**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

|  |  |
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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. |
| Lenovo, Motorola Mobility | No Change required | This seems to be rather a corner case which may happen but should (if at all) only occur at the end of a data burst. Those rare case scenarios have been already discussed at the time of LTE. We also agree with the comment by ZTE. |
| Qualcomm | No change needed | We agree that the comment by ZTE and Samsung on regular BSR is valid and hence the UL grant is not skipped. |
| Nokia | No change needed | Agree with others. |
| CATT | No change needed | 1. BSR in SCG contains the available buffer sizes in PDCP and RLC. So even if the UL grant in MCG is large enough, it is very possible there are data in SCG RLC if BSR in SCG has been triggered.  2. From another aspect, if no data in SCG, UL skipping can be looked as using an empty UL grant and it satisfies the condition that “*All pending SR(s) for BSR triggered according to the BSR procedure (clause 5.4.5) shall be cancelled and each respective sr-ProhibitTimer shall be stopped when the UL grant(s) can accommodate all pending data available for transmission*”. |
| Intel | No change needed | Agree with others. |
| vivo | No change needed | In our understanding, the scenario mentioned is not valid (Sorry if we misunderstood). Specifically, once the data becomes available to the SCG MAC entity, it cannot be scheduled by the UL grant from its MCG as cross cell group scheduling is supported in NR. In this sense, there is still pending data at the SCG path. As a result, the conditions for UL skipping cannot be satisfied and the pending SR is needed for the subsequent scheduling. |
| Ericsson | No change required | Agree with ZTE in this scenario, a Regular BSR triggered in the SCG and when an UL grant is received from the network for SCG, the UE shall build a MAC CE (which is not a padding BSR, it’s a regular BSR) even the buffer is empty, thus the transmission will not be skipped according to 5.4.3.1.3.  Agree also with LG that SR is cancelled since the UL grant(s) can accommodate all pending data available for transmission.  Further, only a bad UE implementation would not cancel also a SCG Regular BSR when transmitting a Regular BSR in MCG (or when all data can be accommodated in the UL grant(s) in MCG but the grant cannot accommodate the BSR MAC CE):  All triggered BSRs may be cancelled when the UL grant(s) can accommodate all pending data available for transmission but is not sufficient to additionally accommodate the BSR MAC CE plus its subheader. All BSRs triggered prior to MAC PDU assembly shall be cancelled when a MAC PDU is transmitted and this PDU includes a Long or Short BSR MAC CE which contains buffer status up to (and including) the last event that triggered a BSR prior to the MAC PDU assembly. |
| OPPO | No change required | If the triggered BSR is regular BSR, the UL grant won’t be skipped according the specification below, thus the regular BSR will be transmitted and the SR will be cancelled  The MAC entity shall not generate a MAC PDU for the HARQ entity if the following conditions are satisfied:  - the MAC entity is configured with *skipUplinkTxDynamic* and the grant indicated to the HARQ entity was addressed to a C-RNTI, or the grant indicated to the HARQ entity is a configured uplink grant; and  - there is no aperiodic CSI requested for this PUSCH transmission as specified in TS 38.212 [9]; and  - the MAC PDU includes zero MAC SDUs; and  - the MAC PDU includes only the periodic BSR and there is no data available for any LCG, or the MAC PDU includes only the padding BSR.  If the triggered BSR is periodic BSR, the case would happen as the skipping conditions are met as the specification says above. Then if the UL grant is skipped while the SR is still pending, UE will keep trying to send the SR until reaches the maximum threshold. We show sympathy on the reason for change but we also think it’s a corner case because as also commented by other companies, this case happens in the end of data burst. |
| Xiaomi |  | We think that this seems to be corner case, and the issue can happen only at the end of the data transmission. We are not sure whether it is urgent to resolve this issue. |
| MediaTek | No change needed | As indicated by the proponent, there is no issue to resolve. |
| Sequans | No change needed | Agree with ZTE |

