**3GPP T****SG-RAN WG2 Meeting #116-e DRAFT\_R2-2110604**

**E-meeting, 1 – 12 November 2021**

**Agenda item:**8.1.3.3

**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** |
| OPPO | Yes  | It is reasonable to make it optional for both UE and network. |
| MediaTek | **Yes** |  |
| Ericsson | **No** | Service continuity for broadcast is not seamless and we do not expect that with this enhancement it will be seamless neither. That is also why it is optional for MBS in LTE for both UE and NW, i.e. it is not essential to have. The UE is typically not roaming at the "border", i.e. we think this does not need to be optimized. In case a lot of UEs roam in such area, we assume the broadcast will be provided via MRB, i.e. non-supporting node will become supporting node. When the UE is supposed to request a unicast bearer before changing to a cell not providing the session, then there can be issues:* When the UE requests a unicast bearer while in coverage of the target cell, then there is a risk that the source cell ends up with unicast bearers for UEs that had the intention to move out of the source cell, but eventually did not do so.
* When the UE requests a unicast bearer of the target cell when the cell re-selection criteria of the target cell are fulfilled then the continuity is likely not seamless, and we wonder what use this feature has.

The required UE behavior when to request a unicast bearer should be discussed further and specified. The list of cells for intra- and inter-frequencies will increased the MCCH size, and increase the power consumption for UE and NW. It is complex and costly for the NW to configure and maintain cell lists. In our view cell list should be avoided, and only applied when there are problems to solve in a specific area (e.g. specific cell). But cell lists should be avoided to be needed for general deployment of the feature as a whole. We are not sure if this enhancement is needed. A simpler way to configure and maintain this functionality is to introduce an "MCCH area" (instead of cell lists) similar as with s*ystemInformationAreaID*. |
| Samsung | **Yes** | Neighbour cell information was added to SC-PTM to enhance the service continuity aspects, alleviating drawbacks with the LTE eMBMS having no prior information for service availability accessible to the UEs. Regarding Ericsson comment for “MCCH area”, it seems to be difficult to have a such static and common deployments when different cells may have different service requirements and network operational factors may also differ across cells. Neighbour cell information can provide more flexibility. NR MBS broadcast resembles SC-PTM significantly, it seems legacy approach of neighbour cell information can be adopted easily. |
| CATT | **Yes with comments** | We are fine to follow if this is the majority view, even though it is not clear whether it is in the R17 scope to support unicast reception of the broadcast service on a cell not providing the MBS service(i.e. out of the Broadcast MBS service area).At least it seems not supported according to SA2 TS 23.247,

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| NOTE: When the UE moves out the Broadcast MBS service area, how the UE get the same content via application level is out scope of 3GPP. |

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| Xiaomi | **Yes** | We can reuse the same function as LTE. |
| vivo | **Yes** | From the UE perspective, it is beneficial to have this kind of information, just the same as the LTE SC-PTM mechanism. This is used for the UE to setup the RRC connection with PDU session in advance.Further, regarding the comments from CATT, it is our understanding that that quoted NOTE is referred as to the case where a cell is not supporting (instead of not providing) 5MBS within the Broadcast MBS service area, according to TS 23.247, that *when the UE moves into NG-RAN node not supporting 5MBS within the Broadcast MBS service area, how the UE get the same content via application level is out scope of this specification*. In this sense, we think this topic is included in the Rel-17 WI scope and should be considered.  |
| Qualcomm | **Yes** | We think for service continuity purpose, each cell should provide information about neigbor cell list. When UE moves to neighbor cell not supporting broadcast service, it can request service through App Layer as UE implementation choice. From OTA signaling perspective, neighbor cell info has to be provided. This configuration can be optional from network configuration point of view.  |
| Kyocera | **Yes** | We think it’s same with SC-PTM baseline.  |
| ZTE | **No** | Agree with Ericsson on the raised issues.Since we have agreed there will be no cell granularity cell re-selection, we find it irrelevant to broadcast cell level availability info. |
| TD Tech, Chengdu TD Tech | **Yes** | 1. Reusing the corresponding mechanism in LTE SC-PTM is necessary for the service continuity during the UE mobility.
2. We suggest to add question 1a to collect the views of the different companies on question 1a. The reason for adding question 1a is given below.

Question 1a: **Do companies agree that** extra N bits with each bit associated with an MBS group/type are used in MCCH change notification to indicate which MBS group/MBS type has the configuration updated, where N=8？In MCCH change notification of LTE MBSFN, a field of N=8 bits long on the DCI format scrambled with M-RNTI is used to indicate which MBSFN area has the configuration updated, where M-RNTI is used to identify MCCH change notification over Uu. In NR MBS, we can use extra N bits to indicate which MBS group/type has configuration updadete to reduce the power consumption in UE.Based on the discussion on the DCI format for MCCH, the DCI format for MCCH has many idle bits because several existing fields are not used for MCCH, and can provide more than 2+N idle bits for MCCH change notification if MCCH is used to carry MCCH change notification. If a new RNTI is used to carry MCCH change notification, far more than 2+N bits can be used to carry MCCH change notification.In other word, no matter which RNTI is used to carry MCCH change notificiation, 2+N (N<=8) idle bits can be provided in RAN1. RAN2 can make best use of the idle bits of the DCI format for MCCH change notification.Reason for question 1a: in the following email discussion, extra bits are suggested to indicate which MBS groups/MBS types have configuration updated. * Reason: [AT115-e][048][MBS] Notifications (Samsung)

 Scope: Treat R2-2108847. Reach agreements as far as possible, can also define FFSes when helpful. Intended outcome: Agreements, report Deadline: Wednesday W2 (CB if needed)**Proposal 2: MCCH change notification can be reused for modification of other information carried by MCCH.****Further, for the other information carried by MCCH, MCCH change notification includes**1. **Change of neighbour cell information (reuse of 2nd DCI bit of MCCH change notification) [Assuming support of neighbour cell information in MCCH]**
2. **Modification of configuration of MBS Session Id or Session group (extension of DCI bits of MCCH change notification)**
3. **Both**
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| Nokia | **Yes** | In LTE SC-PTM we do broadcast scptm-NeighbourCellList on MCCH. We could optionally have the neighbour cell information in NR also if UE vendors see the benefit to have it and also to align NR with LTE. However, it would be nice to specify some clear UE behaviour as to how UE uses the neighbour cell information. It is to be noted that for public safety use case, multicast provides better service continuity than broadcast service. |
| Sony | **Yes** | Same as SC-PTM |
| Spreadtrum | **Yes** | The mechanism in LTE SC-PTM can be reused for service continuity during mobility. |
| Huawei | **Yes** | It should be noted that the cells list for NR broadcast for a particular service might be generated by application server according to the user’s location. The neighbor cell might not broadcast a particular service due to non-support of MBS or absence of interested users. It is therefore probable that NR broadcast is not provided in all cells in an area. Thus, the information about service availability is important for application layer optimization for service continuity (otherwise the application can only establish unicast connection with the application server after the UE entering the new cell and reading SIB/MCCH) and that is why this mechanism was introduced for SC-PTM rather than MBSFN. |
| Intel | Yes | OK to reuse LTE SC-PTM mechanism. |
| Futurewei | **Yes** | Adopting the same mechanism as in LTE SC-PTM is beneficial for the MBS UEs receiving the broadcast service knowing easily the neighboring cells supporting the current service. It is helpful for supporting the service continuity during the mobility. |
| TCL | **Yes** | Reusing the same function as LTE would be useful. |
| ITRI | **Yes** | We are fine to reuse the LTE SC-PTM scheme. |
| Sharp | **Yes** | Ok to reuse LTE SC-PTM mechanism. |
| Apple | **Yes** | It’s for service continuity purpose, and we can reuse LTE SC-PTM mechanism. |
| LGE |  | As mentioned by several companies, the neighbor cell list in MCCH can help UE to request the unicast transmission as soon as the selected cell is not listed. However, since the neighbour cell list is not per MBS session, it cannot be used to check whether the selected cell provides the MBS session that the UE wants to receive. Unless the neighbour cell list is provided per MBS session, it seems not essential for MBS service continuity. |
| Lenovo, Motorola Mobility | **Yes** | We prefer to resue LTE SC-PTM scheme. It is useful for the application layer being aware of the service availability in the neighbor cell. |

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| **Summary of 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.** Vast majority of companies is in favour or OK with specifying a neighbour list in MCCH, by reusing the same principles as in LTE SC-PTM, but there were some comments on whether it is OK to leave the UE behavior up to implementation or not, and that the list would be more useful in case it would indicate the exact BC sessions per neighbour cell. Therefore it is proposed:**Proposal 1: As a baseline, the network may broadcast in MCCH a list of neighbour cells providing the same broadcast MBS service(s) as provided in the current cell, same as in LTE SC-PTM.*** **FFS whether to specify how this information is utilized in RAN2 or whether to leave it up to upper layers or UE implementation.**
* **FFS whether to have a finer granularity of this information, e.g. indicate which broadcast sessions are available per neighbour cell**
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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** |
| OPPO | Yes  |  |
| MediaTek | **Yes** |  |
| Ericsson | **Yes** |  |
| Samsung | **Yes** | RAN1 is considering at least 2 bits for MCCH change notification and further discussion in RAN1 is on whether it is based on either Alt1 or Alt2 approach. It is up to RAN2 to define the purpose of change notification bits and it seems straightforward to reuse MCCH modification notification bit (2nd bit) to also indicate neighbour cell information modification |
| CATT | **Yes** |  |
| Xiaomi | **Yes** |  |
| vivo | **Yes** | It is straightforward. |
| Qualcomm | **Yes** |  |
| Kyocera | **Yes** | We assume it’s important for the UE to notice the change of MCCH due to neighbouring cell information, at least for cell reselection.  |
| ZTE | **Yes** | Since broadcast services deployment is rather static, the overhead is acceptable. |
| TD Tech, Chengdu TD Tech |  | 1. The neighbouring cell information list is only needed by UE at the cell edge. If UE is at the cell edge, it can acquire the lastest neighbouring cell information list and then execute the cell reselection. Therefore, there’s no need to inform UE of the update of the list with MCCH change notification.
2. If many companies support to inform UE of the update of the list, we suggest not reusing the bit for the configuration update to indicate the list update. We suggest to use an extra bit to indicate the list update, which can reduce the power consumption in UE because UE not at the cell edge has no need to acquire MCCH just for the list update.

