**3GPP T****SG-RAN WG2 Meeting #116-e R2-210xxxx**

**E-meeting, 1 – 12 November 2021**

**Agenda item:**8.1.x

**Source:** Huawei, HiSilicon

**Title:** [Report of] e-mail discussion: [Post115-e][091][MBS] Remaining control plane issues (Huawei)

**WI code:** NR\_MBS-Core

**Document for:** Discussion and Decision

# 1 Introduction

This document aims at gathering and summarizing companies’ views for the following e-mail discussion:

* **[Post115-e][091][MBS] Remaining control plane issues (Huawei)**

Scope: Determine and address MBS Remaining CP issues

Intended outcome: Report with open issues, and proposed resolutions as far as reasonable.

Deadline: Long

# 2 Discussion

## 2.1 Neighbouring cell information in MCCH

This topic has been already discussed as part of e-mail discussion summarized in [1] and there was a vast majority of companies agreeing that it is useful if the gNB provided a list of neighbouring cells where the MBS broadcast service is provided. Based on this information, the UE can request unicast reception of the service before changing to a cell not providing the MBS service. During the discussion during RAN2#115-e meeting some companies raised that this mechanism may be complex to manage and that it should not be mandatory for the network. On the other hand, it was noted this information can be particularly useful, e.g. for Public Safety applications.

**Question 1: Do companies agree that it should be possible for the network to optionally broadcast in MCCH a list of neighbour cells providing the same broadcast MBS service(s) as provided in the current cell?**

**NOTE1: It is assumed that network coordination to achieve this is up to OAM/implementation.**

**NOTE2: It is assumed that how this information is utilized by the UE is up to UE implementation.**

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| **Company** | **Yes/No** | **Comments / justification** |
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**Question 2: If Q1 is agreed, do companies agree that MCCH changes due to neighbouring cell information modification reuse the MCCH modification notification bit, if agreed by RAN1?**

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| **Company** | **Yes/No** | **Comments / justification** |
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## 2.2 MCCH related issues

RRC running CR [4], contains the following editor’s notes:

* FFS whether to keep MCCH-RNTI name or use another one.
* FFS whether the values of MCCH window parameters captured currently need to be modified.

Based on this, the following questions are asked.

**Question 3: Do you agree to use the name “MCCH-RNTI” for the RNTI scheduling MCCH? If not, please justify and propose an alternative naming.**

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| **Company** | **Yes/No** | **Comments / justification / alternative name** |
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When it comes to MCCH window parameters values, currently the CR in [4] captures the following:

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| MCCH-Config-r17 ::= SEQUENCE {  mcch-RepetitionPeriodAndOffset-r17 MCCH-RepetitionPeriodAndOffset-r17,  mcch—WindowStartSlot-r17 INTEGER (0..79),  mcch—WindowDuration-r17 ENUMERATED {sl2, sl4, sl8, sl10, sl20, sl40,sl80, sl160} OPTIONAL, -- NEED S  mcch-ModificationPeriod-r17 ENUMERATED {rf2, rf4, rf8, rf16, rf32, rf64, rf128, rf256,  rf512, rf1024, r2048, rf4096, rf8192, rf16384, rf32768, rf65536}  }  MCCH-RepetitionPeriodAndOffset-r17 ::= CHOICE {  rf1-r17 INTEGER(0),  rf2-r17 INTEGER(0..1),  rf4-r17 INTEGER(0..3),  rf8-r17 INTEGER(0..7),  rf16-r17 INTEGER(0..15),  rf32-r17 INTEGER(0..31),  rf64-r17 INTEGER(0..63),  rf128-r17 INTEGER(0..127),  rf256-r17 INTEGER(0..255)  } |

**Question 4: Do you think the currently captured values of mcch-RepetitionPeriodAndOffset, mcch-WindowStartSlot, mcch-WindowDuration, mcch-ModificationPeriod are appropriate and sufficient? If not, please indicate which values should be removed/added.**

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| **Company** | **Yes/No** | **Comments / justification** |
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## 2.3 Cell reselection and frequency prioritization in RRC IDLE/INACTIVE

Even though the general rules of frequency prioritization are captured in the 38.304 running CR in [5], there are also some open points which need to be clarified, as captured by the following FFS points:

1. FFS whether UE needs to read the SIBx of the candidate cell before cell reselection. As an alternative, UE may determine whether the reselection candidate cell is broadcasting SIBx based on whether the scheduling info of SIBx is present in SIB1 of the reselection candidate cell or not.
2. FFS whether UE should stop to prioritize the frequency if SIBx is not scheduled on the serving cell(i.e. reselected cell) anymore.
3. FFS whether frequency in USD should also be checked when One or more IDs (e.g. SAI) of that frequency are indicated in SIBy of the serving cell.
4. FFS whether the UE can prioritize the frequency indicated in USD when SIBy is broadcast but does not provide the mapping for the concerned service.

With respect to the first bullet, the rapporteur understands that the UE is not required to read the contents of SIBx broadcasted in another cell, but needs to ensure that SIBx is available in the cell which is a candidate for reselection, i.e. it is scheduled by SIB1 in this cell. Furthermore, even though the condition as captured currently in the running 38.304 CR [5] speaks of SIBx being broadcast, SIBx can actually be available on demand and may therefore not be broadcast, but still present in SI-SchedulingInfo in SIB1 in the reselection candidate cell. Similar consideration holds for SIBy (i.e. “service continuity” MBS SIB). Companies are then requested to answer the following questions.

**Question 5: Do you agree that SIBx and SIBy can be available on demand?**

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| **Company** | **Yes/No** | **Comments / justification** |
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**Question 6: Do you agree to clarify that the UE in RRC IDLE/INACTIVE may consider the frequency for prioritization in case SIBx is included in SI-SchedulingInfo in SIB1 of the reselection candidate cell (i.e. the status of the associated SI message can be either broadcasting or notBroadcasting and the UE is not required to read SIBx before making prioritization)?**

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| **Company** | **Yes/No** | **Comments / justification** |
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When it comes to the second bullet, i.e. “whether UE should stop to prioritize the frequency if SIBx is not scheduled on the serving cell (i.e. reselected cell) anymore”, rapporteur’s understanding is that this refers to a situation where not all cells on a certain frequency provide SIBx. In that case, it may happen that even though the UE verified the frequency prioritization conditions positively, it ended up on a cell not providing SIBx after cell reselection on a prioritized frequency. It is rapporteur’s understanding that even though such situation may happen, it would rather be a corner case, mainly due to bad UE implementation. Furthermore, if the UE was forced to deprioritize the frequency, this could lead to ping-pong situation. Companies are then requested to answer the following question.

**Question 7: Do you agree that it is not required to address the case where the UE reselects a cell not providing/scheduling SIBx, after having performed frequency prioritization/deprioritization?**

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| **Company** | **Yes/No** | **Comments / justification** |
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With respect to the third bullet above, i.e. “whether frequency in USD should also be checked when One or more IDs (e.g. SAI) of that frequency are indicated in SIBy of the serving cell”, there were different views in the e-mail discussion on the running 38.304 CR. Some companies indicated this is how frequency prioritization conditions were worded in LTE while other companies indicated that this condition is unnecessary as SIBy based prioritization could be independent of the information carried by USD.

**Question 8: Do you agree that the UE should be allowed to prioritize a frequency in case this frequency is signaled in SIBy for the UEs service/session of interest (e.g. identified by an additional ID such as SAI) regardless of whether this frequency is included in the USD for this service?**

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| **Company** | **Yes/No** | **Comments / justification** |
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The fourth bullet above, i.e.: “whether the UE can prioritize the frequency indicated in USD when SIBy is broadcast but does not provide the mapping for the concerned service” was captured based on the observation that in LTE, in case SIBy was provided in the cell, the UE could not prioritize the frequency included in USD, even in case the related service was not included in SIBy. However, for some services which are deployed on the same frequency throughout the operator’s network, it may make more sense to provide a semi-static frequency configuration in USD directly, while still providing frequencies via SIBy for other services. Therefore, companies are requested to answer the following question:

**Question 9: Do you agree that the UE should be allowed to prioritize the frequency indicated in USD when SIBy is provided in the cell but does not provide the frequency mapping for the concerned service?**

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| **Company** | **Yes/No** | **Comments / justification** |
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Finally, there is also an issue captured in TS 38.304 running CR [5] related to multicast MBS, i.e. whether the UE is RRC IDLE/INACTIVE mode which joined a multicast session, should be allowed to prioritize a frequency for multicast activation monitoring:

* FFS if there is a need to prioritize a frequency with multicast support for idle/inactive UEs that monitor multicast activation notification.

