3GPP TSG-RAN WG2 #131 R2-250xxxx

**Bengaluru, India, 25-29 August 2025**

**Agenda item:**8.18 (LTE-based 5G Broadcast)

**Source:** Samsung

**Title:** Discussion of [POST130][511][LTE Broadcast] MAC running CR and open issues (Samsung)

**Document for:** Report

# 1. Introduction

This document summarizes the discussion of the following offline discussion.

* [POST130][511][LTE Broadcast] MAC running CR and open issues (Samsung)

Scope:

* Prepare and review the CR
* List open issues related to the CR

Intended outcome:

* Running CR for endorsement in the next meeting
* List of open issues for discussion at the next meeting

Deadline: 01 Aug 2025, 10:00 UTC

Note: Please provide your comments to the MAC CR in this document only (i.e. no bubble comments and no direct changes to the CR)

# 2. Contact information

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| --- | --- | --- |
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# 3. Review of MAC running CR

* 1. Comments to the MAC running CR v00

**Companies are invited to list their comments on the CR v00, using comment identifier (company ID and number), e.g. SS001. The rapporteur will provide update based on the comments in proper time.**

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| Comment identifier | Clause | Comments and/or change suggestions | Rapporteur resolution |
| HW001 | 5.12a | It would be more simple and clear to specify the delta part for TFI just in 5.12 with a separate paragraph instead of repeating most of the contents in a new section. It is not easy to identify what is specific to Interleaved MCH.  ZTE : Similar view as HW. Actually, it is beneficial to have one single section that reader can spot the different without scrolling up and down. | [Rapp] In fact it is easier and clearer with a separate section for interleaved MCH. Even as a separate para, the contents would not be different than what is proposed. Rapp’s perspective I see it is better as a new section. Open to further views from other companies.  [Rapp2] Placed the new contents in existing clause 5.12  (Incorporated in draft CR v03) |
| HW002 | 5.12a | Seems that we don’t have the agreement for the following?  *“Unused part of the subframe(s), if any, is filled with padding.”*  RAN1 agreed to filled the residual spacewith the last MTCH service with a different TFI configuration.  ZTE: Although I share Rapp’s view that this is not about residual space, we can simply leave this to NW implementation. | [Rapp] @HW, this part is NOT about the residual space at the end of the scheduling period. Though residual space cannot be completely eliminated with alternate scheduling periodicities or using different TFI configuration, these approaches are best effort basis. However, residual space at the end of scheduling is the same case as was even with the legacy, known to the UE from MSI and so no spec text is needed.  Here “Unused part of subframe(s)” refers to the possible presence of padding in the subframes where MSI or MCCH is carried. Unlike legacy, any remaining space in these subframe(s) cannot be used by MTCH, due to time-interleaving differences. This is already clear from RAN1 agreement of excluding MSI and MCCH from time interleaved MCH transmission.  Unlike leagcy, padding is expected after MSI or MCCH in the subframe. In Rapp’s view it is quite simply stated and brings clarity.  [Rapp2] @ZTE, there is no NW implementation choice here. It is quite clear “unused part of subframe(s)” needs to be padded and as this is different from legacy behavior, it is essential to mention this  (No change is applied to draft CR) |
| HW003 | 6.1.3.7 | In “(excluding subframes containing MSI and/ or MCCH for time interleaved MCH)”, we can remove “and” without changing the meaning. | [Rapp] “and/or” was used as MSI and MCCH may occur together (e.g. in first subframe of scheduling period) while MCCH repetitions alone may occur in subsequent subframes.  However, Huawei’s suggestion seems fine and “and/” can be omitted.  (Incorporated in draft CR v03) |
| HW004 | 6.1.3.7 | In “For time interleaved MCH, Stop MTCH value(s) used is integer multiple of product of corresponding pmch-TimeInterleaving-M and pmch-TimeInterleaving-N configuration parameters as specified in [36.331] .”, we need to add a reference number for TS 36.331. | Thanks for the suggestion  (Incorporated in draft CR v03) |
| ZTE001 | 5.12a | As in 4.2.1, “De-Multiplexing is not applicable to MTCH corresponding to time interleaved MCH.” So I think the following part in 5.12a should be removed?  “~~- demultiplex the MAC PDU and~~ deliver the MAC SDU(s) to upper layers.” | (Incorporated in draft CR v03) |
| ZTE002 | 4.2.1 | No strong view, but update to Figure 4.2.1-1 makes it even more complex. I think a note should work. | [Rapp] @ZTE, On the contrary, for clarity it is important to reflect no demux for time-interleaved MTCH to Figure 4.2.1-1  (No change is applied to draft CR) |
|  |  | **Add Comments under new section 3.2** |  |

