3GPP RAN WG2 Meeting #114e R2-210xxxx

eMeeting May 19th – May 27th, 2021

Agenda Item: 8.10.2.2

Source: InterDigital (summary rapporteur)

Title: [Pre114-e][103][NTN] Summary 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)

The further guidance is provided by session chair regarding summary scope:

*This can cover all aspects in 8.10.2.2. But the focus should be on UL HARQ issues (RTT timers, LCP restrictions, etc), as it's not clear how much time we will have to discuss other enhancements in this meeting.*

This contribution therefore concentrates on aspects regarding UL HARQ Retransmission and LCP aspects, including: *drx-HARQ-RTT-TimerUL* and *drx-RetransmissionTimerUL*, indication of scheduling strategy, and the possible introduction and details of a new LCP restriction. Other proposals are grouped in Section 4 for reference.

# UL HARQ Retransmission

From RAN2 perspective it has been agreed that the NW can continuously schedule the UE using one or a combination of scheduling strategies to avoid HARQ stalling in NTN UE:

* HARQ with retransmissions based on the previous PUSCH decoding result
* HARQ with (blind) retransmissions not based on the previous PUSCH decoding result
* HARQ with no retransmission

The following section describes how NW may indicate to UE which strategy is applied, and how to configure/apply appropriate DRX UL timer values to support each possible strategy.

## drx-HARQ-RTT-TimerUL

In RAN2#112e it was agreed that for dynamic grant, HARQ uplink retransmission may be “disabled” by gNB sending grant with NDI not toggled/toggled without waiting for decoding result of previous PUSCH transmission. However, handling of RTT timers (specifically *drx-HARQ-RTT-TimerUL*) is listed as FFS. In RAN2#113bis-e, it was agreed:

*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.*

*RAN2 confirms that in NTN using the value= “zero” for drx-HARQ-RTT-TimerUL and drx-RetransmissionTimerUL is possible. No specification change is needed.*

*In NTN, The drx-HARQ-RTT-TimerUL is configured per UE DRX group and the behaviour can be configured per HARQ process. FFS the different behaviours and how to indicate the behaviour to the UE and the number of behaviours (e.g., two or more behaviours).*

The following section summarized contributions addressing open aspects of the drx-HARQ-RTT-TimerUL.

### Possible configured values

**Extension of timer by offset:** [1] [3] [8] [18] [21]

Supporting contributions note that for a HARQ scheduling strategy with retransmission based on the decoding result of previous PUSCH transmission, currently defined values of *drx-HARQ-RTT-TimerUL* are insufficient to accomodate the greatly increased propagation delay in NTN. This could lead to premature timer expiry and unnecessary monitoring of PDCCH if the UE was not required to be in drx Active time for other purposes. The timer length should therefore be offset (as in DL case).

**Timer not started:** [3] [4] [8] [20]

For a HARQ scheduling strategy with retransmission disabled, supporting companies note that if a retransmission grant is not expected then there is no reason to monitor PDCCH. If the timer is disabled/not started *drx-RetransmissionTimerUL* will not start, so unnecessary monitoring is minimized, and behaviour is aligned with DL. [8] and [20] also mention this is applicable for HARQ with blind retransmissions, with [20] further noting if the UE receives a grant for new transmission, it will (re)start *drx-InactivityTimer* and there is plenty of opportunities to send blind retransmission grants if wanted.

**Timer set to zero:** [18] [20] [21]

For a HARQ scheduling strategy where a grant is sent before full RTT (i.e. not relying on PUSCH result), it is noted in [18] that offsetting drx-HARQ-RTT-TimerUL proportional to RTT could limit ability to receive grant as soon as possible (i.e. UE must be in drx Active time for other reasons to receive grant). To guarantee UE is monitoring PDCCH at the soonest possible opportunity after initial PUSCH transmission, *drx-HARQ-RTT-TimerUL* could to be set to zero. [20] notes that a 0 value is possible in legacy and should remain so in NTN.

*Rapporteur summary:*

From rapporteur perspective configuring different behaviours of *drx-HARQ-RTT-TimerUL* per HARQ process could ensure the UE is monitoring PDCCH at the optimal time for each of the various NW scheduling strategies. Based on this there seem to be valid technical reasons to support each of the proposed timer configurations, so it is suggested that all values be possible configurations.

**Proposal 1:** **The following configurations 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 3) Timer disabled (i.e. not started).**

Considering RAN1 response LS regarding details on UE-gNB RTT is pending, it is proposed to align language with agreement for drx-HARQ-RTT-TimerDL and have a RAN2 working assumption that the offset to UL RTT timer be offset via UE-gNB RTT.

