**3GPP TSG-RAN WG2 #118-e *R2-22xxxxx***

**E-meeting, 09 – 20 May 2022**

**Agenda item:** 6.4.3

**Source:** Samsung

**Title:** Summary of discussion [AT118-e][065][eIAB] MAC (Samsung)

**Document for:** Discussion and decision

# Introduction

This contribution summarizes the following discussion:

* [AT118-e][065][eIAB] MAC (Samsung)

Scope: 1. Address the remaining TS issues from tdocs submitted under AI 6.4 (and below), except those issues addressed in specific discussion. Review collect comments identify agreement points, points for online CB etc. 2. Progress the CR, merge all TS impacts into a single CR.

Intended outcome: Report, CR

Deadline: 1 for CB W2 Wed, 2 CR agreement is expected in Post meeting discussion

Please note that the scope of this discussion does not include the issue of introduction of outstanding MAC CEs and the related RRC/MAC CE split discussion. The present discussion looks at submissions to the meeting proposing changes to the existing spec/existing MAC CEs.

In Section 2, companies’ views are collected on the various issues raised in submissions to the meeting. Section 3 contains rapporteur’s proposals based on input in Section 2, and companies’ comments on these proposals. Section 4 then lists final version of proposals, to be reviewed by RAN2 and used in any modification of draft MAC CR (which is made available in parallel with this discussion document).

# Key issues

The following Table 1 contains a list of the documents that the rapporteur believes are relevant to the MAC spec, the summary of proposed changes therein, and rapporteur’s reply/proposed action. Companies are invited to comment by providing their input into Table 1.

