**所以3GPP T****SG-RAN WG2 Meeting #117-e R2-220xxxx**

**E-meeting, 21 February – 3 March 2022**

**Agenda item:** 8.1.x

**Source:** Huawei, HiSilicon

**Title:** Discussion on CP open issues for NR MBS

**WID:** NR\_MBS-Core

**Document for:** Discussion and decision

# 1 Introduction

This document aims at gathering companies views on Control Plane open issues for NR MBS, as identified in [2].

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|  |  |
| --- | --- |
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# 2 RRC open issues

## 2.1 Broadcast configuration

Currently, the RRC running CR in [1] captures the following default values of MCCH configuration parameters.

#### 9.1.1.X MCCH configuration

Parameters that are specified for MCCH.

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| RLC configuration |  | UM RLC |  |
| *>sn-FieldLength* | 12 |  |  |
| *>t-Reassembly* | ms0 |  |  |

**Question 1: Do you agree with the default configuration parameters of MCCH as currently captured by RRC CR?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Samsung | Yes |  |
| CATT | Yes,but | 6bit seems sufficient for the *sn-FieldLength.* MCCH is RLC UM and SN field is only needed for segmented RLC UM PDU. Therefore, it is not necessary to define large value for SN length. |
| ZTE |  | agree with CATT. other references  - for broadcast control channel in Sidelink, it is 6-bit too.  - for SC-MCCH in LTE, it is 5-bit. |
| OPPO | Yes | It seems 6bit is better. |
| Apple |  | Agree with CATT that 6 bits is sufficient for *sn-FieldLength*. |
| Xiaomi | Yes | No strong view on the SN length. |
| Nokia | Yes |  |
| Kyocera | Yes |  |
| Ericsson | Yes | No strong view on SN length |
| vivo | Yes | We agree with the RRC CR rapporteur. And we are fine with either 6-bit length or 12-bit length as it is mandatory for the UE to support them (No extra UE complexity will be introduced). |
|  |  |  |

For MTCH, the following default values are captured in [1]:

#### 9.1.1.Y MTCH configuration for MBS broadcast

Parameters that are specified for MBS broadcast MTCH.

| Name | Value | Semantics description | Ver |
| --- | --- | --- | --- |
| PDCP configuration |  |  |  |
| *>t-Reordering* | 0 |  |  |
| *>pdcp-SN-SizeDL* | 18 |  |  |
| *>rohc* |  |  |  |
| *>profiles* | profile0x0001 |  |  |
| RLC configuration |  | UM RLC |  |
| *>sn-FieldLength* | 12 |  |  |
| *>t-Reassembly* | ms0 |  |  |

**Question 2: Do you agree with the default configuration parameters of MTCH as currently captured by RRC CR?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Samsung | Yes |  |
| CATT | Yes, but | It seems 12bit for pdcp-SN-SizeDL and 6bit for RLC sn-FieldLength is sufficient as typically there may be not so large data amount for MBS broadcast transmission.  Even thorough short PDCP SN and short UM RLC SN are optional in NR unicast, it is no problem to use the short PDCP SN and short UM RLC SN as default broadcast configuration as We have agreed that they are mandatory broadcast capabilities.  //RAN2#116bis-e,   * [026] A set of mandatory MBS broadcast capabilities is adopted:     PDCP short SN;    RLC UM with short SN    RLC UM with long SN    DRX with long DRX cycle |
| ZTE |  | same view as CATT, 6-bit for RLC UM only is sufficient. |
| OPPO | Yes with comments | 1. Row “*>rohc*” should be removed? 2. We also think RLC SN is 6bit and it align with MCCH. |
| Apple |  | Agree with CATT on 12-bit pdcp-SN-SizeDL and 6-bit RLC sn-FieldLength. |
| Xiaomi | Yes, but | ROHC which is configurable should be removed. |
| Nokia | Yes |  |
| Kyocera | Yes |  |
| Ericsson | Yes |  |
| vivo | Comments | We agree with OPPO that the “rohc” row can be removed, which aligns with the style of sidelink. Moreover, if default profile configuration is introduced, then we think the default configuration for maxCID is needed to implement RoHC function with all necessary parameters via default configuration. |
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Another point that was raised during RRC CR review was whether ROHC profile0x0006 can be configured for broadcast MRB. ROHC profile 0x0006 corresponds to TCP/IP (RFC 6846), so it is indeed unlikely it will be used for MBS in practice. On the other hand, the current list just follows the list of ROHC profiles available for NR and the network may just choose those profiles that make sense for a specific service. Please also note that this list is not supposed to denote mandatory ROHC profiles that a MBS broadcast UE should potentially support, which is discussed separately in section 2.6.