The rapporteur’s understanding is that the goal of such prioritization would be to minimize the paging overhead by restricting paging to only a certain frequency. On the other hand, some issues would have to be resolved, e.g. how can the UE determine which frequency to prioritize, can it be ensured that all UEs which joined the session camp on the same frequency in a certain area etc.

Question 10: Should it be possible for the UE in RRC IDLE/INACTIVE which joined a multicast session to prioritize a certain frequency for group paging monitoring? If yes, please clarify how this can be achieved.

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| **Company** | **Yes/No** | **Comments / justification** |
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## 2.4 MBS Interest Indication

With respect to MBS Interest indication, the following FFS is captured in RRC running CR [4]:

* It is FFS whether the any modification is needed for MII triggers as captured above.

The triggering conditions that are mentioned are as follows:

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| An MBS capable UE in RRC\_CONNECTED may initiate the procedure in several cases including upon successful connection establishment, upon entering or leaving the broadcast service area, upon MBS broadcast session start or stop, upon change of interest, upon change of priority between MBS broadcast reception and unicast reception, upon change to a PCell broadcasting *SIBx1*. |

**Question 11: Do you think the currently captured triggers for sending MII are correct and sufficient? If not, please indicate which condition should be removed/modified or added.**

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| **Company** | **Yes/No** | **Comments / justification** |
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What is also still unclear are the procedures for frequencies and services of interest determination. In LTE, the frequencies of interest are determined in the following way, as per TS 36.331 [6]:

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| 5.8.5.3 Determine MBMS frequencies of interest The UE shall:  1> consider a frequency to be part of the MBMS frequencies of interest if the following conditions are met:  2> at least one MBMS session the UE is receiving or interested to receive via an MRB or SC-MRB is ongoing or about to start; and  NOTE 1: The UE may determine whether the session is ongoing from the start and stop time indicated in the User Service Description (USD), see TS 36.300 [9] or TS 26.346 [57].  2> for at least one of these MBMS sessionseither *SystemInformationBlockType15* acquired from the PCell includes for the concerned frequency one or more MBMS SAIs as indicated in the USD for this session or this session is in receive only mode; and  NOTE 2: The UE considers a frequency to be part of the MBMS frequencies of interest even though E-UTRAN may (temporarily) not employ an MRB or SC-MRB for the concerned session. I.e. the UE does not verify if the session is indicated on (SC-)MCCH  NOTE 3: The UE considers the frequencies of interest independently of any synchronization state, e.g. TS 36.300 [9], Annex J.1.  2> the UE is capable of simultaneously receiving MRBs and/or is capable of simultaneously receiving SC-MRBs on the set of MBMS frequencies of interest, regardless of whether a serving cell is configured on each of these frequencies or not; and  2> the *supportedBandCombination* the UE included in *UE-EUTRA-Capability* contains at least one band combination including the set of MBMS frequencies of interest;  NOTE 4: Indicating a frequency implies that the UE supports *SystemInformationBlockType13* or *SystemInformationBlockType20* acquisition for the concerned frequency i.e. the indication should be independent of whether a serving cell is configured on that frequency.  NOTE 5: When evaluating which frequencies it can receive simultaneously, the UE does not take into account the serving frequencies that are currently configured i.e. it only considers MBMS frequencies it is interested to receive.  NOTE 6: The set of MBMS frequencies of interest includes at most one frequency for a given physical frequency. The UE only considers a physical frequency to be part of the MBMS frequencies of interest if it supports at least one of the bands indicated for this physical frequency in *SystemInformationBlockType1* (for serving frequency) or *SystemInformationBlockType15* (for neighbouring frequencies). In this case, E-UTRAN may assume the UE supports MBMS reception on any of the bands supported by the UE (i.e. according to *supportedBandCombination*). |

