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):

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| **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. |
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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):

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| **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 |
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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?**

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| **Company** | **Agree/Disagree** | **Additional comments** |
| Xiaomi | Agree |  |
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# 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;**

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| **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. |
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## 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):

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| **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.***

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| **Company** | **Agree/Disagree** | **Additional comments**  |
| Xiaomi | Agree | We are ok with this compromised proposal. |
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**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):

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| **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.***

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| **Company** | **Supported Option(s)** | **Additional comments**  |
| Xiaomi | Yes |  |
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**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):

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| **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.***

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| **Company** | **Supported Option(s)** | **Additional comments**  |
| Xiaomi | Yes |  |
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# 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):

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| **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.  |
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## 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**  |
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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

1. [R2-2200244](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200244.zip) Remaining issues on other MAC aspects in NTN – OPPO
2. [R2-2200271](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200271.zip) Remaining issues related to HARQ retransmission state – Xiaomi
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
4. [R2-2200444](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200444.zip) HARQ process for SPS and CG – Qualcomm Incorporated
5. [R2-2200618](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200618.zip) Remaining issues on disabling uplink HARQ retransmission – MediaTek Inc.
6. [R2-2200619](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200619.zip) Round trip delay offset for configured grant timer – MediaTek Inc.
7. [R2-2200628](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200628.zip) Discussion on HARQ and LCP remaining issues – Spreadtrum
8. [R2-2200689](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200689.zip) Left Issues on DL/UL HARQ Aspects – CATT
9. [R2-2200787](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2200787.zip) Remaining issues on HARQ related timer handling for NR NTN – vivo
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
15. [R2-2201325](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201325.zip) Consideration on remaining issues of other MAC aspects – ZTE Corporation, Sanechips
16. [R2-2201364](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201364.zip) Discussion on other MAC aspects – LG Electronics Inc.
17. [R2-2201480](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201480.zip) HARQ State A/B for CG/SPS aspects – ITL
18. [R2-2201629](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_116bis-e/Docs/R2-2201629.zip) On configured scheduling, DRX, LCP, HARQ and SR/BSR in NTNs – Ericsson