3GPP RAN WG2 Meeting #116bis-e R2-2201739

eMeeting January 17th – 25th, 2022

Agenda Item: 8.10.2.2

Source: InterDigital (summary rapporteur)

Title: Summary of [AT116bis-e][107][NTN] Other MAC aspects

Document for: Discussion, Decision

# Introduction

This document is a discussion paper to obtain company input to the following offline discussion:

* [AT116bis-e][107][NTN] Other MAC aspects (InterDigital)

Initial scope: Discuss remaining MAC open issues, focussing on DRX timers, CG/SPS and remaining HARQ state aspects

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

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

The following deadline for company feedback has been provided:

* Initial deadline (for companies' feedback): **Wednesday 2022-01-19 1300 UTC**
* Initial deadline (for rapporteur's summary in R2-2201739): Wednesday 2022-01-19 1500 UTC

Please also note the following chair guidance:

* Proposals marked "for agreement" in R2-2201739 not challenged until **Thursday 2022-01-20 0300** UTC will be declared as agreed via email by the session chair (for the rest the discussion might continue in the GTW session).

Topics within this document represent a subset of issues most addressed via contributions. If a company feels a critical issue has not been captured in this email discussion, they are encouraged to highlight the issue for subsequent discussion in Section 4.2.

# DRX Timers

## Drx-RetransmissionTimerUL

For dynamic grants, if a Serving cell is configured with *uplinkHARQ-DRX-LCP-Mode* and a HARQ process is configured with DRX-LCP Mode B, *drx-HARQ-RTT-TimerUL* is not started for the corresponding HARQ process. As a consequence, *drx-RetransmissionTimerUL* is also not started.

The following agreement regarding support of blind retransmission has been captured as FFS in RAN2#116e:

* *RAN2 to down-select between the following options to support blind retransmission for HARQ process(es) configured with HARQ state B: 1) Rely on UE being in DRX Active Time via other means (e.g. Inactivity Timer); or 2) Start drx-RetransmissionTimerUL at the end of PUSCH transmission;*

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

|  |  |  |
| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – New conditions for retransmission timer start** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P1:** For UL HARQ process with HARQ state B, UE starts drx-RetransmissionTimerUL for the corresponding HARQ process at the end of PUSCH transmission. | OPPO |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P1:** To support blind retransmission for HARQ process(es) configured with HARQ state B, drx-RetransmissionTimerUL is restarted at the end of PUSCH transmission. | Xiaomi |
| [9] [R2-2200787](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200787.zip) | **P3:** For the HARQ process configured with HARQ state B, drx-RetransmissionTimerUL is started to cover UL retransmission scheduling.  **P4:** For the HARQ process configured with HARQ state B, UE starts drx-RetransmissionTimerUL at the end of PUSCH transmission. | Vivo |
| [16] [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) | **P1:** The drx-RetranmissionTimerUL for HARQ process with HARQ state A is used for receiving the blind UL retransmission. | LG |

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| **Contribution** | **Relevant proposal(s) – No modification to retransmission timer start** | **Company** |
| [3] [R2-2200348](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200348.zip) | **P5a:** To support blind retransmission for UL HARQ process(es) configured with HARQ state B, it is gNB implementation to keep UE in active time through proper configuration of inactivity timer. | Huawei, HiSilicon |
| [5] [R2-2200618](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200618.zip) | **P2:** In HARQ State B (RTT-TimerUL-disabled), drx-RetransmissionTimerUL is not started for blind retransmissions. | Mediatek |
| [8] [R2-2200689](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200689.zip) | **P2:** Rely on UE being in DRX Active Time (e.g. Inactivity Timer) to support blind retransmission for UL HARQ process(es) configured with HARQ state B. | CATT |
| [13] [R2-2201008](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201008.zip) | **P1:** Rely on UE being in DRX Active Time via other means (e.g. inactivity Timer) to support UL blind retransmissions for HARQ process(es) configured with HARQ state B in Rel-17. | Nokia |
| [14] [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) | **P6:** drx-RetransmissionTimerUL is not started at the end of PUSCH transmission for HARQ process(es) configured with DRX-LCP mode B. | InterDigital |
| [15] [R2-2201325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201325.zip) | **P3:** No adaption on drx-RetransmissionTimerUL is needed. | ZTE |
| [18] [R2-2201629](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201629.zip) | **P15:** drx-RetransmissionTimerUL timer length is not extended in NTN.  **P16:** The start of drx-RetransmissionTimerUL is not changed in NTNs. | Ericsson |

**Start Retransmission Timer [1, 2, 9, 16]:**

Companies which support relying on the drx-RetransmissionTimerUL note that relying on Active time due to other HARQ process (e.g. drx-Inactivity Timer) is unreliable and inflexible [1, 9] and can lead to additional power consumption [1]. Furthermore, the drx-InactivityTimer is configured for a new transmission so the duration of drx-InactivityTimer is not properly configured for the blind UL retransmission [16], and retransmission scheduling will not restart the DRX inactivity timer so the number of blind retransmissions can be scheduled during inactivity timer will be limited [2].

**Rely on UE being in DRX Active time via other means [3, 5, 8, 13, 14, 15, 18]:**

Companies which prefer relying on the UE being in DRX Active Time via other means to support blind retransmission note that this minimizes specification impact [3, 13] and existing timers such as the Inactivity Timer are sufficient and allow plenty of opportunity for blind retransmission [3, 5, 13, 14, 15, 18]. Furthermore, using the retransmission timer would require the UE to know whether the network will use blind retransmission which adds complexity [5, 8]. Otherwise, starting the retransmission timer all the time would lead to additional power consumption when there is no blind retransmission [13, 15]

Rapporteur notes that this topic has been discussed for several meetings now without consensus on the need of the retransmission timer to support blind retransmission. Although there seems to be scenarios where there is benefit, based on majority and considering there is little time left in the release, it is suggested this topic not be furthered pursed in Rel-17 to minimize specification impact.

**Question 1:** **Do you agree that for HARQ process(es) configured with HARQ Mode B, blind retransmission relies on UE being in DRX Active Time via other means (i.e. *drx-RetransmissionTimerUL* is not started) in Rel-17?**

**If “Disagree” please provide technical justification why blind retransmission requires the *drx-RetransmissionTimerUL.***

