX are not precluded*

In the Phase 1 email discussion description, it was assumed that HARQ UL retransmission being ‘enabled’ requires the gNB to receive the PUSCH transmission, attempt to decode it, and if unsuccessful provide the UE with an UL retransmission grant. The description of ‘disabled’ HARQ UL retransmission was the gNB provides a grant assigned to the HARQ process with NDI toggled before waiting on the decoding results of the previous PUSCH transmission (as per the agreement from the previous meeting).

However, the same agreement also mentions that gNB can also send a grant with NDI *not toggled* without waiting for the decoding result of the previous PUSCH transmission as well. As pointed out by Nokia, this introduces two understandings for what ‘enabled’ HARQ UL retransmission means in NTN:

* Case#1) HARQ with retransmissions relying on previous/initial transmission packet decoding result in gNB. (as per email discussion description)
* Case#2) HARQ with blind retransmissions which is NOT relying on previous/initial transmission packet decoding result in gNB (i.e. no matter previous PUSCH transmission can be decoded successfully or not, gNB will schedule retransmission).

To avoid HARQ stalling, unlike in the case of DL HARQ feedback, HARQ UL retransmission is not ‘enabled’ or ‘disabled’. Instead, the UE may expect a grant at different times (e.g. >1 RTT if based on decoding result or < 1 RTT according to above agreement). Rapporteur would like to ask companies to confirm the following to ensure that RAN2 is aligned on current agreements:

**Question 1a: Do you agree intention of previous agreement on ‘enabling/disabled HARQ UL retransmission’ is to allow gNB to send UL grant less than one RTT regardless of NDI state (e.g. with NDI not toggled/toggled) and NOT to ‘disable’ HARQ UL retransmission?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
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**Question 1b: Do you agree there are two possibilities to receive an UL retransmission grant?**

1. **Based on decoding result of previous PUSCH transmission (> 1 UE-gNB RTT)**
2. **NOT relying on decoding result of previous PUSCH transmission (< 1 UE-gNB RTT)**

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| **Company** | **Agree/Disagree** | **Additional comments** |
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**Question 1c: Do you agree to change description ‘enabled’ and ‘disabled’ HARQ UL retransmission to be more in-line with agreements e.g. ‘HARQ UL retransmission’ and ‘sub-RTT HARQ UL retransmission’? Companies may indicate candidate names in the ‘Additional Comments’ section.**

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| **Company** | **Agree/Disagree** | **Additional comments** |
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## drx-HARQ-RTT-TimerUL (P5, P7, P8)

If HARQ uplink retransmission requires the gNB to receive the TB, attempt to decode it, and if unsuccessful provide the UE with an UL retransmission grant, this would take at least one UE-specific RTT. During Phase 1 discussion a large majority (19/24) companies agree that for HARQ processes where gNB sends grant based on decoding result of previous PUSCH transmission, *drx-HARQ-RTT-TimerUL* length is increased by offset.

Though not agreed in online session for UL, a similar behaviour was agreed for DL [3]:

*For HARQ processes with DL HARQ feedback enabled, drx-HARQ-RTT-TimerDL length is increased by offset (i.e. existing values within value range increased by offset). RAN2 working assumption: offset is equal to UE-gNB RTT (if RAN1 decides something that requires to change this we can revisit it)*

Based on comments from Phase 1, there seems to be a strong desire to have unified behaviour for UL and DL RTT Timer behaviour. Considering this in addition to strong Phase 1 majority, rapporteur suggests that proposal be confirmed.

**Question 2: Do companies agree to the following Phase 1 proposal (i.e. same RTT Timer behaviour for both UL and DL)?**

***“For HARQ processes where gNB sends grant based on decoding result of previous PUSCH transmission, drx-HARQ-RTT-TimerUL length is increased by offset (i.e. existing values within value range increased by offset). RAN2 working assumption: offset is equal to UE-gNB RTT. (if RAN1 decides something that requires to change this we can revisit it)*”**

*Note: The following 19 companies were supportive of this proposal in Phase 1:*

APT, Panasonic, Huawei, Lenovo, CATT, Spreadtrum, Samsung, Intel, Mediatek, ZTE, Qualcomm, Xiaomi, Apple, China Telecom, Vodaphone, Thales, Sequans, Rakuten Mobile, InterDigital.