**Question 3: Do you think the ROHC profile 0x0006 can be kept in the ROHC profile list for broadcast MRB?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | No | TCP is intended for reliable unicast delivery. Broadcast will not use TCP/IP. |
| MediaTek | No |  |
| Samsung | No |  |
| CATT | Yes | It can be up to network implementation to use which profile for broadcast services. |
| ZTE | No | It is assumed less options will bring less signaling overhead.  TCP is just not compatible with PTM distribution in Broadcast or Multicast. |
| OPPO | No |  |
| Apple | No | We share the same understanding as Qualcomm, it’s not suitable to use TCP/IP for MBS broadcast service transmission.  In addition, ROHC profile0x0006 is the optionally feature, not all UEs are required to support it. |
| Xiaomi | No |  |
| Nokia | Yes | No strong view but it should not hurt to keep this and e.g. leave it optional for UEs |
| Kyocera | No |  |
| Ericsson | Yes | The motivation to not support this seems speculative. Although if not used it seems fine to keep this for gNB to configure as deemed fit. |
| vivo | Yes | No signaling optimization is required. The NW anyway would not indicate that profile even though the existing rohc field is used. No issue is found. |
|  |  |  |

RAN1 sent an LS to RAN2 in [4] on MTCH scheduling window where they inform RAN2 that:

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| --- |
| **Conclusion**  Is up to RAN2 decision:   * the configuration of the MTCH scheduling window parameters: monitoring periodicity and the starting of the periodicity: * whether the MTCH scheduling window is associated to one or multiple or all G-RNTIs   Send an LS to RAN2 to inform about RAN1 conclusion |

This issue was discussed in the offline discussion during RAN2#116bis-e meeting, but there seemed to be a confusion with respect of the purpose of MTCH scheduling window which is to allow PDCCH occasions to SSB mapping. The related RAN1 agreements are as follows:

“Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs for broadcast reception, MTCH scheduling is associated with a window defined by the MTCH monitoring periodicity and the starting of the periodicity

* FFS: the window is associated to one or multiple or all G-RNTI.

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs for broadcast reception, at least support that within the MTCH scheduling window, the association between the PDCCH monitoring occasions and SSB is defined as:

* the [*x*×*N*+*K*]th PDCCH monitoring occasion(s) for MTCH in the scheduling window corresponds to the *K*th transmitted SSB, where *x* = 0, 1, ...*X*-1, *K* = 1, 2, …*N*, *N* is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in SIB1 and *X* is equal to CEIL(*number of PDCCH monitoring occasions in MTCH transmission window*/*N*).

For the purpose of associating PDCCH monitoring occasion for MTCH and SSB,the UE assumes that, in the MTCH scheduling window, PDCCH for an MTCH scrambled by G-RNTI is transmitted in at least one PDCCH monitoring occasion corresponding to each transmitted SSB.”

Based on this, RAN2 has to specify MTCH scheduling window somehow and in [5], it was propose to do this in the following way:

1. For G-RNTIs configured with DRX, DRX periodicity and offset are reused for MTCH window determination.
2. Explicit MTCH window periodicity and the offset can be optionally configured and is applicable commonly to all G-RNTIs for which DRX is not configured.

This way the signalling overhead is saved as MTCH window does not have to be signalled separately for those G-RNTIs which are configured with DRX. An alternative option would be to always configure MTCH scheduling window separately. In this case, the UE would potentially have to maintain two separate windows (for DRX and for MTCH scheduling). RAN2 would also need to decide whether a single MTCH scheduling window is configured common to all G-RNTIs or whether it is configured per G-RNTI.