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| **Company** | **Agree/Disagree** | **Additional comments** |
| Xiaomi | Disagree | The reason for not reusing inactivity timer is two folder:  First, it will require configuring a much longer inactivity timer, because per RAN1 agreement, a second DCI can only be received after the end of last PUSCH transmission. This limits the number of blind schedulings in a given time. To support more blind schedulings, much longer inactivity timer is required.  Second, inactivity timer is per DRX group, longer timer will impact all the HARQ operation, resulting in overall much larger power consumption. While DRX retran timer is per HARQ, it only impacts HARQ configured with HARQ mode B. |
| OPPO | Disagree | If relying on the Active Time due to other HARQ processes, opportunities of blind retransmission would not be guaranteed and thus not reliable.  If relying on the Active Time due to drx-InactivityTimer, drx-InactivityTimer needs to be configured longer, which limits NW implementation. This would also increase UE’s power consumption and not be flexible on configuration since the same drx-InactivityTimer is also used for those DL HARQ processes with HARQ feedback enabled and those UL HARQ processes configured with state A. |
| MediaTek | Agree |  |
| Ericsson | Agree | The HARQ mode B was introduced to avoid HARQ stalling, and its purpose is to reuse the HARQ process IDs before a full HARQ RTT has elapsed. In normal operation with HARQ mode B there can be no blind retransmissions as the HARQ process ID have been reused with new data transmissions.  There is absolutely no reason optimize for the rare case that 1) there are no more UL data and 2) the gNB have awaliable resources (no other UEs that require to be scheduled) and 3) the UEs drx-InactivityTimer has expired and no other drx timer keeps the UE listening to PDCCH.  There is also no reason to extend the InactivityTimer for supporting blind retransmissions. If retransmissions are really needed and inactivityTimer have expired, any of the other drx timers can be relied on and ther retransmissions may then be blind or based on the UL decoding result. |
| Intel | Agree | Existing timers such as the Inactivity Timer are sufficient. |
| Huawei, HiSilicon | Agree | Starting retransmission timer is not intended for blind retransmission reception even in legacy. For blind retransmission, the gNB is well aware of when UE is in active time via other timers, e.g. inactivity timer. So gNB implementation can guranteen that UE receive the blind retransmission without retransmission timer. |
| vivo | Disagree | Share the views of Xiaomi and OPPO.  Inactivity timer is used to cover the consecutive new transmission scheduling. One cannot ensure that the scheduling of such new transmission opportunieis can always coincide with retx transmission scheduling on every HARQ process, even for the blind retransmission. |
| LG | Disagree | As commented by Xiaomi, since the inactivity timer is configured per DRX group, the duration of inactivity timer is not configured only for the retrnamsission. However, retranmissionTimer is configured only for the retramission and the The network can properly configure the duration of the retranmissionTimer to receive the blind retransmission.  However, this issue has been discussed in a long time but it is not concluded. So, for compromise, we are ok to use the inactivity timer to receive the blind retramisssion. |
| ZTE | Agree | More like over enhancements, especially considering HARQ state B might also used for no retransmission thus the timer might be started in vain. Also rely on inactivityTimer is only one of the approach, if there are other DRX timer that can keep UE in ACTIVE time UE will still monitor PDCCH anyway. |
| Spreadtrum | Disagree | If Active Time is guaranteed by the timer of other HARQ processes, the blind retransmission would not be reliable. |
| Qualcomm | Agree |  |
| Samsung | Disagree | We agree with Xiaomi and OPPO. Short inactivity timer cannot be really used which brings more UE power consumption. |
| CATT | Agree | In the current DRX mechanism, the *drx-InactivityTimer* is started or restarted when the PDCCH indicates a new transmission,allowing UE receives the subsequent retransmission within same bundle after the first DL transmission of blind retransmission in the duration of *drx-InactivityTimer*. |
| Nokia | Agree |  |
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## Drx-RetransmissionTimerDL

Similarly, if a Serving cell is configured with *downlinkHARQ-FeedbackDisabled-r17* and DL HARQ feedback is disabled for a HARQ process, *drx-HARQ-RTT-TimerDL* is not started for the correspoinding HARQ process. As a consequence, *drx-RetransmissionTimerDL* is also not started.

The following agreement regarding support of blind retransmission has been captured as FFS in RAN2#116e:

* *RAN2 to down-select between the following options to support blind retransmission for HARQ process(es) configured with disabled HARQ feedback: 1) Rely on UE being in DRX Active Time via other means (e.g. Inactivity Timer); or 2) Start drx-RetransmissionTimerDL in the first symbol after the end of the reception of the last PDSCH or slot-aggregated PDSCH plus X (X = T\_proc,1);*

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

|  |  |  |
| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – New conditions for retransmission timer start** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P2:** For DL HARQ process with feedback disabled, UE starts drx-RetransmissionTimerDL for the corresponding HARQ process in the first symbol after the end of the reception of the last PDSCH or slot-aggregated PDSCH plus X (X = T\_proc,1). | OPPO |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P2:** To support blind retransmission for HARQ process(es) configured with DL HARQ feedback disabled, drx-RetransmissionTimerDL is restarted. | Xiaomi |
| [7] [R2-2200628](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200628.zip) | **P5:** Drx-RetransmissionTimerUL shall be started for HARQ mode B. | Spreadtrum |
| [9] [R2-2200787](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200787.zip) | **P1:** For the HARQ process for which DL HARQ feedback is disabled, drx-RetransmissionTimerDL is started to cover DL retransmission scheduling.  **P2:** For HARQ process for which DL HARQ feedback is disabled, UE starts the drx-RetransmissionTimerDL in the first symbol after the end of the reception of the last PDSCH or slot-aggregated PDSCH plus X (X = T\_proc,1). | Vivo |
| [16] [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) | **P2:** The drx-RetranmissionTimerDL for a HARQ process with HARQ feedback disabled is used for receiving the blind DL retransmission. | LG |

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| **Contribution** | **Relevant proposal(s) – No modification to retransmission timer start** | **Company** |
| [3] [R2-2200348](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200348.zip) | **P5b:** To support blind retransmission for DL HARQ process(es) configured with disabled HARQ feedback, it is gNB implementation to keep UE in active time through proper configuration of inactivity timer. | Huawei, HiSilicon |
| [8] [R2-2200689](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200689.zip) | **P1:** Rely on UE being in DRX Active Time (e.g. Inactivity Timer) to support blind retransmission for DL HARQ process(es) configured with disabled HARQ feedback. | CATT |
| [13] [R2-2201008](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201008.zip) | **P2:** Rely on UE being in DRX Active Time via other means (e.g. inactivity Timer) to support DL blind retransmissions for HARQ process(es) configured with disabled HARQ feedback. | Nokia, Nokia Shanghai Bell |
| [14] [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) | **P7:** drx-RetransmissionTimerDL is not started in the first symbol after the end of the reception of the last PDSCH or slot-aggregated PDSCH plus X (X = T\_proc,1) for HARQ process(es) configured with disabled DL HARQ feedback. | InterDigital |
| [15] [R2-2201325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201325.zip) | **P2:** No adaption on drx-RetransmissionTimerDL is needed. | ZTE Corperation, Sanechips |
| [18] [R2-2201629](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201629.zip) | **P14:** The start of drx-RetransmissionTimerDL is not changed in NTNs. | Ericsson |

In general similar arguments for and against relying on the drx-RetransmissionTimerDL as in the UL case (for additional DL-specific arguments, companies are encouraged to refer to contributions [9], [15], and [18]).

Similar to UL case, Rapporteur notes that this topic has been discussed for several meetings now without consensus on the need of the retransmission timer to support blind retransmission. Although there seems to be scenarios where there is benefit, based on majority and considering there is little time left in the release, it is suggested this topic not be furthered pursed in Rel-17 to minimize specification impact.