* 1. Comments to the MAC running CR v03

**Based on companies’ comments in section 3, an updated CR version could be provided by Rapporteur for further review.**

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| Comment identifier | Clause | Comments and/or change suggestions | Rapporteur resolution |
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# 4. Discussion on open issues

* 1. Open issue list

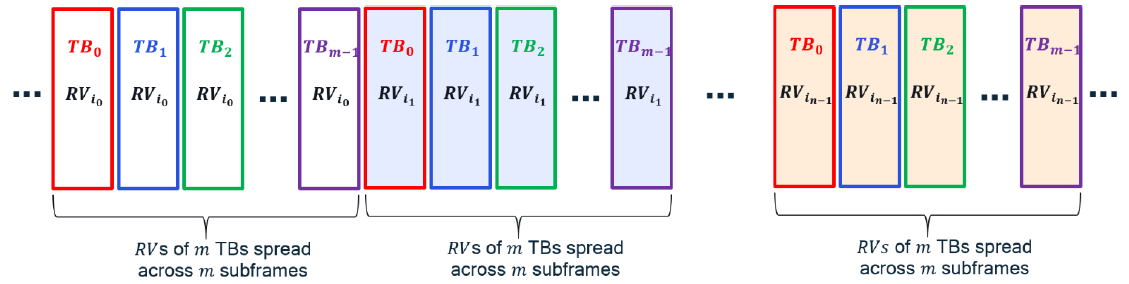
**Rapporteur provides the list of open issues as below, and the corresponding suggestions on how to address them. Some of them could be further discussed based on contributions or resolved based on further progress. Companies are invited to provide comments on whether it is open issue and whether the suggestions from rapporteur is accurate enough.**

* + 1. HARQ handling for Time-Interleaved MCH reception

RAN1 made the below agreement in RAN1#121 about the HARQ for time interleaved MCH and sent a LS to RAN2 [2]

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| **Agreement**  **RAN1 asks RAN2 whether/how to address the HARQ handling in the MAC specification for the Rel-19 time-interleaved PMCH transmission with M TBs and N RVs.** |

Time interleaving enhancements for LTE-based 5G Broadcast are based on the reuse of the 3GPP building block behind the HARQ retransmission and combining, which allows spreading the coded bits of a transport block across multiple non-consecutive subframes [RP-242534]. RAN1 discussed the matter and reached the above agreement, and a LS is sent to RAN2 given the HARQ handling is described in MAC specs.



**Fig. 1 Time interleaved MCH [RP-242534]**

In Rapp’s view, similar mechanisms for the HARQ handling have been addressed in MAC specs for SIB reception (TS 36.321, TS 38.321) and NR MBS Broadcast reception (TS 38.321) and it is straight-forward to inherit the approach for time interleaved MCH reception. Accordingly, the two spec changes (Change#1 and Change#2) as required in TS 36.321 to address HARQ handling for M transport blocks and N redundancy versions corresponding to the time interleaved MCH reception should be considered.

