3GPP RAN WG2 Meeting #115e R2-210xxxx

eMeeting August 9th – 27th, 2021

Agenda Item: 8.10.2.2

Source: InterDigital (summary rapporteur)

Title: [DRAFT] [Pre115-e][101][NTN] Summary of AI 8.10.2.2 - Other MAC aspects

Document for: Discussion, Decision

# Introduction

This document provides a pre-meeting summary of contributions in agenda item 8.10.2.2 – Other MAC aspects as per the following:

* [Pre114-e][103][NTN] Summary 8.10.2.2 - Other MAC aspects (InterDigital)

A focus is put on continuing discussion from the previous RAN2#114e meeting, specifically on aspects regarding UL HARQ Retransmission, LCP, and DRX timers. Other proposals are grouped in Section 5 for reference.

# UL HARQ Retransmission

## Indication/configuration of UL HARQ retransmission scheme

**RRC signalling** [1, 11, 12, 18, 20]

Proponents of RRC signalling note that if the decision to enable/disable HARQ uplink retransmission is not made semi-statically (e.g. via RRC configuration), it is not clear how the network can reliably decide if it should/should not send a retransmission grant for a transport block that it was unable to decode, at run-time [12], nor how the UE knows the purpose of the scheduling [18]. Several companies [1, 11, 20] also mention that for DL, RAN2 agreed HARQ process can be configured with HARQ feedback enabled/disabled via RRC in a semi-static manner, and it would be good to align for UL HARQ retransmission scheme. Additional advantages for semi-static configuration are that it facilitates simple solutions to both proper DRX timer configuration and LCP [20], and that the NDI-toggling approach is not applicable to the configured grant case whose HARQ process is determined by formula [18].

As mentioned in [4], the primary concern is semi-static signalling can restrict the network to a specific scheduling strategy, thus reducing scheduling flexibility (among other potential issues – see section 3.2). However, [11] notes that RAN1 concluded in RAN1#104-e meeting that, on the scheduling of the same HARQ process, the common understanding is the DCI is expected to be received after the end of the last PUSCH. Considering at least one slot may elapse before same HARQ processes reuse, two HARQ processes (e.g. HARQ processes without retransmission) can be reserved for each UE to continuously schedule UE without HARQ stalling. Since 32 HARQ processes are agreed to be supported in NTN, two HARQ processes reserved for HARQ retransmission disabling will not bring much restriction on the scheduling flexibility as the remaining HARQ process can be used for retransmission based on the decoding results or blind retransmissions. [20] further mentions that if scheduling restrictions are a concern, the network may choose to not configured any HARQ process as having UL HARQ retransmission “disabled”.

**DCI** [4]

[4] proposes an indication is introduced in the DCI format for UL scheduling, indicating the HARQ retransmission scheme that is applied to the associated TB in the UL transmission. For each TB in UL transmission, the UE handles the HARQ related DRX timers of the HARQ process associated with the TB based on the HARQ retransmission scheme indicated by the related DCI.

**Other methods** [22]

[22] notes that to monitor the PDCCH appropriately for different UL retransmission schemes, the drx-HARQ-RTT-TimerUL behavior should be connected to UL retransmission scheme.To control the PDCCH monitoring, the drx-HARQ-RTT-TimerUL behavior for each HARQ process should be connected to UL retransmission scheme. In RAN2 #114 meeting [2], it has been agreed that the drx-HARQ-RTT-TimerUL behavior applied for each HARQ process is also decided by the NW. The NW may indicate or configure the drx-HARQ-RTT-TimerUL behavior for each HARQ process to the UE.

*Rapporteur’s summary:*

The topic of semi-static configuration of enabling/disabling UL HARQ retransmission has been extensively discussed in the NTN WI over many meetings and email discussions.

In RAN2#114e, a compromise proposal was suggested by the vice chair which allows both disabled UL HARQ retransmission and legacy behaviour via configuration. In [AT114-e][103][NTN] Other MAC aspects: Phase 2, this proposal (as is or minor modifications) were acceptable to 15/17 companies. Rapporteur therefore suggests a similar set of proposals which allows both semi-statically enabled/disabled UL HARQ retransmission and the option to schedule as per legacy behaviour.

**Proposal 1:** **A HARQ process can be optionally configured as having UL HARQ retransmission state “enabled” or “disabled”. Configuration is semi-static and signalled via RRC. The decision and criteria to enable/disable UL HARQ retransmission for a HARQ process is under network control.**

**Proposal 2:** **If a HARQ process is not configured with an UL HARQ retransmission state, the network may schedule according to any scheme (i.e. as in legacy).**

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| **Contribution** | **Relevant proposal(s) – RRC Signalling** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P2:** The UL HARQ retransmission scheme, i.e., whether gNB sends UL grant for retransmission based on decoding result of previous PUSCH transmission, is configured per HARQ process via RRC in a semi-static manner. | OPPO |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P1:** The UL HARQ retransmission scheme is semi-statically configured per HARQ process via RRC to support one scheduling strategy used for one HARQ process. | Nokia, Nokia Shanghai Bell |
| [12] [R2-2108318](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108318.zip) | **P1:** Enabling/disabling HARQ uplink retransmission per HARQ process is configured by the network and signalled to the UE using RRC signalling. | MediaTek |
| [18] [R2-2108610](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108610.zip) | **P2:** The gNB disables the UL HARQ retransmission per HARQ process via RRC in a semi-static manner. | Huawei, HiSilicon |
| [20] [R2-2108661](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108661.zip) | **P4:** UL HARQ retransmission state is semi-statically configured per HARQ process via RRC signalling. | InterDigital |

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| **Contribution** | **Relevant proposal(s) – DCI** | **Company** |
| [4] [R2-2107449](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107449.zip) | **P3:** It is necessary to introduce an indication on whether HARQ retransmission is enabled or disabled for UL scheduling from the perspective of DRX timer handling.**P4:** Support UL HARQ retransmission enabled/disabled indication in DCI at a per TB level. RAN2 further discusses whether/how RRC-based semi-persistent indication can be supported as another option for more gNB configuration flexibility. | vivo |

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| **Contribution** | **Relevant proposal(s) – Other methods** | **Company** |
| [22] [R2-2108716](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108716.zip) | **P1:** In NTN, to monitor the PDCCH appropriately, the UE should know the UL HARQ retransmission scheme for a HARQ process * Alternative 1: implicitly by the indication of behavior of the drx-HARQ-RTT-TimerUL or
* Alternative 2: explicitly by a NW configuration/indication.
 | ASUSTeK |

## Retransmission scheme definition

[1] and [4] propose configuring two retransmission schemes from the *UE service delay perspective* i.e. HARQ retransmission based/not based on the previous PUSCH decoding result. Once scheme could be defined for the former scheduling strategy (i.e. based on PUSCH decoding result) where for a certain HARQ process retransmitted TBs will have high delay. For the latter, retransmitted TBs don’t need to wait that long, and “blind retransmissions” and “no retransmission” could be merged into one category.

[20] proposes configuring two retransmission schemes from *the UE reliability perspective* i.e. HARQ retransmission enabled or not. As in legacy, a UE is expected to perform HARQ retransmission for HARQ processes in an “enabled” retransmission state. An UL retransmission grant may be either determined blindly from the gNB or based on UL decoding result. A UE is not expected to perform any HARQ retransmissions for HARQ processes in a ”disabled” UL state.

*Rapporteur’s summary:*

If proposal 1 is acceptable, RAN2 to discuss definition of UL HARQ retransmission states, for example, what network scheduling strategies are associated with which state and the expected UE behaviour.