**Question 2:** **Do you agree that for HARQ process(es) configured with disabled HARQ feedback, blind retransmission relies on UE being in DRX Active Time via other means (i.e. *drx-RetransmissionTimerDL* is not started) in Rel-17?**

**If “Disagree” please provide technical justification why blind retransmission requires the *drx-RetransmissionTimerDL.***

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| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Xiaomi | Disagree | Same reasoning as Q1 |
| OPPO | Disagree | As stated in Q1 |
| MediaTek | Agree |  |
| Ericsson | Agree | Same reason as for Q1. Disabled HARQ feedback was introduced to avoid HARQ stalling. In normal operation there can be no blind retarnsmissions as the HARQ process ID have been reused by scheduling new data.  There is absolutely no reason optimize for the rare case that 1) there are no more DL data and 2) the gNB have awaliable resources (no other UEs that require to be scheduled) and 3) the UEs drx-InactivityTimer has expired and no other drx timer keeps the UE listening to PDCCH.  There is also no reason to extend the InactivityTimer for supporting blind retransmissions. If retransmissions are really needed and inactivityTimer have expired, any of the other drx timers can be relied on. |
| Intel | Agree | Similar argument like Q1 |
| Huawei, HiSilicon | Agree | See the answer to Q1. |
| vivo | Disagree | Same comments as to Q1. |
| LG | Disagree | See the comment in Q1. |
| ZTE | Agree | Please refer to comment in Q1. |
| Spreadtrum | Disagree | Same as comments to Q1. |
| Qualcomm | Agree |  |
| Samsung | Disagree | As stated in Q1 |
| CATT | Agree |  |
| Nokia | Agree |  |
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## Drx-HARQ-RTT-TimerUL

In the current version of the running NTN MAC CR, there is the following Editor’s note regarding *drx-HARQ-RTT-TimerUL* and configured grant:

* *Editor’s note: drx-HARQ-RTT-TimerUL behaviour is controlled via configuration of a HARQ state, however current agreements specify that network may optionally configure UL HARQ retransmission state “For at least dynamic grants”. RAN2 to confirm whether such states may also apply for configured uplink grants (at least for control of DRX timers).*

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

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| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – HARQ mode applies to CG** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P8:** The current UL HARQ retransmission state (HARQ state A/B) configured per HARQ process for dynamic grant also applies to CG. | OPPO |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P8:** RAN2 to agree that the following agreement adopted for CG also applies for CG/SPS case:  a.For HARQ processes with DL HARQ feedback disabled, drx-HARQ-RTT-TimerDL is not started.  b.For HARQ processes with UL HARQ retransmission not based on decode result, drx-HARQ-RTT-TimerUL is not started. | Xiaomi |
| [14] [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) | **P2:** For configured grant, drx-HARQ-RTT-TimerUL behaviour for a corresponding HARQ process is indicated by uplinkHARQ-DRX-LCP-Mode, if configured. | InterDigital |
| [18] [R2-2201629](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201629.zip) | **P9:** The uplinkHARQ-DRX-Mode-r17 controls the DRX behaviour of HARQ processes in the same way for configured grants as for dynamic grants. | Ericsson |

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| **Contribution** | **Relevant proposal(s) – HARQ mode does not apply to CG** | **Company** |
| [15] [R2-2201325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201325.zip) | **P7:** UL HARQ states are not applied in CG, i.e., for HPs associated with CG UE ignores the UL HARQ states if configured. | ZTE Corporation, Sanechips |

Proponents of applying *uplinkHARQ-DRX-Mode-r17* to configured grant note that there is no need to introduce CG/SPS-specific handling [1, 2, 14, 18].

[15] however disagrees, noting that by proper configuration of configureGrantTimer as well as periodicity of CG NW can flexibly schedule any (re)transmission scheme it wants for the same HP. Configuring CG with certain UL HARQ states might lead to extra delay when blind retransmission is expected, and the gain can be provided by linking CG with a UL HARQ state is not obvious but instead will lead to extra implementation and specs impact.

Based on majority opinion it is proposed that *uplinkHARQ-DRX-Mode-r17* could control the DRX behaviour of HARQ processes in the same way for configured grants as for dynamic grants, however considering this is the first time this topic is discussed further technical input may be required.

**Question 3:** **Do you agree *uplinkHARQ-DRX-Mode-r17* controls the DRX behaviour of HARQ processes in the same way for configured grants as for dynamic grants?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Xiaomi | Agree |  |
| OPPO | Agree |  |
| MediaTek | Agree |  |
| Ericsson | Agree | Simpler to only use one and the same scheme for dynamic and configured scheduling. |
| Intel | Agree |  |
| Huawei, HiSilicon | Agree |  |
| vivo | Agree |  |
| LG | Agree |  |
| ZTE | Disagree | Based on existing DRX behavior UE sill start the drx-HARQ-RTT-Timer after UL transmission based on CG which will then trigger start of retransmissionTimer for monitoring retransmission. And we think it is sufficient for NW to schedule any retransmission if needed which has lease specs impact. |
| Spreadtrum | Agree |  |
| Qualcomm | Agree with comment | Only if network properly configures UE such that the result is same HARQ type for the particular configured grant. |
| Samsung | Agree |  |
| CATT | Agree |  |
| Nokia | Agree |  |
|  |  |  |

# Configured Grant/SPS aspects

## ConfiguredGrantTimer extention

For a configured grant (CG) configuration, the network may optionally configure a *configuredGrantTimer*. While the *configuredGrantTimer* is running, the corresponding HARQ process will not be used for a new CG transmission. This facilitiates network scheduling of retransmissions for that HARQ process ID. To ensure the length of *configuredGrantTimer* can cover the larger round trip delay in NTN for smaller values of periodicity, in RAN2#116e it was agreed that the *configuredGrantTimer* may be extended, however the method of extension remains FFS:

* *configuredGrantTimer can be extended in NTN. FFS details of when extension is applicable and method of extention.*
* *FFS:RAN2 to down-select between the following options to extend configuredGrantTimer: 1) Introducing value(s) of configuredGrantTimer larger than 64; 2) Value of the configuredGrantTimer is extended by UE-gNB-RTT;”*

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

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| **Contribution** | **Relevant proposal(s) – CGT extended by RTT** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P6:** Value of the configuredGrantTimer can be extended by UE-gNB RTT in NTN. | OPPO |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P6:** Value of the configuredGrantTimer is extended by UE-gNB-RTT. | Xiaomi |
| [3] [R2-2200348](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200348.zip) | **P4:** The value of the configuredGrantTimer is extended by UE-gNB-RTT in NTN. | Huawei, HiSilicon |
| [6] [R2-2200619](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200619.zip) | **P1:** Value of the configuredGrantTimer is extended by UE-gNB-RTT in NTN. | MediaTek |
| [8] [R2-2200689](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200689.zip) | **P5:** If configured, value of configuredGrantTimer is extended by UE-gNB RTT. | CATT |
| [11] [R2-2200870](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200870.zip) | **P2:** It is proposed to extend the value of configuredGrantTimer by UE-gNB-RTT when the HARQ retransmission state is set as “mode A”. | CMCC |
| [17] [R2-2201480](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201480.zip) | **P2:** It is proposed that CGT is extended by UE-gNB RTT | ITL |