## 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:\Documents\3GPP\tsg_ran\WG2\TSGR2_115-e\Docs\R2-2108343.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.  [QC] It seems that Huawei have considered this issue to be related to non-numerical K1. Please note that drx-HARQ-RTT-TimerDL is only started when there is a DL transmission in the current MAC. A one-shot HARQ feedback request can be sent without any DL transmission which triggers the UE to includes HARQ feedback for ALL HARQ processes. This is the problem we are trying to solve here. |
| 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 NOTE  NOTE 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.  [QC] Please note that this is not an issue related to non-numerical K1. Also note that drx-HARQ-RTT-TimerDL is only started when there is a DL transmission in the current MAC. A one-shot HARQ feedback request can be sent without any DL transmission which triggers the UE to includes HARQ feedback for ALL HARQ processes. This is the problem we are trying to solve here.  [LG] one-shot HARQ feedback is not to postpone the HARQ feedback. As the network may not receive HARQ feedback from the UE due to LBT failure, even when not postponed, the network intends to receive the HARQ feedback for the HARQ processes at a time. NOTE3 is not relevant to one-shot HARQ feedback, hence we don’t think it is clear from the spec now. |
| Lenovo, Motorola Mobility | Option C  (Proponent) | According to the current spec, drx-HARQ-RTT-TimerDL is started only when PDCCH indicates a DL transmission. Since drx-HARQ-RTT-TimerDL is not started for cases when PDCCH does not indicate a DL transmission (PDCCH only), it may happen that UE is in sleep mode not listening to PDCCH when the gNB has sent a One-shot HARQ-ACK feedback request to the UE, i.e. DCI format requesting for a Type-3 HARQ-ACK codebook report which does not schedule a PDSCH transmission. Since the UE does not start HARQ retransmission timer, it will not monitor DL until the next ON duration. Therefore, the gNB will have to wait until the next ON duration to schedule those retransmissions, which will incur additional latency. Hence we propose that UE should start drx-HARQ-RTT-TimerDL for all the requested HARQ processes, regardless of their respective “state when UE receives PDCCH for one-shot HARQ feedback (indicating no DL transmission).  Furthermore, a one-shot feedback includes HARQ feedback information for all HARQ processes; therefore starting the drx-HARQ-RTT-TimerDL and stopping the drx-RetransmissionTimerDL for all HARQ processes may result in that the UE is not listening for any PDCCH for as long as the drx-HARQ-RTT-TimerDL timer is running. Such a behaviour is detrimental to the user experience (e.g. latency of data delivery) and the network efficiency. Therefore we think that any started/running drx-HARQ-RTT-TimerDL of the requested HARQ processes should be considered as expired immediately, so that drx-RetransmissionTimerDL will start immediately upon reception of a One-shot HARQ-ACK feedback request.  [LG] We agree that we should not delay the retransmission. However, the UE may still be in progress of the received data if drx-HARQ-RTT-TimerDL is running. Therefore, we wonder if early start of drx-RetransmissionTimerDL by immediate stopping of the running drx-HARQ\_RTT-TimerDL may bring an issue that the UE cannot decide whether to start the drx-RetransmissionTimerDL because the UE cannot tell whether the data is successfully decoded or not yet. |
| ZTE | See comments | Since DCI indicating type-3 HARQ feedback can either schedule or not schedule a PDSCH, according to the current spec, only the case scheduling a PDSCH is included. So we think the below modification is needed, and other description is clear.  2> if the PDCCH indicates a DL transmission or a request for a Type-3 HARQ-ACK codebook report and does not schedule a DL transmission as specified in TS38.213 [6]:  3> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  [LG] With this approach, the drx-HARQ-RTT-TimerDL will be started for a HARQ process for which drx-HARQ-RTT-TimerDL expired and drx-RetransmissionTimerDL started already. It would be confusing whether the MAC shall start or restart drx-RetransmissionTimerDL when drx-HARQ-RTT-TimerDL expires during drx-RetransmissionTimerDL is running. Alternatively, the UE may stop the running drx-RetransmissionTimerDL when starting the drx-HARQ-RTT-TimerDL, which only results in delaying the retransmission scheduling. That is the reason why we in option B suggest to start drx-HARQ-RTT-TimerDL only when neither drx-HARQ-RTT-TimerDL nor drx-RetransmissionTimerDL is running. |