**Proposal 2:** **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 as in DL).**

**Proposal 3: RAN2 to discuss whether value of drx-HARQ-RTT-TimerUL is connected to UL HARQ retransmission scheme (e.g. as in DL for HARQ feedback enabled/disabled).**

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| **Contribution** | **Relevant proposal(s) – extension of Timer** | **Company** |
| [1] [R2-2104813](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104813.zip) | **P2:** For an UL HARQ process whose scheduling strategy for UL HARQ retransmission is based on the previous PUSCH decoding result, drx-HARQ-RTT-TimerUL length is increased by a UE-gNB RTT.  | OPPO |
| [3] [R2-2104851](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104851.zip) | **P1**: For UE with pre-compensation capability, the drx-HARQ-RTT-TimerUL length is increased by UE-specific RTT (UE-gNB delay) when HARQ uplink retransmission is enable. | CATT |
| [8] [R2-2105413](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105413.zip) | **P4:** In NTN, the following two drx-HARQ-RTT-TimerUL behaviours can be configured: * 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.
 | Nokia, Nokia Shanghai Bell |
| [18] [R2-2106444](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106444.zip) | **P1:** In NTN, the following possible values for drx-HARQ-RTT-TimerUL timer can be configured: 1) existing values within value range are increased by offset; or 2) timer is set to zero.**P3:** 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). | InterDigital, MediaTek, Samsung, ZTE |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.zip) | **P7:** The drx-HARQ-RTT-TimerUL length should be increased by offset when the UE transmits the MAC PDU containing at least one MAC SDU associated with a logical channel requiring the UL HARQ retransmission.  | LG |

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| **Contribution** | **Relevant proposal(s) – Timer not started** | **Company** |
| [3] [R2-2104851](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104851.zip) | **P2:** If the HARQ UL retransmission is disabled, the drx-HARQ-RTT-TimerUL should not be started for NTN. | CATT |
| [4] [R2-2104967](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104967.zip) | **P4:** The UE does not start the drx-HARQ-RTT-TimerUL for a UL HARQ process if the functionality of UL HARQ retransmission for the UL HARQ process is disabled. | Asia Pacific telecom, FGI |
| [8] [R2-2105413](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105413.zip) | **P4:** In NTN, the following two drx-HARQ-RTT-TimerUL behaviours can be configured: * For the scheduling with no HARQ retransmission and blind retransmission, drx-HARQ-RTT-TimerUL should not be started.
 | Nokia, Nokia Shanghai Bell |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P7:** Two different behaviours for drx-HARQ-RTT-TimerUL can be configured per HARQ process with RRC signalling.**P8:** For UL HARQ processes that the gNB intends to reuse for new transmissions before a full UL HARQ RTT have elapsed, the drx-HARQ-RTT-TimerUL is not started.  | Ericsson |

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| **Contribution** | **Relevant proposal(s) – Timer to zero** | **Company** |
| [18] [R2-2106444](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106444.zip) | **P1:** In NTN, the following possible values for drx-HARQ-RTT-TimerUL timer can be configured: 1) existing values within value range are increased by offset; or 2) timer is set to zero.  | InterDigital, MediaTek, Samsung, ZTE |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P3:** In NTNs, it shall be possible to configure the value zero for drx-HARQ-RTT-TimerDL and drx-HARQ-RTT-TimerUL. | Ericsson |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.zip) | **P5:** The UE considers drx-HARQ-RTT-TimerUL as ‘0’ when the UE transmits the MAC PDU only containing the MAC SDUs from a logical channel not requiring the UL HARQ retransmission. | LG |

### Selection between values

In [18] it is noted that configuring different behaviours of *drx-HARQ-RTT-TimerUL* per HARQ process could ensure the UE is monitoring PDCCH at the optimal time for each of the various NW scheduling strategies (i.e. to take increased RTT into account, or to facilitate immediate reception). Considering what strategy the NW uses to avoid HARQ stalling in NTN is up to NW implementation, what behaviour the UE applies to timers for each HARQ process shall also be up to network implementation.

[19] describes activation of a specific behavior can be based on the combination of one or more of (i) the HARQ enabling/disabling indicator (e.g., in a DCI) (ii) the time of the DCI assignment, and (iii) a separate implicit or explicit behavior indicator in the DCI carrying the UL assignment.

*Rapporteur Summary:*

The following proposal seems like a starting point to progress discussion. Detailed activation signalling may be further discussed at a later date.

**Proposal 4:** **Which drx-HARQ-RTT-TimerUL value is applied for each HARQ process is up to network implementation (e.g. to support NW scheduling strategy to avoid HARQ stalling).**

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| **Contribution** | **Relevant proposal(s) – selection between configured values** | **Company** |
| [18] [R2-2106444](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106444.zip) | **P2:** Which drx-HARQ-RTT-TimerUL value is applied for each HARQ process is up to network implementation (e.g. to support NW scheduling strategy to avoid HARQ stalling).  | InterDigital, MediaTek, Samsung, ZTE |
| [19] [R2-2106068](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106068.zip) | **P6:** We suggest that RAN2 consider dynamic selection of the UE behavior for drx-HARQ-RTT-TimerUL from the set of RRC-configured UE behaviors based on DCI-based HARQ enabling/disabling. | Samsung |

## Drx-RetransmissionTimerUL

In legacy systems *drx-RetransmissionTimerUL* starts upon expiry of *drx-HARQ-RTT-TimerUL* and UE enters drx Active time to monitor for retransmission grant. Considering different possible behaviours of *drx-HARQ-RTT-TimerUL* in NTN, the following contributions discuss potential impacts to *drx-RetransmissionTimerUL*.

In [1], for UL HARQ process where gNB sends grant not based on PUSCH decoding result, UE should be monitoring directly after PUSCH transmission for future grant. UE should therefore start *drx-RetransmissionTimerUL* directly after PUSCH transmission. This is also proposed in [4], however only for the blind retransmission case. In this contribution the HARQ RTT Timer is not started, so this would be a new starting condition.

