**3GPP TSG RAN WG1 #102-e R1-200xxxx**

**e-Meeting, 17th - 28th August, 2020**

**Agenda item:** 8.12

**Source:** Moderator (CMCC)

**Title:** Phase 1 moderator summary on NR Multicast and Broadcast Services

**Document for:** Discussion/decision

# Introduction

As announced by chairman, one email thread is planned to discuss high-level aspects for NR MBS in this meeting.

[102-e-NR-MBS-01] Email discussion/approval using R1-2007001 as a starting point, focusing on high-level aspects – Fei (CMCC)

* By 8/19 – Classification of high priority/medium priority items for this e-Meeting
* By 8/24 – high priority items
* By 8/27 - medium priority items

The initial moderator summary is provided in R1-2007001 which can be found in the inbox. The issues in the summary are classified into two tiers.

The first tier issues are the ones for the high level concept and will be discussed primarily for this meeting, which are summarized in table 1 below and the details can be found in section 2 in R1-2007001.

The second tier issues are low priority issues and are mainly the ones for details or further step issues set up on the conclusion of the first tier issues, which are targeted to be discussed in the following meeting but some of them can also be discussed in this meeting upon the first tier issues are concluded. The summary and the details for the second tier issues can be found in section 3 in R1-2007001.

**Table 1: The first tier issues**

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| **Sub-agenda** | **Issues (summary in section 2 in R1-2007001)** |
| Group scheduling for RRC\_CONNECTED UEs | **Issue 1 (Question 1 in R1-2007001)**: Regarding the two high level group scheduling mechanisms, i.e., group-common PDCCH based group scheduling and UE-specific PDCCH based group scheduling, whether down selection is needed or both of them can be considered for MBS for RRC\_CONNECTED UEs? |
| **Issue 2 (Question 2 in** **R1-2007001)**: Please share your views on the following two alternatives for frequency resource configuration for MBS for RRC\_CONNECTED UEs.  • Alternative 1: Introduce a MBS specific BWP  • Alternative 2: Define a MBS common frequency resource confined within UE’s active BWP. |
| **Issue 3 (Question 3 in** **R1-2007001)**: Whether the simultaneous operation with unicast reception in the WID means a UE is required to receive multicast PDSCH and unicast PDSCH simultaneously in one slot? If the answer is YES, which multiplexing type(s) of simultaneous reception of unicast PDSCH and multicast PDSCH in a slot can be supported in NR MBS? e.g., TDM, FDM, SDM. |
| Reliability improvement for RRC\_CONNECTED UEs | **Issue 4 (Proposal 1 in R1-2007001)**: For RRC\_CONNECTED UEs, HARQ-ACK feedback is supported for multicast without additional evaluation for it. |
| **Issue 5 (Proposal 2 in R1-2007001, with little update)**: For RRC\_CONNECTED UEs, consider following reliability improvement mechanisms for MBS.  • CSI feedback, FFS whether modification is needed on top of existing CSI feedback mechanism for unicast  • PDSCH repetition, FFS whether spec impact is implied |
| **Issue 6 (Question 4 in R1-2007001)**: Whether a common evaluation methodology and assumptions are necessary for NR MBS? If the answer is YES, what’s the purpose of the evaluation? |
| Basic functions for MBS for RRC\_IDLE/RRC\_INACTIVE UEs | **Issue 7 (Proposal 3 in R1-2007001)**: For UE in IDLE/INACTIVE state, the frequency resource for PTM transmission is  • Alt 1: Initial BWP  • Alt 2: Configured with larger size to cover initial BWP  • Alt 3: Configured to be within initial BWP |
| **Issue 8 (Proposal 4 in R1-2007001)**: Multi-beam/beam-sweeping operation is supported for PTM in IDLE/INACTIVE state. |

According to Chairman’s guidance, this email thread will be organized in three phases:

* Phase 1: by 8/19, classification of high priority/medium priority items for this e-Meeting based on the summarized first tier issues.
* Phase 2: by 8/24, discuss and conclude the high priority items.
* Phase 3: by 8/27, discuss and conclude the medium priority items.