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| **Contribution** | **Relevant proposal(s) – CGT extended by additional values** | **Company** |
| [4] [R2-2200444](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200444.zip) | **P4:** Define new values larger than 64 to extend the configuredGrantTimer. | Qualcomm |
| [13] [R2-2201008](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201008.zip) | **P5:** The value range of configuredGrantTimer can be extended with introducing value(s) larger than 64 to cover the UE-gNB RTT. | Nokia, Nokia Shanghai Bell |
| [14] [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) | **P1:** configuredGrantTimer IE is extended in Rel-17 NTN. | InterDigital |
| [15] [R2-2201325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201325.zip) | **P1:** ConfiguredGrantTimer is extended with selective number of values to cover the worst case scenarios. The detailed values can be further discussed. | ZTE Corporation, Sanechips |
| [16] [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) | **P7:** Introduce a new configuredGrantTimerExt-r17 IE having larger value than 64. | LG |
| [18] [R2-2201629](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201629.zip) | **P11:** Introduce an OPTIONAL field configuredGrantTimer-r17 with 8 bits representing values 66, 68, …, 574, 576.  **P12:** Add “The network does not configure the configuredGrantTimer-r17 simultaneously with configuredGrantTimer (without suffix).” to the field description of configuredGrantTimer. | Ericsson |

**configuredGrantTimer extended by UE-gNB RTT [1, 2, 3, 6, 8, 11, 17]:**

Proponents of extending the *configuredGrantTimer* by UE-gNB RTT note that introducing additional values of CGT would lead to unnecessary signaling overhead [1, 2] and it would be difficult to configure values which properly match the RTT [2, 11]. This may lead to a waste of CG resources for some UEs near cell center [6], and it would be simple and efficient to extend by UE-gNB RTT similar to the HARQ RTT Timer [3, 8, 11].

**configuredGrantTimer extended by additional values [4, 13, 14, 15, 16, 18]:**

Proponents of extending the CGT by additional values note that this method is simple [4, 13], and that extension by UE-gNB RTT may be complicated as this value changes over time [14, 15]. Furthermore, current specification allows network to configure values of CGT lower than RTT to enable e.g. blind retransmission, which would not be possible by UE-gNB extension methods [15, 16]. Furthermore, the need for many additional values may also be limited as there is little benefit in covering more than one RTT in GEO due to unreasonably long delays [18].

Rapporteur understanding is that both methods could work. Considering opinion is essentially evenly split, it is suggested a basic preference is asked to allow companies which did not contribute on this topic to provide an opinion, and for proponents of each method to provide further technical arguments to support their preferred solution.

**Question 4: What is your preferred method to extend configuredGrantTimer in NTN?**

**1) Value of the configuredGrantTimer is extended by UE-gNB-RTT;**

**2) Introducing value(s) of configuredGrantTimer larger than 64;**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred Option** | **Additional comments** |
| Xiaomi | Option 1 | The drawback of option 2 is that it requires additional bits, and due to the coarse granularity of configuredGrantTimer which is in unit of configured grant periodicity, it can hardly match the UE-gNB RTT. As a result, leading to unnecessary delay. |
| OPPO | Option 1 | Option 2, i.e. introducing value(s) of configuredGrantTimer larger than 64, would lead to unnecessary signalling overhead.  Besides, since the unit of configuredGrantTimer is periodicity of CG, the length of configuredGrantTimer depends on not only the value of configuredGrantTimer but also the length of periodicity. It is also difficult to determine how many values to introduce to cover the UE-gNB RTT. |
| MediaTek | Option 1, or both options | Regarding the purported synchronization issue between the UE and the network, the TA reporting mechanism will ensure that synchronization is achieved.  A simple solution is to make the extension optional (by introducing a flag that indicates that CGT will be extended by UE-gNB RTT), and make it conditional on if CGT is configured. So, the network can configure a small value for CGT, say X, and optionally indicate that UE-gNB RTT extension will be applied. When the network receives the UL transmission for a CG, it will have time X to respond with a retransmission grant. Note that in Option 1, the CGT value will be extended by UE-gNB RTT.  Another alternative (as a compromise) is to support both Options 1 and 2 (making Option 1 as optional, and conditional on CGT as mentioned above) so the network can decide which option (1 or 2) to apply. If the network does not want to apply UE-gNB RTT extension but it wants to extend the CGT by a fixed value, it can configure the new values from Option 2. If the network wants to apply UE-gNB RTT extension, it can configure a small value for CGT and also indicate the UE to extend it by UE-gNB RTT. Specification and implementation complexity for this combined solution is minimal, as UE-gNB RTT is already used in other procedures in MAC, and ASN.1 impact is small. |
| Ericsson | Option 2 | Option 2 is simple, and avoids mismatch between the UE and gNB for example the issue tha the gNB do not know when the UE updates the configuredGrantTimer when RTT changes and do not detect a configured grant transmission. |
| Intel | Option 1 | For option 2, it would be difficult to configure values which properly match the RTT. |
| Huawei, HiSilicon | Option 1 |  |
| vivo | Option 1 |  |
| LG | Option 2 | The UE-gNB RTT can be dynamically changed due to UE specific TA. It means that there may be a case where the the UE and network manages the different configuredGrantTimer value due to change of the UE specific TA. Thus, we prefer Option 2. |
| ZTE | Option2 | Similar view as Ericsson. |
| Spreadtrum | Option 2 | Based on option1, if UE-gNB RTT could not be delivered to gNB in time, UE and gNB is not aligned with the configuredGrantTimer. |
| Qualcomm | Option 2 | Option 2 is simple. |
| Samsung | Option 2 | Agree with Ericsson |
| CATT | Option 1 |  |
| Nokia | Option 2 | Share the view as Ericsson and LG. |
|  |  |  |

## HARQ/LCP configuration for CG/SPS

**Issue 1) Applicability of LCH mapping configuration to CG**

In RAN2 #115e and RAN2#116e a new LCP mapping restriction *allowedHARQ-DRX-LCP* was agreed for dynamic grant in NTN, however it is not clear whether this restriction also applies to configured grant case.

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

|  |  |  |
| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – New LCH mapping restrictions apply to CG** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P7:**The new LCP mapping restrictions introduced for dynamic grant, i.e. allowedHARQ-DRX-LCP, also apply to configured grant. | OPPO |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P10:** If allowedCG-List is configured together with UL HARQ retransmission state, ignore the UL HARQ retransmission state restriction for CG. Otherwise, apply the UL HARQ retransmission state restriction also for CG. | Xiaomi |
| [7] [R2-2200628](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200628.zip) | **P7:** Apply the new LCP restriction for configured grant. | Spreadtrum |
| [18] [R2-2201629](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201629.zip) | **P10:** The uplinkHARQ-DRX-Mode and allowedHARQ-DRX-Mode affect the LCP for configured grants in the same way as for dynamic grants. | Ericsson |

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| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – New LCH mapping restrictions don’t apply to CG** | **Company** |
| [10] [R2-2200788](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200788.zip) | **P1:** New LCP mapping restriction introduced for dynamic grant does not apply to configured grant. | Vivo |
| [13] [R2-2201008](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201008.zip) | **P7:** No new CG-specific LCP restriction is introduced for NTN. | Nokia, Nokia Shanghai Bell |
| [14] [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) | **P4:**The LCP restriction allowedHARQ-DRX-LCP does not apply to configured grants. | InterDigital |
| [15] [R2-2201325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201325.zip) | **P6:** New LCP restriction defined in NTN is not applied to CG. | ZTE Corportation, Sanechips |
| [16] [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) | **P3:** No new LCP restriction is applied to the configured grant for NTN. | LG |

**New restrictions apply to CG [1, 2, 7, 18]**

Proponenets of applying *allowedHARQ-DRX-Mode* to CG note there is no potential use case to keep two different HARQ states between DG and CG, since the QoS requirement of a LCH is same [1, 7]. For simplicity, we can reuse *uplinkHARQ-DRX- Mode* and *allowedHARQ-DRX-Mode* to set mapping restrictions for configured grants, even though there is the existing *allowedCG-List* [18].