In [3], if UL HARQ RTT Timer is disabled, to support blind retransmission, a new start condition is introduced based on when a MAC PDU is transmitted in a configured uplink grant or the PDCCH indicates a UL transmission when a DRX group is in Active Time.

In [20], for HARQ processes not intended to be retransmitted based on the UL decoding result, there is no need to modify *drx-RetransmissionTimerUL* (i.e. start time or extension).

*Rapporteur Summary:*

Considering *drx-RetransmissionTimerUL* behaviour is related to *drx-HARQ-RTT-TimerUL*, rapporteur suggests that RAN2 first progress on RTT Timer aspects before addressing possible impacts to Retransmission Timer.

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [1] [R2-2104813](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104813.zip) | **P3:** For an UL HARQ process whose scheduling strategy for UL HARQ retransmission is not based on the previous PUSCH decoding result, UE starts drx-RetransmissionTimerUL for the corresponding HARQ process after PUSCH transmission. | OPPO |
| [3] [R2-2104851](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104851.zip) | **P4:** A modified trigger condition of drx-RetransmissionTimerUL(DL) only works for NTN scenario: when HARQ feedback is disabled (assuming drx-HARQ-RTT-TimerUL/drx-HARQ-RTT-TimerDL aren’t started) and the blind retransmission is configured.**P5:** The modified trigger condition of drx-RetransmissionTimerUL can be a MAC PDU is transmitted in a configured uplink grant or the PDCCH indicates a UL transmission when a DRX group is in Active Time.**P7:** The start of the drx-RetransmissionTimerUL(DL) can be offset by UE-specific RTD (UE-gNB delay) in LEO/GEO adding the value of drx-HARQ-RTT-TimerUL(DL) only when HARQ feedback is disabled and the blind retransmission is configured.  | CATT |
| [4] [R2-2104967](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104967.zip) | **P6:** If the functionality of UL HARQ retransmission for the HARQ process is enabled and the UL blind retransmission is enabled, the UE should start the drx-RetransmissionTimerUL after the end of the PUSCH transmission but not start the drx-HARQ-RTT-TimerUL. | Asia Pacific telecom, FGI |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P9**: For HARQ processes not intended to be retransmitted based on the UL decoding result, there is no need to change the start of drx-RetransmissionTimerUL.**P10:** There is no need to extend the drx-RetransmissionTimerUL. | Ericsson |

## Indication of HARQ retransmission scheme

Depending on which scheduling strategy is employed to avoid HARQ stalling state, UE may expect a retransmission grant after UE-gNB RTT, before UE-gNB RTT, or not at all. This may impact DRX timers or LCP, which is discussed further in Section 3.

**Indication by RRC** [1] [2] [4] [5] [7] [15] [19]**:**

Contributions which support semi-static indication via RRC note that if UE receives a grant with NDI toggled, it cannot tell whether the gNB wants to perform scheduling with UL retransmission disabled or the gNB just wants a new transmission. UE will need to know the different scheduling strategies of each HARQ process, for example, for LCP restriction to map LCH to HARQ process or to properly configure HARQ RTT timer. It is also mentioned that semi-static indication per HARQ process is already agreed for enabling/disabling DL HARQ feedback.

**Indication via DCI** [19]

In [19] it is suggested that a DCI-based dynamic enabling/disabling of HARQ feedback could be used in addition to semi-static RRC signaling-based. This would utilize radio resources more efficiently and to adapt to the prevailing radio environment and QoS requirements. It is proposed to send an LS to RAN1 regarding re-purposing DCI PDCCH bits for this purpose.

**No indication** [20]:

In [20] it is noted that when the UE receives a new transmission grant/assignment (that is, NDI is toggled), then previous TB cannot be retransmitted by HARQ. Previous TB may have been successfully received or not, and time elapsed since last time a grant/assignment for the same HARQ process was received with toggled NDI may be shorter or longer than the HARQ RTT. Semi-static indication may limit network scheduling flexibility, and in NTN, as in legacy, the UE shall always do what received grants and assignments indicate.

*Rapporteur Summary*:

A majority of companies support semi-static indication of NW scheduling strategy per HARQ process via RRC signaling. However, the same discussion has continued for several meetings now with no agreement, and companies seem to maintain their positions.

Rapporteur therefore proposes a compromise that HARQ retransmission scheme may be determined implicitely by UL HARQ RTT Timer behaviour. Since the configured value of this timer is meant to optimize UE PDCCH monitoring for a particular strategy, this would provide a likely indication of which retransmission scheme is employed per HARQ process. The additional benefit is that an implicit indication does not restrict network to a specific scheduling strategy as retransmission grant can be sent any time the UE is in DRX Active time.

**Proposal 5:** **RAN2 to discuss whether indication of HARQ retransmission scheme is: 1) via semi-static RRC configuration; 2) determined implicitly, e.g. via current HARQ RTT Timer behaviour; 3) via DCI; or 4) not needed.**

Regardless of whether indication is configured via RRC or implictly determined, the majority of companies seem to support that an indication of HARQ retransmission scheme (if agreed) should be per HARQ process.