For phase 1, companies are invited to provide their views on the classification of high priority/medium priority items for this e-Meeting in section 3 by UTC 18:00 8/19. Moderator will provide the observation and proposal on the classification in section 2 based on companies’ inputs.

# Observation and Proposal for Phase 1

Moderator will provide the observation and proposal based on companies’ input in section 3.

# Companies’ Views on Priorities in Phase 1

Please provide the view on the priorities (high/medium/low) in the table below. Please note that, if companies provide “low” for an item, it means we will not discuss this item in this meeting.

For RRC\_IDLE/INACTIVE, though there may not be plan to treat this agenda for this meeting, two high level issues that do NOT need RAN2 guidance are also summarized here to collect companies’ views. They can be considered for this meeting if majority view is they are high/medium priority.

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|  | Group scheduling | | | Reliability improvement | | | RRC\_IDLE/RRC\_INACTIVE | |
| Company | Issue 1  (Question 1 in R1-2007001) | Issue 2  (Question 2 in R1-2007001) | Issue 3  (Question 3 in R1-2007001) | Issue 4  (Proposal 1 in R1-2007001) | Issue 5  (Proposal 2 in R1-2007001) | Issue 6  (Question 4 in R1-2007001) | Issue 7  (Proposal 3 in R1-2007001) | Issue 8  (Proposal 4 in R1-2007001) |
| CMCC | High | High | Medium | High | High | High | Medium | Medium |
| Huawei, HiSilicon | High | High | Medium | High | Medium | High | High | Medium |
| Qualcomm | High | Medium | High | High | High | Medium | Low | Low |
| Spreadtrum | High | High | Medium | High | Medium | Medium | Low | Low |
| vivo | High | Medium | High | High | Medium | Medium | Low | Low |
| Intel | High | Medium | High | High | High | Medium | Low | Low |
| LG Electronics | High | High | Medium | Medium | Medium | High | Medium | Medium |
| MTK | High | Medium | Medium | High | High | Low | Low | Low |
| ZTE | High | Low | High | Medium | Medium | High | Medium | Medium |
| Sony | High | High | Medium | Medium | High | High | High | High |
| OPPO | High | High | High | High | Medium | Medium | Low | Low |
| Nokia | High | Medium | Medium | High | Medium | High | Medium | Low |

Please provide detailed comments, if any.

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| **Company** | **Comments** |
| Qualcomm | Firstly, we think the following are the pre-conditions of receiving NR multicast with flexible configuration and reliability support (related with issue 1-6):   * Multicast reception in RRC CONNECTED state is prioritized in WID. * For RRC CONNECTED UEs, at least part of the configuration is received by unicast RRC signaling.   Secondly, we think the issue 7/8 need to wait for RAN2 guidance on whether the broadcast signaling will be introduced for multicast reception of IDLE/INACTIVE UEs. Also, in Chairman’s notes, it is explicitly mentioned that 8.12.3 will not be treated in this meeting.  **8.12.3 Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**  *A placeholder - no plan to treat during this meeting* |
| vivo | We think discussion for IDLE/INACTIVE UEs can be deprioritized in this meeting.  Discussion on issue 1/3/4 will have great impact on the design for NR multicast and should be treated with high priority. |
| Intel | We agree that discussion on IDLE/INACTIVE UEs should be deprioritized in this meeting.  Discussion on issues 1/3/4/5 should be treated with high priority and will have major impact on NR multicast design.  Issue 6 is also good to discuss in this meeting so that baseline EVM can be established for the next steps. Our understanding is that eMBB SLS can be used as a baseline tool for evaluations and baseline schemes especially for evaluation of improvements through feedback can be further discussed. |
| LG Electronics | If MBS specific BWP is supported. MBS specific BWP does not need to be restricted to Connected UEs only. Thus, MBS specific BWP can be one option for Issue 7.  In addition, options of Issue 7 do not need to be ‘alternatives’, because the network may configure PTM transmission on initial BWP and/or MBS specific BWP, if any. The MBMS specific BWP may be overlapped or not overlapped with the initial BWP. Depending on network configuration, UE may receive PTM transmission in the initial BWP or MBS specific BWP. |
| MTK | The discussion about RRC\_IDLE/RRC\_INACTIVE UEs issues shall be deprioritized according to the chairman note’s description.  We think the discussions about evaluation methodology and assumptions are unnecessary, we can refer to the simulation results in TR 36.910 and directly discuss reliability improvement mechanism. |
| ZTE | Issue 1: Issue 1 is the most fundamental issue for group scheduling, which will impact the subsequent technical discussion, e.g., CORESET/SS design. Thus, Issue 1 is of the high priority.  Issue 2: From our perspective, it seems this issue is more like a detailed issue that has slight impact on the subsequent discussion. Thus, our preference is to discuss this issue in next RAN1 meeting.  Issue 3: Clarifying the “simultaneous operation” is critical MBS initial design as this is a fundamental implementation restriction on UE side, we need to take this into account from the very beginning.  Among Issue 4, Issue 5 and Issue 6, we believe the Issue 6 is the most fundamental issue. To comprehensively understand and compare the performance of each solution, it may be better if we could finalize the common evaluation methodology and assumptions.  For Issue 7 and Issue 8, per chairman’s guidance, we may need to focus on our discussion on group scheduling and reliability improvement in this RAN1 meeting. Our preference is discuss these issues in next RAN1 meeting. However, if most companies prefer to discuss them in this meeting, we are also ok to do so as long as the discussion workload is still under control. |
| OPPO | It is also our opinion that issue#7 and issue#8 on RRC\_IDLE/RRC\_INACTIVE modes should not be discussed this meeting.  Issue#1~6 should be discussed and preferably concluded this meeting, such that companies can make further detailed design based on them. |