| Qualcomm | A\*/B/C | No changes to the current specification is not good as a HARQ retransmission will have to wait for the next DRX ON cycle which might be quite long, e.g. 40 or 80ms. This is not good for latency and UE processing of the HARQ process. In addition, since gNB had cleared the LBT to send the Type-3 request, it is better to perform retransmissions in this COT rather than waiting for the next DRX ON where LBT may not be successful.  We are fine with any solution which can effectively makes the UE to monitor DL, i.e. start DRX retransmission timer. In that regard, any of Ax, x >1 or B or C are acceptable. We can also merge B and C, which will again be fine with us, as follows:  2> if the PDCCH indicates One-shot HARQ-ACK request as specified in TS 38.213 [6]:  3> consider the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process as expired, if neither the *drx-HARQ-RTT-TimerDL* nor the *drx-RetransmissionTimerDL* is running.  [LG] Thanks for the effort. However, we have a concern on C because,  - drx-RetransmissionTimerDL is started only when the received data is not successfully decoded. When the drx-HARQ-RTT-TimerDL is immediately stopped, the UE may still be in progress of the received data and cannot decided whether to start the drx-RetransmissionTimerDL or not (as the UE doesn’t know yet whether the received data is successfully decoded or not). It may cause tricky handling of drx-RetransmissionTimerDL, e.g., delay for a while the UE has a decoding result for the received data.  In our view, the main difference between option B or C is the actual action, i.e., whether to start the drx-HARQ-RTT-TimerDL (Option B) or the drx-RetransmissionTimerDL (Option C), which seems not possible to be merged. |
| Nokia | See comment | Ok without any change. If to do anything, option B seems to be most reasonable option without impact the ongoing process. |
| CATT | Option B | We believe it is the cleanest option. |
| Intel | See comments | We tend to agree that UE behavior needs to be defined, but it might be better to be defined for Rel-17. |
| vivo | Option B | This solution can avoid further operation on the ongoing DRX-related times, it seems simpler. |
| Ericsson | A5 | This address all the issues brought forward, and it is future proof.  Regarding Samsung and Huawei comments, the start of drx-HARQ-RTT-TimerDL is not for the case of assignments with non-numerical K1. It is for the HARQ processes scheduled WITH numerical K1, as then there is nothing that can trigger the start of the drx RTT timer when One-shot HARQ feedback is sent.  B seems very similar to A3.  C seems very similar to A1.  A0: if we do nothing, the UE may be in drx sleep when the gNB is ready to send assignments based on the received One-short HARQ feedback. This delay may be too long for acceptable QoS.  A1: the gNB cannot know for sure which HP the UE selects, as the UE may have missed an assignment or gNB may have missed an earlier HARQ feedback transmission. Then gNB may schedule the selected HP with new data, and drx-HARQ-RTT-TimerDL is then restarted. This cannot be avoided by gNB implementation.  A2: the UE may go to DRX sleep if all drx-HARQ-RTT-TimerDL are running (if no other drx timer keeps it awake). Then gNB cannot reach the UE for other DL transmissions that were not dependent on the HARQ feedback in the One-shot HARQ feedback transmission.  A3: will be hard to define which HARQ processes are active or not and get UE and gNB to have the same opinion. If choosing the HARQ processes with drx RTT timer not running and drx-retx timer not running, those may all be used by the gNB for other transmissions before the gNB want to send assignments based on the One-shot HARQ feedback, in that case the UE may not be awake when the gNB want to send assignments based on the One-shot HARQ feedback.  