**Question 4: Which option do you prefer for MTCH scheduling window specification:**

* **Option 1: For G-RNTIs configured with DRX, DRX periodicity and offset are reused for MTCH window determination. Explicit MTCH window periodicity and the offset can be optionally configured and are applicable commonly to all G-RNTIs for which DRX is not configured.**
* **Option 2: Separate MTCH scheduling window is always configured and is common to all G-RNTI.**
* **Option 3: Separate MTCH scheduling window is always configured per G-RNTI.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Justification / comments** |
| Qualcomm | Partially Option 1 with comments | **Option 1: For G-RNTIs configured with DRX, DRX periodicity and offset are reused for MTCH window determination.**  **For the case of DRX not configured, explicit MTCH window periodicity and the offset can be optionally configured. We should allow a group of Broadcast G-RNTIs with common delay characteristics to be mapped to common MTCH window periodicity instead of having common for all G-RNTIs.** |
| MediaTek | Option-1 |  |
| Samsung | Option-1 |  |
| CATT | Option 1 |  |
| ZTE | option 1 |  |
| OPPO | Not option 1 | According to the text for broadcast DRX operation, the DRX active time depends on the on-duration timer and also inactivity timer. So, it is too complex to define a dynamic MTCH scheduling window. So the explicit MTCH scheduling window configuration is necessary.   |  | | --- | | When broadcast DRX is configured for a G-RNTI, the MAC entity shall for this G-RNTI:  1> if [(SFN × 10) + subframe number] modulo (*drx-LongCycle-PTM*) = *drx-StartOffset-PTM*:  2> start *drx-onDurationTimerPTM* after *drx-SlotOffsetPTM* from the beginning of the subframe.  1> if the MAC entity is in Active Time for this G-RNTI:  2> monitor the PDCCH for this G-RNTI as specified in TS 38.213 [6];  2> if the PDCCH indicates a DL transmission for broadcast MBS:  3> start or restart *drx-InactivityTimerPTM* in the first symbol after the end of the PDCCH reception. | |
| Apple | Option 1 |  |
| Xiaomi | Option 1 |  |
| Nokia | option 3 | It is bit confusing what is the question by rapporteur. Are we talking about broadcast reception in RRC\_CONNECTED?  If UE is receiving broadcast in CONNECTED it will receive MCCH and it will provide scheduling similarly as for IDLE i.e. window. No need to mix with DRX. One should not require to align unicast (or multicast) DRX to receive MTCH for broadcast services. That would align all the UEs receiving broadcast to same cycle and that would limit scheduling possibilities too much.  If UE is receiving multicast in connected there is no window i.e. UE is configured with DRX and that is used for the reception of multicast. |
| Kyocera | Option 1 | Though, we just wonder what the UE behaviour is, when neither DRX nor the explicit MTCH window periodicity/offset is configured. |
| Ericsson | Option 1/3 | The question is somewhat unclear w.r.t the mix of BC and UEs possibly in connected. |
| vivo | Comments | For simplicity, we think explicit MTCH window periodicity and the offset is configured and are applicable commonly to all G-RNTIs for all cases. |
|  |  |  |

## 2.2 MBS Interest Indication

During the previous RAN2 meeting it was agreed that MBS Interest Indication message can be forwarded from the source node to the target node during handover preparation. During the CR review it was raised that we need to decide whether What remains to be clarified is whether MBS Interest Message can be exchanged during SCG change. It should be noted that according to WID description, the following restrictions apply during NR MBS workL

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| --- |
| Restrictions and assumptions:  Architecture: it is the one in Figure 4.1-1 in TR 23.757 v0.2.0: High level MBS architecture, with the further restriction that only NR in NG-RAN (i.e. connected to 5GC) is considered as RAT. Consequently, in addition to in NR SA, there should be no reasons preventing the use of the feature standardized in this WI in case of MR DC configurations in the MCG when the MN is a gNB (NE-DC, NR DC). |

Hence, in principle, no MR-DC specific changes should be considered. In any case, the proponents are requested to clarify the scenario they had in mind when raising this issue and all companies are requested to reply to the following question:

**Question 5: Do you think there is a need to exchange MBS Interest Indication message during SCG change operation. If, yes, please clarify the scenario and how do you think this is supposed to take place (e.g. which inter-node message is used etc.)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | No | We assume R17 broadcast service is served primarily by MN only. |
| MediaTek | Yes | Same view as Qualcomm |
| Samsung | No |  |
| CATT | No | MBS should only be supported on MN, according to MBS WID |
| ZTE | No |  |
| OPPO | Yes | The UE can receive the MBS broadcast from SCell and it is confirmed by RAN1 LS. However, it is not clear the SCell is MCG SCell or SCG SCell. If SCG SCell is allowed, the MII should be forwarded to the SCG via, e.g. CG-ConfigInfo. |
| Apple | No | We assume MBS is only supported on MN. |
| Xiaomi | Yes | We think that the SCG MBS can be supported without much extra specification change. |
| Nokia | No | No need to work on this as per WI |
| Kyocera | (Yes) | We agree the rapporteur’s analysis and Qualcomm’s view in general. However, MCG is different depending on UEs in a network, i.e., UE-specific configuration. So, MCG for a UE providing the broadcast session may not be MCG for another UE. In addition, since this is broadcast, the UE is allowed to receive the broadcast session from non-serving cells, unless it affects the unicast transfer in MCG. So, we just wonder what happens if MCG configures the UE with SCG operating these cells (i.e., which provide the broadcast session the UE is receiving). We assume it’s a possible scenario on this issue. |
| Ericsson | No | At this stage we should limit to MN as decided in the WI scope |
| vivo | No | Regarding the deployment scenario, we should follow the agreement below (i.e. only MBS on SCG is supported),  *Focus initially on NR SA, TBD to what extent other scenarios NR DC, NE DC can be supported.* |
|  |  |  |

There was also the following issue raised during open issues list preliminary discussion:

“Whether the existing MII is sufficient to indicate the UE is interested in broadcast on SCell (or non-serving cell) , for the network to do configuration.”