Furthermore, if MCCH-RNTI is used to carry MCCH change ntofication, the DCI format scheduling MCCH can provide far more than 3 idle bits because several fields of the DCI format are not used for MCCH. If a new RNTI is used to carry MCCH change notification, far more than 3 bits can be used for MCCH change notification.No matter which RNTI is used for MCCH change notification, it’s better to use 3 bits for MCCH change notification instead of 2 bits if UE is required to be informed of the list update. If question 1a is agreed, no matter which RNTI is used for MCCH change notification, it’s better to use 3+N bits for MCCH change notification. |
| Nokia | **Yes** | If neighbour cell information over MCCH (for broadcast service) is agreed then we are OK to have any MCCH change indicated by this “one bit” i.e. no need to add any additional information for MCCH change indication for the purpose of neighbour cell information modification. |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** |  |
| Intel | Yes | In general, we prefer to use MCCH modification bit to cover all MCCH content. |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Sharp | **Yes** |  |
| Apple | **Yes** |  |
| LGE |  | If the neighbour cell list is used for the sevice conionuity, it would be better to use the SIB containing the service continuity information, rather than MCCH message.  |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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?**All but two companies agree that MCCH changes due to neighbouring cell information modification should reuse the MCCH modification notification bit, if agreed by RAN1. Therefore, it is proposed:**Proposal 2: MCCH changes due to neighbouring cell information modification will be notified using the MCCH modification notification bit, if agreed by RAN1.** |

## 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** |
| OPPO | Yes  |  |
| MediaTek | **Yes** |  |
| Ericsson | **Wait?** | In our understanding RAN1 is still studying whether to use a dedicated RNTI for the MCCH notification, i.e. perhaps we should wait for RAN1 progress?:Agreement:For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, study the following alternatives for MCCH change notification indication due to session start:* Alt 1: Define a dedicated RNTI to scramble the CRC of a DCI indicating a MCCH change notification;
* Alt 2: Use of a field in a DCI format scheduling a MCCH without a dedicated RNTI for MCCH change notification;

Other solutions are not precluded and it is also not precluded whether to support both Alt1 and Alt2.Agreement:Study and reach an agreement by RAN1#106b-e on whether Alt1 and Alt2 for MCCH change notification indication can accommodate at least 2 bits for the notification of MCCH configuration changes due to a session start and the notification of MCCH configuration changes of an ongoing session (including session stop). |
| Samsung | **Yes** | It is rightly mentioned by Ericsson that RAN1 is yet to decide on Alt1 or Alt2. However, in any case there is a need for RNTI for DCI scheduling MCCH (whether DCI does not include change notification field as in Alt1 or DCI includes for change notification field also as in Alt2) and it should be defined. MCCH-RNTI seems appropriate name of RNTI for DCI scheduling MCCH.  |
| CATT | **Yes with comments** | It is fine to use the name “MCCH-RNTI” .but for simplification, would it be better to use a shorter name such as “M-RNTI”? |
| Xiaomi | **Yes** |  |
| vivo | **Yes** | We think RAN2 can determine the name and send this to RAN1 with LS. |
| Qualcomm | **Yes** | Same view as Samsung |
| Kyocera | **Yes** |  |
| ZTE | **Yes** | M-RNTI suggested by CATT sounds good. |
| TD Tech, Chengdu TD Tech | **Yes** | We suggest the following MCCH related issues to be added for discussion.Can MCCH specific SIB (carrying MCCH configuration information, like SIB 20 in LTE) be area specific, which means MCCH of each cell within the area has same configuration information and thus UE can use the configuration information of MCCH in the source gNB to receive MCCH in the target gNB.Can service continuity specifc SIB (SIBy just like SIB 15 in LTE) be area specific?Can MCCH support the slot level repetition within each repetition period? If supported, a new parameter”slot-level MCCH repetition times” needed to be added in the above parameter list. |
| Nokia | **Yes** | This is good starting point but e.g. RAN1 identifies need to change periods we can come back to this. |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** |  |
| Intel | Yes |  |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Sharp | **Yes** |  |
| Apple | **Yes** |  |
| LGE | **Yes** |  |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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.**All but one compay agree that “MCCH-RNTI” term can be applied for the RNTI scheduling MCCH.**Proposal 3: The RNTI scheduling MCCH is called “MCCH-RNTI”.** |

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** |
| OPPO | Yes with other comments | (1)*mcch—WindowStartSlot* and *mcch—WindowDuration* are useful only when MCCH repetition period is longer enough than *mcch—WindowDuration*, right? So *mcch—WindowStartSlot* and *mcch—WindowDuration* are not essential parameters and the both two parameters can be optional.(2)Network should ensure that the MCCH repetition period is longer than *mcch—WindowDuration.*  |
| MediaTek | **Yes** |  |
| Ericsson | **Yes with comments** | It would be beneficial to have a configurable offset between the MCCH notification (PDCCH) and MCCH control/content (PDSCH) which enables some power saving in the UE when waking up to monitor the notification, similar as with WUS/PEI ([R2-2108078](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs/R2-2108078.zip)). We are not sure (but do not have strong view):* is a repetition period of 1 frame needed (it gives an odd 9 element in the list)?
* Should the window duration be in submsec/msec like the DRX inactivityTimer?

PS: there is a different format/type for the highlighted dash?mcch—WindowStartSlot-r17mcch—WindowDuration-r17  |
| Samsung | **Yes** | *mcch-WindowstartSlot* and *mcch-WindowDuration* are needed given MCCH can be likely segmented and needs to be accommodated in multiple slots.@Oppo, we understand MCCH repetition period will always be configured longer than *mcch-WindowDuration*. So there should be no such concern. |
| CATT | **Yes with comments** | The values for these IEs are related to the latency requirement of the supported MBS services, it is hard to say whether the currently captured values for these IE are appropriate and sufficient as there is no clear latency requirement.so we can keep the current currently captured values until there is requirement coming in. |
| Xiaomi | **Yes** |  |
| vivo | **Yes** | We think the parameter *mcch-WindowDuration* should be mandatory, similarly to *si-WindowLength* in NR. Then it is not needed to specify the corresponding behavior when *mcch-WindowDuration* is absent.  |
| Qualcomm | **Yes** | Agree with Vivo comment about *mcch-WindowDuration* as mandatory. |
| Kyocera | **Yes** |  |
| TD Tech, Chengdu TD Tech | **Yes** | 1. Is the range below right? A frame can include 160 slots for FR2. Only consider FR1?

mcch—WindowStartSlot-r17 INTEGER (0..79),1. Is sl160 big enough? MCCH may be segmented. Consider 64 beams for a cell? Whetehr or not to support slot-level repetition within each repetition period?

 mcch—WindowDuration-r17 ENUMERATED {sl2, sl4, sl8, sl10, sl20, sl40,sl80, sl160} OPTIONAL, -- NEED S1. The range is too great. Which service types can use a modification period of more than 2048 radio frames? If a far great modification period can be used, maybe it’s better to re-consider multiple modification periods/repetition periods?

 mcch-ModificationPeriod-r17 ENUMERATED {rf2, rf4, rf8, rf16, rf32, rf64, rf128, rf256, rf512, rf1024, r2048, rf4096, rf8192, rf16384, rf32768, rf65536}} |
| Nokia | **Yes** | We are fine with the proposed values of the parameters above but if RAN1 identifies a need for additional values we should be flexible to update the values in the running CR later. |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** | We think 1 frame repetition window is important for services requiring quick changes, so if we were to remove some value, we would prefer some middle one, e.g. 64/128 frames. But since we would only save a single bitm, then we are not sure this is really an issue to keep current values. It is also better to keep the unit in slots as it gives more flexibility when using different SCS. For DRX, it has to be in ms, since DRX is applied across different cells in general, which can use different numerology. This is not the case for MCCH. We also prefer to keep *mcch-WindowDuration* as optional, as in LTE. If the window only consistis of the start slot, it is not necessary to additionally configure the duration. The definition as in LTE SC-PTM can be used as a baseline here.  |
| Intel | Yes |  |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Sharp | **Yes** |  |
| Apple | **Yes** |  |
| LGE | **Yes** |  |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of** **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.**All companies are in general OK with the currently captured values of MCCH window parameters. **Proposal 4: The values of mcch-RepetitionPeriodAndOffset, mcch-WindowStartSlot, mcch-WindowDuration, mcch-ModificationPeriodm, as captured in the RRC running CR in R2-2108970, are confirmed.** |

## 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** |
| OPPO | No  | Considering the service interruption during cell reselection, SIBX cannot be on demand. |
| MediaTek | **Yes** | We do not think the UE needs to read the SIBx of the candidate cell before cell reselection, as this will make the cell reselection procedure complicated |
| Ericsson | **Yes, with comments** | We do not have a strong view, but perhaps SIBx can be off until the first BC session starts in the cell (again), i.e. there is no interruption to service continuity in such case. It is not obvious when to switch SIBx off again, but perhaps this can be done during certain "no broadcast" hours. We do not see strong reasons to exclude this option, even though the whole BC solution is far from "on demand".  |
| Samsung | **Yes** | UE need not read SIBx of the candidate cell before cell reselection. SIBx and SIBy can be available on demand. |
| CATT | **No** | 1. UE should not be required to read SIBx of the reselection candidate cell, the scheduling info in SIB1 of the candidate cell is sufficient. but it is not the reason to support on demand SIBx is supported or not.2.The reason why on demand MBS SIB(i.e. SIBx,SIBy) should not be supported is similar as logic to not support on demand MCCH, i.e. this mechanisms will cause more issues than benefits, e.g. due to impact to the service continuity of idle/inactive mode UEs, extra service interruption due to request the on demand SIBx etc.//RAN2#115e agreement* [049] On-demand MCCH mechanism is not introduced in Rel-17.
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| Xiaomi | **Yes** | There is no need for the UE to read the SIBx of the candidate cell before cell reselection. No specific issue on supporting on-demand SIBx/SIBy is observed from our understanding. |
| vivo | **Yes** | It seems a spontaneous logic to reuse the on-demand mechanism for SIB for MBS. We don’t see any specific technical issues neither.  |
| Qualcomm | **Yes** | Same view as MediaTek and Samsung. i.e UE is not required to read SIBx of target cell before idle cell reselection. SIBx can be area based and serving cell indicates which services are available in intra/inter frequency neighbor cells. |
| Kyocera | **Yes** | We think it’s up to network implementation whether SIBx and SIBy are always broadcasted or provided on-demand.  |
| ZTE | **Yes**  | Can be left to network to decide on demandable or not. |
| TD Tech, Chengdu TD Tech |  | 1. UE has no need to read the MBS specific SIBs of the candidate cells during the cell reselection.

 UE has no need to read SIB1 of the candidate cells during the cell reselection.1. It’ better not to support on-demand mode of MBS specific SIBs to reduce the interruption time of MCCH/MBS session reception in the target cell.
2. As mentiones by CATT, the agreement that MCCH specific SIB is not on-demand has been made.
3. UE can know whether or not a candidate cell supports MBS through many methods:
* If MBS specific SIBs are area specific and the candidate cell is within the area, the candidate cell supports MBS
* If the neighboring cell information lists are provided in the source cell and the candidate cell provides at least one MBS service according to the lists, the candidate cell supports MBS.
* If the PTM bearer used to send an MBS session with PTM mode is area specific and the candidate cell is within the area, the candidate cell supports MBS.
 |
| Nokia | **Yes** | At least for SIBx we see benefits in having it as an on-demand SIB. Irrespective of whether SIBx is on-demand broadcast or not we agree that UE just needs to check if SIBx is scheduled (periodic or on-demand) or not scheduled by SIB1 in the candidate cell. |
| Sony | **Yes** | Agree with Qualcomm |
| Spreadtrum | **Yes** | UE should not be required to read the SIBx of the candidate cell before cell reselection. Whether SIBx can be provided on demand is up to network implementation. |
| Huawei | **Yes** | We think SIBx/SIBy can be configured as on-demand based on network implementation. |
| Intel | Yes | Since there is no additional specification complexity, we’re OK that SIBx and SIBy can be on demand and the decision is up to gNB implementation. |
| Futurewei | **Yes** | UEs should be allowed to request SIBx/SIBy, then the network decides whether to broadcast SIBx/SIBy in the cell. |
| TCL | **Yes** | SIBx and SIBy can be configured on demand by gNB. |
| ITRI | **Yes** | Same view as Samsung. |
| Sharp | **Yes** | UE is not required to read SIBx of the candidate cell before cell reselction. |
| Apple | **Yes** | It can be left to NW implementation to provide the SIBx/SIBy via on demand or broadcast way.  |
| LGE | **Yes** | UE needs to read SIBx and MCCH message of the candidate cell before cell reselection, unless the neighbour cell list is provided per broadcast session. However, compnies agree to introduce a single neighbour cell list in MCCH as in LTE in Q1. We should note that the single neighbour cell list is useful only when the UE moves to a cell not supporting all broadcast sessions provided from serving cell, and is not useful to check whether the broadcast session of interest is provided or not from a candidate cell.Anyway, the broadcast session must be tolerant of latency, so on-demand broadcast would be suitable at least for some broadcast sessions. |
| Lenovo, Motorola Mobility | **No** | Agree with CATT, since we already agreed to not support on-demand MCCH, why we want to support on demand SIB which is related to MCCH provision? On demand SIB is not applicable for UE in IDLE/INACTIVE.  |