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| **Tdoc no.** | **Summary of change(s)** | **Rapporteur’s proposed way forward** | **Companies’ view**  **[Company name]: comments** |
| R2-2205268 (rapporteur submission) | 1. change *logicalChannelGroup-IABExt* to *logicalChannelGroup-IAB****-****Ext* (clause 5.4.5), to align with RRC spec  2. change (3072, -3071, …, 1023) to (**-**3072, -3071, …, 1023), to correct the error made when previous CR was implemented (clause 6.1.3.38)  NB – other changes from this submission are to do with introduction of new MAC CEs and are out of scope of present discussion | Implement both changes | [LGE] agree with rapporteur’s change.  [Ericsson]: Ok to changes 1/2 indicated by the rapporteur  [Apple] Fine with both changes.  [ZTE] agree with the two changes.  [vivo] OK with the two changes  [Intel]: Agree.  [QCOM]: Agree |
| R2-2204901 | 1) If the Extended Long Truncated BSR MAC CE cannot be used for padding BSR with multiple LCGs having data for transmission, proposal is to allow one MAC PDU to carry multiple Extended Short Truncated BSR MAC CEs  2) Due to perceived clash between 5.4.5 and 6.1.3.1, consider whether to remove the description to include the BS fields for Long/Extended Truncated BSR in ascending order of the LCG IDs in Clause 6.1.3.1. | Rapporteur agrees that 1) does identify a potential wastage of padding bits. However this was already discussed at length in the previous meeting and agreement was to live with this wastage. Also, a MAC PDU can only carry one BSR MAC CE. Therefore rapporteur proposes not to pursue 1).  Regarding 2), rapporteur feels there is no inconsistency. In 5.4.5, it is stated that when reporting Extended Long Truncated BSR, LCGs should following a **decreasing** order of the highest priority logical channel in each of these LCG(s). In rapporteur’s understanding, this means that the highest priority LCG is selected for reporting first, followed by second highest priority LCG, and so on until we run out of padding.  In 6.1.3.1, it is stated that for the Extended Long Truncated format, the Buffer Size fields are included in **ascending** order based on the LCGi.  Rapporteur’s understanding is as follows:  - Based on 5.4.5, we decide which LCGs to include - Based on 6.1.3.1, we decide how to put them together in a BSR MAC CE  Therefore there is no apparent “contradiction” in rapporteur’s understanding, and rapporteur proposes not to pursue 2). | [LGE] agree with rapporteur and no changed is needed.  In addition, for issue 1), considering the description in LCP section, i.e., “- the UE should maximise the transmission of data;”, if there is a remaining data in a logical channel, the normal UE should include a data into a MAC PDU as much as possible and should not generate that much padding bits for padding BSR as addressed in the R2-2204901. So, we think that wastage would be small and negligible.  [vivo] Thanks for the comments. We agree that if there are available data which can be included in the MAC PDU for a UL grant according the LCO procedure, it is less likely to have several tens of padding bytes. However, it may exist that the available data cannot be included in the MAC PDU for a UL grant due to the LCP restriction. Then it is possible to have several tens of padding bytes.  [Huawei]: Agree with rapporteur’s view on that 2) is not needed (This is legacy issue. And there is no issue in legacy).  [Ericsson]: For 1) we agree with the issue, but RAN2 decided to do not address this problem. Further, P1 in R2-2204901 is not a minor change. For 2) we agree with Rapporteur.  [Apple] We have some sympathy with 1) but this is an optimization, and it is going to complicate the procedure. We prefer not to adopt this proposal even though the current procedure is not ideal either. For 2) we agree with the rapporteur.  [ZTE] Agree with rapporteur’s analysis.  [vivo] for 1), we don’t understand the high complexity. As the procedure to generate single extended Long Truncated BSR MAC CE is already in MAC protocol. It is easy to generate multiple ones by iterating the existing procedure.  [Intel]: Agree with Rapporteur’s view that both 1) and 2) are not pursued. It was previously discussed in RAN2 general UP related discussions and also not to address the problem.  [QCOM] For 1), we agree with Ericsson and Apple. For 2), we agree with Rapporteur. |
| R2-2205255 | 1) It is observed that in 5.4.7, for pre-emptive BSR, only generation of Pre-emptive BSR is captured and not the generation of the Extended version.  2) Comment is made that the function of Timing Delta MAC CE for Case-6 timing is not only for the IAB-DU Tx, but also for the IAB-MT Tx, and appropriate correction is proposed.  3) The description of the MAC CE in 6.1.3.39 is missing. | Regarding 1), rapporteur agrees this is a potential issue. However, for legacy BSR we also do not list all types of BSR formats that should be generated – we simply say generate the BSR MAC CE(s) as defined in clause 6.1.3.1. Rapporteur’s proposal is therefore to fix this by removing reference to Pre-emptive BSR MAC CE altogether, as it is clear that the procedure we refer to is the ‘Pre-emptive Bufer status reporting procedure’. Please see accompanying CR draft for rapporteur’s proposed change to resolve this issue.  Regarding 2) and 3), rapporteur proposes to agree the original change. | [LGE] agree with Rapporteur’s analysis and change.  [Huawei] On 1), prefer the original proposal. But fine with rapp update.  [Ericsson]: On 1), agree with Rapporteur´s way forward. On 2) ok. On 3) there is no need to specify that the IAB-MT is a child IAB node: “An ~~child~~ IAB-MT can inform a parent node whether Case 6 timing is required for simultaneous operation by this MAC CE.”  [Apple] On 1), we slightly prefer the proposal made by the rapporteur. For change 2) and 3) we are ok to agree it with the update proposed by Ericsson.  [ZTE] For 1st change, prefer the rapporteur suggested change. For the 3rd change, agree the update from Ericsson.  [vivo] For 1st change, we agree with the rapporteur’s proposal.  For 2nd change, OK.  For 3rd one, we agree with Ericsson’s update.  [Intel] For 1), by removing “pre-emptive” makes it even more unclear what BSR MAC CE should be generated. We think the change is not essential as both pre-emptive BSR format and extended pre-emptive BSR formats are included in pre-emptive BSR MAC CE in clause 6.1.3.1. For 2), agree with the changes. For 3), ok with Ericsson’s update.  [QCOM] Agree with Ericsson. |
| R2-2205287 | 1) For the IAB node that is configured with *logicalChannelGroup-IAB-Ext-r17*, the IAB node should report the extended Short BSR, when the maximum configured LCG ID is less than 8. | Rapporteur agrees this is a potential issue which should be fixed.  It is theoretically possible (although change to RRC spec would be needed) to use *logicalChannelGroup-IAB-Ext-r17* (i.e. the extended formats, especially the Extended Short format) for when we have fewer than 8 LCGs as well, and this would give us better granularity for the Short BSR by using Extended Short BSR, which offers 8 bits instead of 5 for the buffer size. This can be especially useful given the volume of data on the backhaul.  Rapporteur therefore proposes to agree the change, but also notes that this needs to be aligned with RRC discussions. | [LGE] agree with Rapporteur’s analysis and change.  Considering that 5bits buffer size field in the Legacy Short BSR is designed only for one UE, not for backhaul traffic from many UEs, the IAB node should use an extended Short BSR if the IAB node support extended BSR format.  We also think that RRC change would be simple, i.e., just change logicalChannelGroup-IAB-Ext-r17 to start from 0 and that’s it.  [Huawei]: No strong view on this issue itself. It is discussed in RRC RIL. We suggest to wait, at least to align the conclusion from RRC and MAC.  [Ericsson]: We do not see the need for this change. If more granularity is required for the short BSR, the network can configure the IAB node with the extended logical channel groups. If the network just configures the legacy LCGs 0-7, it means that this extra granularity is not required and the IAB node can just use the legacy BSR, without any need to enhance the way of reporting the BSR for the LCGs 0-7. Using the extended LCG configuration to enhance the legacy reporting of the LCGs 0-7 is strange from a technical perspective.  [Apple] We agree with observation 3 and 4 in R2-2205287. However, the extended formats were introduced to facilitate a higher number of LCGs. If an IAB node operates with the same number of LCGs as a UE in legacy, then there might be no need to use the extended formats. Besides RAN2 agreed not to introduce new triggering conditions for BSR/Extended BSR.  The *logicalChannelGroup-IAB-Ext* is used at multiple other places. If we adopt the change, then these places will be affected. Maybe another parameter would be needed then. More importantly, the proposed solution brings back the issue that Extended Long Truncated BSR could be used when there are less than 8 LCGs with data available (even though more are configured), which seems like a waste.  We’d tend to not agree this change - but open to discuss more or consider alternative ways.  [ZTE] We think this change is not necessary. If the data volume associated with one LCG is really large, donor CU may setup more BH RLC channels and LCGs and thus the available LCGs may be larger than 8. The issue can be solved up to donor CU implementation.  [Intel] Disagree. It was agreed in previous RAN2 meeting that legacy short BSR formats are used when max configured LCG ID is less than 8. Additionally, if an IAB-node is configured with less than 8 LCG IDs, it also indicates that this IAB-node is far from IAB-donor (i.e. more closer to the accessed UE). For such scenario, the buffer size is not expected to be large, and 8 bits are not necessary. Hence, we don’t think this change should be pursued.  [QCOM] We should not discuss this matter in two places. Let’s wait how on the RIL discussion converged. |