Regardless of whether Scell and non-serving cell broadcast reception capabilities are confirmed by RAN2 (which is discussed in section 2.6), it is rapporteur’s understanding that the current MII framework is sufficient to handle this case. Currently, a UE can provide a list of frequencies and/or services it is interested to receive, regardless of whether the UE has a serving cell configured on a given frequency or not. There seems to be no issue in supporting the scenario listed in the open issues list, as quoted above.

**Question 6: Do you think current MII framework needs any modifications in order to allow the UE to indicate the UE is interested in MBS broadcast on SCell (or non-serving cell)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | No |  |
| MediaTek | No | We prefer to discuss this issue before we reach the conclusion on the support of MBS broadcast on SCell and/or non-serving cell.  If non-serving cell based broadcast reception is supported, we may need more time to discuss which type of assistance info is needed. One additional question is why not use UAI if there is a need for assistance info. |
| Samsung | No |  |
| CATT | No | The current MII framework is simply reusing the LTE MBMS mechanism, which is sufficiently mutual. |
| ZTE | No |  |
| OPPO | Not sure | It is up to how to model it.  If the UE report the MII based on SIB-y in PCell, the network can decide to make the UE receive the broadcast via one SCell, not PCell and it assume the network know the deployment of MBS in other neighbour Cells. Then the current MII is enough. |
| Apple | No |  |
| Xiaomi | No |  |
| Nokia | No | As long as UE can indicate interest list of services it is interested in (along with frequencies) seems to be sufficient |
| Kyocera | No |  |
| Ericsson | No |  |
| vivo | No | In our understanding, the UE can indicate the interested frequency associated with SCell on PCell with the existing MII framework. We fail to see the motivation to make additional modifications. |
|  |  |  |

## 2.3 Group Paging

According to the 38.331 running CR [1], when the RRC\_INACTIVE UE receives a group paging message which includes the TMGI indicating MBS session that UE has joined, the UE shall initiate the RRC connection resumption procedure with resumeCause set to mt-Access. This is not in line with the unicast RAN paging where other resume causes are also available, e.g., mps-PriorityAccess, mcs-PriorityAccess, highPriorityAccess. It was argued that these additional resumeCause values are related to UE’s Access Identity and UEs with these special AIs always use them regardless of the service they connect for. Similarly, such resume causes should be used by such UEs regardless of whether they access to the network in reply to unicast or group paging.

**Question 7: Do you agree that UEs configured with Access Identity 1 / 2 / 11-15 should utilize mps-PriorityAccess / mcs-PriorityAccess / highPriorityAccess as a resume cause, respectively, when replying to group paging (i.e. the same as in the case of unicast RAN paging)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Samsung | Yes |  |
| CATT | Yes | It is reasonable to follow the legacy unicast procedure. |
| ZTE | Yes |  |
| OPPO | No | In current 38331CR, the MBS id is delivered to NAS layer no matter the RRC state is RRC\_IDLE or RRC\_INACTIVE. So in this case, it is up to NAS to inform AS about the cause to be used, just like paging for RRC\_IDLE UE in unicast. There is no AS work on it. |
| Apple | No |  |
| Xiaomi |  | No strong as the unicast procedure seems not proper for the MBS service, but considering the limited time for Rel-17, we can follow the majority view. |
| Nokia | No | If the reason for access is something else than priority access reason there is no need to utilize those access causes. |
| Kyocera | Yes |  |
| Ericsson | No |  |
| vivo | Yes | We are okay to follow this modeling and we should use the same principle for INACTIVE and IDLE. |
|  |  |  |

A similar FFS was captured for UE in RRC IDLE, i.e.:

* When RRC connection establishment is triggered by group paging, R2 expects that NAS sets the establishment cause to ‘mt-Access’. I.e., no MBS specific establishment cause. FFS for UEs with special access IDs whether other current establishment cause should be used.

However, for the UE in RRC IDLE, the applicable establishment cause is provided from upper layers and there seems to be no need to capture anything special for group Paging.

**Question 8: Do you agree there is no need to specify any specific establishment cause handling due to Group Paging of RRC IDLE UEs configured with special Access Identities (AIs 1, 2, 11-15)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
| MediaTek | Yes |  |
| Samsung | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| OPPO | Yes | It is not related issue. It is up to NAS, there is no AS work on it. |
| Apple | Yes |  |
| Xiaomi | Yes |  |
| Nokia | Yes | No need for any special handling |
| Kyocera | Yes |  |
| Ericsson | Yes |  |
| vivo | Yes | No cross-WI impact is expected. |
|  |  |  |

## 2.4 Multiplicity and type constraint definitions

The values of multiplicity and type constraints for NR have to be decided. The parameters, their definition and the proposed values are provided below, together with an additional justification in some places:

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value (INTEGER) | Definition | Justification |
| maxDCI-4-2-Size-r17 | 140 | Maximum size of DCI format 4-2 | As agreed by RAN1 (per L1 parameters list) |
| maxFreqMBS-r17 | 5 | Maximum number of carrier frequencies for which an MBS capable UE may indicate an interest in |  |
| maxNrofDRX-ConfigPTM-r17 | 64 | Max number of DRX configuration for PTM provided in MBS broadcast in a cell |  |
| maxNrofMBS-ServiceListPerUE-r17 | 16 | Maximum number of services which the UE can include in the MBS interest indication |  |
| maxNrofMBS-Session-r17 | 1024 | Maximum number of MBS sessions provided in MBS broadcast in a cell | In TS 22.261, 800 groups are required:  “The 5G system shall be able to support broadcast/multicast of voice, data and video group communication, allowing at least 800 concurrently operating groups per geographic area. ” |
| maxNrofMRB-Broadcast-r17 | 4 | Maximum number of broadcast MRBs configured for one MBS broadcast service |  |
| maxNrofPageGroup-r17 | 32 | Maximum number of paging groups in a paging message | Same as Maximum number of page records for unicast |
| maxNrofPDSCH-ConfigPTM-1-r17 | 15 | Maximum number of PDSCH configuration groups for PTM minus 1 |  |
| maxG-RNTI-r17 | 16 | Maximum number of G-RNTI that can be configured for a UE | Should be no more than the supported MRB |
| maxG-CS-RNTI-r17 | 16 | Maximum number of G-CS-RNTI that can be configured for a UE |  |
| maxMRB-r17 | 16 | Maximum number of multicast MRBs (that can be added in MRB-ToAddModLIst) |  |
| maxSAI-MBS-r17 | 64 | Maximum number of MBS service area identities |  |
| maxNeighCell-MBS-r17 | 8 | Maximum number of MBS broadcast neighbour cells |  |

**Question 9: Do you agree with the proposed values of the parameters above? If not, please justify and propose another value.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments (e.g. which value is not OK, alternative proposal)** |
| Qualcomm | Yes but | maxFreqMBS-r17 can be upto 16 from ASN limitation perspective. Which is same as maxNrofMBS-ServiceListPerUE-r17 and different frequencies can be used for different services. |
| MediaTek | Yes but | We prefer a smaller number for maxG-RNTI-r17/ maxG-CS-RNTI-r17 (e.g. 2), since this may impact the UE simultaneous reception on the MBS. This may be discussed by RAN1. |
| Samsung | Yes | We also think maxFrqMBS-r17 as 5 seems sufficient for MII and in line with eMBMS/SC-PTM |
| CATT | Yes but | Just wondering whether we need to limit the Maximum number of broadcast MRBs configured for one MBS broadcast(i.e. maxNrofMRB-Broadcast-r17) to 4? Or just set it to 16 based on below agreement?  [026] Reuse the current defined max RB (i.e. 16 RB per UE). Additional note shall be added to TS 38.306 to clarify the max RB is a total number for MRBs and DRBs, and the total number of RBs for split-MRB is considered as two. |
| OPPO | Yes but | I wonder the maximal number of configuration is decided by RAN1 or RAN2? |
| Apple |  | The value of maxG-CS-RNTI-r17 should be no more than the max number of the SPS configuration (i.e. 8). |
| Xiaomi | Yes |  |
| Nokia | Yes | Data forwarding and PDCP SR can be used in this case. They can guarantee that packets are not lost during HO but this should not be used as mechanism to recover packets lost during PTM transmission in the source, i.e., data forwarding should be based on what has been transmitted to the UE via PTM. |
| Kyocera | Yes | We share Qualcomm’s view, i.e., maxFreqMBS-r17 can be larger number. |
| Ericsson | Yes |  |
| vivo | Yes | We are fine with the current values. |
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## 2.5 Multicast mobility

During RAN2#116bis-e, RAN two agreed the following:

* RAN2 assumes both source and target cells supporting PTP RLC AM as baseline for supporting Multicast loss-less HO with data forwarding between MBS supporting cells
* FFS whether same mechanisms as for PTP RLC-AM loss-less HO can be applicable in case of source cell with PTM only configuration and target cell supporting PTP only or PTM + PTP configurations. (FFS may come for free).

It was argued that in order to support lossless handover, the source cell has to be configured with PTP leg with RLC AM. Otherwise, e.g. in case UE is configured with PTM only leg in the source cell, there can be no guarantee that all the packets sent in the source cell are successfully delivered to the UE and lossless handover may not always be achieved. However, it should be noted that even in case of a split bearer configuration in the source cell, the source gNB may use PTM only transmission before the handover. As long as the UE is configured with a PTP leg in the target cell, the UE may provide the target gNB with a PDCP SR and the missing PDUs can be delivered to the UE in the target cell. It seems to make no difference whether the source cell was configured with a PTP leg with RLC AM entity as long as data forwarding and/or PDCP SR operations are performed (data forwarding is up to RAN3 to decide). Based on this, it does seem to come for free to allow usage of the data forwarding and/or PDCP SR also in the case UE is not configured with PTP with RLC AM in the source cell, as long as PTP with RLC AM is configured in the target cell.

