**3GPP TSG-RAN WG2 Meeting #116-e R2-2xxxxxx**

**Online, 1~12 November 2021**

**Agenda item: 5.3/6.1.3.1 MAC Corrections**

**Source: Qualcomm Incorporated**

**Title: Report of [AT116-e][006][NR1516] MAC**

**Document for: Discussion and decision**

1. Introduction

This document is to report the outcome of the following email discussion at RAN2#116-e Meeting:

* [AT116-e][006][NR1516] MAC (Qualcomm)

 Scope: Determine agreeable parts in a first phase, for agreeable parts agree on CRs. Treat R2-2109457 (AI 5.3.1), R2-2109458 (AI 5.3.1), R2-2109921, R2-2110948, R2-2110949, R2-2110244, R2-2109650, R2-2109948, R2-2110763, R2-2110946, R2-2111231, R2-2109533

 Intended outcome: Report, Agreed CRs if applicable

 Deadline: Schedule 1

***Note from Chair:***

*Discussions with Deadline* ***Schedule 1****:*

A **first round** with **Deadline for comments Thursday W1 Nov 4 1200 UTC** to settle scope what is agreeable etc. A Final round with **Final deadline Thursday W2 Nov 11 1200 UTC** to settle details / agree CRs etc. Additional check points etc if needed are defined by the Rapporteur.

2. Contact Information

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| Huawei, HiSilicon | Chong Lou (louchong@huawei.com) |
| ZTE Corporation | Dong.fei@zte.com.cn |
| LG | SunYoung LEE (ssunyoung.lee@lge.com) |
| Samsung | sangkyu.baek@samsung.com |
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3. Phase 1 discussion

## 3.1 SR/BSR procedures with UL skipping

[1] R2-2109457 Correction to SR procedure with UL skipping Qualcomm Incorporated CR Rel-15 38.321 15.12.0 1165 - F NR\_newRAT-Core

[2] R2-2109458 Correction to SR procedure with UL skipping Qualcomm Incorporated CR Rel-16 38.321 16.6.0 1166 - F NR\_newRAT-Core

The above two CRs (for R15 and R16, respectively) propose that UE should cancel a pending SR and the corresponding BSR when it skips a dynamic UL grant due to empty buffer if the pending SR was triggered by new data.

Such a scenario may happen in MR-DC configuration. For example, UE is configured with a UL split bear and transmits SRs in both MCG and SCG when new data arrives. After the UE receives a UL grant from its MCG which is large enough to accommodate all the buffered data, UE will skip subsequent UL grant(s) from its SCG because it no longer has any buffered data. However, according to the current spec, UE would keep retransmitting the pending SR in its SCG until it reaches the *sr-TransMax*, because the current spec does not require UE to cancel a pending SR when it skips a UL grant.

**Q1**: Do you agree to the changes proposed in the above two CRs?

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| --- | --- | --- |
| Company | Agree as is/Agree with change/No change needed | Comments |
| Huawei, HiSilicon |  | The issue may exist theoretical, but we are not sure if it has been observed in any field text since from LTE. From our understanding, this correction is not minor and thus not sure if it is urgent to fit in R15 or R16.  |
| ZTE | No change needed | In our understanding, the concern as below from proponent is not existing:*However, according to the current spec, UE would keep retransmitting the pending SR in its SCG until it reaches the sr-TransMax, because the current spec does not require UE to cancel a pending SR when it skips a UL grant.*Because the **Short BSR MAC CE** is still generated when UL grant is received from lower layer and no data available for transmission. For Regular and Periodic BSR, the MAC entity shall:1> if more than one LCG has data available for transmission when the MAC PDU containing the BSR is to be built:2> report Long BSR for all LCGs which have data available for transmission.1> else: 2> report Short BSR.Moreover, the BSR MAC CE still can indicate the buffer status being zero by setting the BS value to zero.Table 6.1.3.1-1: Buffer size levels (in bytes) for 5-bit Buffer Size field

