3GPP RAN WG2 Meeting #116e R2-2111354

eMeeting November 1st – 12th, 2021

Agenda Item: 8.10.2.2

Source: InterDigital (offline rapporteur)

Title: [DRAFT] Summary of [AT116-e][101][NTN] Other MAC aspects: Phase 2

Document for: Discussion, Decision

# Introduction

This document is a intended to continue discussion on the following aspects:

* [AT116-e][101][NTN] Other MAC aspects (InterDigital)

Updated scope: Continue the discussion on remaining aspects of timers, HARQ, and LCP including CG/SPS aspects, based on the outcome of the discussion in R2-2111339

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

* List of proposals for agreement (if any)
* List of proposals that require online discussions
* List of proposals that should not be pursued (if any)

The following deadline for company feedback has been provided:

* Initial deadline (for companies' feedback): **Monday 2021-11-08 1600 UTC**
* Initial deadline (for rapporteur's summary in R2-2111354): Monday 2021-11-08 2000 UTC

Please also note the following chair guidance:

* Proposals marked "for agreement" in R2-2111354 not challenged until **Tuesday 2021-11-09 0800 UTC** will be declared as agreed via email by the session chair (for the rest the discussion will continue in the CB session in Week2).

Companies are encouraged to review Phase 1 discussion summary in [R2-2111339](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Inbox/R2-2111339.zip) for relevant background.

# Discussion

## P7

In Phase 1 discussion, possible LCH to HARQ process mappings were discussed and considered all possible configurations of LCH and HARQ. The following agreement was made based on outcome of Phase 1:

* *If uplinkHARQ-DRX-LCP-Mode-r17 is configured, a HARQ process may be mapped to either ‘HARQ mode A’ or ‘HARQ mode B’.*

Based on this agreement, if *uplinkHARQ-DRX-LCP-Mode-r17* is configured then all HARQ processes will either be HARQ mode A or HARQ mode B. If *uplinkHARQ-DRX-LCP-Mode-r17* is not configured, then no HARQ process is configured with a HARQ mode.

For the case *uplinkHARQ-DRX-LCP-Mode-r17* is not configured, an existing agreement from RAN2#115e covers the mapping behaviour:

* *If HARQ process has not been configured with an UL HARQ retransmission state, new LCH mapping rule has no effect (i.e. UE applies legacy behaviour).*

Therefore, the original proposal 7 can be simplified to describe behaviour when *uplinkHARQ-DRX-LCP-Mode-r17* is configured (i.e. all HARQ processes are either Mode A or B). Based on comments received, Rapporteur suggests the following behaviour:

If*uplinkHARQ-DRX-LCP-Mode-r17*is configured,the following LCH to HARQ process mapping rules are supported:

1. LCHismapped only to a HARQ process configured with HARQ mode A;
2. LCHismapped only to a HARQ process configured with HARQ mode B;
3. If an LCH is not configured with a mapping rule, it may be mapped to any HARQ process (HARQ mode A or B)."

Combing existing agreed behaviour with this proposal would result in the following mapping restriction:

Diagram

Description automatically generated

**Question 1: Do you agree to the following proposal?:**

**“*If uplinkHARQ-DRX-LCP-Mode-r17 is configured, the following LCH to HARQ process mapping rules are supported:***

1. ***LCH is mapped only to a HARQ process configured with HARQ mode A;***
2. ***LCH is mapped only to a HARQ process configured with HARQ mode B;***
3. ***If an LCH is not configured with a mapping rule, it may be mapped to any HARQ process (HARQ mode A or B)."***