In Table 2, companies are invited to provide any additional comments:

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| **Company** | **Comment** |
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# Proposals

There are no specific proposals below on the issues which had consensus in the discussion above – they are simply implemented in R2-22xxxxx\_eIAB\_CR\_to\_38321 -r2\_v00\_Rapp (the revision of the CR, available in the relevant Drafts folder).

On the issue of potential wastage of padding bits for the case where the Extended Long Truncated BSR MAC CE cannot be used for padding BSR due to the its sizeable header (R2-2204901), many companies recognize this issue but there is no support (apart from the proponent company, who maintain their proposal is valid) for the proposal to allow one MAC PDU to carry multiple Extended Short Truncated BSR MAC CEs. The rapporteur therefore puts forward the following:

1. The padding BSR procedure using the Extended formats is not modified.

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| **Company** | **Comment (agree/disagree, and if disagree – why)** |
| Apple | Agree |
| Intel | Agree |
| LGE | Agree |
| Huawei, HiSilicon | Agree |
| ZTE | Agree |
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Regarding the perceived clash between 5.4.5 and 6.1.3.1, and the proposal (R2-2204901) to modify the description to include the BS fields for Long/Extended Truncated BSR in ‘ascending’ order of the LCG IDs in Clause 6.1.3.1, there was no support for the proposal, with everyone except the proponent company maintaining that there is no issue to begin with. The rapporteur therefore proposes the following:

1. RAN2 agrees that there is no contradiction between 5.4.5 and 6.1.3.1, and no changes are introduced in the description of how to include the BS fields for the case of Long/Extended Truncated BSR.

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| **Company** | **Comment (agree/disagree, and if disagree – why)** |
| Apple | Agree |
| Intel | Agree |
| LGE | Agree |
| Huawei, HiSilicon | Agree |
| ZTE | Agree |
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On the issue of Pre-emptive BSR, rapporteur proposes to add the following into section 5.4.7, as it appears to be a major omission not to explain how IAB-MT chooses between Pre-emptive BSR and the Extended version:

1. RAN2 agrees to introduce the following paragraph into clause 5.4.7:  
     
   “IAB-MT may report Extended Pre-emptive BSR or Pre-emptive BSR (as defined in clause 6.1.3.1) based on whether the MAC entity of the IAB-MT is configured with *logicalChannelGroup-IAB-Ext* by upper layers.”