# Appendix A: Second tier issues summarized in R1-2007001

**Table A.1: Summary of second tier issues of group scheduling for RRC\_CONNECTED UEs**

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| **Second tier issues** | **Possible questions or proposals** |
| 3.1.1 Configuration of group scheduling for multicast/broadcast | Question: Whether broadcast and multicast need to be differentiated for RRC\_CONNECTED UEs? If the answer is YES, whether the same configuration mechanism of group scheduling for Broadcast is applied for both RRC\_CONNECTED UEs and RRC\_IDLE/INACTIVE UEs? |
| Proposal: For RRC\_CONNECTED UEs, at least part of the parameters for multicast configuration is received by dedicated RRC signaling. |
| 3.1.2.1 CORESET configuration for MBS | Proposal: For group common PDCCH based group scheduling and a MBS common frequency resource configured with in UE’s active DL BWP, the CORESET is configured within the MBS common frequency resource. |
| Proposal: For group common PDCCH based group scheduling and a MBS common frequency resource configured with in UE’s active DL BWP, the CORESET for MBS is configured per BWP. |
| 3.1.2.2 Search space configuration for MBS | Proposal: Consider the following options for search space configuration for MBS for RRC\_CONNECTED UEs:  • Option 1: CSS (existing CSS type or new defined CSS type)  • Option 2: USS |
| 3.1.2.3 DCI format for MBS | Proposal: Consider the following options for DCI format for MBS for RRC\_CONNECTED UEs:  • Option 1: DCI format 1\_0  • Option 2: DCI format 1\_1  • Option 3: DCI format 2\_x  • Option 4: New DCI format |
| 3.1.2.4 Blind decoding related issues | Proposal: The maximum number of monitored PDCCH candidates and non-overlapped CCEs per slot are not increased for MBS. |
| Proposal: Keep the “3+1” DCI size budget for MBS with group common PDCCH based group scheduling. |
| 3.1.2.5 Multi-beam/beam sweeping operation | Proposal: Support multi-beam/beam sweeping operation for MBS PDCCH/PDSCH for RRC\_CONNECTED UEs. |
| 3.1.3 Simultaneous operation with unicast reception | Proposal: The UE is expected to process maximum two transport blocks for simultaneous reception of unicast PDSCH and multicast PDSCH. |
| 3.1.4 Other issues | Proposal: Support DL SPS for MBS for RRC\_CONNECTED UEs. |
| Proposal: Support multi-layer MIMO for MBS PDSCH for RRC\_CONNECTED UEs. |
| Question: Whether modifications are needed for QCL framework in order to support MBS transmission? |
| Proposal: Introduce a new reception type of PDCCH and PDSCH for MBS for RRC\_CONNECTED UEs, if group common PDCCH based group scheduling is supported. |
| Question: Whether to support receiving MBS service on a Scell? |
| Question: Whether to support SFBC for MBS? |