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| MediaTek | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Apple | Agree |  |
| Qualcomm | Agree |  |
| Xiaomi | Agree |  |
| Samsung | Agree |  |
| Lenovo, Motorola Mobility | Agree |  |
| Spreadtrum | Agree |  |
| LG | Agree |  |
| OPPO | Agree |  |
| ZTE | - | Our understanding on phase 1 agreements is that HP with/without a state is still allowed, therefore would like to keep not configured in 3). However, if majority agrees that when uplinkHARQ-DRX-LCO-Mode configured, it shall be configured for HPs, we are fine to go with the majority. |
| Nokia | Agree | For the right figure, our understanding is that: if uplinkHARQ-DRX-LCP\_Mode=r17 is NOT configured, the LCH mapping restriction allowedHARQ-DRX-LCPmode should not be configured (i.e. ModeA and ModeB should not be illustrated in the right figure). |
| ITL | Agree |  |

## P10/P11/P13

The HARQ-processes ID of both CG and SPS are calculated from parameters of radio resource allocation in time domain, e.g. configured periodicity, start off in time domain, configured HARQ process number. This is different from dynamic scheduling, where there is no relationship between HARQ ID and radio resource allocation in time domain.

As noted in Phase 1, this may result in the HARQ processes used by an SPS configuration to have different HARQ feedback behaviour, or HARQ processes used by a CG configuration to have different a UL HARQ mode. There seems to be a general understanding that this is not desired behaviour.

In Phase 1 input, two main options were discussed to address this issue: Configure HARQ behaviour per CG/SPS configuration, or leave it to network implementation. From Phase 1 company feedback, a majority agreed that network configuration would be sufficient in both cases.

**Question 2: Do you agree to the following proposal?:**

**“*It is up to network implementation to ensure downlinkHARQ-FeedbackDisabled, if configured, has the same value for each HARQ process used in an SPS configuration (i.e. no specification impact)."***

**If ‘Disagree’, please provide technical justification why the above would not work and additional specified behaviour is required.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| MediaTek | Agree |  |
| Huawei, HiSilicon | Disagree | We don’t think leaving it to the network implementation is a good choice. When the network configures the HARQ states for HARQ processes, It cannot predict what the SPS configuration will be. Therefore, the network has to calculate and reconfigure the HARQ states for HARQ processes according to the configuration/reconfiguration of an SPS each time. This will pose big restriction and complexity to NW implementation.  What’s worse, the HARQ state reconfiguration will affect the ongoning feedbacks of HARQ processes and lead to low throughput for the services whose HARQ state is different from that of the configured grant.  Considering the drawbacks above, per SPS HARQ state configuration is a clean and simple way with little specs effort to make sure that the HARQ processes used by an SPS configuration have the same HARQ feedback behaviour. |
| Apple | Disagree | Agree with Huawei, HiSilicon |
| Qualcomm | Disagree | At least it has to be clarified how network implementation guarantees it and whether this results in HARQ stall within a SPS configurations due to long RTT. There can be as many as 8 SPS configurations.  maxNrofSPS-Config-r16 INTEGER ::= 8 -- Maximum number of SPS configurations per BWP  So, we also prefer to have a simple per SPS HARQ state configuration. |
| Xiaomi | Agree | No matter DG or SPS, they can share the same HARQ state configuration bitmap(32bits), some bits are for DG, some for SPS，depending on the HARQ configured for SPS. |
| Samsung | Agree | We don’t see or understand a real reason that we cannot leave it to NW implementation. We prefer simple option with no specification impact. |
| Lenovo, Motorola Mobility | Agree |  |
| Spreadtrum | Agree |  |
| OPPO | Agree |  |
| ZTE | Disagree | Similar to DG, per HARQ state SPS feedback disabling is simpler. |
| Nokia | Agree |  |
| ITL | Disagree | Agree with Huawei.  And, we also support NW implementation not force to guarantee same value for each HARQ process used in an SPS configuration. (i.e., NW flexibly allocate HARQ process to an SPS, either one of HARQ mode or both of them) |

**Question 3: Do you agree to the following proposal?:**

**“*It is up to network implementation to ensure uplinkHARQ-DRX-LCP-Mode-r17, if configured, has the same value for each HARQ process used in a configured grant configuration (i.e. no specification impact)."***