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| **Summary of Question 5:** **Do you agree that SIBx and SIBy can be available on demand?**Yes: 19 companiesNo: 4 companiesVast majority of companies agree that SIBx and SIBy can be availaboe on-demand. The sceptical companies rasie mainly an issue of additional service interruption time. However, as indicated vy other companies, it can be left to network implementation how to use this feature to avoid the interruptions where necessary.**Proposal 5: SIBx and SIBy can be available on-demand, same as other SIBs.** |

**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** |
| OPPO | Yes  | If majority view to support on demand SIB X/Y, we think Q6 is yes.  |
| MediaTek | **Yes** |  |
| Ericsson | **Yes** |  |
| Samsung | **Yes** |  |
| CATT | **Yes** | UE should not be required to read SIBx of the reselection candidate cell, the scheduling info in SIB1of the candidate cell is sufficient.  |
| Xiaomi | **Yes** |  |
| vivo | **Yes** | The mentioned condition is needed.  |
| Qualcomm |  **No** | We don’t see any need for UE to read target candidate cell SIBx or scheduling info in SIB1. We share the same view as TDTech, Intel, Nokia mentioned below. |
| Kyocera | **Yes** | Especially in case SIBx is provided on-demand, it enables the cell reselection process faster.  |
| ZTE | **Yes** |  |
| TD Tech, Chengdu TD Tech |  | The question needs clarifying. UE has no need to acquire SIB1 of the candidate cell during cell reselection.After UE selects a cell, UE camps on the cell and then starts to acquire SIBs and monitor paging. According to the question descripton, UE acquires SIB1 in the candidate cell and then finds SIBx is scheduled in SIB1. Finally UE prioritizes the frequency used by the candidate cell.If the understanding above is right, the logic of the question is not right, isn't it? |
| Nokia | **Yes (if SIBy is not provided in the camping cell)** | The requirement for the UE to check whether the reselection candidate cell provides SIBx (either broadcasting or on-demand) could be subject of availability of SIBy in the camping cell. We assume the network to provide SIBy in cells of MBS supporting gNBs and in areas where MBS broadcast may be provided and thus the UE may not be required to check for SIBx in the reselection candidate. If SIBy is not provided in the camping cell, then the UE may consider the frequency prioritization based on USD information only if the reselection candidate cell provides SIBx.  |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** |  |
| Intel | No | Our understanding is that in current cell reselection procedure, to determine the reselection priority, UE is not required to read SIB1 of the inter-frequency neighbor cell(s). The proposal results in additional UE power consumption. |
| Futurewei |  | Have similar view as TD Tech. and NOK. Normally the camping cell should provide sufficient MBS neighboring information with SIBx/SIBy for supporting MBS prioritized reselection. An idle/inactive UE needs to acquire even only SIB1 of a neighboring candidate cell is a stretch before the UE camping on the cell. |
| TCL | **Yes** |  |
| ITRI | Yes |  |
| Sharp | Yes |  |
| Apple | Yes |  |
| LGE |  | RAN2 agreed followings in the last meeting:* The UE is allowed to prioritize the MBS frequency of interest when the cell of the MBS frequency provides MBS SIB carrying the MCCH configuration, as LTE SC-PTM.
* The UE is allowed to prioritize the MBS frequency of interest when the UE is only capable of receiving the MBS service by camping on the MBS frequency, as LTE SC-PTM.

We think the second agreement means that the UE is allowed to prioritize a frequency when the broadcast session of interest is provided from the candidate cell, i.e. the best cell of the frequency. Therefore, if the neighbour cell list is provided per multicat session, UE doesn’t need to read SIBx and MCCH of the candidate cell before the frequency prioritization. However, if the neighbour cell list is common for all broadcast sessions provided form the serving cell, UE should read not only SIBx but also MCCH form the best cell before prioritizing the frequency to check whether the broadcast session of interest is provided from the best cell. |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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)?**17 companies agree the UE should verufy that the reselection candidate cell is providing SIBx by reading SIB1 of the candidate cell, before prioritizing a frequency for MBS. 6 companies either disagree or indicate the UE may not verify whether SIBx is available via other means, e.g. neighbouring cell information or SIBy.In rapporteur’s understanding, TS 36.304, section 5.2.4.1, is rather clear that for LTE SC-PTM the UE needs to ensure the candidate reselection cell is broadcasting SIBx. The intention of the question was to clarify that in case on-demand SIB is supported, then SIBx may not actually be broadcasted, but be available in the candidate cell on demand (i.e. its status in SIB may be set to ”not broadcasting”. Since verification of SIBx preence in the candidate cell was a requirement already in LTE SC-PTM and considering the view expressed above, the following is proposed:**Proposal 6: Before the UE in RRC IDLE/INACTIVE considers the frequency for prioritization due to MBS, the UE is not required to read SIBx, but needs to verify that SIBx is available in the reselection candidate cell (i.e. the status of the associated SI message in SIB1 can be either broadcasting or notBroadcasting). FFS how the verification is achieved.** |

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** |
| OPPO | Yes  |  |
| MediaTek | **Yes** | We have the same understanding as rapporteur and think that it would be a corner case if the UE verified the frequency prioritization conditions positively, but it ended up on a cell not providing SIBx after cell reselection on a prioritized frequency.  |
| Ericsson | **No, with comments** | The UE has to check if SIBx is scheduled in SIB1 of the **strongest/highest ranked cell** on the target frequency, i.e. the UE reselect to a cell broadcasting SIBx. It is a NW configuration error when SIB1 indicates SIBx, but SIBx it not broadcasted. In case some cells on the target frequency do not support MBS the UE may end up on a cell not broadcasting SIBx due to mobility. But in case some cells on the frequency do not support MBS, we assume that cells on other frequencies in the same geographical area as the non-supporting cell do not broadcast SIBy either, i.e. they would not "redirect" the UE to that frequency. We thought that bullet 2 describes the use case where the MC session has stopped, because it says "*not scheduled … anymore*". When there are no more active sessions in the cell, we assume that the MCCH and SIBx are removed. Perhaps this should be discussed more, i.e. is there a use case where the last session is stopped and a new session is started frequently, i.e. this would then cause frequency SIB changes?In case the UE is no longer interested in a MC session, or the MC session has stopped, the UEs should "disperse" from the MBS frequency in our view. Otherwise there is a risk that MC UEs start to congregate on the MBS frequency, which is unwanted for load balancing reasons. This was captured in LTE with the offset:NOTE: UE should search for a higher ranked cell on another frequency for cell reselection as soon as possible after the UE stops using QoffsetSCPTM. |
| Samsung | **Yes** | We agree with rapporteur’s understanding that it is a corner case that UE ends up on a cell not providing SIBx after cell reselection on a prioritized frequency |
| CATT | **No,with comments** | The answer to Q7 itself is Yes. But it is not the case that the FFS tries to address.As the rapporteur of the 38.304 running CR, please allow me to clarify this FFS further.The FFS is added due to the companies’ different views on which word to use (i.e. “reselected cell” or “reselection candidate cell”) when performing the frequency prioritization. The “reselection candidate cell” is used in the current 304 CR, but the “reselected cell” is used in LTE.The reason why “reselected cell” is used in 36.304 is for the case below,1. UE receiving broadcast service did the frequency prioritization and reselected to a cell which scheduling/broadcasting SIBx. 2. After reselection, UE continues the broadcast reception based on SIBx and MCCH on the new serving cell.3. The serving cell stop the scheduling/broadcasting of the SIBx for some reason (e.g. for congestion control in LTE).The conclusion in LTE is: UE should stop to prioritize the related frequency after step 3 above. So the wording “reselected cell” is used finally to address this issue. |
| Xiaomi | **Yes** |  |
| vivo | **Yes** | As long as the UE keeps prioritizing the frequency (associated with a broadcast service the UE interested in), it can receive the broadcast service after future mobility. In this sense, we don’t see any essential issue.  |
| Qualcomm | **No** | It seems there is some confusion about intent of this FFS. From [Post115-e][072][MBS] 38304 running CR (CATT) reflector discussion, here is snippet from CATT rapporter email :1. After cell reselection

After a certain frequency is set to highest priority  during a cell reselection, UE is supposed to  treat the corresponding frequency with highest priority in the subsequent cell reselection during the broadcast session reception, But UE should stop to prioritize the MBMS frequency if SIB20 disappears on the serving cell(i.e. reselected cell),according to LTE MBMS agreement.That is why “reselected cell” is used in 36.304.However, this scenario has not been touched in NR MBS.UE is not required to read SIBx or Scheduling Info in SIB1 of target candidate cell and UE can perform frequency prioritization based on servng cell SIBy. As long as UE does frequency prioritization based on SIBy and USD and reselected cell is providing SIBx/MCCH , then there is no issue. But after cell reselection, if SIBx/MCCH is not available on reselected cell (it can be due to Broadcast service not available on that cell or error in configuration etc), what is the point for UE to keep the same frequency as high priority. We think UE should stop priorititing that frequency. |
| Kyocera | **No** | Since the UE once checks whether SIBx is broadcasted as in Q6 above, we assume the issue is caused, e.g., if the UE didn’t check SIBx in the best cell or if the UE moves from the cell broadcasting SIBx to the cell not broadcasting SIBx after the frequency prioritization. In any case, we think it’s straightforward that the frequency is no longer considered as the highest priority. As another (but similar) scenario, the UE may notice the reselected cell on the prioritized frequency (in SIBy or USD) does not provide the MBS service of interest later, since we assume it’s up to the cell whether to provide the MBS service at the end. In this case, we assume the UE no longer considers this frequency as the highest priority |
| ZTE | **Yes, no need to address.** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **Yes, no need to address** | Question 7 is a bit confusing since it also mentions “deprioritization”. However, no special behaviour needs to be specified for the case where the UE after reselecting to a cell, based on frequency prioritization, the reselected cell does not broadcast SIBx but it would be better to stick to that frequency and not reselect away as it would cause ping pong.  |
| Sony | **Yes** | We think this is a corner case and may be associated with network error. |
| Spreadtrum | **Yes** | We think this is a corner case and no need to address. |
| Huawei | **Please see comments** | Thank you for the clarifications on the intention of the FFS. We tend to agree with other companies it would be then good for the UEs to disperse into other frequencies, if the service is not provided any more. We could clarify in 38.304 that the UE should stop prioritizing the frequency in case SIBx is not scheduled any more on the reselected cell.When it comes to the scenario described by the rapporteur, then we think it does not have to be addressed.  |
| Intel | Yes, there is no need to address | Agree with rapporteur. |
| Futurewei | **Yes** |  |
| TCL | Yes  |  |
| ITRI | **Yes** | In this case, UE may follow the frequency priority broadcasted by the cell which does not broadcast SIBx. |
| Sharp | **Yes** | Agree with the rapporteur this is a corner case. |
| Apple | **Yes** | The case should not happen.  |
| LGE | **Yes** | Though the broadcast session of interest is not being provided from the re-selected cell, the subsequent cell re-selection can be up to UE implementation. |
| Lenovo, Motorola Mobility | **See comment** | There seems to be confusion with the question and the related issue especially considering CATT’s explanation. Better to further clarify and have a common unstanding first.  |