**Proposal 3:** **RAN2 to discuss definition of “enabled” and “disabled” UL HARQ retransmission state (i.e. supported network scheduling strateg(ies) and corresponding UE behaviour).**

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P1:** Two retransmission scheme options are configured to UE, i.e., UE needs to distinguish HARQ retransmission schemes per HARQ process between the following options:* HARQ with retransmissions based on the previous PUSCH decoding result
* HARQ with retransmissions NOT based on the previous PUSCH decoding result, including HARQ with blind retransmissions and no retransmission
 | OPPO |
| [4] [R2-2107449](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107449.zip) | **P1:** Classify different UL HARQ retransmission schemes into “disabling HARQ retransmission” and “enabling HARQ retransmission” as follows:* Disabling HARQ retransmission: the NW performs UL scheduling without PUSCH decoding result, including no HARQ retransmission and blind HARQ retransmission, on the relevant HARQ process(es);
* Enabling HARQ retransmission: the NW schedules UL HARQ retransmission based on the decoding result of previous PUSCH receptions on the relevant HARQ process(es).
 | vivo |
| [20] [R2-2108661](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108661.zip) | **P1:** Two possible UL HARQ retransmission states are defined in NTN: “enabled” and “disabled”.**P2:** A UE is expected to perform HARQ retransmission for HARQ processes in an “enabled” UL HARQ retransmission state. The UL retransmission grant may be either determined blindly from the gNB or based on UL decoding result.**P3:** A UE is not expected to perform any HARQ retransmissions for HARQ processes in a “disabled” UL HARQ retransmission state | InterDigital |

# LCP

The following was agreed in RAN2#113bise regarding LCP in NTN:

*LCP restrictions should be further considered for an UL HARQ process in NTN. FFS if no further LCP restrictions are needed, or if (R16) existing LCP restrictions can be re-used or if new LCP restriction shall be defined for this purpose.*

This section summarizes proposals addressing LCP, including a brief background on LCP in NTN, whether additional LCP restrictions are necessary, details on a potential new/modified LCP procedure, and if introduced the applicability of LCP to MAC CEs.

## Background of LCP in NTN

In legacy specification, RRC controls LCP procedure by configuring mapping restrictions for each logical channel (LCH). The following LCP restrictions are defined, with parameters *configuredGrantType1Allowed* and *allowedCG-List* specific to configured grant, and *allowedPHY-PrioirtyIndex* specific to dynamic grant:

- ***allowedSCS-List*** which sets the allowed Subcarrier Spacing(s) for transmission;

- ***maxPUSCH-Duration*** which sets the maximum PUSCH duration allowed for transmission;

**- *configuredGrantType1Allowed*** which sets whether a configured grant Type 1 can be used for transmission;

- ***allowedServingCells*** which sets the allowed cell(s) for transmission;

**- *allowedCG-List*** which sets the allowed configured grant(s) for transmission;

- ***allowedPHY-PriorityIndex*** which sets the allowed PHY priority index(es) of a dynamic grant for transmission.

To avoid HARQ stalling in NTN due to much larger propagation delay, the following was agreed in RAN2#113bise:

*It is NW scheduling strategy to avoid NTN UE in HARQ stalling state. From RAN2 perspective, the NW can continuously schedule the UE using one or a combination of scheduling strategies, such as without HARQ retransmissions, or with blind retransmissions, or with HARQ retransmissions based on DL HARQ feedback (or UL decoding result).*

Due to the different scheduling strategies for UL HARQ retransmission, HARQ processes with different delay/reliability attributes may coexist. To ensure, for example, a UE does not multiplex data from a LCH requiring high reliability to a HARQ process without retransmission, LCP may require modification.

Past discussion has focused on whether re-purposing existing LCP restrictions (*allowedPHY-PriorityIndex*) can serve this purpose. The parameter *allowedPHY-PriorityIndex* was introduced in R16 IIoT to ensure high priority (i.e. mainly time-sensitive) data is mapped to an appropriate UL grant. gNB may configure LCHs with less important data to use PHY priority index p0 and p1, while important LCHs are configured to only use priority index p1. gNB can distinguish between SR for low priority data and SRs for high priority data via separate PUCCH SR resources, and gNB may dynamically decide which PHY index (p0 or p1) to use for each grant.

According to current specification, the usage of *allowedPHY-PriorityIndex* is given as follows:

* ***allowedPHY-PriorityIndex* is configured and the dynamic grant has a PHY-priority index**: UL MAC SDUs from this LCH can only be mapped to the dynamic grants indicating PHY-priority index equal to the values configured by this field.
* ***allowedPHY-PriorityIndex* is configured and the dynamic grant does not have a PHY-priority index:** UL MAC SDUs from this logical channel can only be mapped to this dynamic grant if the value of the field is p0. Since the presence of PHY-priority index is configured by IE priorityIndicatorDCI-0-1 in RRC signaling, the present or not can not be changed dynamically.
* ***allowedPHY-PriorityIndex* is not configured**: UL MAC SDUs from this logical channel can be mapped to any dynamic grants.

In RAN2#114e the following options have been captured regarding LCP restriction in NTN:

*At least the following options for LCP in NTN are further studied: 1) allowedPHY-PriorityIndex is re-used; and 2) A new LCP restriction is introduced to map LCH to one or more HARQ process(es). FFS if HARQ processes can be classified as having retransmission “enabled” or “disabled” in this case.*

The following section summarizes company opinion on the whether a new LCP restriction should be introduced in NTN, whether existing LCP restrictions are sufficient (i.e. *allowedPHY-PriorityIndex*), or whether LCP should consider different scheduling strategies of UL HARQ retransmission at all.

## Introduction of new LCP restriction

**Introduce a new LCP restriction** [1, 2, 5, 6, 7, 11, 18]

Proponents of introducing a new LCP restriction note that if HARQ UL retransmissions are disabled by sending UL grant with NDI toggled in NTN, at the time of initial transmission of PUSCH, UE will have no idea whether network intends to disable HARQ retransmission or not [2,6]. If NW schedules the UE using different scheduling strategies while not considering different HARQ retransmission schemes in LCP, the UE will multiplex packets from different services (LCHs) into one MAC PDU [11]. Consequently, UE risks multiplexing data from a logical channel that requires high reliability (i.e., that requires UL HARQ retransmission) [6], or delay requirements of different logical channels [1] to an unsuitable UL HARQ retransmission scheme.

In case of HARQ transmission loss, RLC retransmission mechanism to recover the data is too costly in terms of latency impact, UE power consumption and network resources [6]. As well, in NTN systems the cell coverage is large and many UEs will be supported in one cell, therefore the time-frequency resources is quite expensive and it is important to improve the transmission efficiency, it is not necessary to use more resources to achieve high reliability and low latency for some service which is not necessary [11]. [5] further notes the indication of HARQ retransmission disabled/enabled will be needed anyway for configuration of *drx-HARQ-RTT-TimerUL*.

Further arguments are presented that re-using *allowedPHY-PriorityIndex* is unsuitable to distinguish between UL HARQ retransmission schemes. [5] explains that *allowedPHY-PriorityIndex* along with the priority index was introduced in the IIOT feature. Its main use is for related prioritization operations in the PHY (e.g. transmission cancellation or transmission power reduction), among the overlapped PUCCH, PUSCH and/or related SL transmissions. Therefore, a key concern is possible L1 impacts to intra-UE prioritization [11, 20]. Specific examples are provided in [12] which concludes that use of *allowedPHY-PriorityIndex* in NTN to differentiate between grants which have HARQ enabled and disabled introduces significant complexities in RAN1 which are non-trivial to solve by NW implementation and impacts link adaptation due to dropped UCIs. Furthermore, re-using this feature would not work for configured grant [10] or MAC CE [11], and may impact IoT or future adoption of IIoT services in NTN [1, 20].