A4: same issue as A3.  A5: this ensures the UE and the gNB have the same opinion on the DRX state and that the UE is awake when the gNB sends assignments for any HARQ process based on the One-shot HARQ feedback (or any HARQ process that can have an assigmnet earlier). A5 is simpler to implement as neither the UE nor the gNB needs to search any/all HARQ processes to decide which drx-HARQ-RTT-TimerDL shall be started. A5 is future proof, if later RAN1 decides that the DCI for requesting HARQ feedback indicates a subset of HARQ processes to report for, there will be no need to change the drx operation. |
| OPPO | Tend to leave the spec as it is | Based on the current specification on the condition to trigger drx-HARQ-RTT-TimerDL, the UE will not trigger drx-HARQ-RTT-TimerDL when receiving the PDCCH indicating one-short HARQ feedback, because the condition says the PDCCH should indicate a DL transmission while one-short HARQ feedback PDCCH does not.  2> if the PDCCH indicates a DL transmission:  3> start the *drx-HARQ-RTT-TimerDL* for the corresponding HARQ process in the first symbol after the end of the corresponding transmission carrying the DL HARQ feedback;  To us, one way is we leave the current specification as it is, because even if the one-short HARQ feedback PDCCH does not trigger the start of drx-HARQ-RTT-TimerDL, network can still schedule retransmission within the next on-duration, so nothing broken.  If we really need a solution, we think those HARQ process which corresponds to the scheduling with non-numerical PDCCH can be regarded to trigger the corresponding drx-HARQ-RTT-TimerDL when UE perfomrs the feedback indicated by one-short feedback PDCCH. |
| Xiaomi | See comments | It is not clear why the UE should start the HARQ RTT timer for a dummy NACK. If there is a real transmission, and the current NOTE 3 does not start the HARQ RTT timer for cases other than “non-numerical k1”. We can accept to add some clarification sentence in NOTE 3 to cover extra cases. |
| MediaTek | A2/A3/B | These options enable the UE to monitor for retransmissions of HARQ processes that were indicated as ‘NACK’ in the one-shot feedback.  We don’t think option C works well for the same reasons as Ericsson and LG |
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## 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:\Documents\3GPP\tsg_ran\WG2\TSGR2_115-e\Docs\R2-2107199.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. |
| Lenovo,  Motorola Mobility |  | We don’t have strong opinion whether anything needs to be clarified in the MAC spec. We would support the majority view here. But we confirm the understanding of the contribution. |
| Qualcomm | No change needed | We think it is mostly a modelling issue and no change to the current spec is needed. If all companies share the understanding of the contribution and support capturing it in the Chair’s Notes, that’s fine with us too. |
| Nokia | No change needed | As discussed in the previous meeting, the behaviour is clear. |
| CATT | Option 1 or 2  [proponent] | The contribution is to confirm the correct understanding and capture it somehow. Whether option 1 or option 2 is OK. |
| Intel | Option 2 | We agree with the understanding in the contribution and are OK to capture it in Chair notes. |
| vivo | No change needed | Although we think the behavior is clear, we can follow the majority view. |
| Ericsson | No change needed | It is unclear the need for clarification. Any other understanding would mean that the RAN1 agreements are not correctly captured. Additionally, multi-TB is introduced by RAN1 and if RAN1 is fine with the MAC, then it is better to leave as it is. |
| OPPO | Option 2 | We do not think there is a need for change in the spec. if majority thinks it is unclear, we can compromise to capture something in Chairman’s notes. |
| Xiaomi |  | We confirm the understanding as provided in the above contribution. No strong view on whether to change anything in the specification. |
| MediaTek | Option 1 | We agree with the understanding as provided in this contribution. For avoidance of future confusion, it would be good to capture this understanding as a NOTE in the specifications |
|  |  |  |