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Index | BS value | Index | BS value | Index | BS value | Index | BS value |
| 0 | 0 | 8 | ≤ 102 | 16 | ≤ 1446 | 24 | ≤ 20516 |
| 1 | ≤ 10 | 9 | ≤ 142 | 17 | ≤ 2014 | 25 | ≤ 28581 |
| 2 | ≤ 14 | 10 | ≤ 198 | 18 | ≤ 2806 | 26 | ≤ 39818 |
| 3 | ≤ 20 | 11 | ≤ 276 | 19 | ≤ 3909 | 27 | ≤ 55474 |
| 4 | ≤ 28 | 12 | ≤ 384 | 20 | ≤ 5446 | 28 | ≤ 77284 |
| 5 | ≤ 38 | 13 | ≤ 535 | 21 | ≤ 7587 | 29 | ≤ 107669 |
| 6 | ≤ 53 | 14 | ≤ 745 | 22 | ≤ 10570 | 30 | ≤ 150000 |
| 7 | ≤ 74 | 15 | ≤ 1038 | 23 | ≤ 14726 | 31 | > 150000 |

So the UL grant would not be skipped because of the generation of Short BSR MAC CE with a LCG indication and 0 BSR value, the concern from proponent is not valid. |
| LG | No change needed | It may happen at the end of data burst, so we don’t see it is critical issue that frequently happen. In the meanwhile, in 5.4.4, it is specified that all pending SR shall be cancelled when UL grant can accommodate all pending data available for transmission. As there is no data, one reasonable UE behaviour would be to cancel SR by considering that the received UL grant CAN accommodate all of zero pending data.  |
| Samsung | No change needed | If a regular BSR is pending, the transmission cannot be skipped. The case described by the contributions is that regular BSR is triggered. Thus, it does not happen, as ZTE mentioned.If the triggered BSR is only periodic BSR, we think "UL grant(s) can accommodate all pending data available for transmission" covers UL skipping, so we do not see the CRs are necessary.< Minor comment >If this CR is agreed, the Rel-16 CR should be Cat A. |

## 3.2 One-shot HARQ feedback for NR-U

[3] R2-2109921 Handling of One-shot HARQ feedback for NR-U Qualcomm Incorporated discussion

Moved from 6.1.3

[4] R2-2110948 DRX HARQ RTT timer for one-shot HARQ feedback LG Electronics Deutschland discussion Rel-16 38.321 NR\_unlic-Core

[5] R2-2110949 CR to DRX HARQ RTT timer for one-shot HARQ feedback LG Electronics Deutschland CR Rel-16 38.321 16.6.0 1175 - F NR\_unlic-Core

[6] R2-2110244 Start of DRX RTT timer for one-shot HARQ feedback Lenovo, Motorola Mobility CR Rel-16 38.321 16.6.0 1170 - F NR\_unlic-Core

[3][4][6] all discuss the issue of whether to re-/start *drx-HARQ-RTT-TimerDL* when UE receives a PDCCH without any DL transmission but triggers a Type-3 HARQ feedback (aka “one-shot HARQ feedback”). This issue was discussed at RAN2#115-e in the offline [AT115-e][021][NR16] MAC III (ZTE) but no conclusion was made. The meeting notes on that discussion is copied in the following:

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| [R2-2108343](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2108343.zip) Start of DRX RTT timer for one-shot HARQ feedback    Qualcomm Incorporated    CR    Rel-16    38.321    16.5.0    1148    -    F    NR\_unlic-Core - [021] Rap: further discussion is needed to clarify whether something is needed (e.g. for the case of LBT failure, in case of numerical K1 etc) and decide whether the CR can be accepted or not.**[021] Postponed** |

In [3] six options are proposed to address the issue, which are listed in the following:

* Option A0: No changes to Rel-16 (do not start *drx-HARQ-RTT-TimerDL* with Type-3 HARQ feedback)
* Option A1: Start *drx-HARQ-RTT-TimerDL* only for a single HARQ process.
* Option A2: Start *drx-HARQ-RTT-TimerDL* for all HARQ processes.
* Option A3: Start *drx-HARQ-RTT-TimerDL* only for the “active” HARQ processes.
* Option A4: Start *drx-HARQ-RTT-TimerDL* only for the “non-active” HARQ processes.
* Option A5: Define separate *drx-HARQ-RTT-TimerDL* and *drx-RetransmissionTimerDL* for One-shot HARQ feedback.