**If ‘Disagree’, please provide technical justification why the above would not work and additional specified behaviour is required.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| MediaTek | Agree |  |
| Huawei, HiSilicon | Disagree | See our reply to Q2. |
| Apple | Disagree | Agree with Huawei’s reply to Q1 |
| Qualcomm | Disagree | See our response in Q2 and Q4. |
| Xiaomi | Agree | No matter DG or CG, they can share the same HARQ state configuration bitmap(32bits), some bits are for DG, some for CG，depending on the HARQ configured for CG. |
| Samsung | Agree |  |
| Lenovo, Motorola Mobility | Agree |  |
| Spreadtrum | Agree |  |
| LG | Agree |  |
| OPPO | Agree |  |
| ZTE | Disagree | CG case is not the same as SPS. In our understanding, NW can already control whether retransmission is expected for a CG by proper configuration of CGT, thus we don’t see a need to configure a UL HARQ mode for CG configuration. Also, we don’t see the need to restrict NW’s implementation |
| Nokia | Agree |  |
| ITL | Disagree | See our respone in Q2. |

## P16

In Phase 1 it was discussed whether to link the HARQ mode configuration with CG timer configuration (i.e. require the CGT setting / CGT not configured to match the HARQ mode uplinkHARQ-DRX-LCP-Mode-r17 of each HARQ process that belongs to the CG-config). For example:

* For the configured grant for which the *configuredGrantTimer* is configured, the HARQ retransmission state is considered to be “mode A”.
* For the configured grant for which the *configuredGrantTimer* is NOT configured, the HARQ retransmission state is considered to be “mode B”.

Justification for this is that for configured grant associated with HARQ state B, HARQ RTT timer is not used because retransmission is not expected. Then it is not clear why *configuredGrantTimer* needs to be used for this. It should be clarified that the network should not configure this timer for such CG configuration, otherwise it will block any new transmission in any CG associated with the same HARQ process. Considering the possible RTT in NTN, this could lead to large delay.

Rapporteur understanding is that the above is valid reasoning and that this would indeed be the intended behaviour. However, the question is whether this association needs to be specified or may be left to network implementation. Based on large majority from in Phase 1 responding an association is not needed, it is suggested that this be left to proper network configuration.

**Question 4: Do you agree that if *uplinkHARQ-DRX-LCP-Mode-r17*****is configured, proper setting/ configuration of the *configuredGrantTimer*  is left to network implementation?**

**If ‘Disagree’, please provide technical justification why the above would not work and additional specified behaviour is required.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| MediaTek | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Apple | Agree |  |
| Qualcomm | Disagree | We need to think how retransmission using CS-RNTI works considering there can be as many as 12 CG configurations possible and RTT is not as small as what we have today in TN (so issue in TN and NTN would not be same). We do not want UL HARQ state within a CG be stalled for UL traffic.  maxNrofConfiguredGrantConfig-r16 INTEGER ::= 12 -- Maximum number of configured grant configurations per BWP  If network guarantees that multiple CG configurations never have to re-use the same HARQ process ID, network can set any proper value of CG timer. Otherwise, not for the same reason Rapportuer explained. |
| Xiaomi | Agree |  |
| Samsung | Agree |  |
| Lenovo, Motorola Mobility | Agree |  |
| Spreadtrum | Agree |  |
| LG | Agree |  |
| OPPO | Agree |  |
| ZTE | Agree |  |
| Nokia | Agree |  |
| ITL | Agree |  |

## Other proposals

### SR-Prohibit Timer

So far in RAN2#116e, the following has been agreed regarding extension of the *sr-ProhibitTimer* in NTN:

* *The extended values for sr-ProhibitTimer in NTN can include values less than UE-gNB RTT (as in legacy). FFS on the actual values and how this is extended*
* *Introduce a new sr-ProhibitTimerExt-r17 IE. Values FFS*

Taking the above agreements into consideration, companies are invited to propose a candidate set of additional values for the new *sr-ProhibitTimerExt-r17* IE.