**Do not introduce new LCP restriction** [14, 15, 17]

Companies which to not support introduction of a new LCP restriction note that the arguments to support indicating whether UL retransmission is “enabled/disabled” is to avoid LCHs with different QoS requirement to use the same UL grant for transmissions. However, there are different options can achieved the same purpose without using such indication [14, 15], such as the *allowedCG-List* for configured grant or the *allowdPHY-PriorityIndex* for dynamic grant [17]. Re-using existing LCP parameters would minimize impact to existing specification, and semi-static indication could introduce unnecessary complexity in NWs implementation and reduce scheduling scheduling flexibility [14, 15]. Other potential downsides of semi-static indication include additional signalling overhead to manage the different groups [15], and that changing the LCP procedure to restrict LCHs to only use HP IDs with or without retransmissions will incur delay and possibly require new type of SRs for LCHs blocked in LCP [15].

Furthermore, a detailed argument is presented in [15] as to why there is already sufficient mechanisms to properly handle transmission failure. For example, the gNB is aware of the decoded data and failed decoding and can adapt the scheduling and/or link adaptation and/or the gNB estimation algorithm for UE buffer status [15]. Assuming link adaptation adjust for 10% BLER (a common BLER target in TNs) even when retransmissions is not used 90% of the transmissions will be successful. It is noted that link adaptation in NTNs will most likely aim at a lower block error rate (BLER) because the pathloss differences are smaller over a cell and the long RTT has severe drawbacks as retransmissions are delayed for long [15]. Therefore likely BLER target will be much lower in NTNs, thus block errors will be rare.

Even in the event of a HARQ failure, existing mechanisms are in place to mitigate the impact, for example [15]:

* If gNB fails to decode a TB, the gNB can immediately send an RLC status report (and possibly an UL grant) to trigger an early RLC retransmission
* For important LCHs, usually the RLC setting for polling (pollPDU, pollByte) will result in frequent polling. In the case a PDU is sent with the poll bit set and no status report is received and *t-PollRetransmit* expires, then the UE will retransmit the latest SDU (or transmit available new PDUs) with the poll bit sat in the header.

Regarding re-use of the *allowedPHY-priorityIndex*, [15] notes there is no mentioning of URLLC or IIoT services in the TR nor in the WID, thus those use cases are outside of the scope of this WI. URLLC can be supported in parallel with differentiating *allowedPHY-PriorityIndex* for HARQ processes with or without retransmissions.

*Rapporteur’s summary:*

The topic of LCP has been extensively discussed in the NTN WI over many meetings and email discussions.

It has been shown in [14] that the existing LCP restriction *allowedPHY-PriorityIndex* can be used to differentiate UL HARQ retransmission. It has further been shown in [15] that there are already a number of existing mechanisms and strategies to mitigate any issues which may arise from incorrect HARQ retransmissions and re-use of LCP may not even be needed at all. However, Rapporteur notes that has been a consistently large majority which support both introduction of a new LCP restriction, with a number of accompanying arguments on why this is preferable. Based on this majority, the following is proposed:

**Proposal 4:** **A new LCP restriction is introduced in NTN.**

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| **Contribution** | **Relevant proposal(s) – Introduce new LCP restriction** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P6:** New LCP restriction is introduced for the mapping between LCH and HARQ process. | OPPO |
| [2] [R2-2107315](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107315.zip) | **P1:** A new LCP mapping restrictions of HARQ UL retransmission disabled or enabled should be introduced for NTN. | CATT |
| [5] [R2-2107450](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107450.zip) | **P1:** Introduce a new LCP restriction for the mapping of LCH to HARQ transmission schemes. Do not reuse the allowedPHY-PriorityIndex which was introduced for other purposes in IIOT feature.  | vivo |
| [6] [R2-2107563](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107563.zip) | **P1:** A new LCP restriction is defined for an UL HARQ process. | Qualcomm, Huawei, HiSilicon, Xiaomi, Samsung |
| [7] [R2-2107632](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107632.zip) | **P3:** RAN2 to discuss additional restrictions to LCP for NR NTN using similar agreements that led to lcp-Restrictions parameter in Rel-16. **P4:** RAN2 to consider lcp-Restrictions-NTN as a new parameter to handle all NTN related LCP restriction mechanisms**P5:** RAN2 to discuss LCP restrictions separately for UL and DL for HARQ feedback enablement or disablement | Apple |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P2:** HARQ related LCP restriction should be considered for NTN, to satisfy different services (logical channels) requirements in one NTN UE and improve the transmission efficiency.**P3:** New LCP restriction should be defined for NTN. | Nokia, Nokia Shanghai Bell |
| [18] [R2-2108610](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108610.zip) | **P1:** Introduce a new LCP restriction for HARQ differentiation. | Huawei, HiSilicon |

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| **Contribution** | **Relevant proposal(s) - Do not introduce new LCP restriction** | **Company** |
| [14] [R2-2108351](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108351.zip) | **P1:** No need to introduce retransmission scheme based LCP restrictions in NTN. | ZTE, Sanechips |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P13:** No new LCP restrictions for LCHs are introduced in NTNs. | Ericsson |
| [17] [R2-2108608](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108608.zip) | **P3:** The legacy LCP procedure is reused to generate a MAC PDU only containing the data associated with the same service for configured grant as well as dynamic grant.  | LG |

## Details of LCP enhancements

**Reusing *allowedPHY-PriorityIndex*** [3, 14]

In [3], the LCP restriction is based on HARQ process type, where mapping between HARQ process ID and HARQ process type is configured via RRC message and *allowedPHY-PriorityIndex* is configured per logic channel to clarify the different requirement of reliability. If allowedPHY-PriorityIndex is set to the value of p0, the data of this LCH shall be mapped to the HARQ process with feedback. If allowedPHY-PriorityIndex is set to the value of p1, the data of this LCH shall be mapped to the HARQ process without feedback. If allowedPHY-PriorityIndex is not present, the MAC SDU of this LCH could be mapped to the any type of HARQ process.

[14] A mapping strategy is proposed which reuses *allowedPHY-PriorityIndex* to map LCH to one or more HARQ process(es) to accommodate different possible UL retransmission strategies. (companies are encouraged to refer to contribution for detailed mapping strategy). The strategy can ensure that services with high latency and high/normal reliability requirement can only be mapped to UL grant with blind retransmission, and services with normal latency and reliability requirement will not be mapped to the UL grant without any HARQ retransmission.

**Mapping-based solution** [1, 5, 10, 11, 12, 20]

[1] provides two options to define the new mapping rule for a UL grant. In the first, data from all LCHs can be mapped according to an *adjusted priority* (e.g. LCHs requiring high-reliability have higher-priority to be mapped to an “enabled” HARQ PID). In the second option, *only* data from a few LCHs are to be mapped to the grant (e.g. only LCHs requiring high reliability are allowed to be mapped to an “enabled” HARQ PID).

[5] proposes introducing an LCP restriction that indicates the applicable HARQ retransmission scheme per LCH. When the UE receives the DCI scheduling an UL grant (also indicating whether UL HARQ is enabled or disabled for the corresponding transmission) it multiplexes the data of the LCH(s) with the matching HARQ retransmission scheme into this UL grant for transmission.

[10] Prefers a unified solution for both dynamic grant and configured grant i.e. introducing new LCP restriction to map LCH to one or more HARQ process(es).

[11] discusses signalling from NW to UE to support LCP mapping restriction between LCH and HARQ process where two candidate options are provided. In the first option, NW indicates each HARQ’s retransmission scheme each LCH’s preferred retransmission scheme to UE. Only the LCHs which have same retransmission schemes as what is supported by specific HARQ can be allowed or prioritized to be multiplexed to corresponding HARQ's UL grant/MAC PDU (this is similar to solution proposed [20]). In the second, NW indicates each LCH's association with one or multiple HARQ processes to UE. Only those LCHs indexed to specific HARQ can be allowed or prioritized to be multiplexed to corresponding HARQ's UL grant/MAC PDU.