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| **Summary of 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?**Most companies agree the case described by the rapporteur does not have to be addressed, i.e. if the UE happens to reselect to a cell not providing SIBx, no standardized behaviour is specified. However, it was also indicated the editor’s note in the running CR intended to describe a scenario where the broadcast session is no longer providing the UE’s service of interest. For this case, it seems reasonable to assume the UE stops frequency prioritization, as suggested by several companies describing this scenario.**Proposal 7: When the cell reselected by the UE due to frequency prioritization for MBS stops providing SIBx, the UE should stop prioritizing the frequency of this cell.** |

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** |
| OPPO | Not sure | It is related the concept of USD, we can wait for response from SA2. |
| MediaTek | **Yes** |  |
| Ericsson | **Maybe** | In case frequency info is provided in both USD and SIBy, then there is a potential risk for conflicts. Perhaps we can say that the frequency info in SIB is prioritized (configured by RAN), when it conflicts with the frequency info in USD (service announcement). But we are not sure if both methods of redirecting would be deployed together.  |
| Samsung | **-** | We think it is related to USD which is to be defined by other WGs. In implementations, Service announcement or USD information is typically refreshed frequently through certain pre-configured MTCH channel, even accessible to the UEs in IDLE/INACTIVE state and therefore, there should not be issue related to mismatch between USD and SIB transmission in general. |
| CATT | **Yes** | If the frequency and SAI mapping info for the interested broadcast service is present in SIBy, there is no need to check the frequencies for this service in USD further.  |
| Xiaomi | **Yes** |  |
| vivo | **Comments** | Generally, we prefer to reuse the LTE mechanism. Anyway, we can wait for more input regarding USD before discussing this topic.  |
| Qualcomm | **Yes** | Same view as CATT. |
| Kyocera | **Yes** | We assume the up-to-date information is provided in SIBy, which the UE should take into account.  |
| ZTE | **-** | Can be left to UE choices. |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **Yes** | It should not be necessary for the frequency indicated in SIBy to match the frequency indicated in USD. There may be situations where network update to frequency information is not reflected in the USD yet. |
| Sony |  | Wait for SA2 |
| Spreadtrum | **Yes** | Same view as CATT. |
| Huawei | **Yes** | We think the information in SIB can be in general changed more dynamically and will be normally more up to date than USD information. Hence SIB information should have higher priority and should be relevant even without information in USD. |
| Intel | - | As the question is related to USD, we can wait for response from other WGs.  |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Sharp | **Yes** | We have no strong view, but fine to follow the majority. |
| Apple | **-** | It’s related to SA2 discussion on USD. We should first check whether the mismatch between USD and SIB will occur. |
| LGE | **Yes** | We don’t know yet what information will be in USD, but though the mapping between service id and frequency will be provided via USD, the information may be out-of-date because it cannot be updated in IDLE/INACTIVE, so SIB should be prioritized. |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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?**Clear majority of companies agrees 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. Some companies indicate this may also depend on how USD is defined exactly. The following is proposed:**Proposal 8: RAN2 assumes 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. This can be revisited once USD definition becomes clearer, if issue is identified.** |

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** |
| OPPO | Not sure | It is related the concept of USD, we can wait for response from SA2. |
| MediaTek | **Yes** |  |
| Ericsson | **Maybe** | This depends on whether the two methods of frequency redirection can be used simultaneously (i.e. frequency info in USD and SIBy) |
| Samsung | **-** | We think it is related to USD which is to be defined by other WGs |
| CATT | **Maybe** | We agree with the general idea, but We are wondering which frequency to be prioritized by UE if a TMGI maps to multiple frequencies in USD? |
| Xiaomi | **Not sure** | Maybe the network by implementation can ensure that if SIBy is provided and a frequency for a MBS service is not provided, the frequency in the USD for the same MBS service is not provided as well. This is to align the assistance information in USD and SIBy. Otherwise we may need to handle many other issues regarding the miss-aligned configuration between USD and SIBy/SIBx. |
| vivo | **Comments** | Generally, we prefer to reuse the LTE mechanism. Anyway, we can wait for more input regarding USD before discussing this topic.  |
| Qualcomm | **Yes** |  |
| Kyocera | **FFS** | We’re wondering if there is a case that the gNB may intentionally not provide the frequency mapping for the concerned service in SIBy, e.g., in case (some cells on) the frequency currently suspends the MBS service (i.e., USD may not provide up-to-date information). On the other hand, we agree with the rapporteur’s analysis that the semi-static frequency information in USD would be efficient if the MBS service is deployed on the same frequency throughout the operator’s network. However, we’re wondering how the UE knows such a deployment policy.  |
| ZTE | **-** | We don’t know whether frequency will be in USD yet. Suggest postponing this issue. |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia |  **No** | It is likely that USD information is not correct/out-of-date. RAN information should take precedence in terms of frequency prioritization. Also, it avoids another layer for prioritization which makes testing this impossible as the USD information is quite challenging to test in RAN. |
| Sony |  | Wait for SA2 |
| Spreadtrum | **Not sure** | It is related to USD and we can wait for SA2 response.If the semi-static frequency information is contained in USD, poritization of the frequency indicated in USD will be beneficial to the mobility. |
| Huawei | **Maybe** | This might be useful especially if the UE is interested in MBS frequency provided by another PLMN, and that frequency is not broadcast in the serving PLMN. |
| Intel | - | As the question is related to USD, we can wait for response from other WGs.  |
| Futurewei |  | Not sure the semi-static frequency information is reliable over the time for mobile UEs. |
| TCL | **-** | Wait or LS other WGs regarding this issue .  |
| ITRI | **Yes** |  |
| Apple | **-** | It’s related to SA2 discussion on USD. We should first check whether the mismatch between USD and SIB will occur. |
| LGE |  **No** | The USD information cannot be updated in IDLE/INACTIVE, so it may be out-of-date.  |
| Lenovo, Motorola Mobility | **See comment** | Better to wait for the USD definition from SA2. |

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| **Summary of 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?**Majority of companies prefers to wait for details of USD before deciding on this question. Therefore no proposal is made. |

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** |
| OPPO | No  | No matter the camped cell is MBS cell or non-MBS cell, the paging will be available for UE due to MBS activation. Even if the serving cell is non-MBS cell, the unicast can be used to receive MBS service. |
| MediaTek | **No** | We did not see the need and we think it is a bit unusual to mandate the idle UE behaviour as such, since multicast activation notification is based on unicast paging.  |
| Ericsson | **Not sure anymore** | We sent an LS to RAN3/SA2 to ask if group paging can only happen in the POs where MC users are monitoring. It would be beneficial when paging can also be reduced in the frequency domain as well.In case the session is deactivated, and the UE is released to idle/inactive, the UE should perhaps consider this frequency the highest priority frequency, as long as the UE is interested in it, the UE has not left the group, and the session has not stopped. This would enable the NW to group page only on the "MC" frequency. When the UE roams out of "MC" frequency coverage, the UE re-selects to another frequency, and would not be able to receive MC session when it is activated again. Only when the UE roams into "MC" frequency coverage again, and reselects to the "MC" frequency the UE can receive the MC session again when it is activated. The NW may have to perform some "periodic" group paging, to catch UEs that return out of coverage.We are not sure if the UE should be camped on a "MC" frequency when the session has not started yet, i.e. the UE should perhaps only camp on the MC frequency when the session is about to start/has started. It will also be difficult to guarantee that all MC UEs will be camped on the MC frequency and that paging can be limited to the MC frequency. Furthermore frequency info would be needed in SIB (i.e. does not come for free).RAN2 should perhaps also discuss if there is impact on RAN2 when a SAI-list is provided in the JOIN accept, i.e. when the UE should not send a JOIN request outside the MBS service. |
| Samsung | **No** | When the serving cell is non-MBS cell, unicast means are available for paging. Prioritization for multicast is needed only when activated session is being received by UE and it can be taken care by connected mode mobility by network (e.g. non-MBS to MBS mobility). We think it is undesired complexity to prioritize a frequency for activation notification monitoring. |
| CATT | **Yes** | Obviously it is resource efficient to receive the MBS data via multicast session/PTM on MBS cell if possible, when the deactivated session is reactivated again.So UE should prioritize to camp on a frequency where multicast cell exists in case there are MBS cell and non-MBS cell nearby. |
| Xiaomi | **No** | The network should ensure that the group paging for multicast session is broadcast in every cell of a TA for IDLE UE and every cell of a RNA for INACTIVE UE.  |
| vivo | **No** | From UE perspective, this optimization will incur much complexity. What’s worse, the PRACH capacity issue might become severe as all the MBS UEs are gathered together. |
| Qualcomm | **Yes** | There are 2 cases to consider. MBS cell and Non-MBS Cells.In case of MBS cells, from efficient resource utilization perspective, it makes sense to limit Multicast services to certain frequency and mapping between Multicast services and frequency can be provided as part of SIB. So within MBS cells to receive UE interested Multicast service, UE can prioritize freqs during idle cell reselection . When it comes to Multicast activation, it is reasonable UE to remain on frequency where Multicast session is deactivated as long as UE does not leave Multicast session.In case of non-MBS Cells, where Multicast session can only be delivered using Unicast manner, UE can stay on any frequency and Unicast paging can be used to alert Multicast UEs to receive Multicast service in Unicast manner. |
| Kyocera | **Yes** | In our understanding, the goal is to minimize number of the individual (legacy) paging to the UEs that cannot receive the multicast activation notification (i.e., the group paging), e.g., due to the UEs are in the cell not supporting MBS function. In general, that’s the same with the motivation to introduce the multicast activation notification, so we think it’s beneficial to maximize number of UEs that can receive it. The multicast activation notification is only for delivery mode 1 (i.e., multicast) and the multicast session join is done by the UE in Connected, so we think the gNB can know which multicast service the UE joined and whether the UE in Connected will be waiting for the multicast activation after transitioning to IDLE/INACTIVE. Thus, we assume the gNB may provide a necessary information in RRC Release, and/or optionally SIBy, in order for the UE in IDLE/INACTVE to prioritize the suitable frequency.  |
| ZTE | **No** | Limiting MC deployment to certain frequency sounds complicating. An area like SI area seems a better choice. |
| TD Tech, Chengdu TD Tech | **Yes** | In the intra-frequency network, an multicast session is provided on the different cells with the same carrier. It’ better to make UE in RRC\_IDLE/RRC\_INACTIVE UEs to monitor on the corresponding carrier for group notification to re-enter RRC\_CONNECTED to receive the re-activated multicast session. If UE moves out of the intra-frequency network, the unicat paging can be used to draw UE back to receive the re-activated multicast session on another carrier. |
| Nokia | **No** | Not needed as multicast session is only provided in CONNECTED state and the UE can be paged by non-supporting gNB. To realize such a prioritization would be complex and overhead caused by paging is minimal compared to unicast paging. |
| Sony | **No** | We suspect it will allow service based frequency prioritisation and RAN2 should go for a simple solution in the first release. |
| Spreadtrum | **Yes** | It is efficient to receive the MBS service in the MBS cell as possible, although the group paging message will be sent per TA. |
| Huawei | **Yes, but** | We agree with the overhead reduction benefits, but we do not think introducing additional mechanisms for this is desired. Steering the UEs to specific frequencies can be achived by the network configuring a UE with dedicated frequency priorities witout extra specification impact. |
| Intel | No | During the multicast joining procedure, UE initiates RRC connection and might be released back to RRC\_IDLE / INACTIVE. If gNB prefers UE to stay in one frequency, it can include *cellReselectionPriorities* in *RRCRelease* message. Given that existing procedure can achieve the same purpose, we don’t think additional mechanism is needed. |
| Futurewei | **No** | We don’t see much benefit by adding mechanism to support this. If multicast only support connected UEs, anyway the UE need to be paged to wake up when the multicast service is re-activated. For semi-static frequency prioritization, it can be configured by the network as Huawei pointed out. It is not worth to use the overhead signaling to dynamically stering the UE especially the service is not activated on would be servicing carry. It would compromise normal reselection performance.If multicast support inactive/idle, it would be another story. |
| TCL | **No** | Same view with MediaTek |
| ITRI | **No** | We share the same view as Nokia. The multicast session is only provided in CONNECTED state and the idle/inactive UE could also be paged by non-supporting gNB when the interested multicast session activation. |
| Apple | **No** | Same view as Nokia.  |
| LGE | **Yes** | It can be useful to reduce the unicast paging in non-supporting nodes.  |
| Lenovo, Motorola Mobility | **No** | In this release, UE can only receive multicast in RRC connected state, not sure why we need to limit multicast service in a specific frequency? And the relevant paging message can be sent via non MBS cell in legacy way for unicast.  |