In [4] it is argued that whether UE re-/starts *drx-HARQ-RTT-TimerDL* should depend on the “state” of a HARQ process, e.g. whether a HARQ process has already sent its feedback or *drx-HARQ-RTT-TimerDL* has not started yet or is running. More specifically, UE should start the *drx-HARQ-RTT-TimerDL* for a HARQ process if neither the *drx-HARQ-RTT-TimerDL* nor the *drx-RetransmissionTimerDL* associated with the HARQ process is running when the request for one-shot HARQ feedback is received.

In [6] it is proposed that when UE receives PDCCH for one-shot HARQ feedback, UE should start *drx-HARQ-RTT-TimerDL* for all the requested HARQ processes, regardless of their respective “state”. In addition, any running *drx-HARQ-RTT-TimerDL* of the requested HARQ processes should expire immediately.

Let us first focus on the proposals in Phase 1. If we can converge to one of the options, we then discuss the TP in Phase 2.

**Q2**. Please indicate your preference among the following three options:

* Option A: one of the options (Option A0~A7) proposed in [3];
* Option B: the change proposed in [4];
* Option C: the change proposed in [6].

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| --- | --- | --- |
| Company | Option A0~A7/Option B/Option C | Comments |
| Huawei, HiSilicon | None | We still don't think any clarification is needed. Our interpretation of the current spec is that the *drx-HARQ-RTT-TimerDL* can be started after a PUCCH feedback, which is not indicated in the DCI, not by Type 3 HARQ feedback. In this sense, we don't think any option is the intended behavior.  |
| LG | B [proponent] | In our understanding, option B is the same as Option A3 in [6]. We don’t think the current spec is clear and correctly work for one-shot HARQ feedback. The current spec says to start *drx-HARQ-RTT-TimerDL* for the corresponding HARQ. Type 3 HARQ feedback actually includes HARQ feedback for all HARQ Processes although virtual NACK is set for some HARQ processes, e.g., for which already HARQ feedback is sent. Thus, it is unclear what should be the corresponding HARQ.  |
| Samsung | None | We think the current spec is clear.According to the following NOTENOTE 3: When HARQ feedback is postponed by PDSCH-to-HARQ\_feedback timing indicating a non-numerical k1 value, as specified in TS 38.213 [6], the corresponding transmission opportunity to send the DL HARQ feedback is indicated in a later PDCCH requesting the HARQ-ACK feedback.If the HARQ feedback is postponed, the *drx-HARQ-RTT-TimerDL* is started when HARQ FB is transmitted, for only the postponed HPs. For other HP, there is no reason to start the timers for other HPs.  |

## 3.3 IIoT

[7] R2-2109650 Clarifying the handling of Multi-TB CGs in MAC CATT discussion NR\_IIOT-Core

[7] discusses whether/how to clarify MAC behaviour for handling multi-TB CGs, a feature introduced by RAN1 in Rel-16 NR-U. This issue was discussed in RAN2#115-e in the offline [AT115-e][021][NR16] MAC III (ZTE), but no conclusion was made. The meeting notes on that discussion are copied in the following:

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| [R2-2107199](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_115-e%5CDocs%5CR2-2107199.zip) Handling of Multi-TB CGs in MAC    CATT    discussion    NR\_IIOT-Core- [021] Rap: The following Note was proposed to be captured in Chair notes: “RAN2 confirms the understanding that, in Rel-16 unlicensed band operations, for multi-TB CG configurations, MAC delivers the CG repetitions of a repetition bundle to the HARQ entity as a whole, but treats each repetition bundle opportunity independently as another group of CG transmissions delivered to the HARQ entity.”. There was no consensus. - [021] Rapporteur suggests to mark discussion on the Note and whether to in any way clarify (e.g. in chair notes) to be postponed. * [021] Noted
 |

It is argued in [7] that clarification to the current MAC behavior is still necessary. It hence requests RAN2 to confirm the following understanding:

For multi-TB CG configurations in Rel-16 unlicensed band operations,

* For transmissions without repetitions: MAC treats CGs within the CG period independently and delivers them separately to the HARQ entity;
* For transmissions with repetitions: MAC delivers the CG repetitions of a bundle to the HARQ entity as a whole, but treats bundles within the CG period independently and delivers them separately to the HARQ entity.

In addition, it is suggested that if the above understanding can be confirmed, RAN2 capture it by one of the following two options:

* Option 1: Capture it as a NOTE in Clause 5.4.1, e.g. “*All uplink grants associated with a transmission within a bundle are delivered to the HARQ entity along with the first uplink grant of the bundle. If cg-nrofPUSCH-InSlot or cg-nrofSlots is configured for a configured grant Type 1 or Type 2, each configured grant (for transmissions without repetition) or bundle (for transmissions with repetitions) within the configured grant period is delivered separately to the HARQ entity*”;
* Option 2: Capture it in Chairman’s notes.

**Q3**: Companies are asked to provide feedback on the above issue:

* Do you think any clarification the current MAC behaviour is necessary?
* If your answer is yes, do you prefer Option 1 or Option 2 listed above?

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| --- | --- | --- |
| Company | Option 1/Option 2/No change needed/ | Comments |
| Huawei, HiSilicon | Option 2 | We think no change is needed, but can compromise to Option 2 if it is majority view. |
| ZTE | Follow majorities | We confirm the understanding in this contribution is correct, but it is tightly related to the UE interior implementation, as NW vendor, we can follow the UE vendor’s opinion. |
| LG | Option 2 | We also agree with the understanding. However, in MAC, it seems to be only way that whole grants within the bundle is delivered to the HARQ entity together. In addition, as long as it is clear in PHY that each CG within the CG periodicity, i.e., not a bundle repetition, occurs based on nrofPUSCH-InSlot or cg-nrofSlots, we see not much need for further calcification in MAC. |
| Samsung | Option 2 | We think the misunderstanding rarely happens, so capturing in Chairman’s note is sufficient. |

[8] [R2-2109948](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109948.zip) Clarification on Duplication MAC CE Samsung discussion Rel-16 NR\_IIOT-Core

In [8] it is argued that the following RAN2 agreement, which was made in RAN2#109bis-e, has not been clearly captured in any specification:

|  |
| --- |
| * Rel-15 Duplication MAC CE is *not* used for Rel-16 Duplication configuration (with more than two RLC entities configured).
 |

This issue was discussed at the RAN2#115-e. The meeting notes on that discussion are copied in the following:

**Summary:** There is some support to agree the CRs (YES: 7/13). However, 6 companies don't see a big issue with the current spec. The rapporteur thinks it is not essential correction to Stage 2 spec, and the proponent may consider how/whether to capture the RAN2 previous agreements in the Stage 3 spec in the next meeting.

[8] proposes that a note can be added to 6.1.3.11 in TS38.321, e.g. “*The Duplication Activation/ Deactivation MAC CE is not used if a DRB is configured with more than two RLC entities*.”