**Proposal 6:** **If RAN2 agrees to indication of HARQ retransmission scheme, granularity of indication is per HARQ process**

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| **Contribution** | **Relevant proposal(s) – Indication by RRC** | **Company** |
| [1] [R2-2104813](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104813.zip) | **P1:**The scheduling strategy of each UL HARQ process, i.e., whether gNB sends UL grant for retransmission based on decoding result of previous PUSCH transmission, is configured by RRC in a semi-static manner. | OPPO |
| [2] [R2-2104850](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104850.zip) | **P:** The network is able to enable/disable HARQ feedback on UL. FFS: Whether enabling/disabling HARQ feedback on UL should be signalled to the UE | Thales |
| [4] [R2-2104967](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104967.zip) | **P3:** The functionality of UL HARQ retransmission for a UL HARQ process can be enabled/disabled by a RRC configuration.  | Asia Pacific Telecom, FGI |
| [5] [R2-2105119](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105119.zip) | **P2:** The UL HARQ retransmission is performed per HARQ process in a semi-static manner using RRC.  | Apple |
| [7] [R2-2105250](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105250.zip) | **P1:** Enabling/disabling HARQ uplink retransmission per HARQ process is configured by the network and signalled to the UE using RRC signalling.  | MediaTek |
| [15] [R2-2105612](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105612.zip) | **P2:** The gNB disables the UL HARQ retransmission per HARQ process via RRC in a semi-static manner.  | Huawei, HiSilicon |

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| **Contribution** | **Relevant proposal(s) – indication via DCI** | **Company** |
| [19] [R2-2106068](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106068.zip) | **P5a:** We suggest that RAN2 consider DCI-based dynamic enabling/disabling of HARQ feedback in addition to semi-static RRC signaling-based enabling/disabling of HARQ feedback to utilize radio resources more efficiently and to adapt to the prevailing radio environment and QoS requirements. **P5b:** We suggest that RAN2 send an LS to RAN1 to explore the feasibility of repurposing PDCCH DCI bits. | Samsung |

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| **Contribution** | **Relevant proposal(s) – No Indication** | **Company** |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P14:** RAN2 will not further study “disabling uplink HARQ retransmissions” by indication to the UE. | Ericsson |

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| **Contribution** | **Relevant proposal(s) - Other** | **Company** |
| [5] [R2-2105119](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105119.zip) | **P1:** RAN2 to consider UE Assistance Information from UE to network in order for network to decide if HARQ needs to be enabled or disabled.  | Apple |

# LCP

The following was agreed in RAN2#113bise:

*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 the whether additional LCP restrictions are necessary and if introduced how the existing procedure can be modified.

## Introduction of new LCP restriction

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

### CG-specific LCP restriction in NTN

[17] and [21] suggest that for configured grant, the current LCP restrictions are sufficient to support enabled/disabled UL retransmission. If allowedCG-List is configured to a logical channel, MAC SDUs from the logical channel can only be mapped to the indicated configured grant configuration, so the network can control the allowed CG type and CG to be used for transmission of certain LCHs. Since the configuration of CG and HARQ process ID is also controlled by NW, current LCP is sufficient to guarantee the mapping between LCHs and HARQ process ID for CG case.

*Rapporteur Summary:*

From rapporteur perspective, discussion on disabling UL retransmission and various scheduling strategies to avoid HARQ stalling has focused primarily on dynamic grant i.e. referring to agreement from RAN2#112e:

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

Past discussion has also focused on whether *allowedPHY-PriorityIndex* is sufficient (i.e. a dynamic-grant specific parameter). To reduce scope of discussion, it is suggested to attempt conclusion that at least no additional LCP restrictions *specific to configured grant* are needed.

Note: if a new LCP restriction is agreed for dynamic grant, the following proposal does not preclude future discussion on whether it may also apply to configured grant.

**Proposal 7:** **No new CG-specific LCP restriction is introduced for NTN.**

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| **Contribution** | **Relevant proposal(s) – New restriction not introduced** | **Company** |
| [17] [R2-2105836](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105836.zip) | **P2:** No new LCP restriction is needed for configured grant in NTN. | ZTE |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P12:** The logical channel prioritization is not updated for NTNs. | Ericsson |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.zip) | **P3:** The legacy LCP procedure is reused for enabling/disabling UL HARQ retransmission.  | LG |

### LCP restrictions for dynamic grant

As previously mentioned NW can continuously schedule the UE using one or a combination of scheduling strategies to avoid HARQ stalling in NTN UE. As described in [1] and [10], 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. As described in [17] and [20], 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 follow [17]:

* ***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.

The following is a summary of views provided in contributions regarding introduction of a new LCP restriction for UL HARQ process in NTN.

**Support for new restriction** [1] [3] [7] [8] [10] [15] [19]**:**

Supporting companies argue that uplink traffic is generally differentiated by mapping QoS flows to logical channels (LCHs). The UE should be able to route certain traffic (e.g. requiring high reliability) using the 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.

Unless a mapping between LCHs and UL HARQ processes is introduced, at the time of initial transmission of PUSCH, UE will have no idea whether network intends to disable HARQ retransmission or not. UE therefore risks multiplexing data from a logical channel that is unsuitable for the UL retransmission scheme (i.e. HARQ enabled/disabled). In case of HARQ transmission loss, RLC retransmission mechanism to recover the data could be too costly in terms of latency impact, UE power consumption and network resources (if RLC retransmission is even configured).

Regarding re-use of *allowedPHY-PriorityIndex*, several companies mention that re-purposing this field from IIoT may not be a good way forward. They note that this may: limit possible adoption of IIoT for NTN in a future release [1], may impact future standardization work in IoT over NTN [1], affect intra-UE prioritization (which would have to be evaluated by RAN1) [8] [15], and cannot cover the configured grant case [15].