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| **Summary of 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.**Clear majority of companies does not see the benefit of allowing the UE in RRC IDLE/INACTIVE which joined a multicast session to prioritize a certain frequency for group paging monitoring. Companies indicate it will be complex to make all multicast UEs camp on a single frequency and it may bring additional issues such as making PRACH collision more severe. Some companies steering UEs to a certain frequency can be achieved using existing mechanisms, e.g. dedicated frequencies in RRC Release. Therefore, the following is proposed:**Proposal 10: No new mechanism is specified to allow frequency prioritization for MB multicast session reception.** |

## 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.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments / justification** |
| OPPO | Yes  |  |
| MediaTek | **Yes** |  |
| Ericsson | **Yes, with comments** | This introduction paragraph specifies the trigger conditions as a "may", i.e. a hint to the UE implementation. The normative text for the sending the MMI message and setting the content is more critical. We are not sure if the UE should send MMI message when the session stops, assuming that the UE send the MMI message when it has started. In our understanding "entering or leaving the broadcast service area" is not clearly defined, and it overlaps with "PCell broadcasting *SIBx1*"?It would be beneficial to understand the use cases we are trying to solve, some of which might be the same as for LTE (e.g. HO/SCell config, unicast and BC scheduling) and some might be different (e.g. BWP config). In our view there should be more control over the MMI signalling, i.e. currently the UE may send a lot of MMI signalling. There is no possibility for the NW to disable MMI signalling, there is no prohibit timer for UE frequently changing its interest/priority, and it is not possible to control the signalling for specific use cases. It seems that the MMI signalling only covers the case where the frequency info is provided in SIBx1. We wonder if the case where the frequency info is provided in USD only should also be included.  |
| Samsung | **No** | Apart from “upon entering or leaving the broadcast service area” as were in legacy, there is also new BWP aspect in NR MBS. BWP switch may restrict/allow MBS broadcast reception for the UE and UE should additionally consider this event for sending MII to the network. |
| CATT | **No** | An MBS capable UE may send MII during connection establishment(i.e. before security activation), according to the following agreement,//RAN2#115e agreement,* Send an LS to SA3 to check whether the MBS interest information can be reported by the UE before security activation.
 |
| Xiaomi | **Yes with comments** | We think that the current procedural text can be considered as the baseline. Other issues (e.g. security concerns for MII) and enhancements (e.g. BWP switching) can be discussed based on the replies from other WGs and contributions from companies. |
| vivo | **Yes** | We are fine to follow the LTE principle.  |
| Qualcomm | **Yes with comments** | Additionally, we need to consider case of BWP switch as well to maintain servie continuity during BWP switch. |
| Kyocera | **Yes** |  |
| ZTE | **Yes** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **Partially Yes** | Agree that the currently mentioned triggers for MII are correct but we also propose a new trigger for MII viz. “upon request for on-demand SIBx” |
| Sony | **Yes with comments** | BWP switch aspects should be considered. |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes, with some comments** | For the condition "entering or leaving the broadcast service area", this would depend on whether SAI is introduced or not.For the condition “upon successful connection establishment”, this indeed depends on the reply from SA3 on whether MII can be reported before security activation. For BWP switch, we are not sure how this would impact MII. It is sufficient for the network to know which services the UE is interested in and the network may consider this when configuring the UE’s BWP. We do not see how BWP switch would impact UE’s interest in MBS. |
| Intel | Yes |  |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Apple | **Yes** |  |
| LGE  | **Yes** |  |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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.**Almost all companies agree the currently captured conditions are correct. Several companies mention that some additional triggers may be needed, which can be discussed based on companies contributions.**Proposal 11: Confirm that the UE may initiate MII procedure 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. FFS other triggers.** |

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 interestThe 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; andNOTE 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; andNOTE 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-)MCCHNOTE 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; and2> 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?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments / justification** |
| OPPO | Yes  | It is up to UE capability and can receive broadcast service from both MCG SCell and SCG SCell, and also possible on a non-serving cell. |
| MediaTek | **No** | Our assumption is that in Rel-17 MBS, UE receives MBS broadcast service only from a PCell. Otherwise, RAN1 work is needed.  |
| Ericsson | **Yes, but** | The MMI discussion is shifting from what the UE is not capable to do, into what the UE is capable to do. But the expected NW actions are not clear to us in the latter case. If the UE is capable to receive BC session(s) on SCells and SCells are configured on the frequencies of interest, then there is no NW action, and the UE should not send the MII, right? The procedure text does not seem to be clear on this in LTE. 36.300 also say:- the UE may indicate its MBMS interest even if the current configured serving cell(s) do not prevent it from receiving the MBMS services it is interested in.We do not understand what problem the MMI signalling solves in this case, and we prefer to limit excessive signalling, if possible. In LTE simultaneous reception of multiple services is left to UE implementation: In this release of the specification, an MBMS capable UE is only required to support reception of a single MBMS service at a time, and reception of more than one MBMS service (also possibly on more than one MBSFN area) in parallel is left for UE implementation.But then for MII signalling there is an attempt to make simultaneous reception on multiple frequencies work?If the UE is capable to receive a BC session simultaneously on another frequency than the PCell frequency, we wonder why the NW should be informed about this, i.e. why does this then require SCell configuration or HO (change of PCell) be needed? This can then be left to UE implementation? Perhaps RAN1 should be involved in this discussion and verify the need for MII signalling.We think that reception of multiple BC sessions on multiple frequencies easily becomes complex to handle. The UE may be able to receive multiple BC sessions on one frequency, and only one BC session on another frequency, while the UE cannot indicate which sessions are more important than others.  |
| Samsung | **No** | For Rel-17 we should restrict this to PCell given limited WI time and RAN1 work involved. |
| CATT | **Yes** | As it is already supported in LTE, it seems that there are no reasons to not support MBS on scell in NR. However, it should be confirmed with RAN1. |
| Xiaomi |  | We have no strong view on the UE reception capability for MBS. Probably this can be discussed in RAN1 first. |
| vivo | **Yes** | In LTE SC-PTM, a UE can receive MBS broadcast service based on UE’s capability. So we think it is spontaneous logic to reuse LTE baseline if RAN1 confirms it is feasible to monitor PDCCH addressed to group common RNTI on CSS of the SCell.  |
| Qualcomm | **No** | Lets wait for RAN1 support of Broadcast service via Scells. As per RAN1 discussions, DCI1\_0 is used for scheduling Broadcast. DCI1\_0 can be read by UEs in IDLE/INACTIVE state and on PCell. In SCell, UE does not read DCI1\_0. So, NR Broadcast reception is limited to PCell only. DCI1\_1 is used for connected mode Multicast, so for multicast UE can receive on both PCell and SCell.  |
| Kyocera | **Yes** | We think it’s up to UE capability.  |
| ZTE | **Yes** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **Yes (see comment)** | At least this is possible from RF point of view. But, what would be the impact to 38.331 is the question. If there is no impact to specification why do we need to spend time on this? |
| Sony |  | No strong view and ok for RAN1 to discuss it first |
| Spreadtrum |  | Maybe this should be discussed in RAN1 first. |
| Huawei | **Yes** | This can be based on UE capability as in LTE, and since the impact is more about RAN2 spec, RAN2 should decide this (the impact that we see is for UE capabilities). It is not clear to us what RAN1 impacts of this are. For the sake of progress, we could make a working assumption and check with RAN1 whether they have concerns with it. We are not sure RAN1 is aware they should disucss this issue, so we should not simply be waiting for them. |
| Intel | Yes |  |
| Futurewei | **Maybe** | Support further discussion on the possibility involving RAN1. |
| TCL | **Maybe** | Make a working assumption and check with RAN1 whether they have concerns with it. |
| ITRI | **Yes** |  |
| Apple | **Yes** | It’s up to UE capability.  |
| LGE | **Yes** | It is up to UE capability, as in LTE MBMS. |
| Lenovo, Motorola Mobility | **Ye**s | As in LTE SC-PTM, the UE should only consider MBS frequencies it can simultaneously receive when sending MII. We are fine to check with RAN1 regarding the MBS reception in SCell. |

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| **Summary of Question 12: Do you agree that the UE may receive MBS broadcast service from an SCell?**Clear majority of companies indicate that MBS reception on SCell should be possible based on UE capability. Several companies think that this may have an impact on physical layer and should be verified by RAN1.**Proposal 12: From RAN2 point of view, the UE may receive MBS broadcast service from SCell and this should be a separate UE capability. The feasibility of MBS broadcast reception on SCell needs to be confirmed by RAN1.** |

**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** |
| OPPO | Yes  | It is up to UE capability. |
| MediaTek | **No** |  |
| Ericsson |  | Is there an expected NW action? |
| Samsung | **No** | For Rel-17 we should restrict this to PCell given limited WI time and RAN1 work involved. |
| CATT | **Yes** | It is also related to the conditions to do the frequency prioritization in 38.304 running CR.//38.304 running CRIf the MBS capable UE is receiving or interested to receive an MBS broadcast service(s), the UE may consider cell reselection candidate frequencies at which it can not receive the MBS broadcast service to be of the lowest priority during the MBS broadcast session as specified in TS 38.300 [2], as long as the condition 1) above is fulfilled for the cell on the MBS frequency which the UE monitors and as long as the condition 2) above is fulfilled for the serving cell. |
| Xiaomi |  | This can be discussed in RAN1 first. |
| vivo | **Yes** | We can reuse the LTE design.  |
| Qualcomm | **Yes** | This is upto UE implementation and may need capability support as well. This assumes UE is capable of reading DCI1\_0 from non-serving cells as implementation choie. |
| Kyocera | **Yes** | We think it’s up to UE capability. |
| ZTE | **Yes** | UE implementation and UE capability. |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **Yes (see comment)** | At least this is possible from RF point of view. But what would be the impact to 38.331 is the question. If there is no impact to specification why do we need to spend time on this? |
| Sony |  | Depends on UE capability |
| Spreadtrum |  | Maybe this should be discussed in RAN1 first. |
| Huawei | **Yes** | This can be based on UE capability as in LTE, and since the impact is more about RAN2 spec (UE capabilities), RAN2 should decdide this. |
| Intel | Yes |  |
| Futurewei | **Yes** | Per UE request, at least the service can be provided to the UE in RRC connected to allow the service continuity. |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Apple | **Yes** | It’s up to UE capability.  |
| LGE | **Yes** | It is up to UE capability, as in LTE MBMS. |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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?**Clear majority of companies agree UE in RRC CONNECTED may receive MBS broadcast from non-serving cell, based on a separate capability. The UE in RRC IDLE/INACTIVE may receive an MBS broadcast service from non-serving cell without any network or specification impact.**Proposal 13a: The idle/inactive UE may receive MBS broadcast service from non-serving cell without any network impact.****Proposal 13b: The connected UE may receive MBS broadcast service from non-serving cell and this should be a separate UE capability. Check with RAN1 whether there are any concerns.** |