**New restrictions do not apply to CG [10, 13, 14, 15, 16]**

Proponents of not applying *allowedHARQ-DRX-Mode* to CG note that there are existing LCH restrictions in place which can accomplish the same thing [10, 13, 15, 16] and that the maximum number of configure grant configurations per BWP and MAC can provide granularity for different LCHs to be configured to different CG with different retransmission scheme [13]. Furthermore, there is common understanding that all HARQ processes associated to a CG configuration shall have the same UL HARQ state. It means one CG should have only one retransmission scheme and the *allowedCG-List* can be reused to perform LCP for different retransmission scheme in NTN [13, 14].

Whether the new LCP restriction *allowedHARQ-DRX-LCP* applies to CG or not has been discussed for several meetings now without consensus. Rapporteur suggests a compromise proposal from [2] as a potential way forward, where *allowedHARQ-DRX-LCP* applies to CG, however is overruled by *allowedCG-List*, if configured.

**Question 5:** **Do you agree to the following compromise proposal?**

***If allowedCG-List is configured together with allowedHARQ-DRX-LCP, ignore allowedHARQ-DRX-LCP restriction for CG. Otherwise, allowedHARQ-DRX-LCP* *also applies for CG.***

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree/Disagree** | **Additional comments** |
| Xiaomi | Agree | We are ok with this compromised proposal. |
| OPPO | Disagree | We don’t think UE should ignore allowedHARQ-DRX-LCP restriction for CG. Instead, as legacy, UE should follow whatever LCP restrictions that are configured by the network and it can be up to network’s implementation to ensure that these LCP restrictions can work properly. This will make spec cleaner and we don’t need to specify any exceptions for CG. |
| MediaTek | No strong view | We are fine with the compromised proposal. |
| Ericsson | Disagree | Ignoring allowedCG-List when configured together with allowedHARQ-DRX-LCP requires extra specification effort, similar to the extra effort for specifying that allowedHARQ-DRX-LCP only applies for dynamic grants.  It is simple when the new LCP restrictions applies whenever they are configured for all type of grants. |
| Intel | Agree | allowedCG-List can accomplish the same thing. |
| Huawei, HiSilicon | Disagree | The comprise proposal actually makes it more complex. If gNB implementation can guarantee all HARQ processes for the CG have the same HARQ state. Either the new LCP restriction or the *allowedCG-List* or bothcan be applied to guranteen proper UE behaviour. How to configure can be left to gNB implementation. No extra enhancement is needed. |
| vivo | Disagree | Share the view with Ericsson and Huawei. Existing allwedCG-List can take completely the same effect as allwedHARQ-DRX-LCP. Then why redundantly configure two LCP restrictions, instead of just relying on the existing one? |
| LG | Disagree | We do not see the benefit to apply the allowedHARQ-DRX-LCP to the CG instead of allowedCG-List. |
| ZTE | Disagree | We are not convinced why we need two LCP restrictions that can achieve the same purpose. Also the compromised solution actually undermines NW’s scheduling flexibility. When not configuring allowedCG-List, NW could consider LCHs using the CG can goes into any HP that is available, while applying the HP states might further delay the transmission in order to find HP that fulfil the requirement or NW might need to reconfigure HP states in order to fulfil requirement on both CG/DG. |
| Spreadtrum | Disagree | It is due to gNB implementation to avoid this case. |
| Qualcomm | Disagree | The UE should simply follow ***allowedCG-List.*** |
| Samsung | Disagree | We agree that the LCP mapping restriction rule also applies to CG, but how to configure this is up to the network, no need to specify in the spec. |
| CATT | Disagree | The LCP of allowedCG-List can control the different ULdata mapping to CG correctly. |
| Nokia | Disagree | We understand one CG should have only one retransmission scheme and the *allowedCG-List* can be reused to perform LCP for different retransmission scheme. There is no gain to introduce new CG-specific LCP restriction. The compromised solution make system complex but no gain. |
|  |  |  |

**Issue 2) Configuration of DL HARQ feedback enable/disable for SPS**

In the downlink, the network may optionally configure *downlinkHARQ-FeedbackDisabled* to enable or disable DL HARQ feedback on a per-HARQ process granularity. The HARQ process IDs used by a semi-persistent scheduling (SPS) configuration are calculated from parameters of radio resource allocation in time. This is different from dynamic scheduling, where there is no relationship between HARQ ID and radio resource allocation in time domain.

This may result in the UE transmitting HARQ feedback for a logical channel data that is received in SPS occasion X but NOT transmitting HARQ feedback for the same logical channel data that is received in the SPS occasion Y (if HARQ PID associated with occasion X has HARQ feedback enabled and that associated with occasion Y has HARQ feedback disabled). As noted in previous discussion, such a scenario could lead to variability in reliability based on when the data was transmitted, which is clearly undesirable.

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

|  |  |  |
| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – Up to NW implementation** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P10:** It is up to network implementation to ensure that downlinkHARQ-FeedbackDisabled, if configured, has the same value for all HARQ processes belonging to an SPS configuration (i.e. no specification impact). | OPPO |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P5:** It is up to network implementation to ensure downlinkHARQ-FeedbackDisabled, if configured, has the same value for each HARQ process used in an SPS configuration (i.e. no specification impact). | Xiaomi |
| [4] [R2-2200444](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200444.zip) | **P1:** Capture in the specification that the UE is expected to have same DL HARQ feedback state per SPS configuration. | Qualcomm |
| [8] [R2-2200689](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200689.zip) | **P3:** It is up to network implementation to ensure downlinkHARQ-FeedbackDisabled, if configured, has the same value for each HARQ process used in an SPS configuration (i.e. no specification impact). | CATT |
| [13] [R2-2201008](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201008.zip) | **P6:** There is no need to define either the DL HARQ feedback enabling/disabling per SPS configuration or the UL HARQ state per CG configuration. | Nokia |
| [14] [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) | **P5:** It is up to network implementation to ensure proper configuration of HARQ feedback (i.e. enabled or disabled) for HARQ processes used by an SPS configuration. | InterDigital |
| [15] [R2-2201325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201325.zip) | **P5:** Except for SPS (de)activation, the HARQ feedback status of HPs associated to SPS follows the HARQ feedback indication configured for dynamic grant. | ZTE |
| [16] [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) | **P5:** HARQ feedback mode is configured per HARQ process and the network implementation guarantees that the HARQ processes for the SPS have the same HARQ feedback mode. | LG |

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| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – configured per SPS configuration** | **Company** |
| [11] [R2-2200870](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200870.zip) | **P1:** RAN2 need to consider enabling / disabling the HARQ feedback of SPS configurations via RRC signaling. | CMCC |

Based on company feedback there seems to be a general understanding that proper configuration of HARQ feedback (i.e. enabled or disabled) for HARQ process(es) used by an SPS configuration is up to network implementation. However, there seems to be additional discussion necessary as to whether it needs to be *guaranteed* all HARQ processes have the same DL HARQ feedback state per SPS configuration (e.g. as proposed in [4]). It is suggested as a first step to agree that configuration is up to network implementation, which seems widely agreeable.