**Excerpt from TS 38.321: SIB reception and MR MBS Broadcast reception**

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| 5.3.2.2 HARQ process …  For each received TB and associated HARQ information, the HARQ process shall:  1> if the NDI, when provided, has been toggled compared to the value of the previous received transmission corresponding to this TB; or  1> if the HARQ process is equal to the broadcast process, and this is the first received transmission for the TB according to the system information schedule indicated by RRC; or  1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the broadcast MCCH schedule indicated by RRC; or  1> if the HARQ process is associated with a transmission indicated with a Multicast MCCH-RNTI for MBS multicast in RRC\_INACTIVE, and this is the first received transmission for the TB according to the multicast MCCH schedule indicated by RRC; or  1> if the HARQ process is associated with a transmission indicated with a G-RNTI for MBS broadcast, and this is the first received transmission for the TB according to the MTCH schedule indicated by RRC or according to the scheduling indicated by DCI as specified in TS 38.214 [7]; or  1> if this is the very first received transmission for this TB (i.e. there is no previous NDI for this TB):  2> consider this transmission to be a new transmission.  1> else:  2> consider this transmission to be a retransmission.  The MAC entity then shall:  1> if this is a new transmission:  2> attempt to decode the received data.  1> else if this is a retransmission:  2> if the data for this TB has not yet been successfully decoded:  3> instruct the physical layer to combine the received data with the data currently in the soft buffer for this TB and attempt to decode the combined data.  1> if the data which the MAC entity attempted to decode was successfully decoded for this TB; or  1> if the data for this TB was successfully decoded before:  2> if the HARQ process is equal to the broadcast process:  3> deliver the decoded MAC PDU to upper layers.  2> else if this is the first successful decoding of the data for this TB:  3> deliver the decoded MAC PDU to the disassembly and demultiplexing entity.  1> else:  2> instruct the physical layer to replace the data in the soft buffer for this TB with the data which the MAC entity attempted to decode.  1> if the HARQ process is associated with a transmission indicated with a Temporary C-RNTI and the Contention Resolution is not yet successful (see clause 5.1.5); or  1> if the HARQ process is associated with a transmission indicated with a MSGB-RNTI and the Random Access procedure is not yet successfully completed (see clause 5.1.4a); or  1> if the HARQ process is equal to the broadcast process; or  1> if the HARQ process is associated with a transmission indicated with a MCCH-RNTI or a G-RNTI for MBS broadcast; or  1> if the HARQ process is associated with a transmission indicated with a Multicast MCCH-RNTI for MBS multicast; or  1> if the HARQ process is associated with a transmission indicated with a G-RNTI or a G-CS-RNTI or a configured downlink assignment for MBS multicast and HARQ feedback is disabled for this G-RNTI or G-CS-RNTI or the corresponding G-CS-RNTI, as specified in clause 18 of TS 38.213 [6]; or  1> if the HARQ process is associated with a transmission indicated with a G-RNTI or a G-CS-RNTI or a configured downlink assignment for MBS multicast and NACK only HARQ feedback is used for this G-RNTI or G-CS-RNTI or the corresponding G-CS-RNTI and the data for this TB is successfully decoded and the transmission is not the first transmission of PDSCH where the configured downlink assignment was (re-)initialised; or  1> if the *timeAlignmentTimer*, associated with the TAG containing the Serving Cell on which the HARQ feedback is to be transmitted, is stopped or expired, and the Serving Cell is not configured with two TAGs, and if the *cg-SDT-TimeAlignmentTimer*, if configured, is not running; or  1> if the Serving Cell on which the HARQ feedback is to be transmitted is configured with two TAGs and if the *timeAlignmentTimer* of the TAG, associated with the TCI state(s) used for transmitting the HARQ feedback, is stopped or expired:  2> not instruct the physical layer to generate acknowledgement(s) of the data in this TB. |

**Change#1: HARQ applicability for MTCH corresponding to time interleaved MCH**

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| 4.2.1 MAC Entities …    Figure 4.2.1-1: MAC structure overview, UE side |

**Change#2: TB decoding and soft combining**

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| 5.12a Time interleaved MCH reception Time interleaved MCH transmission may occur in subframes configured by upper layer for MTCH transmission. For each such subframe, *dataMCS* applies. The transmission of an MCH occurs in a set of subframes defined by *PMCH-Config*. An MCH Scheduling Information MAC control element is included in the first subframe allocated to the MCH within the MCH scheduling period to indicate the position of each MTCH and unused subframes on the MCH. The MAC entity shall assume that the first scheduled MTCH starts at the earliest in the next subframe after the subframe containing the MCCH and/or the MCH Scheduling Information MAC control element, and the other scheduled MTCH(s) start immediately after the previous MTCH, at the earliest in the next subframe (which is not containing MCCH) after the subframe where the previous MTCH stops. Unused part of the subframe, if any, is filled with padding. When the MAC entity needs to receive MCH, the MAC entity shall:  - if the HARQ process is associated with a transmission indicated with a M-RNTI for time interleaved MCH:  - if this is the first received transmission for the TB according to the MTCH schedule indicated by MSI:  - attempt to decode the received data.  - else:  - if the data for this TB has not yet been successfully decoded:  - combine the received data with the data currently in the soft buffer for this TB and attempt to decode the combined data.  - if the data which the MAC entity attempted to decode was successfully decoded for this TB; or  - if the data for this TB was successfully decoded before:  - deliver the decoded MAC PDU to upper layers.  - else:  - replace the data in the soft buffer for this TB with the data which the MAC entity attempted to decode.  - do not indicate the positive or negative acknowledgement to the physical layer.  NOTE: The MAC entity should continue receiving MCH until the MTCH is removed from the MCCH. |