**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** |
| OPPO | Yes  |  |
| MediaTek | **Yes** |  |
| Ericsson | **Yes, with comment** | Simultaneous to receive when SCells are configured? |
| Samsung | **Yes** |  |
| CATT | **Yes, with comment** | We understand the question is whether the reported frequencies are also used for handover decision. It seems unnecessary. As TMGI is also included in MBS interest indication, serving gNB can make HO decision (i.e.to determine the target cell) based on TMGI. The assumption is that gNB is aware of which neighbouring cell providing what broadcast session identified by TMGI. However, it should be confirmed with RAN3 on this point. |
| Xiaomi | **Yes, with comments** | The simultaneous MBS reception capability via multiple frequencies may need to be discussed/confirmed by RAN1. |
| vivo | Yes | On the NW side, it can be treated as an implicit capability indication of simultaneous reception. It is useful for NW scheduling. |
| Qualcomm | **Yes** |  |
| Kyocera | **Yes** | In our understanding, Q14 means if the UE which is not capable of simultaneous reception on multiple frequencies, e.g., with single Rx chain like RedCap UEs, then the UE can still report at least one frequency of interest.  |
| ZTE | **Yes** | Together with UE capability (like band combination) network is able to decide how to ensure simultaneous reception, with best effort. |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **No** | UE could just report all frequencies and band combinations that it supports and NW will determine configuration based on that and supported band combinations (that UE has reported). |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei, HiSilicon | **Yes** | There is no use of UE providing more frequencies than a UE can actually simultaneously receive. Otherwise, the network would have to decide which frequencies to configure to the UE while it would be better for the UE to do the filtering based on its service preferences. |
| Intel | Yes |  |
| Futurewei | **No** | The UE should report all the frequencies associated with the MBS services of its interest and supported at least one of the frequency at a time. Seperately, the UE will report the frequency combinations it is capable to support simultaneously. |
| TCL | Yes, with comments | Same as Xiaomi view. |
| ITRI | **Yes** |  |
| Apple | **Yes** |  |
| LGE | **Yes** | As in LTE. |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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?**All but two companies agree the UE should only report the set of MBS frequencies of interest the UE is capable to simultaneously receive.**Proposal 14: The UE should only report the set of MBS frequencies of interest the UE is capable to simultaneously receive during MII.** |

**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** |
| OPPO | Yes  |  |
| MediaTek | **Yes** |  |
| Ericsson | **Yes, with comment** | Is that not implicitly included?  |
| Samsung | **Yes** |  |
| CATT | **Yes** | It is relevant to Q14 |
| Xiaomi | **Yes, with comments** | The simultaneous MBS reception capability via multiple frequencies may need to be discussed/confirmed by RAN1. |
| vivo | **Yes** |  |
| Qualcomm | **Yes** |  |
| Kyocera | **Yes** | In our understanding, Q15 is optional behaviour only “*in case the UE supports at least one band combination containing this set of frequencies*”.  |
| ZTE | **Yes** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **No** |  See comment on Q14 |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** | The network needs to understand what band combination it can configure to the UE so that it can receive the MBS frequencies it is interested in. This may be obvious, but it is better to specify/clarify this directly, as in LTE. |
| Intel | Yes |  |
| Futurewei | **Yes** | The UE need not to report the MBS frequency it is not capable to support. |
| TCL | Yes  |  |
| ITRI | **Yes** |  |
| Apple | **Yes** |  |
| LGE | **Yes** |  |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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?**All but one company agree 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**Proposal 15: 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 during MII.** |

**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** |
| OPPO | Yes  | It does not matter to report the current serving frequency or not. We think the serving frequency is default frequency UE can receive simultaneously. |
| MediaTek | **Yes** |  |
| Ericsson | **Yes** |  |
| Samsung | **Yes** |  |
| CATT | **Yes** |  |
| Xiaomi | **Yes** |  |
| vivo | **Yes** |  |
| Qualcomm | **Yes** |  |
| Kyocera | **Yes** |  |
| ZTE | **Yes** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **No** |  See comment on Q14 |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** | This is different than the case in Q14. Here the question is whether the UE should only indicate the frequencies it can support together with its current serving frequency/ies. We think it is better not to do that as the network might reconfigure also current serbing frequencies if needed to allow to receive MBS service. |
| Intel | Yes |  |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Apple | **Yes** |  |
| LGE | **Yes** |  |
| Lenovo, Motorola Mobility | **Yes** |  |

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| **Summary of 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?**All but one company 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 MBS frequencies it is interested to receive.**Proposal 16: When evaluating which frequencies it can receive simultaneously for reporting in MII, the UE does not take into account the serving frequencies that are currently configured i.e. it only considers MBS frequencies it is interested to receive.** |

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** |
| OPPO | Yes  | Multicast is different from unicast, the multicast can serve more users and can define another UAC cat. |
| MediaTek | **No** | We assume the current Access Categories can be reused  |
| Samsung | **Yes** | MBS specific UAC will be useful to address network congestion and service prioritization from network perspective |
| Ericsson | **No, for now** | In case the MC group is large, there is a risk that group paging causes congestion when the session is activated again, because the UE is not required to perform UAC check when reply to paging using *mt-Access* (i.e. the NW is supposed to suppress/control paging to avoid overload due to paging). But then again, the NW can decide to keep (most of) the UEs in connected mode when the MC session is deactivated and there are many MC UEs in connected mode that could cause congestion when released. In case a new MBS specific UAC control is introduced it is not obvious how to configure and control the access in such a way that all UEs of a very large group have returned to connected mode when the session is activated and ensure that no data is missed by any UE. In case of very large groups in connected mode, it might make more sense to handle them partly in idle/inactive temporarily, as was discussed before, but this topic was down-prioritized.  |
| CATT | **Yes** | To enable gNB to control the access attempt for the multicast reception purpose, it seems necessary to define new access category specific for the multicast. Since it is the scope of CAT/SA2, we need to request them to discuss it. |
| Xiaomi | **Yes** | We consider that this MBS-specific UAC can be used to avoid congesting the network when the group paging is received by many UEs. |
| vivo | **No** | We agree with Ericsson. |
| Qualcomm | **Yes** | There are 2 cases:Case 1: For Unicast paging, there is no UAC applicable for paging response but group paging sent in a given Unicast PO may cause multiple UEs to respond at same time and can cause UL signaling overload. To alleviate UL signaling overload, it is beneficial to introduce group paging response delay. In case of Group Paging, to distribute paging response delay, it is beneficial to introduce UAC by using a new access category (note not for the purpose of page response barring but to randomly introduce delay) .Case 2: In case of UE joining Multicast session, in order to differentiate UEs joining for Unicast Vs Multicast, it is beneficial to specify UAC by intruding new AC and new establishment/resume causes. This enables gNB to prioritize connection set up between Unicast Vs Multicast UEs especially under RAN overload scenario. In case of Multicast UEs, using PTM leg common radio resources multiple UEs can be served at same time than Unicast UEs. Based on NW priority, different different access barring parameters can be configuraed for Unicast Vs Multicast services.  |
| Kyocera | **No** | We think there is no need to enhance UAC, e.g., considering RAN2 deprioritized the PRACH capacity issue.  |
| ZTE | **No** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **No** | We have not identified any use case to need new UAC/establishment causes. one should note that PRACH capacity cannot be reason as it was agreed already to be deprioritized.  |
| Sony | **No** | We think current AC should be sufficient. |
| Spreadtrum | **Yes** | The different AC policy can be applied for MBS serivces. The MBS-specific UAC will be used for MO and MT cases. |
| Huawei | **No** | We think it is sufficient to reuse the same behaviour as for unicast Paging, i.e. skip UAC. We agreed to deprioritize RACH overload issue and one reason was that there are network implementation based means of dealing with this. Also, even if we have this MBS specific UAC, the gNB is not able to evaluate whether the MBS specific UAC should be enabled or not before paging as the gNB does not know the number of UEs on a cell basis. Hence, this is not a good rationale to introduce MBS UAC. |
| Intel | No | For multicast, network has already allocated most of the related resources during the multicast joining procedure. Access due to multicast session activation can be considered as Access Category “0” (MO signalling resulting from paging) and should not be barred according to TS 38.331. |
| Futurewei | **No** | Different MBS services can fall into different categories, itself can not be a category. We should still follow the exist categories. |
| TCL | **No** |  |
| ITRI | **No** | We think the current AC is sufficient. |
| Apple | **Yes** | The MBS specific UAC is useful to mitigate the network congestion, so it should not be skipped.  |
| LGE | **Yes** | If UE is allowed to select Access Category 0 when RRC connection establishment is initiated by receiving the group paging, all UEs that have joined the activated multicast session will consider the access is allowed and initiate the RACH procedure almost simultaneously. To mitigate the PRACH congestion caused by the group paging, the access attempt initiated by group paging should be under the unified access control. Therefore, we prefer to define a new Access Category for group paging, and NAS layer set Access Category to the ‘new value’ upon receiving the group paging in RRC\_IDLE. |
| BT | **Yes** | As part of the pre-emption mechanism, it is beneficial to have specific AC, e.g. during an emergency scenario. It is agreed that PRACH does not need to be optimized in Rel-17 but congestion is not limited to RACH procedures. |
| Lenovo, Motorola Mobility | **No** |  |

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| **Summary of 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.**Yes: 10 companiesNo: 13 companiesViews are split on whether MBS specific UAC is required. Proponents believe it would be beneficial for the network to have a possibility to control UEs access for MBS separately from access for unicast services, mainly to avoid congestion due to group paging. Opponents indicate that it was agreed not to address PRACH congestion issue due to paging via specifications as it can be addressed by network implementation and that current ACs can be reused for services running over MBS. Since this issue has been discussed for several meetings already and the majority of companies are still not convinced that UAC enhancements are needed, the following is proposed:**Proposal 17: RAN2 is not going to specify any UAC enhancements specific to MBS.** |