**Question 5: What are possible values to be included in the *sr-ProhibitTimerExt-r17* IE ?**

|  |  |
| --- | --- |
| **Company** | **Possible values** |
| MediaTek | Currently the value range for the sr-ProhibitTimer in NR is: {ms1, ms2, ms4, ms8, ms16, ms32, ms64, ms128}  The maximum round trip delay in NTN is 541.46 ms for GEO, 41.77 ms for LEO in 1200 km orbit, and 25.77 ms for LEO in 600 km orbit.  To support max legacy value + max RTD LEO(1200): 128+42=170ms  To support max legacy value + max RTD LEO(600): 128+26=154ms  To support max legacy value + max RTD GEO: 128+542=670ms  Additional values in between could be considered, especially for GEO, for example: 256, 384, 512, 640 ms  Based on these values, values for sr-ProhibitTimerExt-r17 could consist of:  {ms154, ms170, ms256, ms384, ms512, ms640, ms670}  [Note: As can be seen above, the resulting values look quite arbitrary, this is why it would have made much more sense to extend the legacy sr-ProhibitTimer by UE-gNB RTT] |
| Huawei, HiSilicon | We think the exact values need some some more analyse and we can keep it as FFS for now. |
| Qualcomm | We are ok to finalize the new values later. |
| Samsung | We can discuss it under ASN.1 discussion later. |
| Lenovo, Motorola Mobility | The exact values can be decided later. |
| Spreadtrum | The value shall be didcussed later. |
| LG | Considering the propagation delay for GEO, i.e., 540ms, the proper value range can be [180, 270, 540, 1080, 2160, spare3, spare2, spare1] |
| OPPO | This could be postponed until the ASN.1 discussion. |
| ZTE | The new values can be further discussed |
| Nokia | Can be further discussed. |
|  |  |

### RRC details

In Phase 1 discussion the following was agreed with consensus:

* *uplinkHARQ-DRX-Mode shall be included in PUSCH-ServingCellConfig.*

Several companies also suggested revised placement for parameter *downlinkHARQ-FeedbackDisabled*. In light of the above agreement, Rapporteur thinks this proposal may be confirmed prior to session to save online time.

**Question 6: Do you agree to the following proposal?:**

**“*downlinkHARQ-FeedbackDisabled shall be included in PDSCH-ServingCellConfig."***

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| MediaTek | Agree |  |
| Huawei, HiSilicon | Agree |  |
| Apple | Agree |  |
| Qualcomm | Agree | For now it looks fine. We think this can also be looked at more closely later. |
| Xiaomi | Agree |  |
| Samsung | Agree |  |
| Lenovo, Motorola Mobility | Agree |  |
| Spreadtrum | Agree |  |
| LG | Agree |  |
| OPPO | Agree | As similar as the agreement we has approved for UL. |
| ZTE | Agree |  |
| Nokia | Agree |  |
| ITL | Agree |  |

## Topics requiring further discussion

In Phase 1 discussion several topics had nearly split opinion, and resulting proposals were put under the ‘Requires further discussion’ section. To save online time, Rapporteur suggests that these topics be addressed via contribution to next meeting with the current set of proposals as baseline. If companies agree, then this may be captured in Chair notes as guidance for RAN2#116bis-e.

**Question 7: Do you agree the following proposals are be taken as baseline for further discussion (e.g. in contributions to RAN2#116bise)?**