**Table A.2: Summary of second tier issues of reliability improvement for RRC\_CONNECTED UEs**

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| **Second tier issues** | **Possible questions or proposals** |
| 3.2.1 HARQ-ACK feedback | Proposal: Consider the following two alternatives for HARQ-ACK feedback for RRC\_CONNECTED UEs:   * Alternative 1: ACK/NACK based HARQ-ACK feedback * Alternative 2: NACK-only based HARQ-ACK feedback |
| Proposal: HARQ-ACK feedback for NR MBS should be RRC configurable if it is supported for RRC\_CONNECTED UEs. |
| Proposal: Both PTM-based and PTP-based retransmissions can be supported for NR MBS for RRC\_CONNECTED UEs. |
| Question: Whether multiplexing of HARQ-ACK of unicast and multicast transmission should be supported for UEs receiving both unicast and multicast service. |
| Question: Whether prioritization of HARQ-ACK of unicast and multicast transmission should be supported for UEs receiving both unicast and multicast service. |
| 3.2.2 CSI feedback | Proposal: Consider to support following schemes for NR MBS:   * Option 1: Single port transmission * Option 2: Open-loop spatial multiplexing * Option 3: Closed-loop spatial multiplexing |
| 3.2.3 Other issues | Question: Whether it is needed to discuss the reliability requirements for NR MBS from RAN1 perspective? If the answer is YES, then whether the reliability requirements are RRC state dependent and whether the reliability requirements for multicast and broadcast traffic are the same or not? |
| Question: If it is decided to discuss the reliability requirements for NR MBS in RAN1, then how to define the reliability requirements? |

**Table A.3: Summary of second tier issues of MBS for RRC\_IDLE/RRC\_INACTIVE UEs**

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| **Second tier issues** | **Possible proposals** |
| CORESET for PTM | For UE in IDLE/INACTIVE state, the CORESET for PTM is   * Alt 1: CORESET0 * Alt 2: Configurable |
| Search space for PTM | For UE in IDLE/INACTIVE state, the search space for PTM is   * Alt 1: One(s) of existing common search space * Alt 2: A new type of CSS set |
| Multi-beam operation | Monitoring occasions for PTM is associated with SSB. |
| HARQ-ACK | Whether HARQ-ACK feedback is supported for PTM for UE in IDLE/INACTIVE state:  Alt 1: Supported but NACK only  Alt 2: Not supported |
| Search spaces for SIBx/MCCH if defined | Search spaces for SIBx/MCCH needs to be discussed. |
| MCS table and number of layers | MCS table to be used and how many layers are used should be configured |