**Question 6: Do you agree with the following proposal as a baseline for further discussion?**

***It is up to network implementation to ensure proper configuration of HARQ feedback (i.e. enabled or disabled) for HARQ processes used by an SPS configuration. FFS whether to explicitly specify the UE expects the same DL HARQ feedback state per SPS configuration.***

|  |  |  |
| --- | --- | --- |
| **Company** | **Supported Option(s)** | **Additional comments** |
| Xiaomi | Yes |  |
| OPPO | Agree |  |
| MediaTek | Yes | We don’t think the FFS is needed. |
| Ericsson | No | RAN2 do not specify the NW implementation.  It is completely up to the NW to configure a working system and some configs may not work well.  We propose:  It is up to network implementation to ensure proper configuration of HARQ feedback (i.e. enabled or disabled) for HARQ processes used by an SPS configuration (no specification impact). |
| Intel | Yes |  |
| Huawei, HiSilicon | Yes | We think the general principle should be captured in specs for information. Otherwise, it is not clear whether or how the whole HARQ operation in NTN is appled to SPS/CG. |
| vivo | Yes with comments | Same view as Ericsson. Leaving it to NW implementation w/o embodying it in the Spec is already sufficient. |
| LG | Yes |  |
| ZTE | Yes with comments | No need for ffs.  We don’t think there is a need to always guarantee the same HP configuration is associated to HPs of the same SPS. NW will always jointly consider the HARQ buffer status, the channel condition and QoS requirement to do the configuration and scheduling. To specify restriction might instead restrict NW’s implementation. |
| Spreadtrum | Yes |  |
| Qualcomm | Yes | Agree with Huawei. Any implementator should be aware of this principle how network implementation can handle it this way for a traffic that requires same HARQ type.  We do not want a SPS that is for voice traffic and some voice packets requires HARQ feedback and go through retransmission process. The retransmitted voice traffic has no use in NTN due to long RTT.  Bad implementation will be costly here.  This is the only matter of capturing something like a note, otherwise, everybody seems to be in the same page. We do not understand why it is restricting network implementation. |
| Samsung | Yes |  |
| CATT | Yes |  |
| Nokia | Yes with comments | The FFS part is not needed. It is NW implementation to guarantee that the calculated HARQ processes for a configured grant or SPS configuration have the same HARQ mode/state. |
|  |  |  |

**Issue 3) Configuration of UL HARQ mode for CG**

Similar to SPS, HARQ process IDs used by a CG configuration are calculated from parameters of radio resource allocation in time. This may result in HARQ processes used by a CG configuration having different UL HARQ modes. From past discussion, there seems to be a general understanding that this is not desired behaviour considering the same set of configured grants are usually configured for the same traffic.

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

|  |  |  |
| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – Up to NW implementation** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P11:** It is up to network implementation to ensure that uplinkHARQ-DRX-LCP-Mode-r17, if configured, has the same value for all HARQ processes belonging to a configured grant configuration (i.e. no specification impact). | OPPO |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P4:** It is up to network implementation to ensure uplinkHARQ-DRX-LCP-Mode-r17, if configured, has the same value for each HARQ process used in a configured grant configuration(i.e. no specification impact). | Xiaomi |
| [3] [R2-2200348](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200348.zip) | **P3:** RAN2 to capture the principle that gNB should guarantee that HARQ processes used in a configured grant/assignment configuration have the same HARQ state. | Huawei |
| [4] [R2-2200444](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200444.zip) | **P2:** Capture in the specification that the UE is expected to have same HARQ state per CG configuration. | Qualcomm |
| [8] [R2-2200689](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200689.zip) | **P4:** It is up to network implementation to ensure uplinkHARQ-DRX-LCP-Mode-r17, if configured, has the same value for each HARQ process used in a configured grant configuration (i.e. no specification impact). | CATT |
| [13] [R2-2201008](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201008.zip) | **P6:** There is no need to define either the DL HARQ feedback enabling/disabling per SPS configuration or the UL HARQ state per CG configuration. | Nokia |
| [14] [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) | **P3:** It is up to network implementation to ensure proper configuration of DRX-LCP mode for HARQ processes used by a configured grant configuration. | InterDigital |
| [16] [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) | **P4:** HARQ mode is configured per HARQ process and NW implementation guarantees that the HARQ processes for the configured grant have the same HARQ mode. | LG |
| [17] [R2-2201480](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201480.zip) | **P1:** We support that NW could configure both same and different HARQ state in an CG-config. | ITL |

Similar to SPS case, based on company feedback there seems to be a general understanding that proper configuration of HARQ mode for HARQ processes used by a CG configuration is up to network implementation. However, there seems to be additional discussion necessary as to whether it needs to be *guaranteed* all HARQ processes have the same HARQ mode per CG configuration (e.g. as proposed in [4]). It is suggested as a first step to agree that configuration is up to network implementation, which seems widely agreeable.

**Question 7: Do you agree with the following proposal as a baseline for further discussion?**

***It is up to network implementation to ensure proper configuration of HARQ mode for HARQ processes used by a CG configuration. FFS whether to explicitly specify the UE expects the same HARQ mode per CG configuration.***

|  |  |  |
| --- | --- | --- |
| **Company** | **Supported Option(s)** | **Additional comments** |
| Xiaomi | Yes |  |
| OPPO | Agree |  |
| MediaTek | Yes | No need for FFS. |
| Ericsson | No | RAN2 do not specify the NW implementation.  It is completely up to the NW to configure a working system and some configs may not work well.  We propose:  It is up to network implementation to ensure proper configuration of HARQ mode for HARQ processes used by a CG configuration (no specification impact). |
| Intel | Yes |  |
| Huawei, HiSilicon | Yes | We think the general principle should be captured in specs for information. Otherwise, it is not clear whether or how the whole HARQ operation in NTN is appled to SPS/CG. |
| vivo | Yes with comments | Same comments as to Q6. |
| LG | Yes |  |
| ZTE | Yes with comments | Same view as mediaTek. |
| Spreadtrum | Yes |  |
| Qualcomm | Yes | Agree with Huawei. Any implementator should be aware of this principle how network implementation can handle it this way for a traffic that requires same HARQ type.  We do not want a configured grant that is for voice traffic and some voice packets go through retransmission process. The retransmitted voice traffic has no use in NTN due to long RTT.  Bad implementation will be costly here.  This is the only matter of capturing something like a note, otherwise, everybody seems to be in the same page. We do not understand why it is restricting network implementation. |
| Samsung | Yes |  |
| CATT | Yes |  |
| Nokia | Yes with comments | Same comments as Q6. FFS should be removed. |
|  |  |  |

# Remaining HARQ Aspects and Other issues

## PUSCH transmission scheduled by RAR

Since the HARQ process cannot be dynamically selected for a PUSCH transmission scheduled by RAR as for other dynamic PUSCH transmissions, NW has no tight control on the HARQ retransmission state applied for the data transmitted in the PUSCH and accordingly the corresponding UE DRX behaviour. This may lead to a situation that the allocated PUSCH resources cannot be efficiently used by the UE, i.e. the configured LCH restriction may prevent UE from using such allocated PUSCH resources or DRX behaviour is not suitable for the data transmitted on the PUSCH.