[12] A mapping between LCHs and UL HARQ processes is needed for the UE should be able to route certain traffic (e.g. requiring high reliability) to HARQ processes for which HARQ UL retransmission is enabled, and other traffic (e.g. requiring high throughput) using the HARQ processes for which HARQ UL retransmission is disabled. Additionally, all or a subset of MAC CEs could be mapped to UL HARQ processes for which HARQ UL retransmission is enabled. The mapping for LCHs and/or MAC CEs could be decided by the network, preconfigured by RRC signalling, and considered during the logical channel prioritization (LCP) procedure in the UE.

[20] A new LCP restriction could map a LCH to a set of one or more HARQ processes configured with the desired UL retransmission state. the state of each HARQ process would be semi-statically indicated, and the UE may multiplex only LCH with the right/similar QoS requirement (e.g. not requiring HARQ retransmission or requiring HARQ transmissions) within a grant.

**Other possible LCP strategies** [14]

In [14] an alternative method is proposed where different HARQ processes can be assigned with different priorities levels (e.g., high-medium-low), and this priority level can be used for UE to select the grant for certain LCHs. When selecting UL grant, UE can only select the UL grant whose HARQ process priority level is the same as that configured for the LCHs for transmission of the LCHs, therefore the mapping between LCHs and UL grant is restrictively guaranteed. To reduce complexity and/or scheduling restrictions in NW implementation for some NTN scenarios, this may be optionally configurable.

*Rapporteur’s summary:*

If proposal 4 is acceptable, RAN2 to discuss definition of new LCP restriction including the UE behaviour upon reception of UL grant assigned to HARQ process(es) not configured with an UL HARQ retransmission state.

**Proposal 5: RAN2 to discuss details of new LCP restriction, e.g. if LCP restriction maps LCH to HARQ process ID or UL HARQ retransmission state, and if LCP restriction is optionally configurable (i.e. it may not apply UL grant assigned to HARQ process(es) not configured with an UL HARQ retransmission state).**

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| **Contribution** | **Relevant proposal(s) – New mapping rule** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P7:** The new LCP restriction is configured via RRC for each LCH.**P8:** RAN2 considers the following options of new LCP restriction:* Option (a)：For a UL grant for new transmission using a HARQ process enabling/disabling HARQ retransmission, allowing data from all LCHs to be mapped to the grant according to an adjusted priority.
* Option (b)：For a UL grant for new transmission using a HARQ process enabling/disabling HARQ retransmission, only allowing data from partial LCHs to be mapped to the grant.
 | OPPO |
| [5] [R2-2107450](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107450.zip) | **P1:** Introduce a new LCP restriction for the mapping of LCH to HARQ transmission schemes. Do not reuse the allowedPHY-PriorityIndex which was introduced for other purposes in IIOT feature.**P2:** An LCP restriction that indicates the applicable HARQ retransmission scheme per LCH (i.e. disabled HARQ retransmission or enabled HARQ retransmission) is introduced.**P3:** An indication of the HARQ retransmission scheme used for an UL grant is included in DCI, and the UE only multiplexes the data of the LCH(s) with the matching HARQ retransmission scheme into this UL grant. | vivo |
| [10] [R2-2107986](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107986.zip) | **P4:** RAN2 agree to adopt introducing new LCP restriction to map LCH to one or more HARQ process(es). | Xiaomi |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P4:** RAN2 to decide signalling from NW to UE, to support LCP mapping restriction between LCH and HARQ process with two candidate options.* Option 1, NW indicates each HARQ’s retransmission scheme and indicates each LCH’s preferred retransmission scheme to UE.
* Option 2, NW indicates each LCH's association with one or multiple HARQ processes to UE.
 | Nokia, Nokia Shanghai Bell |
| [12] [R2-2108318](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108318.zip) | **P2:** If HARQ uplink retransmission is disabled per HARQ process, LCP restrictions are introduced on the UE for mapping: 1) Data from specific LCHs, and 2) MAC CEs, to those uplink HARQ processes for which uplink retransmission is enabled or disabled. | MediaTek |
| [20] [R2-2108661](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108661.zip) | **P8:** If a new LCP restriction is agreed, LCP restriction will map an LCH to one or more UL HARQ retransmission state(s); i.e. upon reception of an UL grant, UE will determine UL HARQ retransmission state of the associated HARQ process and only multiplex data from LCHs mapped to that UL HARQ retransmission state. | InterDigital |

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| **Contribution** | **Relevant proposal(s) – Reuse of *allowedPHY-PriorityIndex*** | **Company** |
| [3] [R2-2107361](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107361.zip) | **P2:** The parameter "allowedPHY-PriorityIndex" is configured per logic channel to clarify the different requirement of reliability.**P3-1:** If allowedPHY-PriorityIndex is set to the value of p0, the data of this LCH shall be mapped to the HARQ process with feedback.**P3-2:** If allowedPHY-PriorityIndex is set to the value of p1, the data of this LCH shall be mapped to the HARQ process without feedback.**P4:** If allowedPHY-PriorityIndex is not present, the MAC SDU of this LCH could be mapped to the any type of HARQ process.**P6:** Mapping between HARQ process ID and HARQ process type is configured via RRC message. | Spreadtrum |
| [14] [R2-2108351](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108351.zip) | **P2:** Discuss LCP enhancements based on following alternatives:* Alt1: reuse allowedPHY-PriorityIndex (i.e., no enhancements);
* Alt2: Group HARQ process with different priority

**P3:** It is optional for NW to configure additional LCP restriction if agreed in NTN. | ZTE, Sanechips |

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| **Contribution** | **Relevant proposal(s) – other methods** | **Company** |
| [14] [R2-2108351](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108351.zip) | **P2:** Discuss LCP enhancements based on following alternatives:* Alt1: reuse allowedPHY-PriorityIndex (i.e., no enhancements);
* Alt2: Group HARQ process with different priority

**P3:** It is optional for NW to configure additional LCP restriction if agreed in NTN. | ZTE, Sanechips |

## LCP restriction and MAC CE

In email discussion [AT114-e][103][NTN] Other MAC aspects it was asked: *if a new LCP resctirion is introduced in NTN, should it also apply to MAC CEs*? In the discussion outcome company feedback was split, with 8 agreeing, 8 disagreeing, and 5 companies remaining neutral. The following is a summary of company views provided via contribution to RAN2#115e.

**Do not support** [3, 10, 15]

The main morivation for having LCP restrictions for MAC CE is to ensure reliability with various scheduling strategies (i.e. UL HARQ retransmission enabled/disabled). However, [3] notes that difference in reliability happens in IIOT scheduling, in which the BLER of uplink grants are different. In this case MAC CE is not specified in the LCP procedure for the uplink grants of different BLER, and unreliability of could be made up by blind retransmission [3, 10].

[15] mentions that LCP modifications have been discussed in numerous work items and no LCP restrictions have been agreed. The reasons are 1) it is better to send them quickly rather than having restrictions that may delay them, 2) in normal operation HARQ do not fail (if it fails often, the gNB is doing something wrong) 3) complexity. It is also argued that in the IIoT WI it was even decided that the priority of MAC CEs is lower than that of LCH data when comparing priority of overlapping grants [15], that there are existing mechanisms to help (e.g. the retxBSR-Timer and the periodicBSR-Timer) [15], and even if a MAC CE is lost the consequence is not serious [10].

**Support** [12]

[12] Notes that enabling HARQ is essential for the MAC CEs. If a transport block carrying a MAC CE(s) is lost, there will be no alternative fast retransmission mechanisms possible for the MAC CE such as RLC AM retransmissions. Possible issues include RLF, improper scheduling, misalignement between the UE and network, and delay fo recovery actions. Companies are encouraged to refer to [12] for a detailed description of potential impacts to loss of C-RNTI, BSR, PHR, Configured Grant Confirmation, and BFR MAC CEs.