The procedure depends to a large extent on the reply to an LS RAN2 send in [7] related to USD/SAI definition for NR. However, the parts highlighted in yellow are not depending on this and they were tentatively discussed in [1], but not concluded eventually. This discussion is somewhat related to UE capabilities as well and the following relevant capabilities are captured in TS 36.306 [8] for MBMS:

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| 4.3.17.1 *mbms-SCell-r11* This parameter defines whether the UE in RRC\_CONNECTED supports MBMS reception via MBSFN on a frequency indicated in an *MBMSInterestIndication* message, when an SCell is configured on that frequency (regardless of whether the SCell is activated or deactivated), as specified in TS 36.331 [5]. 4.3.17.2 *mbms-NonServingCell-r11* This parameter defines whether the UE in RRC\_CONNECTED supports MBMS reception via MBSFN on a frequency indicated in an *MBMSInterestIndication* message, where (according to *supportedBandCombination* and to network synchronization properties) a serving cell may be additionally configured, as specified in TS 36.331 [5]. If this is supported, the UE shall also support MBMS reception via MBSFN on a frequency when an SCell is configured on that frequency (regardless of whether the SCell is activated or deactivated), as specified in TS 36.331 [5]. |

The UE capabilities can be discussed at a later stage, so it is proposed to focus on the supported functionalities for the moment, i.e. leave aside the aspect of whether they require a separate capability or not for the moment. Considering this, the companies are requested to answer the following questions.

**Question 12: Do you agree that the UE may receive MBS broadcast service from an SCell?**

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| **Company** | **Yes/No** | **Comments / justification** |
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**Question 13: Do you agree that the UE may receive MBS broadcast service from a non-serving cell in either RRC CONNECTED or RRC INACTIVE/IDLE state?**

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| **Company** | **Yes/No** | **Comments / justification** |
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**Question 14: For MII, do you agree that the UE should only report the set of MBS frequencies of interest the UE is capable to simultaneously receive?**

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| **Company** | **Yes/No** | **Comments / justification** |
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**Question 15: For MII, do you agree that the UE should only report the set of MBS broadcast frequencies of interest in case the UE supports at least one band combination containing this set of frequencies?**

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| **Company** | **Yes/No** | **Comments / justification** |
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**Question 16: For MII, do you agree that, when evaluating which frequencies it can receive simultaneously, the UE does not take into account the serving frequencies that are currently configured i.e. it only considers MBMS frequencies it is interested to receive?**

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| **Company** | **Yes/No** | **Comments / justification** |
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Other aspects of frequencies and services of interest determination are proposed to be postponed until receiving a reply from other WGs related to USD/SAI definition. Similarly, whether MII is reported via UEAssistanceInformation or a new RRC message is dependent on the reply to the LS RAN2 sent to SA3, hence is not discussed at the moment.

## 2.5 MBS specific UAC and establishment cause

Whether to support MBS specific UAC and establishment cause was discussed tentatively in [2], but no conclusion could be reached. Proponents indicated that MBS specific UAC and EC allows the network to control the access attempts more flexibly and to apply specific treatment for MBS related access attempts during congestion. The sceptical companies indicated that MBS can be used to provide different kinds of services which can apply the current ACs/AIs and that mt-Access establishment cause can be reused as the UE replies to paging from the network. Companies are then requested to answer the following questions.

**Question 17: Do you think that UE access attempts due to multicast MBS (i.e. triggered by group paging) should apply MBS specific Access Categories during UAC and why? If yes, please also indicate some examples of additional ACs, e.g. should there be a common AC for MBS or depending on MBS service etc.**

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| **Company** | **Yes/No** | **Comments / justification** |
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**Question 18: Do you think that UE access attempts due to multicast MBS (i.e. triggered by group paging) should apply MBS specific establishment/resume cause and why? If yes, please also indicate some examples of additional establishment/resume causes, e.g. should there be a common establishment/resume cause for MBS or depending on MBS service etc.**

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| **Company** | **Yes/No** | **Comments / justification** |
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## 2.5 Data loss minimization during HO to non-MBS supporting nodes

With respect to this topic, the following has been previously agreed by RAN2:

* **[037] RAN2 assumes that from RAN2 perspective, mobility from the source gNB supporting MBS to target gNB not supporting MBS can be achieved by switching the traffic from delivery via MRB to delivery via DRB either before or during the handover. Whether and how this can be done without data losses has to be further investigated and requires progress and input from other WGs, i.e. RAN3 and SA2.**

RAN3 made the following agreements during RAN3#112-e meeting [3]:

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| * For mobility from supporting to non-supporting nodes:   + WA: Standards shall provide means whereby the SMF knows when receiving a Path Switch Request when a target NG-RAN node does not support MBS and means for SMF to then switch from shared delivery to individual delivery.   + WA: MBS support Indicator is included in Path Switch Request Transfer sent by an MBS supporting node to indicate support.   + MBS traffic delivery resources will be set up at target side using the information provided in the associated PDU session resource context in HO Request (for both Xn and NG mobility)   + Standards support data forwarding to minimize data loss during handover from MBS-supporting nodes to non-MBS supporting nodes.   + If data forwarding is used from MBS-supporting nodes to non-MBS supporting nodes, the source NG-RAN node should include in forwarded packets the unicast (flow) QFI mapped from the received MBS (flow) QFI. |

The second WA above was subsequently turned into an agreement during RAN3#113-e meeting and is already considered in the handover procedures described by SA2 in TS 23.247 [9]. From SA2 perspective, the Xn/N2 handover procedures are described in sections 7.2.3.2 and 7.2.3.3 of TS 23.247 [9] and they cover both MBS supporting nodes and non-MBS supporting nodes. For the latter, the traffic is switched from multicast session to the PDU session during the handover and the mapping between multicast QFI and the corresponding unicast QFI is provided by SMF to UPF. SA2 also captures the main principles of the handover from MBS supporting node to a node not supporting MBS in section 6.3.1 of TS 23.247 [9]:

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| To support Handover from NG-RAN node that supports MBS to a target NG-RAN node that does not support MBS:  - mapping information about unicast QoS flows for multicast data transmission and the information of associated multicast QoS flows are provided to the NG-RAN node. This is already performed during the PDU session modification procedure for the PDU session associated with the MBS session when the UE Joins into the MBS Session;  - during the handover procedure, the delivery method is switched from 5GC Shared MBS traffic delivery method to 5GC Individual MBS traffic delivery method, i.e. the N3 tunnel of the PDU Session for 5GC Individual MBS traffic delivery needs to be activated towards the target NG-RAN node. The SMF realizes that the target NG-RAN node does not support MBS.  - the SMF and the MB-SMF shall activate the GTP tunnel between the UPF and the MB-UPF for 5GC Individual MBS traffic delivery method, if needed. |

Based on the above, it can be seen that in order to minimize the data loss, the source gNB can forward multicast data with a unicast QFI included, to the target gNB. Subsequently, target gNB can send this data to the UE using unicast, i.e. a DRB. However, in order to avoid packet loss and duplicate forwarding to application layer, the UE needs to be able to associate the data received in the source cell with data received via DRB in the target cell. However, it should be noted that in case the UE is configured with an MRB while the handover to a node not supporting MBS is performed, the target gNB will have to perform full configuration which inevitably leads to data loss or duplicate packet delivery to application layer. One way to avoid this happening would be to reconfigure MRB to DRB in the source node before the handover and deliver multicast data via DRB as a transient state. Companies are then requested to answer the following question.

Question 18: Do you agree that in order to minimize data loss during a handover from MBS supporting node to a node not supporting MBS, the source gNB may provide multicast data via DRB shortly before the handover? If not, please indicate how full configuration can be avoided and data loss minimization ensured otherwise.

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| **Company** | **Yes/No** | **Comments / justification** |
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## 2.6 Other FFS points from the RRC running CR

This section addresses some other FFS points from the RRC running CR related to Control Plane:

1. The definitions/acronyms of radio bearers related to MBS need to be agreed and aligned between TS 38.331 and TS 38.300.
2. Whether mtch-SchedulingInfo is provided in MBS-SessionInfo IE or another place (e.g. depending whether the DRX configuration can be common for multiple MBS sessions).
3. Whether if this field is absent (mtch-schedulingInfo), the MTCH may be scheduled in any slot.
4. Whether and extensible IE should be used instead of TMGI within PagingGroupList.