* ***RAN2 to down-select between the following options to support blind retransmission for HARQ process(es) configured with HARQ state B: 1) Rely on UE being in DRX Active Time via other means (e.g. Inactivity Timer); or 2) Start drx-RetransmissionTimerUL at the end of PUSCH transmission;***
* ***RAN2 to down-select between the following options to support blind retransmission for HARQ process(es) configured with disabled HARQ feedback: 1) Rely on UE being in DRX Active Time via other means (e.g. Inactivity Timer); or 2) Start drx-RetransmissionTimerDL in the first symbol after the end of the reception of the last PDSCH or slot-aggregated PDSCH plus X (X = T\_proc,1);***
* ***For RACH in RRC\_CONNECTED mode, it is FFS whether UE ignores HARQ process configuration (e.g. configured HARQ mode) for the case of a PUSCH transmission scheduled by RAR.***
* ***RAN2 to down-select between the following options to extend configuredGrantTimer: 1) Introducing value(s) of configuredGrantTimer larger than 64; 2) Value of the configuredGrantTimer is extended by UE-gNB-RTT;***

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| MediaTek | Agree |  |
| Huawei, HiSilicon | Agree, but | Not sure that this helps saving online time as they are only guidance for RAN2#116bis-e contributions. Does repporteur recommend that discussions of related issues should be limited within the scope of the guidance? |
| Apple | Agree |  |
| Qualcomm | Agree |  |
| Xiaomi | Agree |  |
| Samsung | Agree |  |
| Lenovo, Motorola Mobility | Agree | We are OK to have an FFS on HARQ mode handling for PUSCH transmission scheduled by RAR. |
| Spreadtrum | Agree |  |
| LG | Agree |  |
| OPPO | Agree |  |
| ZTE | Agree |  |
| Nokia | Agree |  |
| ITL | Agree |  |

# Summary

<To be generated pending company feedback>

# Conclusion

In this contribution the following proposals are suggested based on contributions submitted to RAN2#116e AI 8.10.2.2:

<To be generated pending company feedback>

# References

1. [R2-2109499](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109499.zip) Discussion on HARQ related aspects in NTN – OPPO
2. [R2-2109552](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109552.zip) Co-existence issue of BSR over CG and BSR over 2-step RA – CATT
3. [R2-2109631](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109631.zip) Remaining issue on disabling uplink HARQ retransmission – MediaTek Inc.
4. [R2-2109632](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109632.zip) Round trip delay offset for configured grant timers – MediaTek Inc.
5. [R2-2109661](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109661.zip) Further consideration on LCP and HARQ – Huawei, HiSilicon
6. [R2-2109968](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2109968.zip) HARQ process for SPS and CG – Qualcomm
7. [R2-2110017](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110017.zip) Remaining issues related to HARQ retransmission state – Xiaomi
8. [R2-2110045](file:///C:\Users\wattsdy\OneDrive%20-%20InterDigital%20Communications,%20Inc\3GPP\RAN2\116e\Tdoc%20review\Tdocs\R2-2110045.zip) NTN HARQ Management – Apple
9. [R2-2110126](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110126.zip) Discussion on HARQ and LCP remaining issues – Spreadtrum Communications
10. [R2-2110308](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110308.zip) Remaining UP issues for NR NTN – Lenovo, Motorola Mobility
11. [R2-2110354](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110354.zip) CG enhancements in NTN – Sony
12. [R2-2110704](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110704.zip) Discussion on UL scheduling, DRX and other MAC aspects – Nokia, Nokia Shanghai Bell
13. [R2-2110734](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110734.zip) Remaining issues on HARQ aspects – ZTE Corporation, Sanechips
14. [R2-2110859](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110859.zip) Remaining MAC open issues in NTN – InterDigital
15. [R2-2110926](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110926.zip) Updating SR-Prohibit Timer – MediaTek Inc.
16. [R2-2110951](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2110951.zip) On configured scheduling, DRX, LCP, HARQ and SR/BSR in NTNs – Ericsson
17. [R2-2111044](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2111044.zip) Remaining Issue on LCP Restrictions and CG Impact in NTN – CMCC
18. [R2-2111139](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2111139.zip) Discussion on other MAC aspects – LG Electronics Inc.
19. [R2-2111151](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2111151.zip) Retransmission timer for HARQ state B – ITL
20. [R2-2111154](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116-e/Docs/R2-2111154.zip) HARQ State A/B for CG aspects – ITL