**Q4**: Companies are asked to provide feedback on the above issue:

* Do you think any clarification to the current MAC specification is necessary?
* If your answer is yes, do you agree with the NOTE proposed in [8]?

|  |  |  |
| --- | --- | --- |
| Company | Agree as is/ Agree with change/No change needed/  | Comments |
| Huawei, HiSilicon | Agree  |  |
| ZTE | Agree as is |  |
| LG | No strong view | Agree with the intention. |
| Samsung | Agree | proponent |

## 3.4 2-step RACH

[9] [R2-2110763](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110763.zip) Correction on downlink pathloss reference for 2-step RACH Qualcomm Incorporated CR Rel-16 38.321 16.6.0 1172 - F NR\_2step\_RACH-Core

It is proposed in [9] to add a clarification to *msgA-RSRP-Threshold*, a downlink pathloss reference threshold for UE to select RA type (2-step vs 4-step RACH). It is necessary because the current spec is not clear about which type of RS is measured for comparison with the threshold.

**Q5**: Do you think the proposed clarification is necessary?

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| --- | --- | --- |
| Company | Agree as is/Agree with change/No change needed | Comments |
| Huawei, HiSilicon | No change needed | This issue was discussed over several times. This clarification would make this term even more confused about another *msgA-RSRP-ThresholdSSB.* Our understanding is any measurement in NR should be based on beam, so no further clarification in particular on this term is needed.  |
| ZTE | No change needed | Not similar with 4-step RA, 2 step RA does not support to select the PRACH with CSI-RS in any case which means CSI-RS is not getting involved in 2-step RACH, so we think it is a common understanding msgA-RSRP-Threshold is only referring to the SSB RSRP.In addition, in 38.213, we have the following description:Prior to initiation of the physical random access procedure, Layer 1 receives from higher layers a set of SS/PBCH block indexes and provides to higher layers a corresponding set of RSRP measurements.It is also demonstrating RAN2 mainly acquire the RSRS information only for SSB from PHY layer. |
| LG | No change needed | We see no issue with the clarity of the existing text. The original text is to select the RA type between 2-step or 4-step, but the change seems to state that the UE selects the SSB between 2-step and 4-step RA type, which is more confusing. |
| Samsung | No change needed | RAN1 spec is already clear. No source of confusion. |

[10] [R2-2110946](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110946.zip) Discussion on MSGA grant overlapping with another UL grant for a HARQ process LG Electronics Deutschland discussion Rel-16 38.321 NR\_2step\_RACH-Core

[11] [R2-2111231](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2111231.zip) Correction to MsgA and Msg3 retransmission overlapping with another bundle retransmission Huawei, HiSilicon CR Rel-16 38.321 16.6.0 1178 - F NR\_2step\_RACH-Core, NR\_IIOT-Core Late

[10] and [11] both discuss the issue related to re-/transmission of MsgA/Msg3 grant overlapping with another UL grant. This issue was initially discussed in RAN2#115-e in the offline [AT115-e][021][NR16] MAC III (ZTE). But companies had divergent views on whether any change to the current specification was necessary and hence no conclusion was made.

In [10] it is argued that the current MAC specification already covers all the scenarios of overlapping between retransmission and MsgA payload transmission. In any of those cases, MAC delivers only one of them to the HARQ process. Therefore, all colliding cases are covered and no change to the current spec is needed.

On the other hand, in [11] it is argued that Msg3 retransmission shall be prioritized over the overlapping re-transmission within a bundle. However, the current specification covers only the case in which the initial Msg3 transmission overlaps with another grant, which is left to UE implementation. What should be subject to priority handling is “Msg3 retransmission” overlapping with “retransmission in a bundle”. Hence this difference should be clarified in subclause 5.4.2.2 in the MAC spec. In addition, the text related to MsgA in the same paragraph should be removed because initial transmission of MsgA is already covered by Note 3 in subclause 5.4.1 and fallback to Msg3 should be considered as an initial transmission of Msg3, not a retransmission for MsgA.