[8] [R2-2109948](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2109948.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 |
| Lenovo,  Motorola Mobility | Agree |  |
| Qualcomm | No strong view | The intention is fine but we don’t think the note is critical, as there is little room for UE to misunderstand the MAC CE. |
| Nokia | Agree with change | It is not used for a DRB configured with more than two RLC entities but can still be used for other DRBs with only two RLC entities. Then the bit for the DRB with more than two RLC entities is ignored.  Proposed change:  “The Duplication Activation/ Deactivation MAC CE is not applicable for DRB(s) configured with more than two RLC entities.”” |
| CATT | Agree |  |
| Intel | Agree as is. |  |
| vivo | Agree as is | This revision makes the spec more reader-friendly. |
| Ericsson | Agree |  |
| OPPO | Agree as is |  |
| Xiaomi | Agree |  |
| MediaTek | Agree | Also ok with Nokia’s suggestion |
| Sequans | Agree with change | With Rel-15 duplication, a DRB can be configured with 4 RLC UM entities (2 DL, 2 UL) and the Duplication Activation/ Deactivation MAC CE should still be used in that case. |

## 3.4 2-step RACH

[9] [R2-2110763](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110763.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?

|  |  |  |
| --- | --- | --- |
| 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. |
| Lenovo, Motorola Mobility | No change required |  |
| Qualcomm | No change needed |  |
| Nokia | No change needed | We don't select SSB between 2-step and 4-step RACH, beam selection only after RA type selection. Besides, CSI-RS based beam selection is not supported for 2-step RA. |
| CATT | No change needed | Agree with above comments. Current specification is clear. |
| Intel | No change needed | Agree with others that existing spec is clear. |
| vivo | No change needed | The correction seems not right (i.e. the mentioned threshold is not used for the selection of SSB). Anyway, we think the current spec is clear enough. |
| Ericsson | No change needed |  |
| OPPO | No change needed |  |
| Xiaomi | No change needed | Agree with Samsung and ZTE. It seems that 38.213 already provides sufficient clarification. |
| MediaTek | No change needed | For the same reasons as ZTE |
|  |  |  |

[10] [R2-2110946](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2110946.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:\Documents\3GPP\tsg_ran\WG2\TSGR2_116-e\Docs\R2-2111231.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]?

|  |  |  |
| --- | --- | --- |
| 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; or  3> if the uplink grant is part of a bundle and if no MAC PDU has been obtained for this bundle; or  3> 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. |
| Lenovo, Motorola Mobility | No change required | Same view as expressed in [10] |
| Qualcomm | No change needed | Agree with the analysis in [10] |
| Nokia | No change needed | Same text used in LTE. Even though the CR when introduced the text refers to bundling, no problem with generalizing it. Procedural text takes precedence over NOTE anyway. |
| CATT | No change needed | Considering that MAC subclause 5.4.1 treats CG and DG bundles at once, we interpret Note 3 as applying to not only the first grant of a bundle but all of them. |
| Intel | No change needed | Our preference is to keep current specification without any change. As ZTE pointed out, nothing is broken. If RAN2 sees the need to clean up the specification, we prefer to remove the redundant check for both Msg3 buffer and MsgA buffer for consistency. |
| vivo | No change needed | The current spec works well enough. Generally, we think there is no need to handle repeated descriptions after the spec has been frozen. |
| Ericsson | No change needed | Agree w [10] |
| OPPO | No change needed |  |
| Xiaomi | No change needed |  |
| MediaTek | No change needed | Agree with [10] |
|  |  |  |

## 3.5 eMIMO

[12] R2-2109533 Corrections to LCP for truncated SCell BFR MAC CE Samsung Electronics Co., Ltd CR Rel-16 38.321 16.6.0 1160 - F NR\_eMIMO-Core

It is pointed out in [12] that there are two MAC Ces for BFR: BFR MAC CE and Truncated BFR MAC CE. However, in the current spec Truncated BFR MAC CE is missing in the prioritisation rule for generating MAC PDU. Hence it should be added to the rule together with BFR MAC CE.