**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** |
| OPPO | Yes  | The MBS specific cause can aid the network to decide to reject the access or not due to congestion. |
| MediaTek | **No** | We assume the establishment/resume cause can be reused  |
| Samsung | **Yes** | It is beneficial for network to selectively reject UEs for congestion issue. Among, MBS, there can be low priority MBS, high priority MBS or critical MBS which may need different treatment. We think at least one MBS specific cause value is necessary. Details can be discussed later. |
| Ericsson | **No** | There is *highPriorityAccess* and *mcs-PriorityAccess* that can be used during establishment to not reject high priority access, but reject other accesses. We are not sure if anything new is needed, or if an MBS establishment is needed, which can carry many different services. |
| CATT | **Yes** | For load balance, gNB may accept or reject RRC connection request based on the establishment cause in MSG3 from UE. Since multicast services could have different priorities compared to unicast services, it is beneficial to specify a new establishment cause for the purpose of multicast reception.  |
| Xiaomi | **No strong view** | Maybe we can reuse “mt-Access”. |
| vivo | **No** | In our understanding, there are no essential issues and performance degradation if we reuse the existing casue.  |
| Qualcomm | **Yes** | Same view as Samsung and CATT. |
| Kyocera | **Yes** | We assume a new establishment cause, “MBS reception only”, is beneficial for the gNB to handle the congestion. We think even if the PRACH resource is not congested, there could be congestion due to other reasons. We also assume MBS reception consumes much less resources than unicast communication, especially in case the MBS service is provided by PTM-only MRB.  |
| ZTE | **No** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **No** | We have not identified any use case to need new UAC/establishment causes. one should note that PRACH capacity cannot be reason as it was agreed already to be deprioritized. |
| Sony | **No** | We think this can be handled in future releases once more diverse MBS applications are available. |
| Spreadtrum | **Yes** | Same view as Samsung. |
| Huawei | **Rather No** | In general, the priority of the service does not depend on whether it is provided via unicast or multicast. Hence, it is not true that all MBS services will always be provided when the network is congested and therefore it does not make sense to always accept all UEs in case they connect for MBS. We would have to know the service the UE is connecting for and this is not possible to know by establishment/resume cause, so we do not find it very useful. |
| Intel | No | Given that paging is used for group notification, existing establishment cause *mt-Access* is sufficient. |
| Futurewei | **No** | Existing mechanism should be good. The cause can be determined by the service itself. |
| TCL | **No** |  |
| ITRI | **No** |  |
| Apple | **Yes** | With the MBS specific ResumeCause, NW can prioritize the non-MBS access over MBS access in the RAN overload case.  |
| LGE | **No** | For transmission of multicast session, the PTM transmission would be mainly used and not increase the RAN overload. If UE has passed RACH procedure, no reason to reject the access for multicast reception based on the establishment cause. The existing establishment cause ‘mt-Access’ that is used when unicast paging is received seems suitable also for access initiated by group paging. |
| BT | **Yes** | As Samsung mention, it is possible to have low priority MBS, high priority MBS or critical MBS.In a sports event, different MBS services may run in parallel on a MBS cell, e.g. one service for entertainment and one for emergency. If congestion is detected, e.g, RACH, DL-SCH or UL HARQ ACK, pre-emption can be applied in a more accurate way if the network distinguish among MBS and non-MBS (re)establishment/resume causes. It will be desirable to include a cause indicating low volume data, i.e. keep alive signalling originated on the UE that is required by emergency applications. |
| Lenovo, Motorola Mobility | **No** | We don’t see strong motivation to introduce MBS specific UAC. The legacy UAC and RRC cause for normal MT call are used in the RRC connection establishment/resume procedure for responding to the paging of multicast session activation notification. |

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| **Summary of 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.**Yes: 9 companiesNo/rather no: 13 companiesNo strong view: 1 company The situation is similar to Q17. Slight majority of companies believes the existing establishment causes can be reused and that MBS EC will not be useful. Proponents believe MBS EC would be useful so that network may act differently when the UE accesses the network for MBS and unicast, especially during congestion. Since this topic has also been discussed for several meetings and majority still believes no enhancement is needed, the following is proposed.**Proposal 18: No MBS specific establishment/resume cause is specified.** |

## 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 19: 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** |
| OPPO | Yes  | No strong view. |
| MediaTek | **Yes** |  |
| Samsung | **Yes** |  |
| Ericsson | **-** | This is something for RAN3 to discuss further. We should consult RAN3 in an LS before deciding in RAN2.  |
| CATT | **No** | DRB is associated to unicast PDU session ,and for handover from MBS cell to non-MBS cell case, the unicast PDU session used for multicast is only activated in target cell, as captured in SA2 spec as below,

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| - 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. |

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| Xiaomi | **Yes** |  |
| vivo | **Yes** | Anyway, the mentioned operation is controlled by the network. We don’t see the need to restrict NW behavior.  |
| Qualcomm | **Yes** |  |
| Kyocera | **Yes** | According to the rapporteur’s analysis, we think the simplest way is to reconfigure the UE with DRB before the handover.  |
| ZTE | **No** | DRB is for PDU session. Has this anything to do with SA2?(one possible option is: in Xn signaling during Xn HO, we don’t need to explicitly say an RB is MRB.) If full config is issued, then it is issued. No special treatment needed. Network might even issue it anytime. Therefore any optimization on HO between supporting and non-supporting shall be de-prioritized. |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **No but see comments** | We agree that data loss should be minimized, and duplicates shall not be delivered. However, we do not think the source gNB should provide multicast data via DRB shortly before the handover i.e. already in the source cell as there will be no individual MBS traffic delivery over N3 in the source gNB. We think the DRB config already determined/prepared in the source gNB can be provided to the target and based on this the target can do delta configuration. |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** | Service continuity is a topic with an impact in both RAN2 and RAN3, but the MRB to DRB service continuity before handover should be discussed and decided in RAN2. We can inform RAN3 about the decision in an LS, so that they take it into account in the related work.When it comes to CATT and Nokia comments – the PDU session is available anyway as it is used for, e.g. session join/leave. What is not activated is individual MBS traffic delivery, so in our understanding DRB would temporarily carry data from shared delivery. |
| Intel | See comments | Our understanding is that it might be better to discuss first whether and how the source gNB supports MRB to DRB reconfiguration.  |
| Futurewei |  | Wondering whether enabling DRB at the source before HO could be helpful for filling the data gap. Wouldn’t we still need the data forwarding to the target and establish DRB for MBS at the target? |
| TCL | **Yes** |  |
| ITRI | Yes |  |
| Sharp | **Yes with comments** | Considering RAN2 has agreed that “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”. For the schema switching the traffic from delivery via MRB to delivery via DRB beforethe handover, the proposed solution is simple and has no impacts on UE and can be implement by gNB. But the proposed solution is not so efficient for that it will cause additional delay of HO. So, it is only suitable for UE moving at low speed. For UE moving at high speed switching the traffic from delivery via MRB to delivery via DRB during the handover is more efficient. |
| Apple | - | We share Ericsson and Intel’s view. The MRB and DRB reconfiguration procedure for HO may need to be checked with RAN3 first.  |
| LGE | **No** | It is not clear in the rapporteur’s analysis how to reconfigure MRB to DRB in the source node before the handover. Considering that MRB is for MBS session and DRB is for PDU session, we think that switching from 5GC Shared MBS traffic delivery method to 5GC Individual MBS traffic delivery method in source cell is needed for delivering multicast data over DRB in source cell before handover. Althought it may be considered to deliver multicast data over DRB before handover and it can be performed by nw decision, it does not seem that it works effectively to minimize data loss during a handover from MBS supporting node to a node not supporting MBS. We think that lossless handover is not pursued in this scenario and how to minimize data loss can be discussed for MRB to DRB handover scenario. |
| BT | **Neutral** | Further discussion on how to minimize data loss during a handover from MBS nodes to non-MBS nodes seems to be required. |
| Lenovo, Motorla Mobility | **Yes** | Providing multicast data via DRB shortly before the handover is one way to reduce data loss. Another way to avoid full configuration is to provide a set of RB configuration in advance to UE but only applied when receive the delta configuration from the target node in the HO command. To Nokia: we have some doubt on how to achieve delta configuration. To Ericsson: RAN3 has discussed the issue in last meeting. However, RAN3 expected that RAN2 to discuss the issue first e.g. whether ‘full configuration’ can be avoided during handover from MBS supporting to MBS non supporting node. |

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| **Summary of Question 19: 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.**Yes: 15 companiesNo: 4 companiesNeutral/up to RAN3: 5 companiesClear majority of companies agrees that in order to avoid/minimize data loss during HO from MBS node to non-MBS node, the source gNB can provide multicast data to the UE via DRB before HO. Some companies indicate that this topic needs to be checked by RAN3, but when it comes to RB handling, this is more in RAN2 scope and in rapporteur’s understanding RAN3 is expecting RAN2 input on this. Some companies also indicate that the details of how multicast data can be delivered over DRB in the source cell need to be clarified.**Proposal 19: 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. FFS the details, e.g. whether/what changes are needed to support multicast data delivery over DRB. RAN3 should be informed about this agreement.** |

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

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| **Company** | **Preferred option** | **Comments / justification** |
| OPPO | Option 1? | In R17, the multicast MRB is only for RRC\_CONNECTED and multicast MRB is similar as DRB. Some text in 38.331 will mention multicast MRB as DRB did. But broadcast MRB is mainly for RRC\_IDLE/INACTIVE, some text in 38.331 cannot mention broadcast MRB as DRB did. So, it is better to introduce two definition for multicast MRB and broadcast MRB respectively.However, if we introduce multicast reception for RRC\_INACTIVE/IDLE UE in R18, it seems there is no much difference between multicast MRB and broadcast MRB.**So we can introduce one common definition for MRB, if the text should mention MRB for multicast only or broadcast only, we can say “multicast MRB” or “broadcast MRB”.** |
| MediaTek | **Option-2** |  |
| Samsung | **No change needed (Refer comments)** | **It is possible to distinguish with mentioning in text as broadcast MRB and multicast MRB when needed. There can be one common definition for MRB. We opine to do no change.**Further, we think in an attempt to make things easy now, we may face more issues later e.g. if multicast reception is supported for IDLE/INACTIVE in Rel18.  |
| Ericsson | **Option-2** |  |
| CATT | **Option-2** |  |
| Xiaomi | **Option 2** |  |
| vivo | **Option 2** | We can clarify the definition without reverting the achieved agreement. |
| Qualcomm | **Prefer Option 1 (no strong view)** | Even though in previous email discussion, we indicated that it is clean approach to have MRB and BRB. We are still Ok to use MBR and BRB terminology but no strong view. |
| Kyocera | **-** | We think there is another option that these are distinguished by how the MRB is configured, e.g., Multicast MRB is something like “MRB configured by RRC Reconfiguration” while Broadcast MRB may be “MRB configured by MCCH”. The definition should be modified, if needed, e.g., when MCCH is agreed to be also carried by Handover command. We don’t prefer to discuss Option 1 since it’s already decided, and considering the principle not to specify DM1/DM2 is strictly complied even though it’s not an agreement.  |
| ZTE | **Option 2** | Option 2 seems reasonable. |
| TD Tech, Chengdu TD Tech | **Option 2** |  |
| Nokia | **Option 2** |  |
| Sony | **Option 2** |  |
| Spreadtrum | **Option 2** |  |
| Huawei | **Prefer Option 1** |  |
| Intel | Option 2 | Although sometimes we distinguish between multicast MRB and broadcast MRB, there are also many places in current running CR that mentioning of MRB alone (without multicast or broadcast prefix) is sufficient. Therefore we don’t think it is needed to revert previous decision. |
| Futurewei | **Option 2** |  |
| TCL |  | Same view with Samsung  |
| ITRI | **Option 2** |  |
| Sharp | **Option 2** |  |
| Apple | **Option 2** |  |
| LGE | **Option 2** |  |
| Lenovo, Motorla Mobility | **Option 2** |  |

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| **Summary of Question 20: Please indicate your preferred option for the multicast/broadcast radio bearers’ definition.****• 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.**Clear majority of companies prefer Option 2.**Proposal 20: Introduce definitions of broadcast MRB and multicast MRB in the specifications.** |