**Question 10: Do companies agree that data forwarding (up to RAN3 final decision) and/or PDCP SR can be used during handover in case the UE is configured with PTP RLC AM entity in the target cell, regardless of whether PTP RLC AM entity was configured in the source cell?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes but | In our view, RAN2 has already agreed to support data forwarding and PDCP status reporting to support loss-less HO and is not upto RAN3 final decision. This data forwarding is controversial issue in RAN3 for non-technical reasoning and is limited to specific central CU-UP deployment (which is not correct in practice for all deployments). |
| MediaTek | Yes |  |
| Samsung | Yes | We are ok to support PTM only to AM MRB lossless handover |
| CATT | Yes | It is beneficial to minimize the data loss during handover. |
| ZTE | No | If data forwarding is needed (depending on RAN3 decision), it is only applied to AM MRB, just like what we have in unicast.  PTM itself is lossy. We see no reason to save the data packet that is lost in source node while such loss reduction is not required by source at all. |
| OPPO | Yes |  |
| Apple | Yes | It’s benefit to minimize the data loss during the handover, and we donot see any additional spec impact to support it. |
| Xiaomi | Yes |  |
| Nokia | No | It seems rapporteur has wrong understanding on solution 2 that it is applicable only to R17 gNBs. HO Request message only includes configuration of the (dormant) DRB which also pre Rel-17 gNB will understand. So Solution 2 IS NOT limited to Rel-17 gNBs.  If nothing is done for PDCP SN continuity, then it is same to use full configuration always and that is not really proper handover but should be only used in utmost needs only e.g. inter-vendor HO. |
| Kyocera | Yes | We’re fine that the data forwarding and/or PDCP SR is used in this case, since it comes for free as the rapporteur analysed and it’s expected to minimize (or eliminate) the data loss during handover. However, we just wonder if the lossless handover may not be always ensured (or even not needed), i.e., it’s up to network implementation and QoS requirement, since the PTM is always configured with RLC UM (in the source cell) which does not ensure lossless transfer. |
| Ericsson | No | As previously discussed, it is not sensible to maintain SN book-keeping and store data for a bearer that is not lossless. |
| vivo | Yes | The target cell may have already buffered some data (e.g. data that are supposed to be transmitted during the transmitting gap between the source cell and target cell). When UE accesses the target cell, it can receive retransmitted PDU via PTP leg after receiving UE’s SR. |
|  |  |  |

The following agreements were made during RAN2#116bis-e meeting:

* RAN2 assumes for MRB to DRB switch to avoid full configuration during loss-less HO from MBS supporting node to Non-MBS supporting node and inform RAN3 accordingly.
  + Solution 1 is assumed feasible (from procedure point of view): While the UE is still in source cell, source cell can reconfigure UE from MRB to DRB just before HO is initiated.
  + Solution 2, FFS whether the reconfiguration can be done on the fly: Perform the switch from MRB to DRB during handover to support loss-less HO without full configuration.
* FFS whether to support optimization for either solution 1 or solution 2 or No optimization support to avoid full configuration during Multicast loss-less HO from MBS node to Non-MBS supporting node.

In general, RAN2 agreed that solution 1 can be used during HO from MBS supporting node to non-MBS supporting node. This solution allows to avoid full configuration for both Rel-17 gNB and pre-Rel-17 gNB as the MRB configuration is not included in the UE’s configuration in Handover Preparation message. The drawback of this solution is potentially additional delay as MRB configuration has to be released before triggering the actual HO. Solution 2 allows to avoid this issue, but is applicable only to Rel-17 gNBs which are able to comprehend MBS configuration and release it in the HO command. In general, it seems both of these solutions are workable without any further enhancements needed in RAN2 in case the target gNB can know which SN was successfully delivered to the UE in the source cell. The knowledge of the last delivered SN can come from either the source gNB (for both Solution 1 and 2, and up to RAN3 to decide) or from the UE via PDCP SR (for Solution 1 only). The potential issues include non-in-sequence delivery or duplicates delivery, especially in case PDCP SNs for MRB and DRB are independent. There were some solutions for these issues mentioned in [6] such as using a common PDCP entity for both MRB and DRB. However, since the configuration of MRB and DRB are separated, it would be rather complex to pursue such enhancement in specifications at this stage of the work item. Therefore, it is proposed not to pursue further optimizations for neither solution 1 nor 2 in Rel-17 timeframe.