The below proposals address this topic (via contributions submitted to RAN2#116bis-e):

|  |  |  |
| --- | --- | --- |
| **Contribution** | **Relevant proposal(s) – Up to NW implementation** | **Company** |
| [1] [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) | **P5:** Which HARQ state A or B is configured to HARQ process #0 is up to network implementation, and from UE’s perspective, UE always behaves accorrding to the configured HARQ state and LCP restrictions. | OPPO |
| [10] [R2-2200788](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200788.zip) | **P2:** For RACH in RRC\_CONNECTED mode, the HARQ state configuration does not apply to the case of a PUSCH transmission scheduled by RAR. No extra spec impact is needed. | Vivo |
| [16] [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) | **P6:** The network ensures that the LCP restriction introduced for the dynamic grant and the HARQ state configuration are not configured to the HARQ process ID 0. | LG |

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| **Contribution** | **Relevant proposal(s) – Ignore HARQ state/LCP restriction** | **Company** |
| [2] [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) | **P11:** For the cases that HARQ process 0 carring PUSCH transmission scheduled by RAR or PUSCH payload of MsgA, RAN2 to discuss the following options:  a.Option 1: uplinkHARQ-DRX-LCP-Mode-r17 does not applies to HARQ process 0 carring PUSCH transmission scheduled by RAR or PUSCH payload of MsgA.  b.Option 2: For UL grant in RAR or UL grant associated with MsgA PUSCH resource, LCP restriction of HARQ state does not apply. | Xiaomi |
| [3] [R2-2200348](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200348.zip) | **P2:** For RACH in RRC\_CONNECTED mode, UE ignores LCP restriction of the LCH depending on the triggering event of the RACH when using the UL grant in RAR. | Huawei |

**Up to NW implementation [1, 10, 16]:**

Proponents of leaving this issue up to network implementation/not addressing this issue note that PDCCH monitoring behaviour during RA procedure is perfectly controlled by RAR window and the running of *ra-ContentionResolutionTimer*, and DRX timer running or not has no extra contribution to the PDCCH monitoring during RACH [1, 16]. Regarding LCP, we can simply leave proper configuration up to NW implementation without any specification impact [1, 10, 16].

**Ignore HARQ/LCP configuration [2, 3]**

Proponents of addressing this issue note that there may be multiple ways of solving the issue, for example *uplinkHARQ-DRX-LCP-Mode-r17* does not applies to HARQ process 0 carring PUSCH transmission scheduled by RAR or PUSCH payload of MsgA; or for UL grant in RAR or UL grant associated with MsgA PUSCH resource, LCP restriction of HARQ state does not apply [2]. From the perspective of [3], this should be discussed case by case where the triggering event should to be considered. A general principle is that we could make sure what needs to be transmitted to the gNB during RACH can be carried in the UL grant in RAR (In other words, the LCH that can use the UL grant in RAR is related with the triggering events. And for this LCH, the LCP restriction is not applied)

Considering limited opinions provided via contribution, companies are invited to provide input on the proposed options, or propose an alternative solution.

**Question 8:** **For the cases that HARQ process 0 carries PUSCH transmission scheduled by RAR or PUSCH payload of MsgA, what is your preferred option?:**

1. **Configuration of HARQ mode is up to NW implementation, and UE always follows;**
2. ***uplinkHARQ-DRX-LCP-Mode-r17* does not applies to HARQ process 0 carring PUSCH transmission scheduled by RAR or PUSCH payload of MsgA;**
3. **For UL grant in RAR or UL grant associated with MsgA PUSCH resource, LCP restriction of HARQ state does not apply;**
4. **Other, please describe.**

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| **Company** | **Preferred Option(s)** | **Additional comments** |
| Xiaomi | Option 3 is prefered, ok with option 2 | In general, we agree that it is not suitable to configure a fixed HARQ state for HARQ process #0 since it is designed to take data from any LCH during RACH. If a fixed HARQ state is configured, UL resources for HARQ #0 will be wasted if LCP restricts a different HARQ state. |
| OPPO | Option 1 | For both CBRA and CFRA, DRX timer running or not has no extra contribution to the PDCCH monitoring during RACH. Therefore, we don’t need to care how DRX timers are handled during RACH procedure.  As for the LCP impact on PUSCH transmission scheduled by RAR or PUSCH payload of MsgA, we don’t see the big issue and proper configuration by NW could aid this. Anyway UE in connected mode can use other HARQ processes than ID 0 to transmit data. |
| MediaTek | Option 1 | No strong view, but we think that the network can control this case. |
| Ericsson | Option 3 (option 2 is the legacy behaviour) | The new LCP restriction shall not apply to Msg3/MsgA. Msg3/MsgA shall be independent of what uplinkHARQ-DRX-LCP-Mode-r17 and allowedHARQ-DRX-LCP is configured to. DRX timers are anyway not started for Msg3/MsgA, so no spec impact on those.  We propose to reformulate as (though uplinkHARQ-DRX-LCP-Mode do not matter):  The uplinkHARQ-DRX-LCP-Mode and allowedHARQ-DRX-LCP does not apply to PUSCH transmission scheduled by RAR nor to PUSCH payload of MsgA. |
| Intel | Option 1 | It can be handled by NW implementation, no extra spec change is necessary. |
| Huawei, HiSilicon | Option 4 | LCP restriction should guarantee that what needs to be transmitted can be put in the UL grant scheduled by RAR. It is better UE can ignore the LCP restriction for LCH with data that needs to be transmitted during RACH and apply the LCP restriction for other LCHs. |
| vivo | Option 1 or Option 3 | As what Ericsson pointed out, Option 2 is how the existing Spec is running.  For Option 3, after concluding that the new LCP restriction only applies to dynamic scheduling and reflecting it clearly in the Spec, the grant scheduled by RAR can be excluded at the same time; or for even better clarify, we can say “… only applies to dynamic grant scheduled by PDCCH…”. Anyway, not any specified UE behaviour of skipping/ignoring the LCP restriction is needed. |
| LG | Option 1 | Considering that the HARQ process ID is extended to 32, the fixed HARQ state for HARQ PID 0 is not a big problem. Thus, we prefer Option 1. |
| ZTE | Option 3 | We also think new LCP doesn’t apply to Msg3/MsgA as well. Option 3 means UE ignores the new LCP restriction when transmitting Msg3 or MsgA PUSCH. Option 2 is also feasible, but it means HP#0 cannot be configured with a state which might not be optimal. |
| Spreadtrum | Option 1 | It is due to gNB implementation. |
| Qualcomm | Option 3 |  |
| Samsung | Option 1 |  |
| CATT | Option 1 |  |
| Nokia | Option 1 | For RAR scheduled Msg3, the legacy parameters (e.g. allowedSCS-List, maxPUSCH-Duration) can be applied in LCP. We think it is natural to applied the *uplinkHARQ-DRX-LCP-Mode*.  It is NW implementation to decide the HARQ mode of HARQ PID 0. If the LCHs for RRC messages or data need to be put in Msg3, NW can configure proper HARQ state for the LCHs. Please note, the MAC CE (e.g. C-RNTI in Msg3 for RACH in connected mode) will not apply the new LCP at all. Furthermore, if the LCH is not configured with any mapping rule (e.g. UL CCCH message), it can be mapped to any HARQ process. (agreement as below) .  *If an LCH is not configured with a mapping rule, it may be mapped to any HARQ process (HARQ mode A or B).* |

## Other issues

Companies are invited to list proposals/issues not covered within this discussion which they consider critical to completion of the Rel-17 NTN WI.