**Q7:** Do you agree to add Truncated BFR MAC CE to the prioritisation rule for generating MAC PDU?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| LG | Yes | However, we suggest to use “MAC CE for BFR” instead of adding “truncated BFR MAC CE”, which is the same of specifying BSR MAC CE in prioritization rule.  We also need this change to the NOTE 2 in S5.4.3.1.3  NOTE 2: Prioritization among Configured Grant Confirmation MAC CE, Multiple Entry Configured Grant Confirmation MAC CE, and MAC CE for BFR is up to UE implementation. |
| Samsung | Yes | As mentioned by the rapporteur, the case of Truncated BFR MAC CE is missing in the spec. (Proponent)  We also agree with LG that MAC CE for BFR looks better. |
| ZTE | No | We think BFR MAC CE in spec is to indicate a MAC CE type which includes both BFR MAC CE and truncated BFR MAC CE. If we correct the terminology in one place, we are afraid that a lot of similar correction would be raised, for example:  **6.1.3.1 Buffer Status Report MAC Ces**  Buffer Status Report (BSR) MAC Ces consist of either:  - Short BSR format (fixed size); or  - Long BSR format (variable size); or  - Short Truncated BSR format (fixed size); or  - Long Truncated BSR format (variable size).  Pre-emptive BSR MAC CE consists of:  - Pre-emptive BSR format (variable size).  The BSR formats are identified by MAC subheaders with LCIDs as specified in Table 6.2.1-2.  The Pre-emptive BSR format is identified by MAC subheaders with eLCID as specified in Table 6.2.1-2b.  The fields in the BSR MAC CE are defined as follows:  …  /omit for short/  **6.1.3.23 BFR MAC Ces**  The MAC Ces for BFR consists of either:  - BFR MAC CE; or  - Truncated BFR MAC CE.  The BFR MAC CE and Truncated BFR MAC CE are identified by a MAC subheader with LCID/eLCID as specified in Table 6.2.1-2 and Table 6.2.1-2b.  …  The fields in the BFR MAC Ces are defined as follows:  …  etc.  So we suggest keep it as it is, no change is needed. |
| Qualcomm | Yes | We think the rewording suggested by LG, “MAC Ces for BFR”, is better. |
| Huawei, HiSilicon | Agree with the intention, but not for a CR | We share the view as ZTE. There is no room for misunderstanding of this term as it has been described in other clauses. We are okay with a clarification in the minutes. |
| Nokia | No | Agree with ZTE. Truncated BFR MAC CE is one type of BFR MAC CE under the same section. |
| CATT | Yes with comment | We agree with LG’s way forward, to use “MAC CE for BFR” as a generic terminology covering both types of BFR MAC CEs. Then, LG’s proposed correction should also apply to subclause 6.1.3.23 BFR MAC CEs:  **6.1.3.23 ~~BFR~~ MAC CEs for BFR**  The MAC CEs for BFR consists of either:  - BFR MAC CE; or  - Truncated BFR MAC CE.  The BFR MAC CE and Truncated BFR MAC CE are identified by a MAC subheader with LCID/eLCID as specified in Table 6.2.1-2 and Table 6.2.1-2b.  The BFR MAC CE and Truncated BFR MAC CE have a variable size. They include a bitmap and in ascending order based on the ServCellIndex, beam failure recovery information i.e. octets containing candidate beam availability indication (AC) for SCells indicated in the bitmap. For BFR MAC CE, a single octet bitmap is used when the highest ServCellIndex of this MAC entity's SCell for which beam failure is detected and the evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed is less than 8, otherwise four octets are used. A MAC PDU shall contain at most one ~~BFR~~ MAC CE for BFR.  For Truncated BFR MAC CE, a single octet bitmap is used for the following cases, otherwise four octets are used:  - the highest ServCellIndex of this MAC entity's SCell for which beam failure is detected and the evaluation of the candidate beams according to the requirements as specified in TS 38.133 [11] has been completed is less than 8; or  - beam failure is detected for SpCell (as specified in Clause 5.17) and the SpCell is to be indicated in a Truncated BFR MAC CE and the UL-SCH resources available for transmission cannot accommodate the Truncated BFR MAC CE with the four octets bitmap plus its subheader as a result of LCP.  The fields in the ~~BFR~~ MAC CEs for BFR are defined as follows: |
| Intel | Yes | Agree with the change proposed by LG. |
| vivo | Agree with the intention | Using “MAC CEs for BFR” instead through the MAC spec is fine. |
| Ericsson | yes |  |
| OPPO | Yes |  |
| Xiaomi | Yes | We support the rewording of using “MAC CEs for BFR”. |
| MediaTek | Yes | Prefer LG’s proposed change |
|  |  |  |

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.