It is also noted by [7] that HARQ is essential for MAC CEs. As described by [8], there is no LCP limitation on the MAC CE transmission in IIoT priority index feature (i.e., the MAC CE can be transmitted in both the grant with P0 and the grant with P1). The MAC CE which requires high reliability (e.g. Configured Grant Confirmation for the CG deactivation/activation) maybe transmitted in grant without retransmission instead of other retransmission schemes with retransmissions for high reliability. As a counter, it is noted in [13] that lack of reliability can be overcome by blind retransmission.

**Not introduced** [20] [21] ([13] for at least MAC CE case):

Companies not in favour of introducing further LCP restrictions note that are already several mechanisms to ensure transmission reliability (e.g. BSR MAC CE have retxBSR-Timer, RRC messages can have RLC retransmissions).

Considering gNB is aware of the decoded data and failed decoding, it can adapt the scheduling and/or link adaptation and/or the gNB estimation algorithm for UE buffer status. For example, the gNB can estimate the UE buffer content from BSRs, SRs, and previously decoded TBs so can schedule accordingly. Furthermore, link adaptation in NTNs will most likely aim at a lower block error rate (i.e. possibly 1% BLER) because the pathloss differences are smaller over a cell and the long RTT has severe drawbacks as retransmissions are delayed for long.

Splitting HARQ processes into groups based on if retransmissions are enabled or disabled will require new management algorithms, and if there are available resources in the gNB at the end of a data burst, the gNB may not be able to schedule a retransmission because the HARQ process was configured with ”disable uplink HARQ retransmissions” leading to added delay at the burst end.

Legacy parameters (e.g. *allowedPHY-PriorityIndex*) allow reserving a certain type of grant for some LCHs and to control the QoS of each LCH. As described in [21], if *allowedPHY-PriorityIndex* is configured for a logical channel and the dynamic grant has a priority index, e.g., high or low, the MAC SDUs from the logical channel is only mapped to the dynamic grant indicating the priority index equal to the values.

Note: A detailed description of why new LCP restrictions are unnecessary is provided in [20]. Companies are encouraged to review this contribution for additional details and considerations.

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| **Contribution** | **Relevant proposal(s) – Support new restriction** | **Company** |
| [1] [R2-2104813](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104813.zip) | **P4:** New LCP restriction is introduced for the mapping between LCH and HARQ process.  | OPPO |
| [3] [R2-2104851](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104851.zip) | **P3:** The mapping restrictions that HARQ UL retransmission is disabled or enabled should be introduced in NTN for LCP. | CATT |
| [7] [R2-2105250](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105250.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 |
| [8] [R2-2105413](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105413.zip) | **P1:** 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. **P2:** New LCP restriction should be defined for NTN.  | Nokia, Nokia Shanghai Bell |
| [10] [R2-2105431](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105431.zip) | **P1:** A new LCP restriction is defined for an UL HARQ process.  | Qualcomm, Xiaomi, Huawei, HiSilicon, Samsung |
| [15] [R2-2105612](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105612.zip) | **P1:** Introduce a new LCP restriction for HARQ differentiation.  | Huawei, HiSilicon |
| [19] [R2-2106068](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106068.zip) | **P4:** Allowed HARQ process list is introduced as an LCP restriction for NTN.  | Samsung |

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| **Contribution** | **Relevant proposal(s) – New restriction not introduced** | **Company** |
| [13] [R2-2105528](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105528.zip) | **P1:** Extra modification to LCP is not needed for MAC CE. | Spreadtrum |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P12:** The logical channel prioritization is not updated for NTNs. | Ericsson |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.zip) | **P3:** The legacy LCP procedure is reused for enabling/disabling UL HARQ retransmission.  | LG |

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| **Contribution** | **Relevant proposal(s) – To discuss further** | **Company** |
| [5] [R2-2105119](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105119.zip) | **P5:** RAN2 to discuss additional restrictions to LCP for NR NTN. | Apple |
| [17] [R2-2105836](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105836.zip) | **P1:** The key issue for the LCP discussion is whether the LCP restriction can provide sufficient accurate mapping between LCHs and UL grant in NTN. **P3:** To evaluate the requirement on LCP restriction in NTN, the table below can be considered as a starting point. (Refer to contribution for Table).**P5:** Discuss whether the restriction is acceptable that the “The LCH with normal requirement on latency and reliability” (i.e. LCH aim to use normal HARQ retransmission) can not use the UL grant with blind retransmission, in which case some resource may be wasted. If yes, then no optimization is needed; otherwise, some optimization is needed. | ZTE |

## Details of enhancements to LCP

In [13], it is proposed that In NTN, two mapping relationships shall be indicated to UE. The first performs mapping between LCH and HARQ process type (configured for every LCH via RRC) to indicate whether LCH could be transmitted via HARQ process with or without feedback. The second performs mapping between HARQ process ID and HARQ process type, with mapping indicated via RRC message.

In [19], it is proposed an “allowed HARQ process list” provides suitable mapping between an LCH and one or more HARQ processes.