*Rapporteur’s summary:*

Considering split opinion in RAN2#114e and that it has not been concluded a new LCP restriction is needed in NTN, Rapporteur suggests that whether LCP resctriction applies to MAC CE be postponed until further progress on the need and details of LCP in NTN.

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [3] [R2-2107361](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107361.zip) | **P1:** Extra modification to LCP is not needed for MAC CE. | Spreadtrum |
| [10] [R2-2107986](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107986.zip) | **P5:** LCP restriction is not applied to MAC CE. | Xiaomi |
| [12] [R2-2108318](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108318.zip) | **P2:** If HARQ uplink retransmission is disabled per HARQ process, LCP restrictions are introduced on the UE for mapping: 1) Data from specific LCHs, and 2) MAC CEs, to those uplink HARQ processes for which uplink retransmission is enabled or disabled. | MediaTek |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P12:** No new LCP restrictions for MAC CEs are introduced in NTNs. | Ericsson |

# DRX timers

## Drx-HARQ-RTT-TimerUL

### Timer not started vs. set to zero

In RAN2#113e it was agreed that in NTN, the *drx-HARQ-RTT-TimerUL* is configured per UE DRX group and the behaviour can be configured per HARQ process. In RAN2#114e, the following agreement was made capturing possible supported behaviours:

*The following options are supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer set to zero and/or 3) Timer disabled (i.e. not started). FFS if this is based on explicit configuration or not. We can also come back to see whether both 2 and 3 are needed.*

Nearly all companies contributing to this topic [1, 10, 11, 14, 15, 17, 20]propose to support only two behaviours. This section presents a summary of company views regarding support of setting the *drx-HARQ-RTT-TimerUL* to zero vs. not starting the timer.

**Timer not started** [1, 4, 11, 14, 15, 20]

Proponenents of not starting the *drx-HARQ-RTT-TimerUL* mention that the UE has no need to monitor the PDCCH for retransmissions since it will never come, causing unnecessary power consumption [11, 20]. Though noted in [1] that to support the *drx-RetransmissionTimerUL* a moderate spec change is needed to receive blind retransmissions, this may not be necessary as the UE can rely on other timers such as the *drx-InactivityTimer* or *drx-onDurationTimer* [15]. Additional arguments are that not starting the timer is aligned with behaviour for *drx-HARQ-RTT-TimerDL* [4, 11], and that considering *drx-HARQ-RTT-TimerUL* value in current specs is configured per *DRX-Config*, to avoid too many spec impact it is proposed to reuse the same principle here that only one value for *drx-HARQ-RTT-TimerUL* is configured [14].

**Timer set to zero** [3, 10, 17]

In addition to less specification impact [3] the key motivation for setting the *drx-HARQ-RTT-TimerUL* is to facilitate reception of blind retransmission grant. According to [10], reliance on the DRX inactivity timer to receive blind retransmission grants may not be suitable, noting that retransmission scheduling will not restart the DRX inactivity timer and will thus will limit the number of scheduled retransmissions, especially when time diversity is applied in retransmission scheduling or when radio is overloaded. Furthermore, if the inactivity timer length is no less than DRX retransmission timer (it is possibly the case) there is no gain in not setting the timer to 0.

[17] mentions that reliability may not be ensured because the reliability relies on one-shot transmission (i.e. due to reduced ability to schedule a retransmission). The requirement of the NTN service may therefore not be satisfied according to the LS in R2-2104622, which provides the requirement of packet error rate in NTN is 10-6.

*Rapporteur’s summary:*

Nearly all companies contributing to this topic propose that only two *drx-HARQ-RTT-TimerUL* behaviours are supported (and all support offset to timer length as one option). Rapporteur suggests that behaviour be downscoped between options 2) Timer set to zero and 3) Timer disabled (i.e. not started). Considering twice as many companies support option 3, the following is proposed:

**Proposal 6:** **The following behaviours are supported for *drx-HARQ-RTT-TimerUL* in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer disabled (i.e. not started).**

In case this is not agreeable, it is suggested that further discussion focus on the suitablility of the *drx-InactivityTimer* vs. the *drx-RetransmissionTimerUL* for reception of blind retransmission grant.

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| **Contribution** | **Relevant proposal(s) – timer not started** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P5:** drx-HARQ-RTT-TimerUL is not started for an UL HARQ process whose retransmission scheme is not based on the previous PUSCH decoding result. | OPPO |
| [4] [R2-2107449](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107449.zip) | **P5:** For a HARQ process associated with a TB with UL HARQ retransmission disabled, drx-HARQ-RTT-TimerUL of this HARQ process is not started.  | vivo |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P7:** In NTN, the following two drx-HARQ-RTT-TimerUL behaviours can be configured: * 1) For the HARQ with HARQ retransmissions based on UL decoding result, the length of drx-HARQ-RTT-TimerUL should be increased by offset with the RTT value from UE to gNB.
* 2) For the scheduling with no HARQ retransmission and blind retransmission, drx-HARQ-RTT-TimerUL should not be started.
 | Nokia, Nokia Shanghai Bell |
| [14] [R2-2108351](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108351.zip) | **P4:** Only two behaviors is needed to be configured per HARQ process:* 1) Timer length is extended by offset;
* 2) Timer disabled (i.e. not started).
 | ZTE, Sanechips |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P8:** In NTNs, per HARQ process ID two new options are supported for drx-HARQ-RTT-TimerUL 1) extend by an offset 2) disabled (timer not started). | Ericsson |
| [20] [R2-2108661](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108661.zip) | **P7:** For HARQ processes where UL HARQ retransmission is “disabled” drx-HARQ-RTT-TimerUL is not started | InterDigital |

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| **Contribution** | **Relevant proposal(s) – timer set to zero** | **Company** |
| [3] [R2-2107361](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107361.zip) | **P7:** The drx-HARQ-RTT-TimerUL shall be configured to zero for retransmission disable HARQ process. | Spreadtrum |
| [10] [R2-2107986](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107986.zip) | **P1:** drx-HARQ-RTT-TimerUL behaviour only supports two options: 1) Timer length is extended by offset; 2) Timer set to zero. | Xiaomi |
| [17] [R2-2108608](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108608.zip) | **P4:** Only two options should be supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process* Option 1. Timer length is extended by offset.
* Option 2. Timer set to zero
 | LG |

### Confirmation of drx-HARQ-RTT-TimerUL offset working assumption

In RAN2#114e following working assumption was captured:

*RAN2 working assumption: Offset for drx-HARQ-RTT-TimerUL is equal to UE-gNB RTT (if RAN1 decides something that requires to change this we can revisit it). drx-RetransmissionTimerDL timer length is not extended in NTN*

Three companies [1, 11, 21] include that the offset value should be equal to the UE-gNB RTT value. As described in [21], RAN1 has concluded that UE can obtain and estimate of the UE-gNB RTT by the sum of the UE’s TA and Kmac. RAN1 has further agreed to use this value to offset the ra-ResponseWindow and the msgB-ResponseWindow, i.e. from RAN1#105e:

*The starts of ra-ResponseWindow and msgB-ResponseWindow are delayed by an estimate of UE-gNB RTT.*

* *The estimate of UE-gNB RTT is equal to the sum of UE’s TA and K\_mac.*

Based on this RAN1 agreement, it is proposed [21] that the above RAN2 working assumption be confirmed.

*Rapporteur’s summary:*

It appears RAN1 has concluded the UE can estimate the UE-gNB RTT with sufficient accuracy to offset timing relationships (e.g. the start of the ra-ResponseWindow). Rapporteur therefore suggests RAN2 can confirm the working assumption that the offset to *drx-HARQ-RTT-TimerUL* length is equal to UE-gNB RTT.