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| **Company** | **Comment (agree/disagree, and if disagree – why)** |
| Apple | Agree |
| Intel | Agree with comment.  The description “report Extended Pre-emptive BSR of Pre-emptive BSR” is confusing. We think “of pre-emptive BSR” can be removed. |
| LGE | Agree and Intel’s change is also acceptable. |
| Huawei, HiSilicon | Agree in general, let’s review the CR wording later. |
| ZTE | Agree |
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Still on the topic of Pre-emptive BSR, on the issue raised in R2-2205255 that – in 5.4.7 – for pre-emptive BSR, only generation of Pre-emptive BSR is captured and not the generation of the Extended version it appears the following 3 options have emerged:

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| Option 1 (solution proposed in R2-2205255) | The MAC entity shall:  1> if the Pre-emptive Buffer Status reporting procedure determines that at least one Pre-emptive BSR has been triggered and not cancelled:  2> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the Pre-emptive BSR MAC CE or Extended Pre-emptive BSR plus its subheader as a result of logical channel prioritization:  3> instruct the Multiplexing and Assembly procedure to generate the Pre-emptive BSR MAC CE or Extended Pre-emptive BSR as defined in clause 6.1.3.1.  2> else:  3> trigger a Scheduling Request. |
| Option 2 (solution proposed by the rapporteur in Section 2) | The MAC entity shall:  1> if the Pre-emptive Buffer Status reporting procedure determines that at least one Pre-emptive BSR has been triggered and not cancelled:  2> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the BSR MAC CE plus its subheader as a result of logical channel prioritization:  3> instruct the Multiplexing and Assembly procedure to generate the BSR MAC CE as defined in clause 6.1.3.1.  2> else:  3> trigger a Scheduling Request. |
| Option 3 (solution proposed by Intel in Section 2) | The MAC entity shall:  1> if the Pre-emptive Buffer Status reporting procedure determines that at least one Pre-emptive BSR has been triggered and not cancelled:  2> if UL-SCH resources are available for a new transmission and the UL-SCH resources can accommodate the Pre-emptive BSR MAC CE plus its subheader as a result of logical channel prioritization:  3> instruct the Multiplexing and Assembly procedure to generate the Pre-emptive BSR MAC CE as defined in clause 6.1.3.1.  2> else:  3> trigger a Scheduling Request. |

Companies are asked to share their preference in the Table immediately below:

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| **Company** | **Preference (Options 1/2/3)** |
| Apple | Option 2 |
| Intel | Option 2/3 |
| LGE | Option 2 or 3 |
| Huawei, HiSilicon | Prefer option 1.  Option 2 is acceptable.  Option 3 is not correct, because we have following clearly saying “Pre-emptive BSR MAC CE” is different from “Extended Pre-emptive BSR MAC CE”  Pre-emptive BSR MAC CE consists of:  - Pre-emptive BSR format (variable size); or  - Extended Pre-emptive BSR format (variable size).  Figure 6.1.3.1-2: Long BSR, Long Truncated BSR, and Pre-emptive BSR MAC CE  Figure 6.1.3.1-4: Extended Long BSR, Extended Long Truncated BSR, and Extended Pre-emptive BSR MAC CE |
| ZTE | Option 2 |
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On the issue raised in R2-2205287, proposing that IAB node that is configured with logicalChannelGroup-IAB-Ext-r17 should be able report the extended Short BSR, when the maximum configured LCG ID is less than 8, there is some support but a number of companies are either against it or are advising to wait for this RIL to be resolved in the RRC discussion. The rapporteur therefore proposes the following:

1. On the issue of whether IAB node that is configured with logicalChannelGroup-IAB-Ext-r17 should be able report the extended Short BSR, this should further be discussed offline and/or online, taking into account the developments in the ongoing RRC discussion.

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| **Company** | **Comment (agree/disagree, and if disagree – why)** |
| Apple | The RRC email discussion [064] seems to have concluded that the IAB node that is configured with logicalChannelGroup-IAB-Ext-r17 should not be able report the extended Short BSR. We are ok to follow that. |
| LGE | Agree.  Even if the RRC email [064] has made a conclusion, there is no clear majority and actually “no strong view” is the majority. Considering this situation, we think that this should be discussed at least online to finalize the issue. |
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# Conclusions

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