**Question 11: Do you agree to not pursue any further optimizations for neither solution 1 nor 2 in Rel-17? I.e. it is up to network and/or UE implementation how to minimize/avoid data loss during handover to non-MBS supporting node with either solution 1 or 2, as agreed in the last meeting.**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Justification / comments |
| Qualcomm | No | We prefer to support solution 2 optimization, which avoids additional delay caused by solution 1. |
| MediaTek | Yes |  |
| Samsung | Yes | MBS is DL only service from data perspective. We think NW can fully control. |
| CATT | Yes, but | Agree to support solution 1 and solution 2.which one to use is up to network implementation.  But to minimize data loss with solution 2, configuring dormant DRB associated to the MRB by source cell before handover is helpful. |
| ZTE | Yes | Further optimization is not needed. |
| OPPO | Yes |  |
| Apple | Yes |  |
| Xiaomi | Yes |  |
| Nokia | No | It seems rapporteur has wrong understanding on solution 2 that it is applicable only to R17 gNBs. HO Request message only includes configuration of the (dormant) DRB which also pre Rel-17 gNB will understand. So Solution 2 IS NOT limited to Rel-17 gNBs.  If nothing is done for PDCP SN continuity, then it is same to use full configuration always and that is not really proper handover but should be only used in utmost needs only e.g. inter-vendor HO. |
| Kyocera | Yes |  |
| Ericsson | Yes |  |
| vivo | Yes | The achieved Option 1 and Option 2 (FFS) are sufficient. No further optimization is needed. |
|  |  |  |

## 2.6 UE capabilities

One of the remaining issues for basic MBS broadcast capability is to decide whether ROHC support for MBS broadcast should be optional or mandatory for the UE. An argument in favour of making ROHC mandatory was that in case it is optional, the network will rarely be able to use it as there will usually be a risk that there are UEs in the network which do not support ROHC (and such UEs will not be able to receive MBS broadcast service with ROHC enabled). On the other hand, ROHC is an optional feature even for unicast and it does not seem to be essential for MBS broadcast support.

**Question 12: With respect to ROHC support for MBS broadcast, which option you prefer:**

1. **ROHC is mandatory for MBS broadcast (mandatory number of ROHC context sessions and mandatory profiles are discussed in the next question)**
2. **ROHC is optional feature for MBS broadcast (understanding is that it is optional without capability and the network/operator may employ ROHC based on their own choice, e.g. in case it is certain the service can be received by the UEs, e.g. for some specialized services such as Public Safety)**
3. **ROHC is not supported for MBS broadcast**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option** | **Justification / comments** |
| Qualcomm | Option 1 | If some Broadcast UEs does not support then network can’t use ROHC. |
| MediaTek | Option-1 or Option-3 |  |
| Samsung | Option 1 |  |
| CATT | Option 1 or 3 | Option 2 is not feasible. If it is optional, gNB cannot decide to enable ROHC or not for broadcast as gNB cannot know whether the UE interested in the broadcast services support it or not. |
| ZTE | Option 1 |  |
| OPPO | Option 3 or option 1 | In LTE, there is no PDCP, right?  I wonder whether the PDCP is also removed in NR broadcast? |
| Apple | Option 1/3 |  |
| Xiaomi | Option 1, but | We only need to mandate a few ROHC profiles, but not all. |
| Nokia | 1 | 2 and 3 are equivalent in practice that there is no possibility to actually use RoHC for MBS.. |
| Kyocera | Option 1 | We think Option 2 cannot work since this is MBS broadcast, i.e., the data is also received by the UEs in IDLE/INACTIVE, so the gNB does not know the capabilities of all UEs in the network. As the result, the gNB may never enable RoHC as Qualcomm pointed out.  For Option 3, we think it’s RAN2 understanding that RoHC is supported for broadcast sessions, e.g., in their agreement “*[050] for broadcast MRB, when enabled by the network, RoHC parameters are predefined with configuration optionally provided.*” |
| Ericsson | Option 1 |  |
| vivo | Option 1 | Option 2 is not feasible and Option 3 reverts the achieved agreement for RoHC. So we prefer Option 1. |
|  |  |  |

In case ROHC is mandatory for MBS broadcast, please provide further views on the number of ROHC context sessions and profiles that should be supported.