**Proposal 7:** **Confirm the RAN2 working assumption that offset to *drx-HARQ-RTT-TimerUL* length is equal to UE-gNB RTT.**

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P3:** For an UL HARQ process whose retransmission scheme is based on the previous PUSCH decoding result, drx-HARQ-RTT-TimerUL length is extended by an offset that is equal to UE-gNB RTT. | OPPO |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P7:** In NTN, the following two drx-HARQ-RTT-TimerUL behaviours can be configured: * 1) For the HARQ with HARQ retransmissions based on UL decoding result, the length of drx-HARQ-RTT-TimerUL should be increased by offset with the RTT value from UE to gNB.
* 2) For the scheduling with no HARQ retransmission and blind retransmission, drx-HARQ-RTT-TimerUL should not be started.
 | Nokia, Nokia Shanghai Bell |
| [21] [R2-2108662](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108662.zip) | **P4:** Confirm the RAN2 working assumption that the offset to drx-HARQ-RTT-TimerUL length equal to UE estimate of UE-gNB RTT (i.e. the sum of UE’s TA and Kmac). | InterDigital |

### Configuration of drx-HARQ-RTT-TimerUL behaviour

In RAN2#114e there was an FFS whether configuration of the *drx-HARQ-RTT-TimerUL* behaviour is performed explicitly or not:

*The following options are supported for drx-HARQ-RTT-TimerUL in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer set to zero and/or 3) Timer disabled (i.e. not started). FFS if this is based on explicit configuration or not. We can also come back to see whether both 2 and 3 are needed.*

The following presents a summary of proposals addressing this FFS.

**Explicit configuration** [15, 17]

[15] and [17] proposes explicit signalling is added to configure per HARQ process behaviour. [15] additionally proposes that when this new signal is not present, legacy behaviour for drx-HARQ-RTT-TimerUL apply, whereas [17] proposes that network should explicitly configure the drx-HARQ-RTT-TimerUL in a semi-static manner, i.e., RRC signalling.

**Implicit configuration** [10, 20]

[10] and [20] propose that the *drx-HARQ-RTT-TimerUL* can be implicitly deduced from the configuration of HARQ retransmission scheme, e.g. enabled/disabled, As the configuration of HARQ retransmission scheme is anyway needed for many cases, e.g. LCP, there is no need to have redundant configuration of DRX behaviour.

[20] additionally adds that whether the network may additionally choose to override the baseline timer behaviour for an individual HARQ process and configure a custom behaviour may be further considered once the baseline set of agreements are confirmed.

*Rapporteur’s summary:*

Company opinion appears to be split as to whether an implicit or explicit configuration of *drx-HARQ-RTT-TimerUL* behaviour is necessary. Rapporteur suggests that decision be postponed for now until further progress supported behaviours for the *drx-HARQ-RTT-TimerUL*, and indication/configuration of UL HARQ retransmissions scheme.

However, if proposal 2 is agreeable Rapporteur would like to clarify *drx-HARQ-RTT-TimerUL* behaviour when a UL HARQ retransmission state has not been configured. The following is proposed as a baseline for discussion in RAN2 based on P9 from [15]:

**Proposal 8:** **For HARQ process(es) not configured with an UL HARQ retransmission state, *drx-HARQ-RTT-TimerUL* (unless explicitly configured with** **a different behaviour) and *drx-RetransmissionTimerUL* behave as per legacy (i.e. as per configuration in *DRX-config*).**

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| **Contribution** | **Relevant proposal(s) – explicit configuration** | **Company** |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P9:** Signalling is added to configure per HARQ process behaviour. When this new signal is not present, legacy behaviour for drx-HARQ-RTT-TimerUL apply. | Ericsson |
| [17] [R2-2108608](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108608.zip) | **P5:** The network should explicitly configure the drx-HARQ-RTT-TimerUL in a semi-static manner, i.e., RRC signalling. | LG |

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| **Contribution** | **Relevant proposal(s) - implicit configuration** | **Company** |
| [10] [R2-2107986](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107986.zip) | **P2:** drx-HARQ-RTT-TimerUL behaviour is implicitly indicated by the configuration of HARQ retransmission scheme, e.g. enabled/disabled. | Xiaomi |
| [20] [R2-2108661](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108661.zip) | **P5:** UE determines the behaviour of drx-HARQ-RTT-TimerUL per HARQ process based on configured UL HARQ retransmission state. | InterDigital |

## Drx-HARQ-RTT-TimerDL

**Confirmation of working assumption on *drx-HARQ-RTT-TimerDL* offset** [1, 21]

In RAN2#113-e meeting the following agreement was made for *drx-HARQ-RTT-TimerDL*:

1. 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).

Both [1] and [21] propose to confirm this working assumption, with [1] stating that the UE-gNB offset was already agreed in RAN2#112-e meeting, and [21] noting that RAN1 response LS has confirmed that UE-gNB RTT can be estimated by UE as the sum of UE’s TA and Kmac value.

**Other proposals** [15]

To support proposals in [15], it is argued that the *drx-HARQ-RTT-TimerUL* or *drx-HARQ-RTT-TimerDL* are there to control the DRX state and not for limiting reception of grants or assignments. Thus, if the UE is in DRX Active Time, the running of *drx-HARQ-RTT-TimerUL* or *drx-HARQ-RTT-TimerDL* do not limit what type of grant or assignment the UE can receive. As well, it is noted that in legacy it is possible to not configure DRX at all, t (UE will have to monitor the PDCCH continuously while in connected mode), and that it is possible to configure the HARQ RTT timer and retransmission timer for UL respectively DL or both UL and DL to zero, these possibilities shall remain in NTNs to allow full network flexibility in configuring the DRX.

*Rapporteur’s summary:*

Regarding the confirmation of offset value for *drx-HARQ-RTT-TimerDL*, as in the UL case it appears RAN1 has concluded the UE can estimate the UE-gNB RTT with sufficient accuracy to offset timing relationships (e.g. the start of the ra-ResponseWindow). Rapporteur therefore suggests RAN2 can confirm the working assumption that the offset to *drx-HARQ-RTT-TimerDL* length is equal to UE-gNB RTT.

**Proposal 9:** **Confirm the RAN2 working assumption that for HARQ processes with DL HARQ feedback enabled, the *drx-HARQ-RTT-TimerDL* length is increased by an offset equal to UE-gNB RTT.**

Addressing the proposals in [15], P1 seems to re-iterate existing specification and does not need to be explicitly agreed. Furthermore, this proposal is complimentary to an existing agreement from RAN2#113e, specifically:

*RAN2 confirms that in NTN if the UE is in DRX Active Time for any reason, the UE should monitor the PDCCH regardless of whether drx-HARQ-RTT-TimerUL or drx-HARQ-RTT-TimerDL is running or not. No specification change is needed.*

As mentioned in [15], P4 may be achieved based on how the offset is captured in specification (e.g. by a flag that tells the UE to not add the offset to the timer). It is suggested that this proposal be left to stage 3 discussion.

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P9:** 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). Working assumption on that offset is equal to UE-gNB RTT is confirmed as RAN2 agreement. | OPPO |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P1:** The current RAN2 specification does not need to be updated to enable sending DL assignments, with NDI toggled or not toggled, for a HARQ process having drx-HARQ-RTT-TimerDL running.**P4:** In NTNs, the offset value zero is available when drx-HARQ-RTT-TimerDL is extended by an offset. | Ericsson |
| [21] [R2-2108662](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108662.zip) | **P3:** Confirm the RAN2 working assumption that for HARQ processes with DL HARQ feedback enabled, the drx-HARQ-RTT-TimerDL length is increased by an offset equal to UE estimate of UE-gNB RTT (i.e. the sum of UE’s TA and Kmac). | InterDigital |

## Drx-RetransmissionTimerDL

*Rapporteur’s summary:*

Proposals primarily focus on start of the *drx-RetransmissionTimerDL* when the DL HARQ feedback is disabled (i.e. the *drx-HARQ-RTT-TimerDL* is not started). Rapporteur notes that support for additional start conditions was part of [AT114e][103][NTN] Other MAC Aspects, where only 5/22 companies supported additional start conditions. Considering only two companies have proposals which express support, there does not seem sufficient support at this time to re-propose this issue.