**Q1. Are Change#1 and Change#2 appropriately address the HARQ handling for time interleaved MCH in the MAC spec? Provide your comments and suggest changes, if any.**

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| **Company** | **Comments, if any** |
| Huawei | No spec change expected.  The added part seems not specific to interleaved MCH? Not quite see the need of adding this, since we don’t have this kind of handling before introducing interleaving. In our view, interleaving mainly affects the PHY behaviour, i.e., interleaving and “de-interleaving”, which is close-looped within PHY. Besides that, all legacy behaviour should be reused in MAC.  Unless we need specific HARQ enhancement for the interleaving operation, e.g., we need do HARQ for each RV of TB0 separately before “de-interleaving”. But this certainly requires more work, RAN1 involvement and even maybe WID revision, which is not realistic at this stage.  [Rapp] RAN1 already discussed, made an agreement, sent a LS to RAN2 and asked RAN2 to check HARQ handling. This is now perfectly in RAN2 domain as traditionally MAC spec handles the HARQ handling. It makes no sense to ask back RAN1.  The R19 time interleaving introduced is just not row by column interleaving but also includes redundancy versions across M x N transmission pattern and require to be soft-combined. Of-course it is not the case for pre-R19 MCH. WID is quite clear about this.  The proposed spec text is nothing new but the reuse of the legacy way of handling TBs with different RVs and soft-combining, as has been described by MAC spec.  It will be better for companies to rather point out any discrepancy or short-coming with the description, if any.  Without the proposed text, MAC spec completely misses the handling and soft combining for TBs of time interleaved MCH. |
| ZTE | Similar view as Huawei.  Historically the concept of HARQ is not applied to LTE eMBMS, not sure if we need to make a structural change to the MAC architecture to present how HARQ process works in the case of “interleaving”, i.e., either we can leave it to UE implementation, or we can leave the complexity to PHY layer.  Either way, how UE implements it should not be a problem. |
| Qualcomm | We prefer to capture change#1. Otherwise, it looks incomplete (gives wrong impression that HARQ operations are irrelevant for all MTCHs).  For change#2, we slightly prefer to capture the details as suggested by Samsung but no strong view. |
| Samsung | Both change#1 and change#2 are needed to have a complete and accurate specification. |
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**[Rapp] Opinions shared by the companies are mixed. Some companies think HARQ handling should be left to UE implementation, while other companies think HARQ handling is essential for Rel-19 time-interleaved PMCH and should be specified for completeness and accuracy. Rapp recommends to discuss this issue in next meeting based on companies’ contributions.**

* 1. Others, please specify

**Companies are invited to describe any other identified open issues not currently included within this document.**

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| **Company** | **Any other identified open issues? (please describe) or other comments** |
| ZTE | Last meeting we discussed how legacy and new feature co-exists. Not sure how can this be done in current framework.  “We aim to support co-existence of legacy (pre-Rel19) and R19 transmission and UEs by defining R19 PMCHs to cater to Time Interleaving based configurations, scheduling and transmissions in addition to legacy PMCHs” |
| Qualcomm | I think ZTE’s comment is already addressed by introducing R19 specific configuration in RRC. |
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**[Rapp] Issue raised by ZTE about legacy and new feature co-existence is already addressed as also commented by QC. No open issue is identified**

**[Rapp] One company commented that Extended MSI description should also reflect changes pertaining to time-interleaved MCH (analogous to MSI). Rapp thinks whether Extended MSI is applicable for this case should be ascertained based on companies views in the next meeting. If it is not an applicable case, then description is not really needed. An open issue is added.**

# 5. Conclusion

Based on the discussion, the following open issues have been identified. Companies’ contributions are invited addressing these open issues.

**MAC-1**

**Whether and how HARQ handling is described in the MAC specification for the Rel-19 time-interleaved PMCH transmission.**

**MAC-2**

**Whether Extended MSI is applicable for the Rel-19 time-interleaved PMCH transmission.**

# 6. References

1. RAN2#130 Meeting report
2. R2-2504963 (R1-2504922): LS on RAN2 aspects for LTE-based 5G Broadcast Phase 2
3. RP-250238: (RAN#107) Status report for WI LTE-based 5G Broadcast Phase 2
4. RP-251143: (RAN#108) Status report for WI LTE-based 5G Broadcast Phase 2