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 21: 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** |
| OPPO | Yes  | The ASN.1 should allow this case. |
| MediaTek | **No** | We think we should keep the current assumption that the DRX configuration is per G-RNTI. Whether multiple G-RNTIs are configured with the same DRX pattern is an implementation issue.  |
| Samsung | **Yes** | It is quite likely that multiple MBS broadcast services (G-RNTIs) may use same DRX configuration. Choice can be on network implementation to flexibility configure as and when needed, however, we agree with OPPO that ASN.1 should allow this case. Not considering this may lead to limited number of MBS broadcast services supported in MCCH or a large MCCH information message (may not be allowed by PDCP max SDU size limitation) or more segmentation causing multiple slots transmission (due to restricted BWP usage for MCCH) |
| Ericsson | **Yes, with comments** | We seem to discuss a signalling optimization. MDTK confirms that without this optimization the NW can also configure the same DRX configuration for different G-RNTIs. We are not sure why this signalling optimization should not be allowed. PS: the details are not clear though, i.e. this means that the common DRX configuration is lifted up to *MBSBroadcastConfiguration*? |
| CATT | **-** | Agree with MediaTek and Ericsson, i.e. The same DRX configuration can be used for more than one G-RNTI, but it can be covered by current IE structure, So we can leave it to NW implementation. |
| Xiaomi | **No** | This is more like a signaling optimization. The gNB by implementation can align the values of MBS DRX for different G-RNTI. |
| vivo | Comments | It is also our understanding that the detailed parameters of DRX configurations associated with different G-RNTIs can be the same. |
| Qualcomm | **Yes** | Same view as OPPO and Samsung. We strongly prefer to have ASN.1 flexibility to support configuring multiple MBS services mapped to same G-RNTI. UE maintaining multiple DRX instances for multiple services adds complexity and not power efficient as well. It is upto NW configuration about how to map different services to common DRX. |
| Kyocera | **Yes** | We assume the gNB may configure two independent DRX parameters for two G-RNTIs respectively, but these DRX parameters are exactly same. So, we think Q20 tries to optimize such a configuration option, but we don’t think it’s related to 1:N mapping between G-RNTI and MBS sessions.  |
| ZTE | **Yes** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **Yes** | With per G-RNTI DRX, the network can configure same DRX to more than one G-RNTI. Then it is just a matter of ASN.1 encoding efficiency. For example, whether there is a list of DRX configurations and G-RNTI is associated with one of these configurations. |
| Sony |  | No strong view as it seems like a signaling optimisation |
| Spreadtrum | **Yes** | This configuration should be allowed. |
| Huawei | **Yes** | This is indeed a signaling optimization. In the current CR, the network could configure the same DRX for diffierent G-RNTIs by configuring the same values in diffiernt entities. We think it is useful to reduce the siglling overhead, if we allow a DRX configuration to be used by diffierent G-RNTIs. |
| Intel | No | We don’t think it is needed to pursue signalling optimizations regarding DRX configuration. |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Sharp | **Yes** | It reasonable to used the same DRX configuration when multiple MBS services with the same DRX pattern mapped to different G-RNTIs. |
| Apple | **Yes** |  |
| LGE | **-** | No strong view regarding signalling optimization.We think that multicast DRX patterns for different G-RNTIs can be same. |
| Lenovo, Motorla Mobility | **Yes** |  |

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| **Summary of Question 21: Do you think it should be possible to apply the same DRX configuration for more than one G-RNTI?**All companies seems to agree it is possible for the network to apply exactly same DRX parameters for multiple G-RNTIs. Whether to optimize the signalling for this, can be discussed based on the running CR updates (it might be worth it considering this will be signalled in MCCH for broadcast)**Proposal 21: Confirm that the same PTM DRX configuration parameters can be applied to multiple G-RNTIs.** |

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 22: 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** |
| OPPO | Yes  | We think the RAN1 spec should make it clear for this case. |
| MediaTek | **Yes** | We think in this case, there is no DRX pattern |
| Samsung | **No** | *mtch-schedulingInfo* being absent is not efficient from power consumption perspective and need not be allowed/implemented. Otherwise, we think benefit or rationale should be made clear for such a choice. |
| Ericsson | **Yes** |  |
| CATT | **Yes** |  |
| Xiaomi |  | Maybe we can use “infinite” value for onDurationTimer or “0” value for drxCycle if the gNB wants to have more flexibility to require more monitoring occassions. |
| vivo | **Yes** | Agree with MediaTek. |
| Qualcomm | **No** | Same view as Samsung. |
| Kyocera | **Yes** | We think it’s quite similar to the case of unicast without DRX configuration, i.e., the UE can apply DRX operation only when DRX is configured.  |
| ZTE | **Yes** |  |
| TD Tech, Chengdu TD Tech | **Yes** |  |
| Nokia | **Yes** | Please clarify in the question that this is about whether DRX configuration is provided for the G-RNTI or not i.e. whether DRX config is mandatory or not for the NW. We agree that it is not mandatory for NW to provide DRX configuration and hence agree with the UE behaviour described in the question. |
| Sony | **Yes** |  |
| Spreadtrum | **Yes** |  |
| Huawei | **Yes** | We think DRX should be optional (it is the case even for unicast DRX). For MBS, a rationale would be that the network needs more flexibility in scheduling MBS, especially in loaded cells.  |
| Intel | Yes |  |
| Futurewei | **Yes** |  |
| TCL | **Yes** |  |
| ITRI | **Yes** |  |
| Sharp | **Yes** |  |
| Apple | **No** | We share the same view as Samsung.  |
| LGE | **Yes** |  |
| Lenovo, Motorla Mobility | **Yes** |  |

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| **Summary of Question 22: 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.**Vast majority of companies 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.**Proposal 22: In case mtch-schedulingInfo is absent for a G-RNTI (i.e. no PTM DRX), the UE should monitor for PDCCH scrambled with G-RNTI in any slot according to the search space configured for MTCH.** |

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

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| **Company** | **Yes/No** | **Comments / justification** |
| OPPO | Yes  | It is better to define a new IE who including TMGI for future extension. |
| MediaTek | **-** | We prefer that the structure similar to the one used for unicast paging record be introduced |
| Samsung | **-** | In general, a structure similar to legacy unicast paging format seems suitable, but it is not clear if there is a need for any other ID than TMGI as far as MBS is concerned. |
| Ericsson | **No** | We agree with the rapporteur that a 3 byte overhead is introduced when the record would be extended in the future, and it is more efficient to add an extension field at the end of the message when needed (i.e. list of similar size as PagingGroupList-r17).  |
| CATT | **No** | We agree with rapporteur and Ericsson that it is better to add an extension field at the end of the message when needed in future. |
| Xiaomi | **No** | Agree with Ericsson. |
| vivo | **Yes** | Agree with rapporteur. |
| Qualcomm | **No** | Agree with Rapporteur and Ericsson. |
| Kyocera | **(No)** | We slightly prefer the structure in the current Running CR, since we’re not sure if the future extension will happen as the rapporteur analysed and any group paging has never been introduced in LTE. Though, we don’t object to the structure with the legacy way, if majority prefers.  |
| ZTE | **No** | Agree with Rapporteur and Ericsson. |
| TD Tech, Chengdu TD Tech | **No** |  |
| Nokia | **No strong view** | Probably for effectiveness it would be best to not have extension in each paging group record but just allow extension at the end of message to ensure that there is a way to introduce new type of records in future if necessary. |
| Sony | **No** |  |
| Spreadtrum | **No** | Agree with Rapporteur and Ericsson. |
| Huawei | **No** | For the reasons mentioned above in the description. |
| Intel | No | We think current structure in running CR (TMGI within PagingGroupList) is fine. |
| Futurewei | **No** |  |
| TCL | **No** | An IE structure similar to the one used for unicast paging record is preferred. |
| ITRI | **No** |  |
| Apple | **No** |  |
| LGE | **No** | Agree with Rapporteur and Ericsson. |
| Lenovo, Motorla Mobility | **No** |  |

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| **Summary of Question 23: Do you think an extensible IE should be used instead of TMGI within PagingGroupList?**Vast majority of companies think there is no need to introduce an extensible IE instead of TMGI within PagingGroupList. The extensions can be achieved in future by extension field at the end of the message, if needed.**Proposal 23: An extensible IE is not introduced instead of TMGI within PagingGroupList**  |

# 3 Summary

Based on the discussion, the following is proposed:

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| **Potential easy agreement (proposed to be agreed offline due consensus or a very clear majority):****Proposal 1: As a baseline, the network may broadcast in MCCH a list of neighbour cells providing the same broadcast MBS service(s) as provided in the current cell, same as in LTE SC-PTM.*** **FFS whether to specify how this information is utilized in RAN2 or whether to leave it up to upper layers or UE implementation.**
* **FFS whether to have a finer granularity of this information, e.g. indicate which broadcast sessions are available per neighbour cell**

**Proposal 2: MCCH changes due to neighbouring cell information modification will be notified using the MCCH modification notification bit, if agreed by RAN1.****Proposal 3: The RNTI scheduling MCCH is called “MCCH-RNTI”.****Proposal 4: The values of mcch-RepetitionPeriodAndOffset, mcch-WindowStartSlot, mcch-WindowDuration, mcch-ModificationPeriodm, as captured in the RRC running CR in R2-2108970, are confirmed.****Proposal 5: SIBx and SIBy can be available on-demand, same as other SIBs.****Proposal 6: Before the UE in RRC IDLE/INACTIVE considers the frequency for prioritization due to MBS, the UE is not required to read SIBx, but needs to verify that SIBx is available in the reselection candidate cell (i.e. the status of the associated SI message in SIB1 can be either broadcasting or notBroadcasting). FFS how the verification is achieved.****Proposal 7: When the cell reselected by the UE due to frequency prioritization for MBS stops providing SIBx, the UE should stop prioritizing the frequency of this cell.****Proposal 8: RAN2 assumes 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. This can be revisited once USD definition becomes clearer, if issue is identified.****Proposal 10: No new mechanism is specified to allow frequency prioritization for MB multicast session reception.****Proposal 11: Confirm that the UE may initiate MII procedure 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. FFS other triggers.****Proposal 12: From RAN2 point of view, the UE may receive MBS broadcast service from SCell and this should be a separate UE capability. The feasibility of MBS broadcast reception on SCell needs to be confirmed by RAN1.** **Proposal 13a: The idle/inactive UE may receive MBS broadcast service from non-serving cell without any network impact.****Proposal 13b: The connected UE may receive MBS broadcast service from non-serving cell and this should be a separate UE capability. Check with RAN1 whether there are any concerns.****Proposal 14: The UE should only report the set of MBS frequencies of interest the UE is capable to simultaneously receive during MII.****Proposal 15: 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 during MII.****Proposal 16: When evaluating which frequencies it can receive simultaneously for reporting in MII, the UE does not take into account the serving frequencies that are currently configured i.e. it only considers MBS frequencies it is interested to receive.****Proposal 20: Introduce definitions of broadcast MRB and multicast MRB in the specifications.****Proposal 21: Confirm that the same PTM DRX configuration parameters can be applied to multiple G-RNTIs.****Proposal 22: In case mtch-schedulingInfo is absent for a G-RNTI (i.e. no PTM DRX), the UE should monitor for PDCCH scrambled with G-RNTI in any slot according to the search space configured for MTCH.****Proposal 23: An extensible IE is not introduced instead of TMGI within PagingGroupList**  |

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| **Proposals for online discussion** **Proposal 17: RAN2 is not going to specify any UAC enhancements specific to MBS.****Proposal 18: No MBS specific establishment/resume cause is specified.****Proposal 19: 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. FFS the details, e.g. whether/what changes are needed to support multicast data delivery over DRB. RAN3 should be informed about this agreement.** |

# References

1. [R2-2108799](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_115-e/Docs/R2-2108799.zip), *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*