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [4] [R2-2107449](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107449.zip) | **P6:** For a HARQ process associated with a TB disabling DL HARQ feedback, the UE starts the drx-RetransmissionTimerDL for this HARQ process, after a time offset from the end of the corresponding PDSCH reception (in case DL bundling is not configured).**P7:** For a HARQ process associated with a TB disabling DL HARQ feedback, the UE starts the drx-RetransmissionTimerDL for this HARQ process, after a time offset from the end of the last reception within a bundle of the corresponding PDSCH receptions (in case DL bundling is configured).**P8:** The time offset is configured by the NW. RAN2 to further discuss whether to implement this time offset via 1) a timer maintained by the UE or 2) an offset value directly used by the UE to figure out the starting time. | vivo |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P5:** For a DL HARQ process with HARQ feedback disabled, reusing drx-RetransmissionTimerDL would be beneficial to allow for blind retransmissions.  | Nokia, Nokia Shanghai Bell |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P3:** For HARQ processes with enabled or disabled HARQ feedback, there is no need to change the start of drx-RetransmissionTimerDL.**P5:** In NTNs, the value zero is available for drx-RetransmissionTimerDL. | Ericsson |

## Drx-RetransmissionTimerUL

*Rapporteur’s summary:*

Considering behaviour of the drx-RetransmissionTimerUL is heavily dependant on outcome of discussion on *drx-HARQ-RTT-TimerUL* (i.e. whether to support not starting timer or setting to zero, and whether DRX inactivity timer is sufficient) Rapporteur suggests this discussion is postponed until further progress on *drx-HARQ-RTT-TimerUL.*

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [1] [R2-2107076](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107076.zip) | **P4:** For an UL HARQ process whose retransmission scheme is not based on the previous PUSCH decoding result (i.e., HARQ with blind retransmissions and no retransmission), UE starts drx-RetransmissionTimerUL for the corresponding HARQ process after PUSCH transmission. | OPPO |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P6:** drx-RetransmissionTimerUL timer length is not extended in NTN.**P7:** In NTNs, the value zero is available for drx-RetransmissionTimerUL.**P11:** There is no need to change the start of drx-RetransmissionTimerUL in NTNs. | Ericsson |

# Other Proposals

## BSR over 2-step RACH

### General aspects

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [2] [R2-2107315](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107315.zip) | **P2:** RAN2 confirms that BSR over 2-step RACH is supported in NTN.**P3:** In NTN, the restrictions of using BSR over 2-step RACH may be considered for reducing the collision probability and usage frequency of 2-step RACH resource | CATT |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P8:** LCH-based 2-step RACH selection should be supported. BSR over 2-step RACH should be selected for LCH with time-critical service.**P9:** BSR over 2-step RACH can be supported in both CFRA and CBRA.**P10:** BSR directly triggered 2-step RACH should be supported.**P11:** 2-step RACH can be selectively triggered for an BSR for LCH with valid PUCCH SR resources. | Nokia, Nokia Shanghai Bell |
| [17] [R2-2108608](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108608.zip) | **P1:** Do not introduce a new triggering condition of 2-step RACH for BSR transmission. | LG |

### Selection of 2-step RACH vs. configured grant for BSR

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [2] [R2-2107315](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107315.zip) | **P4:** After the BSR is triggered, if the configured uplink grants and 2-step RACH resources are both available for the UE, RAN2 can discuss the feasibility of the following two options for UE to decide which resources the UE may choose:* Option 1: The UE may be expected to select the configured grants to send the BSR since using the 2-step RACH resource to send BSR may introduce the collision of 2-step RACH resources.
* Option 2: Introduce a new timer to control when to use the configured grant and when to use the 2-step RACH resource.
 | CATT |
| [8] [R2-2107790](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107790.zip) | **P1:** Network can signal time interval value through system information message that helps UE to determine whether to send BSR transmission via 2 step RACH or CG resources.**P2:** UE selects 2-step RACH and CG resources depending on the time interval between the time to trigger BSR and the next available CG resources;* UE send BSR transmission via 2 step RACH, if CG resources are not arrived within time interval.
* UE sends BSR transmission via CG, if CG resources are arrived within time interval.
 | Panasonic |
| [9] [R2-2107909](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107909.zip) | **P1:** To determine the UL resource for BSR (CG or 2-step RA), the arrival time of the next available CG and 2-step RA resource should be considered. E.g. UE may choose the resource in CG and 2-step RA for BSR with earlier arrival time.**P2:** A time offset configured by network can be applied when UE choose the resource in CG and 2-step RA for BSR.**P3:** To determine the UL resource for BSR (CG or 2-step RA), whether UE can use 2-step RA should be considered (whether UE is configured with 2-step CFRA resource or whether UE fulfills RSRP > msgA-RSRP-Threshold). | Lenovo, Motorola Mobility |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P12:** RSRP threshold configured for 2-step and 4-step RA type selection should be used for BSR triggered 2-step RACH selection.**P13:** If multiple BSR reporting resources are configured, the selection of the resource could be depending on the QoS requirement of the LCH that triggers the BSR. For LCH with delay-tolerant service, the UE selects the configured PUCCH SR resource. For LCH with time sensitive service, the UE selects the resource results in shortest estimated scheduling delay. | Nokia, Nokia Shanghai Bell |
| [17] [R2-2108608](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108608.zip) | **P2:** The configured grant should be prioritized over the RACH for BSR transmission if configured grant occurs within a certain time from a BSR trigger. | LG |

## DRX

### Triggers to enter DRX Active time

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P18:** For DRX in NTN, in the case that a UE sends an SR, the UE enters Active time to monitor for a response after an offset time has elapsed.**P20:** In the case that a UE sends msg3 as response to a RAR message during CFRA, the UE enters Active time when an offset time has elapsed.**P22:** Allow the UE to enter DRX when HARQ stalling occurs.**P23:** The UE shall wake up after RTT ms regardless of DRX state to minimize the delay introduced by DRX and HARQ stalling. | Ericsson |

### Other

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [11] [R2-2108115](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108115.zip) | **P6:** RAN2 to decide which DRX timer should be used to support HARQ process with feedback disabled after RAN1 has conclusion on the solutions on link performance enhancement via repetition.  | Nokia, Nokia Shanghai Bell |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P19:** When UL and DL are aligned in the gNB, the UE shall start monitoring the PDCCH in the downlink symbol that has the same symbol number, slot number and system frame number as the first uplink symbol after the end of the Scheduling Request transmission.**P21:** When UL and DL are aligned in the gNB and the UE sends msg3 as response to a RAR message during CFRA, the UE can be configured to start monitoring the PDCCH in the downlink symbol that has the same symbol number, slot number and system frame number as the first uplink symbol after the end of the PUSCH transmission. | Ericsson |

## Configured grant

### CGT

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [13] [R2-2108319](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108319.zip) | **P1:** UE specific pre-compensation offset for round trip delay (RTD) is applied to CGT, i.e. the configured CGT value is extended by UE-specific RTD. | MediaTek |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P25:** Extend configuredGrantTimer to cover the RTT in GEO also when periodicity is short. | Ericsson |
| [23] [R2-2108768](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108768.zip) | **P3:** In CG, UE should not start the CGT when the associated HARQ Process ID is indicated to HARQ Retransmission Disabled even if CGT is configured in IE ConfiguredGrantConfig. | ITL |