With respect to the first bullet RAN2 actually made a decision during RAN2#115-e meeting to define MRB as MBS Radio Bearer covering RBs for both multicast and broadcast. However, during the e-mail discussion on the RRC running CR it turned out that it is anyway required to distinguish radio bearers used for multicast and those used for broadcast as a vast majority of procedures applies to one type of MRB only, but not to the other. This resulted in referring to multicast MRBs and broadcast MRBs in the current RRC running CR. However, there is no definition of multicast MRB and broadcast MRB currently in the CR. The rapporteur thinks there are two possibilities to resolve this:

* Option 1: Revert the previous decision and introduce MRB as Multicast Radio Bearer and BRB as Broadcast Radio Bearer.
* Option 2: Introduce definitions of broadcast MRB and multicast MRB in the specifications.

First option seems to be cleaner, but would require RAN2 to revert its previous decision (this is not necessarily very problematic), while the second option is aligned with the current RAN2 decision and RRC running CR, but is a bit less clear. In any case, the companies are requested to provide their preference for this issue.

Question 19: Please indicate your preferred option for the multicast/broadcast radio bearers’ definition.

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| **Company** | **Preferred option** | **Comments / justification** |
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With respect to the second bullet above, the main question that needs to be addressed is whether the DRX configuration can be common for multiple MBS sessions which are mapped to different G-RNTIs (since the DRX configuration is per G-RNTI, it seems obvious it can be common for multiple sessions mapped to the same G-RNTI, if such mapping is allowed).

Question 20: Do you think it should be possible to apply the same DRX configuration for more than one G-RNTI?

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| **Company** | **Yes/No** | **Comments / justification** |
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With respect to the following FFS: “Whether if this field is absent (mtch-schedulingInfo), the MTCH may be scheduled in any slot”, it is understood that what is actually intended is that in case mtch-schedulingInfo is not configured (i.e. there is no DRX provided for the G-RNTI), the UE should monitor for PDCCH scrambled with G-RNTI in any slot according to the search space configured for MTCH.

Question 21: Do you agree that in case mtch-schedulingInfo is absent for a G-RNTI, the UE should monitor for PDCCH scrambled with G-RNTI in any slot according to the search space configured for MTCH.

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| **Company** | **Yes/No** | **Comments / justification** |
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The last bullet above, i.e. “whether an extensible IE should be used instead of TMGI within PagingGroupList”, refers to the following structure in the RRC running CR:

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| PagingGroupList-r17 ::= SEQUENCE (SIZE(1..maxNrofPageGroup-r17)) OF TMGI-r17 |

Instead of that, the structure similar to the one used for unicast paging record could be introduced:

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| PagingRecord ::= SEQUENCE {  ue-Identity PagingUE-Identity,  accessType ENUMERATED {non3GPP} OPTIONAL, -- Need N  ...  } |

This was considered by the RRC CR rapporteur initially, but the drawback of this approach is that it would introduce additional overhead of three bytes for each group paging record if this extension is used in future while currently it is unclear whether the extension will ever be needed. Even if extension for more IDs is needed in future, the most signalling effective way is to use the extension field in the end of the message. Considering this, the companies are requested to answer the following question:

Question 22: Do you think an extensible IE should be used instead of TMGI within PagingGroupList?

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| **Company** | **Yes/No** | **Comments / justification** |
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# 3 Summary

TBD

# References

1. R2-2108799, *Summary of [Post114-e][073][MBS] Service continuity for Delivery Mode 2 (Xiaomi)*, Xiaomi Communications
2. R2-2109078, *Report of [AT115-e][048][MBS] Notifications*, Samsung
3. RP-211361, *Status report for WI: Core part: NR multicast and broadcast services; rapporteur: Huawei*, RAN2
4. R2-2108970, *38.331 running CR for NR MBS*, Huawei, HiSilicon
5. R2-2108923, *38.304 running CR for NR MBS*, CATT
6. 3GPP TS 36.331, *Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification*
7. R2-2108914, *LS on the MBS broadcast service continuity and MBS session identification*, Source: RAN2
8. 3GPP TS 36.306, *Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio access capabilities*
9. 3GPP TS 23.247, *Architectural enhancements for 5G multicast-broadcast services, version 2.0.0*