In [21] it is noted that network should indicate whether to allow UL retransmission per logical channel

In [8] enabled HARQ UL retransmission is further differentiated into retransmission based on PUSCH decoding, or blind retransmission. If two kinds of services are multiplexed into one MAC PDU, one service (e.g,LCH1) requires the blind retransmission while the other service(e.g ,LCH2) requires decoding-result based HARQ retransmission, the gNB should adopt the blind retransmission to meet the QoS of LCH1. LCH2 is not necessary to use this retransmission scheme, which cause the waste of system resources for blind retransmission. It is proposed LCH with different QoS requirement can be mapped to HARQ processes with corresponding retransmission scheme. To let UE know different retrnamission schemes and LCHs preferred retrnamission scheme, NW indicates each LCH's association with one or multiple HARQ processes to UE.

This differentiation is also discussed in [17], where a possible mapping strategy is provided to acommodate different service types via possible UL retransmission strategies. It is noted given there are 3 possible retransmission schemes which may each support a different type of services (refer to section 3.1 or [17]), the 1 bit available by re-purposing the *allowedPHY-PriorityIndex* is possible but may not provide an optimal/expected mapping. Possible alternatives include extending *allowedPHY-PriorityIndex* to 2 bits, or grouping HARQ processes with different priority together to decide which LCHs can be mapped to UL grant linked to HARQ process. To reduce complexity in NW implementation for some NTN scenarios, this may be optionally configurable.

*Rapporteur summary:*

Based on contribution, there seems to be a large majority of companies which support introducing an additional LCP restriction in NTN for at least dynamic grant case. However, rapporteur notes that this may imply a HARQ process is configured with a specific scheduling strategy, and UE has knowledge of this (e.g.P4/P5) which is not yet agreed. To progress discussion, the following options are captured for further discussion/evaluation:

**Proposal 8:** **Discuss the following options for LCP in NTN:**

1. ***allowedPHY-PriorityIndex* is re-used;**
2. ***allowedPHY-PriorityIndex* is re-used and extended;**
3. **A new LCP restriction is introduced to map LCH to one or more HARQ process(es). HARQ processes can be classified as having retransmission “enabled” or “disabled”;**
4. **A new LCP restriction is introduced to map LCH to one or more HARQ process(es). HARQ processes can be classified as having retransmission “enabled based on PUSCH decoding result”, “enabled based on blind retransmission” or “disabled”.**
5. **A new LCP restriction is introduced to map LCH to one or more HARQ process(es) . And NW can still configure UE with one or more transmission schemes for each HARQ process based on it's implementation.**

**Proposal 9: RAN2 to discuss if new LCP restriction also applies to MAC CEs.**

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [1] [R2-2104813](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104813.zip) | **P5:** The new LCP restriction is configured via RRC for each LCH.  | OPPO |
| [8] [R2-2105413](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105413.zip) | **P3:** 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 NW 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 |
| [13] [R2-2105528](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105528.zip) | **P2:** A new parameter ‘AllowedHARQtype = ENUMERATED {HARQ with feedback, HARQ without feedback}’ is configured to every LCH. **P3:** Mapping between HARQ process ID and HARQ process type is configured via RRC message. | Spreadtrum |
| [17] [R2-2105836](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105836.zip) | **P4:** In NTN, the LCP restriction shall be able to: * Ensure one LCH can only be mapped to UL grant with blind retransmission (i.e. will not be mapped to the UL grant with HARQ transmission, and UL grant without any HARQ retransmission)
* Ensure one LCH will not be mapped to the UL grant without any HARQ retransmission

**P6:** If optimization is confirmed as needed, discuss LCP enhancements based on following alternatives:* Alt1: Extend the bit-length of allowedPHY-PrioirtyIndex;
* Alt2: Group HARQ process with different priority

**P7:** It is optional for NW to configure additional LCP restriction if agreed in NTN.  | ZTE |
| [19] [R2-2106068](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106068.zip) | **P4.** Allowed HARQ process list is introduced as an LCP restriction for NTN. | Samsung |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.zip) | **P4:** The network should indicate whether to allow the UL HARQ retransmission per logical channel.  | LG |

# Other Proposals

## UL scheduling enhancements

### BSR over 2-step RACH

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [3] [R2-2104851](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104851.zip) | **P8:** RAN2 confirms that BSR over 2-step RACH is supported in NTN. **P9:** 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 |
| [9] [R2-2105414](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105414.zip) | **P1:** LCH-based 2-step RACH selection should be supported. BSR over 2-step RACH should be selected for LCH with time-critical service.**P2:** BSR over 2-step RACH can be supported in both CFRA and CBRA. **P3:** BSR directly triggered 2-step RACH should be supported. **P4:** 2-step RACH can be selectively triggered for an BSR for LCH with valid PUCCH SR resources. **P5:** RSRP threshold configured for 2-step and 4-step RA type selection should be used for BSR triggered 2-step RACH. **P6:** 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. **P7:** How UE select BSR resource which result in shortest estimated scheduling delay should consider both the resource occasion and cell’s RTT.**P8:** Triggering BSR over 2-step RACH procedure in parallel with SR-BSR procedure can be further studied.  | Nokia, Nokia Shanghai Bell |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.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** |
| [3] [R2-2104851](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104851.zip) | **P10:** 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 |
| [12] [R2-2105498](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105498.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 |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.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 |