*Unless views have changed or there are additional comments, these companies are assumed to maintain support in Phase 2 and do not need to respond to this question.*

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| **Company** | **Agree/Disagree** | **Additional comments** |
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How HARQ timers (i.e. *drx-HARQ-RTT-TimerUL*) are handled when gNB can send grant without waiting for decoding result of previous PUSCH transmission is currently FFS. In Phase 1, there was near consensus (22/24) that *drx-HARQ-RTT-TimerUL* is either 1) not started or; 2) set to ‘0’.

**Question 3: Do companies agree to the following Phase 1 proposal?**

**“*For HARQ processes where gNB sends grant without waiting for decoding result of previous PUSCH transmission, it is FFS if drx-HARQ-RTT-TimerUL is 1) not started or; 2) set to ‘0’.*”**

*Note: The following 22 companies were supportive of at least one of the options in this proposal in Phase 1:*

APT, Panasonic, Huawei, Lenovo, CATT, Spreadtrum, Samsung, Intel, Mediatek, LG, Nokia, OPPO, ZTE, Qualcomm, Apple, China Telecom, Vodaphone, Thales, ETRI, Sequans, Rakuten Mobile, InterDigital.

*Unless views have changed or there are additional comments, these companies are assumed to maintain support in Phase 2 and do not need to respond to this question.*

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| **Company** | **Agree/Disagree** | **Additional comments** |
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A strong majority of companies in Phase 1 agreed that depending on whether UL grant is sent based on decoding result of previous PUSCH transmission or not results in a different timer behaviour for *drx-HARQ-RTT-TimerUL* i.e.:

*For HARQ processes where gNB sends grant based on decoding result of previous PUSCH transmission, drx-HARQ-RTT-TimerUL length is increased by offset (19/24)*

*For HARQ processes where gNB sends grant without waiting for decoding result of previous PUSCH transmission, drx-HARQ-RTT-TimerUL is either 1) not started or; 2) set to ‘0’. (22/24)*

To at least ensure UE configures the proper value for *drx-HARQ-RTT-TimerUL*, the network mustindicate if it can send UL grant before or after decoding result of previous PUSCH transmission. Although there may be other reasons/uses for this indication, it is proposed to go with significant majority (21/24) from Phase 1 and agree to following as a baseline:

**Question 4 Do companies agree that *for at least UE handling of drx-HARQ-RTT-TimerUL*, whether gNB can send UL grant without waiting decoding result of previous PUSCH transmission is explicitly indicated to UE per HARQ process? FFS details of indication.**

*Note: The following 21 companies were supportive of an explicit indication in Phase 1:*

APT, Panasonic, Huawei, Lenovo, CATT, Spreadtrum, Samsung, Intel, Mediatek, LG, Nokia, OPPO, Qualcomm, Xiaomi, Apple, China Telecom, Vodaphone, Thales, ETRI, Sequans, InterDigital.

*Unless views have changed or there are additional comments, these companies are assumed to maintain support in Phase 2 and do not need to respond to this question.*

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| **Company** | **Agree/Disagree** | **Additional comments** |
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# Summary

<to be generated pending company feedback>

# Conclusion

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# Contact Information

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# References

1. R2-2102013 Report of [AT113-e][103][NTN] HARQ Aspects - InterDigital
2. Draft\_RAN2\_112-e\_Meeting\_Report\_v2
3. RAN2-113-e- Chair notes (Sergio)
4. 3GPP TS 38.321 v16.3.0 Medium Access Control (MAC) protocol specification
5. R2-2101573 HARQ timer aspects – InterDigital