**Q6**: Do you agree with the changes proposed in [11] or no change is needed as argued by [10]?

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| --- | --- | --- |
| Company | Agree as is/Agree with change/No change needed | Comments |
| Huawei, HiSilicon | Agree as is | Proponent. The handling of overlapping Msg3 **re**transmission and **re**transmission in bundle (especially for DG bundle, i.e. PUSCH slot aggregation) is still missing in the spec, and we suggest to follow the LTE principle and not leave it to UE implementation (if nothing is captured, this has to be the only interpretation). |
| ZTE | No change needed | Agree with the opinion in [10]. The related harq process operation is redundant but no harm for the current UE behavior. According to the correction from HW, it has been included in the following description:2> else (i.e. retransmission):3> if the uplink grant received on PDCCH was addressed to CS-RNTI and if the HARQ buffer of the identified process is empty; or3> if the uplink grant is part of a bundle and if no MAC PDU has been obtained for this bundle; or3> if the uplink grant is part of a bundle of the configured uplink grant, and the PUSCH duration of the uplink grant overlaps with an uplink grant received in a Random Access Response (i.e. MAC RAR or fallbackRAR) or an uplink grant determined as specified in clause 5.1.2a for MSGA payload for this Serving Cell; or:3> if the MAC entity is not configured with *lch-basedPrioritization* and this uplink grant is part of a bundle of the configured uplink grant, and the PUSCH duration of the uplink grant overlaps with a PUSCH duration of another uplink grant received on the PDCCH; or:3> if the MAC entity is configured with *lch-basedPrioritization* and this uplink grant is not a prioritized uplink grant:4> ignore the uplink grant.So we think, no specification change is needed.[LC]: Thanks for pointing this out. But above highlighted sentence is used to address CG bundle overlapping with a DG case, and even and hence DG bundle case (at least overlapping with Msg3 retx) is still missing?[Fei]:To Alex, Just a question for clarification, have DG bundling case been included in the note 3：NOTE 3: If the MAC entity receives a grant in a Random Access Response (i.e. MAC RAR or fallbackRAR), or addressed to Temporary C-RNTI or determines a grant as specified in clause 5.1.2a for MSGA payload and if the MAC entity also receives an overlapping grant for its C-RNTI or CS-RNTI, requiring concurrent transmissions on the SpCell, the MAC entity may choose to continue with either the grant for its RA-RNTI/Temporary C-RNTI/MSGB-RNTI/the MSGA payload transmission or the grant for its C-RNTI or CS-RNTI.  |
| LG | No change needed [proponent] |  |
| Samsung | No change needed | Agree with ZTE. Nothing is broken from the current spec. |

4. Phase 2 discussion

TBD (based on phase 1 outcome)

1. Conclusion

TBD

1. References
2. R2-2109457, Correction to SR procedure with UL skipping, Qualcomm Incorporated.
3. R2-2109458, Correction to SR procedure with UL skipping, Qualcomm Incorporated.
4. R2-2109921, Handling of One-shot HARQ feedback for NR-U, Qualcomm Incorporated.
5. R2-2110948, DRX HARQ RTT timer for one-shot HARQ feedback, LG Electronics Deutschland.
6. R2-2110949, CR to DRX HARQ RTT timer for one-shot HARQ feedback, LG Electronics Deutschland.
7. R2-2110244, Start of DRX RTT timer for one-shot HARQ feedback, Lenovo, Motorola Mobility.
8. R2-2109650, Clarifying the handling of Multi-TB CGs in MAC, CATT.
9. R2-2109948, Clarification on Duplication MAC CE, Samsung.
10. R2-2110763, Correction on downlink pathloss reference for 2-step RACH, Qualcomm Incorporated.
11. R2-2110946, Discussion on MSGA grant overlapping with another UL grant for a HARQ process, LG Electronics Deutschland.
12. R2-2111231, Correction to MsgA and Msg3 retransmission overlapping with another bundle retransmission, Huawei, HiSilicon.
13. R2-2109533, Corrections to LCP for truncated SCell BFR MAC CE, Samsung Electronics Co., Ltd.