### Other Proposals

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [5] [R2-2105119](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105119.zip) | **P4:** RAN2 to consider supplementary proactive grant requests from UE to network to reduce UL latency for NR NTN. | Apple |
| [19] [R2-2106068](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106068.zip) | **P3a:** We suggest that RAN2 consider mechanisms that reduce the delay without increasing the radio resource consumption associated with PRACH or Configured Scheduling. A combined Scheduling Request and simplified BSR can be conveyed by the UE to the gNB using enhanced PUCCHs (e.g., more PUCCH sequences to represent), repurposed PUCCHs, and simplified or compact BSRs.**P3b:** We suggest that RAN2 send an LS to RAN1 to explore the feasibility of enhancing or repurposing PUCCHs so that significant amount of radio resources can be saved while reducing the UL scheduling delay. | Samsung |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P18:** Add an in-flight BSR to report the amount of RLC AM data that is waiting for an RLC status report.**P19:** Add an indication from the gNB to the UE that it shall send a BSR or an in-flight BSR or both.  | Ericsson |

## Timers

### Drx-HARQ-RTT-TimerDL

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [1] [R2-2104813](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104813.zip) | **P6:** For HARQ processes with DL HARQ feedback enabled, drx-HARQ-RTT-TimerDL length is increased by UE-gNB RTT. | OPPO |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P1:** From a RAN2 perspective if the UE is in DRX Active Time, the UE can receive assignments for a given HARQ process with NDI toggled or not toggled while drx-HARQ-RTT-TimerDL is running for this HARQ process.**P3:** In NTNs, it shall be possible to configure the value zero for drx-HARQ-RTT-TimerDL and drx-HARQ-RTT-TimerUL. **P6:** The start of drx-HARQ-RTT-TimerDL shall be based on the DL timing.  | Ericsson |

### Drx-RetransmissionTimerDL

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [3] [R2-2104851](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104851.zip) | **P6:** The modified trigger condition of drx-RetransmissionTimerDL can be a MAC PDU is received in a configured downlink assignment or the PDCCH indicates a DL transmission when a DRX group is in Active Time. **P7:** The start of the drx-RetransmissionTimerUL(DL) can be offset by UE-specific RTD (UE-gNB delay) in LEO/GEO adding the value of drx-HARQ-RTT-TimerUL(DL) only when HARQ feedback is disabled and the blind retransmission is configured. | CATT |
| [4] [R2-2104967](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104967.zip) | **P2:** If the functionality of DL blind retransmission is enabled, the UE should start the drx-RetransmissionTimerDL after the end of the PDSCH reception, else if the functionality of DL blind retransmission is disabled, the UE should not start the drx-RetransmissionTimerDL.  | Asia Pacific Telecom, FGI |
| [11] [R2-2105490](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105490.zip) | **P1:** To minimize specification impact, UE would rely on drx-InactivityTimer to support blind retransmission when DL HARQ feedback is disabled and not start drx-RetrasnmissionTimerDL. | Pansonic |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P4:** For HARQ processes with disabled HARQ feedback, there is no need to change the start of drx-RetransmissionTimerDL.**P5:** There is no need to extend the drx-RetransmissionTimerDL. | Ericsson |

### Drx-HARQ-RTT-TimerUL

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P2:** From a RAN2 perspective if the UE is in DRX Active Time, the UE can receive grants for a given HARQ process with NDI toggled or not toggled while drx-HARQ-RTT-TimerUL is running for this HARQ process.**P11:** The start of drx-HARQ-RTT-TimerUL shall be based on the DL timing. | Ericsson |
| [21] [R2-2106201](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106201.zip) | **P6:** The UE handles drx-HARQ-RTT-TimerUL as in legacy when the UE transmits the MAC PDU containing at least one the MAC SDU from a logical channel requiring the UL HARQ retransmission. | LG |

### SR Prohibit TImer

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [14] [R2-2105529](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105529.zip) | **P1:** Extend SR-prohibitTimer by UE derived RTD.  | Spreadtrum |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P20**: The values added to sr-ProhibitTimer in NTN shall include values lower than the round-trip time.  | Ericsson |

### CGT/CGRT

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [6] [R2-2105249](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105249.zip) | **P:** UE specific pre-compensation offset for round trip delay (RTD) is applied to CGT and CGRT (if configured), i.e. the configured CGT/CGRT value is extended by UE-specific RTD.  | MediaTek |

### Contention Resolution Timer

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P13:** The start of ra-ContentionResolutionTimer shall be based on the DL timing.  | Ericsson |

## DRX

### Triggers to enter DRX Active time

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P21:** 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.**P23**: 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.**P25:** Allow the UE to enter DRX when HARQ stalling occurs. **P26:** 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** |
| [19] [R2-2106068](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106068.zip) | **P1a:** We suggest that RAN2 discuss the issue of unnecessary and continuous PDCCH monitoring during HARQ stalling as part of HARQ enhancements. **P1b:** We suggest that RAN2 consider a mechanism that reduces the wait time for the resource allocation when the UE is operating in the DRX mode but ready to resume data transfer. | Samsung |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P22:** 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. **P24**: 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 |

## TA Reporting

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [15] [R2-2105612](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105612.zip) | **P3:** UE specific TA pre-compensation is reported to gNB in MSG3/MSGA if allowed by the message size, otherwise reported in the uplink message following MSG3/MSGA.  | Huawei, HiSilicon |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P15:** The UE shall not report information about UE specific TA pre-compensation to the gNB. **P16**: The UE shall not report information about UE specific TA pre-compensation to the gNB. **P17**: If Proposal 16 is not agreed, then the UE reporting of information about UE specific TA pre-compensation shall be under network control.  | Ericsson |