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| **Company** | **Identified Issues** |
| OPPO | In our understanding, the drx-HARQ-RTT-TimerDL/UL behaviour for DL HARQ feedback enabled and UL HARQ state A needs to be clarified. The current spec on UE DRX behaviour when PDCCH indicates a UL/DL transmission doesn’t consider the case where drx-HARQ-RTT-TimerUL/DL for the corresponding HARQ process has already been running.  Proposal 3 If PDCCH indicates a UL transmission for a HARQ process when drx-HARQ-RTT-TimerUL for the corresponding HARQ process is running, UE should stop the drx-HARQ-RTT-TimerUL for the corresponding HARQ process.  Proposal 4 If PDCCH indicates a DL transmission for a HARQ process when drx-HARQ-RTT-TimerDL for the corresponding HARQ process is running, UE should stop the drx-HARQ-RTT-TimerDL for the corresponding HARQ process. |
| Ericsson | 1 Repetition/bundling based HARQ retransmissions At RAN2#114-e the following agreement was made concerning repetitions/bundling:   1. Repetition transmission based HARQ retransmission is always allowed and is explicitly indicated per HARQ process via DCI (as in legacy).   This agreement is incorrect as it only considers part of the Rel-16 additions to bundling (bundling is called repetition in RAN1). There is also semi-static RRC configuration of bundling from Rel-15 (see repK, pdsch-AggregationFactor and pusch-AggregationFactor) and in Rel-16 for SPS (see pdsch-AggregationFactor-r16). As bundling may be very useful to achieve robustness in NTNs, all options for bundling shall be supported. Therefore, we propose to revise the previous agreement.  **Proposal 17 Repetition transmission based HARQ retransmission is always allowed and is explicitly indicated via DCI or semi-statically with RRC signalling (as in legacy). Note, this revises the agreement from RAN2#114e.**  2 details of extension of the sr-ProhibitTimer  The legacy values may be sufficient to cover a few RTTs for LEO, but not for GEO. This proposal is mainly applicable for the GEO case where the RTT is soo long that we do not expect to need very many times the RTT as the delays becomes too long. If more than 128 ms is needed in LEO the new parameter can be used for LEO too – then also higher factors than 2 can be considered, for example extending the factors with 3, 4, 5 and 6.  **Proposal 20 Add a sr-ProhibitTimerExt with values {1/4, 1/2, 1, 2} where the timer value is sr-ProhibitTimerExt \* (UE-gNB RTT)**  3 details of DRX behaviour after sending SR and msg3 for CFRA  **Proposal 21 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.**  **Proposal 23 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.**  4 the modelling details of the MAC spec  **Proposal 1 Rename the uplinkHARQ-DRX-LCP-Mode-r17 to uplinkHARQ-DRX-Mode-r17.**  **Proposal 2 Change the field description of uplinkHARQ-DRX-Mode-r17 to “Used to set the DRX mode per HARQ process ID, see TS 38.321 [3]. The first/leftmost bit corresponds to HARQ process ID 0, the next bit to HARQ process ID 1 and so on. Bits corresponding to HARQ process IDs that are not configured shall be ignored. A bit set to one identifies a HARQ process with HARQ-DRX modeA and a bit set to zero identifies a HARQ process with HARQ-DRX modeB.”.**  **Proposal 3 Change the MAC spec description of uplinkHARQ-DRX-LCP-Mode in the beginning of 5.7 of running MAC CR to “uplinkHARQ-DRX-Mode (optional per HARQ process and per Serving Cell): the configuration to set the HARQ DRX-LCP mode per UL HARQ process per Serving Cell”.**  **Proposal 4 RAN2 to discuss introducing two helper variables HARQ\_RTT\_TIMER\_DL and HARQ\_RTT\_TIMER\_UL to avoid the current Running MAC CR ambiguity introduced by the UE autonomously setting the RRC fields drx-HARQ-RTT-TimerDL and drx-HARQ-RTT-TimerUL.**  **Proposal 5 Rename the allowedHARQ-DRX-LCP to allowedHARQ-DRX-Mode.**  **Proposal 6 Change the allowedHARQ-DRX-Mode field description to “If the field is present, UL MAC SDUs from this logical channel can only be mapped to a grant associated with a HARQ process ID not configured with a uplinkHARQ-DRX-Mode or to a grant associated with a HARQ process ID configured with uplinkHARQ-DRX-Mode indicating a value equal to the value configured by this field. If the field is not present, UL MAC SDUs from this logical channel can be mapped to any grant.”** |
| Huawei, HiSilicon | 1. **The extended values for sr-ProhibitTimerExt-r17 shoulf be specified.**   We give some candidate values in R2-2200348.  **2. The names of some RRC parameters should be finalized as some are still FFS, e.g. *allowedHARQ-DRX-LCP* and *uplinkHARQ-DRX-LCP-Mode*.**  Current naming is complex and confusing. We cannot see the connections of the different terminologies (*HARQ,DRX,LCP*) from the name. We propose “*allowedHARQ-State*” for the LCH and “*UL-HARQ-States*” for the HARQ processes, which is clear and aligned with the definition in the agreements. The detailed meaning or the related behavious can be further illustrated in the field descriptions or the procedure anyway, which doesn’t need to be reflected all in the name. |
| vivo | Rename of the HARQ state indicator “uplinkHARQ-DRX-LCP-Mode-r17” and LCP restriction “allowedHARQ-DRX-Mode” and update of their descriptions in the Spec need discussing, with several companies submitting papers discussing the issue. |
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# Summary

<To be generated pending company feedback>

# Conclusion

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

<To be generated pending company feedback>

# References

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3. [R2-2200348](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200348.zip) Remaining issues about other MAC aspects – Huawei, HiSilicon
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10. [R2-2200788](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200788.zip) Remaining issues on LCP aspects – vivo
11. [R2-2200870](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200870.zip) Further Considerations on CG/SPS for NR NTN – CMCC
12. [R2-2200911](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200911.zip) CG enhancements in NTN – Sony
13. [R2-2201008](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201008.zip) Discussion on left issues on MAC aspects – Nokia, Nokia Shanghai Bell
14. [R2-2201163](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201163.zip) Remaining MAC open issues in NTN – InterDigital
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