### Configured grant - other

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P24:** The ConfiguredGrantConfiguration shall allow for up to 32 number of HARQ processes, and up to 31 in harq-ProcID-Offset and harq-ProcID-Offset2. | Ericsson |
| [16] [R2-2108544](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108544.zip) | **P4:** RAN2 need to consider enabling/disabling the HARQ feedback of UL CG configurations via RRC signaling in case of NR-U scenario. | CMCC |
| [23] [R2-2108768](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108768.zip) | **P1:** We kindly ask RAN2 to discuss HARQ Retransmission Enabling/Disabling for CG aspects**P2:** In CG, Granularity of HARQ Retransmission Enabling/Disabling is per HARQ Process. | ITL |

### LCP restriction and configured grant

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [3] [R2-2107361](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107361.zip) | **P5:** Apply the new LCP restriction for configured grant. | Spreadtrum |
| [10] [R2-2107986](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107986.zip) | **P3:** A unified LCP restriction solution should be applied for both dynamic grant and configured grant. | Xiaomi |

## Timers

### Drx-HARQ-RTT-TimerUL – miscellaneous

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| **Contribution** | **Relevant proposal(s)**  | **Company** |
| [14] [R2-2108351](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108351.zip) | **P5:** Only one value is configured for drx-HARQ-RTT-TimerUL per DRX-Config with value “0” is also possible options as in legacy. | ZTE, Sanechips |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P2:** The current RAN2 specification does not need to be updated to enable sending UL grants, with NDI toggled or not toggled, for a HARQ process having drx-HARQ-RTT-TimerUL running**P10:** In NTNs, the offset value zero is available when drx-HARQ-RTT-TimerUL is extended by an offset. | Ericsson |

### Other timers

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P17:** The values added to sr-ProhibitTimer in NTN shall include values lower than the round-trip time. | Ericsson |
| [21] [R2-2108662](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108662.zip) | **P1:** The offset applied to the start of the ra-ContentionResolutionTimer is equal to the sum of UE’s TA and Kmac (i.e. UE estimate of UE-gNB RTT). | InterDigital |

## Repetition-based HARQ retransmission

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| **Contribution** | **Relevant proposal(s)**  | **Company** |
| [4] [R2-2107449](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107449.zip) | **P2:** The classification of disabling/enabling UL HARQ retransmission has no impact on the repetitions in a bundle, which can be performed in the legacy R15/16 way in either case. Different HARQ schemes in Proposal 1 involve only retransmission UL grants dynamically scheduled, other than those repetitions that follow previous transmissions in the same bundle.  | vivo |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P14:** Repetition transmission based HARQ retransmission is always allowed and is explicitly indicated via DCI, or semi-statically with RRC signalling (for dynamic scheduling, CG and SPS) (as in legacy). Note, this revises the previous agreement. | Ericsson |

## SPS

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P26:** HARQ feedback shall always be sent for SPS deactivation.**P27:** The SPS-Config shall allow for up to 32 number of HARQ processes, and up to 31 in harq-ProcID-Offset | Ericsson |
| [16] [R2-2108544](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108544.zip) | **P3:** RAN2 need to consider enabling / disabling the HARQ feedback of SPS configurations via RRC signaling.**P5:** RAN2 need to consider the conflict between RRC configuration of enabling / disabling of HARQ feedback and SPS/configured grant configurations via RRC signaling | CMCC |

## TA reporting

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [19] [R2-2108611](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108611.zip) | **P1:** Support TA report in MSG5, FFS in MSG3/MSGA. **P2:** The content of TA report is NTA, UE-specific.**P3:** The priority of TA report MAC CE should be lower than the LBT failure MAC CE and higher than the the MAC CE for SL-BSR. | Huawei, HiSilicon |

## UL scheduling enhancements

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [15] [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) | **P15:** Add an in-flight BSR to report the amount of RLC AM data that is waiting for an RLC status report.**P16:** Add an indication from the gNB to the UE that it shall send a BSR or an in-flight BSR or both. | Ericsson |

## Miscellaneous

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [7] [R2-2107632](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107632.zip) | **P1:** RAN2 to consider UE latency and power consideration for network to decide if HARQ feedback needs to be enabled or disabled. **P2:** For effective HARQ feedback disablement RAN2 to consider signaling through UE Capability or UE Assistance Information indications | Apple |
| [16] [R2-2108544](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108544.zip) | **P1:** UE should have knowledge of RLC PDU corresponding radio bearer (LCH)'s HARQ mode, (via gNB configuration or derived per QoS performance and UE’s HARQ buffer capacity) to determine whether two RLC PDUs can be multiplex into one MAC PDU or not.**P2:** it is proposed to enable the MAC be aware of which RLC PDUs are segmented from one RLC SDU or not and scheduled in HARQ process in same HARQ feedback mode | CMCC |
| [21] [R2-2108662](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108662.zip) | **P2:** The ra-ResponseWindow and msgB-ResponseWindow are not extended in NTN. | InterDigital |

# Conclusion

In this contribution the following observation and proposals were made based on contributions submitted to RAN2#115e AI 8.10.2.2:

## Likely agreeable

**Proposal 7:** **Confirm the RAN2 working assumption that offset to *drx-HARQ-RTT-TimerUL* length is equal to UE-gNB RTT.**

**Proposal 9:** **Confirm the RAN2 working assumption that for HARQ processes with DL HARQ feedback enabled, the *drx-HARQ-RTT-TimerDL* length is increased by an offset equal to UE-gNB RTT.**

## Needs discussion

**Proposal 1:** **A HARQ process can be optionally configured as having UL HARQ retransmission state “enabled” or “disabled”. Configuration is semi-static and signalled via RRC. The decision and criteria to enable/disable UL HARQ retransmission for a HARQ process is under network control.**

**Proposal 2:** **If a HARQ process is not configured with an UL HARQ retransmission state, the network may schedule according to any scheme (i.e. as in legacy).**

**Proposal 3:** **RAN2 to discuss definition of “enabled” and “disabled” UL HARQ retransmission state (i.e. supported network scheduling strateg(ies) and corresponding UE behaviour).**

**Proposal 4:** **A new LCP restriction is introduced in NTN.**

**Proposal 5: RAN2 to discuss details of new LCP restriction, e.g. if LCP restriction maps LCH to HARQ process ID or UL HARQ retransmission state, and if LCP restriction is optionally configurable (i.e. it may not apply UL grant assigned to HARQ process(es) not configured with an UL HARQ retransmission state).**

**Proposal 6:** **The following behaviours are supported for *drx-HARQ-RTT-TimerUL* in NTN per HARQ process: 1) Timer length is extended by offset; 2) Timer disabled (i.e. not started).**

**Proposal 8:** **For HARQ process(es) not configured with an UL HARQ retransmission state, *drx-HARQ-RTT-TimerUL* (unless explicitly configured with** **a different behaviour) and *drx-RetransmissionTimerUL* behave as per legacy (i.e. as per configuration in *DRX-config*).**

# References

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2. [R2-2107315](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107315.zip) Discussion on HARQ Aspects and UL Scheduling Enhancement in NTN – CATT
3. [R2-2107361](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107361.zip) Discussion on HARQ and LCP remaining issues – Spreadtrum Communications
4. [R2-2107449](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107449.zip) Impact on DRX timers with UL/DL HARQ enhancement in NTN – vivo
5. [R2-2107450](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107450.zip) Impact on LCP with disabled UL HARQ retransmission in NTN – vivo
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10. [R2-2107986](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2107986.zip) Consideration on HARQ aspects – Beijing Xiaomi Mobile Software
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15. [R2-2108452](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_115-e/Docs/R2-2108452.zip) On DRX, LCP, HARQ, SR/BSR, and configured scheduling – Ericsson
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