# References

1. R1-2007001 FL summary on NR Multicast and Broadcast Services Moderator (CMCC)
2. RP-193248 New WID proposal: NR Multicast and Broadcast Services
3. RP-201038 Revised WID: Core part: NR multicast and broadcast services
4. R1-2005249 Resource configuration and group scheduling for RRC\_CONNECTED UEs Huawei, HiSilicon
5. R1-2005406 Discussion on mechanisms to support group scheduling for RRC\_CONNECTED UEs vivo
6. R1-2005436 Mechanisms to Support Group Scheduling for RRC\_CONNECTED UEs ZTE
7. R1-2005531 Group Scheduling Mechanisms to Support 5G Multicast / Broadcast Services for RRC\_CONNECTED Ues Nokia, Nokia Shanghai Bell
8. R1-2005589 Considerations on MBMS group scheduling for RRC\_CONNECTED UEs Sony
9. R1-2005693 Discussion on group scheduling mechanism for RRC\_CONNECTED UEs in MBS CATT
10. R1-2005898 Group Scheduling for NR-MBS Intel Corporation
11. R1-2006013 Group scheduling for NR Multicast and Broadcast Services OPPO
12. R1-2006173 On Mechanisms to support group scheduling for RRC\_CONNECTED UEs Samsung
13. R1-2006233 Discussion on group scheduling mechanisms in NR MBS CMCC
14. R1-2006320 Support of group scheduling for RRC\_CONNECTED UEs LG Electronics
15. R1-2006631 On group scheduling mechanism for NR multicast and broadcast Convida Wireless
16. R1-2006830 Views on group scheduling for Multicast RRC\_CONNECTED UEs Qualcomm Incorporated
17. R1-2006918 Mechanism for group scheduling of RRC\_CONNECTED UEs in NR Ericsson
18. R1-2005250 Mechanisms to improve reliablity for RRC\_CONNECTED UEs Huawei, HiSilicon
19. R1-2005407 Discussion on mechanisms to improve reliability for RRC\_CONNECTED UEs vivo
20. R1-2005437 Mechanisms to Improve Reliability for RRC\_CONNECTED UEs ZTE
21. R1-2005532 Mechanisms for 5G Multicast / Broadcast Reliability Improvements for RRC\_CONNECTED Ues Nokia, Nokia Shanghai Bell
22. R1-2005590 Considerations on MBMS reliability for RRC\_CONNECTED UEs Sony
23. R1-2005694 Discussion on reliability improvement mechanism for RRC\_CONNECTED UEs in MBS CATT
24. R1-2005899 Mechanisms to Improve Reliability for NR-MBS Intel Corporation
25. R1-2006014 UL feedback for RRC-CONNECTED UEs in MBMS OPPO
26. R1-2006174 On Mechanisms to improve reliability for RRC\_CONNECTED Ues Samsung
27. R1-2006234 Discussion on reliability improvement in NR MBS CMCC
28. R1-2006321 Mechanisms to improve reliability of Broadcast/Multicast service LG Electronics
29. R1-2006632 On reliability enhancement for NR multicast and broadcast Convida Wireless
30. R1-2006831 Views on UE feedback for Multicast RRC\_CONNECTED UEs Qualcomm Incorporated
31. R1-2006863 HARQ-based time-interleaving for NR Multicast/Broadcast BBC
32. R1-2006919 Mechanisms to improve reliability for RRC\_CONNECTED UEs receiving PTM transmission Ericsson
33. R1-2005272 Discussion on multicast support for IDLE/INACTIVE UEs Huawei, HiSilicon
34. R1-2005408 Discussion on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs vivo
35. R1-2005438 Basic Functions for Broadcast or Multicast for RRC\_IDLE or RRC\_INACTIVE UEs ZTE
36. R1-2005533 Basic Functions for Broadcast / Multicast for RRC\_IDLE / RRC\_INACTIVE Ues Nokia, Nokia Shanghai Bell
37. R1-2005695 Discussion on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs CATT
38. R1-2006015 Discussion on enhancements for IDLE and INACTIVE state UEs OPPO
39. R1-2006175 On Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs Samsung
40. R1-2006235 Discussion on NR MBS in RRC\_IDLE RRC\_INACTIVE states CMCC
41. R1-2006322 Basic function for broadcast/multicast LG Electronics
42. R1-2006832 Views on group scheduling for Multicast RRC\_IDLE/INACTIVE UEs Qualcomm Incorporated
43. R1-2006920 Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs Ericsson
44. R1-2005439 Preliminary Simulation Results of Rel-17 MBS ZTE
45. R1-2005534 Simulation assumptions and evaluation scenarios for 5G Multicast Services Nokia, Nokia Shanghai Bell
46. R1-2006016 PUCCH resource allocation for UL feedback in MBMS OPPO
47. R1-2006236 On R17 NR MBS WI CMCC
48. R1-2006410 Performance evaluation of HARQ for NR multicast Huawei, HiSilicon
49. R1-2006658 Other issues for Rel-17 MBS vivo
50. R1-2006861 MIMO support in NR Multicast/Broadcast BBC
51. R1-2006921 Assumptions for Performance Evaluations of NR-MBS Ericsson