## Configured grant

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [16] [R2-2105698](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105698.zip) | **P1:** RAN2 to discuss the reduction of signalling overhead for Configured Grant configurations as well as activation/deactivation for NTN. | Sony |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P27:** Configured grants can be configured with or without HARQ retransmissions in Rel-15.**P28**: 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 |
| [22] [R2-2106245](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106245.zip) | **P4:** RAN2 need to consider enabling/disabling the HARQ feedback of UL CG configurations via RRC signaling in case of NR-U scenario. **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 |

## SPS

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [20] [R2-2106089](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106089.zip) | **P29**: HARQ feedback shall always be sent for SPS deactivation.**P30**: The SPS-Config shall allow for up to 32 number of HARQ processes, and up to 31 in harq-ProcID-Offset.  | Ericsson |
| [22] [R2-2106245](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106245.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 |

## Miscellaneous

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| **Contribution** | **Relevant proposal(s)** | **Company** |
| [4] [R2-2104967](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2104967.zip) | **P1:** NW can send a DL blind retransmission indication to UE to enable/disable the functionality of DL blind retransmission for a HARQ process when the DL HARQ feedback of the HARQ process is disabled. **P5:** NW can send a UL blind retransmission indication to UE to enable/disable the functionality of UL blind retransmission for a HARQ process when the UL HARQ retransmission of the HARQ process is enabled. | Asia Pacific Telecom, FGI |
| [5] [R2-2105119](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2105119.zip) | **P3:** RAN2 to consider and expand on techniques identified for Small Data Enhancements for NR NTN. | Apple |
| [19] [R2-2106068](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106068.zip) | **P2:** We suggest that RAN2 consider introducing a “High Capacity- RNTI” to support a larger size RNTI and give the gNB flexibility to choose a regular 16-bit RNTI or an HC-RNTI with more bits. | Samsung |
| [22] [R2-2106245](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_114-e/Docs/R2-2106245.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 |

# Conclusion

In this contribution the following observation and proposals were made based on contributions submitted to RAN2#114e AI 8.10.2.2:

**Proposal 1:** **The following configurations 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 3) Timer disabled (i.e. not started).**

**Proposal 2:** **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 as in DL).**

**Proposal 3: RAN2 to discuss whether value of drx-HARQ-RTT-TimerUL is connected to UL HARQ retransmission scheme (e.g. as in DL for HARQ feedback enabled/disabled).**

**Proposal 4:** **Which drx-HARQ-RTT-TimerUL value is applied for each HARQ process is up to network implementation (e.g. to support NW scheduling strategy to avoid HARQ stalling).**

**Proposal 5:** **RAN2 to discuss whether indication of HARQ retransmission scheme is: 1) via semi-static RRC configuration; 2) determined implicitly, e.g. via current HARQ RTT Timer behaviour; 3) via DCI; or 4) not needed.**

**Proposal 6:** **If RAN2 agrees to indication of HARQ retransmission scheme, granularity of indication is per HARQ process**

**Proposal 7:** **No new CG-specific LCP restriction is introduced for NTN.**

**Proposal 8:** **Discuss the following options for LCP in NTN:**

1. ***allowedPHY-PriorityIndex* is re-used;**
2. ***allowedPHY-PriorityIndex* is re-used and extended;**
3. **A new LCP restriction is introduced to map LCH to one or more HARQ process(es). HARQ processes can be classified as having retransmission “enabled” or “disabled”;**
4. **A new LCP restriction is introduced to map LCH to one or more HARQ process(es). HARQ processes can be classified as having retransmission “enabled based on PUSCH decoding result”, “enabled based on blind retransmission” or “disabled”.**
5. **A new LCP restriction is introduced to map LCH to one or more HARQ process(es) . And NW can still configure UE with one or more transmission schemes for each HARQ process based on it's implementation.**

**Proposal 9: RAN2 to discuss if new LCP restriction also applies to MAC CEs.**

# References

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2. R2-2104850 About HARQ for NTN THALES
3. R2-2104851 Discussion on HARQ Aspects and UL Scheduling Enhancement in NTN CATT
4. R2-2104967 HARQ retransmission schemes in NTN Asia Pacific Telecom, FGI
5. R2-2105119 Other MAC aspects for NR NTN Apple
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8. R2-2105413 On LCP and DRX impact for NTN Nokia, Nokia Shanghai Bell
9. R2-2105414 Discussion on UL scheduling enhancements for NTN Nokia, Nokia Shanghai Bell
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13. R2-2105528 LCP enhancement for NTN Spreadtrum Communications
14. R2-2105529 Discussion on extending of SR-prohibitTimer Spreadtrum Communications
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16. R2-2105698 Other MAC enhancements in NTN Sony
17. R2-2105836 Considerations on LCP in NTN ZTE Corporation, Sanechips
18. R2-2106444 UL HARQ RTT timer in NTN InterDigital, MediaTek, Samsung, ZTE
19. R2-2106068 Remaining Issues on HARQ Stalling, RNTI Capacity, UL Scheduling, LCP, and UL HARQ Behaviors for an NTN Samsung Research America
20. R2-2106089 On DRX, LCP, timing, HARQ, SR/BSR, and CG and SPS Ericsson
21. R2-2106201 Discussion on other MAC aspects LG Electronics Inc.
22. R2-2106245 Left Issues for HARQ operation in NTN CMCC discussion