**Question 13:** P**lease provide your views on the number of ROHC context sessions and profiles that should be supported for MBS broadcast.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Number of context sessions** | **Profiles** | **Justification / comments** |
| Qualcomm | 15 | Except profile 0x0006 |  |
| MediaTek | Default value | A minimum set excluding 0x0006 |  |
| Samsung | 15 | Except profile 0x0006 |  |
| CATT | 16 | all | Same comments as Q3 |
| ZTE | Default value | A minimum set excluding 0x0006 |  |
| OPPO | Default value | The scope can be discussed. |  |
| Apple | Default value | A minimum set, e.g. profiles 0x0000, 0x0001, 0x0002 | The same mandatory ROHC capability today is expected to be used for MBS. And in legacy, only ROHC profiles 0x0000, 0x0001, 0x0002 are required for the IMS voice capable UE. |
| Xiaomi | 15 | 0x0000, 0x0001, 0x0002 | Same as the IMS voice capable UE. |
| Nokia | TBD | See Q3 | This might depend on Q7 of the UP discussion. If we agree to share the HARQ process, it would seem logical to share the ***maxNumberROHC-ContextSessions*** |
| Kyocera | (No strong view) | Except profile 0x0006 |  |
| Ericsson | 16 |  | See Q3 |
| vivo | 15 | Not 0x0006 |  |
|  |  |  |  |

RAN2 made the following agreements during RAN2#116-e meeting with respect to MBS broadcast reception over SCell and non-serving cell for UEs in RRC Connected state:

|  |
| --- |
| * **From RAN2 point of view, the UE may receive MBS broadcast service from SCell in intra-PLMN case and if supported this may be a separate UE capability. Send an LS to RAN1 to ask to check the feasibility of MBS broadcast reception on SCell.** * **From RAN2 point of view, the connected UE may if supported receive MBS broadcast service from non-serving cell in intra-PLMN case, under the condition this does not have any impact to operation on serving cell(s). This may be a separate UE capability. Send an LS to RAN1 to ask to check the feasibility.** |

In [3], RAN1 confirms the feasibility of MBS broadcast reception for both SCell and non-serving cell and provides the following agreements:

***Agreement***

*From RAN1 perspective, it is feasible for UE in RRC\_CONNECTED state to receive MBS broadcast on an activated SCell as long as UE has capability of supporting MBS broadcast on SCell. From RAN1 perspective, if a UE is to receive MBS broadcast on SCell,*

* + *The capability of supporting MBS broadcast on SCell is separate capability from the one of CA for unicast.*
  + *The UE is not required to monitor DCI formats associated with SI-RNTI, P-RNTI, RA-RNTI in SCell.*
  + *Overbooking for SCell is not supported.*
  + *MBS broadcast reception on SCell can be supported only for RRC\_CONNECTED UEs only with self-scheduling.*
  + *Type0-PDCCH CSS set is only configured on the primary cell of the MCG.*
  + *Configuring the search space on SCell for PDCCH monitoring of MBS DCI formats is via unicast RRC signaling.*
  + *The UE capability is expected to be defined by RAN2.*
    - *E.g. the total number of component carriers for receiving broadcast on SCell may be subject to UE capability*
  + *The UE is not required to receive broadcast on PCell and SCell simultaneously*

***Agreement***

*From RAN1 perspective, it is feasible for UE in RRC\_CONNECTED state to receive MBS broadcast on non-serving cell, which is up to UE implementation and transparent to the network.*

* + *It is assumed in RAN1 that UE receiving MBS broadcast on non-serving cell does not have any impact to operation on serving cell(s), e.g., does not require UE to obtain the related configuration from the serving cell, does not require the network to guarantee the scheduling doesn’t exceed UE’s capability on serving cell, etc.*
  + *RAN1 assumes that receiving MBS broadcast on non-serving cell could be on the same or on a different band, but on a different carrier frequency than a UE’s serving cell*
  + *No RAN1 spec impact and no optimization is pursued in Rel-17 for MBS broadcast reception on non-serving cell.*
  + *The UE capability(ies), if any, is(are) expected to be defined by RAN2.*

Based on the above RAN2 is requested to confirm that UE capabilities for MBS broadcast reception over SCell and non-serving cell will be specified.

**Question 14: Do you agree that it is optional (with UE capabilities) to support the following features, as per RAN1 agreements from [3]:**

* **MBS broadcast reception on SCell**
* **MBS broadcast reception on non-serving cell (for UE in RRC Connected state)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes / no** | **Justification / comments** |
| Qualcomm | Yes |  |
| MediaTek | No | We prefer to only support MBS broadcast reception on non-serving cell (for UE in RRC Connected state).  We do not think there is enough time to discuss the support of Scell based MBS broadcast reception at Rel-17 considering the following issues:  (1) where to get the BCCH (e.g., SIBx) and the corresponding MCCH/MTCH information to receive MBS broadcast at Scell  (2) UE’s RF retuning behaviour and whether the current RF requirement can be enough to enable UE to receive broadcast service (RAN4 issue)  For the support of non-serving cell MBS broadcast reception, we did not see the need to define any UE capabilities at Rel-17, since this can be seen as a best-efforts behaviour, per UE implementation. |
| Samsung | No | We think there is no need for standardized solutions. As first version of MBS, specification impact can be minimized unless there is a critical issue. We can notice many complexities as reception in SCell requires additional signalling including SIB delivery and capability reporting, and whereas reception in non-serving cell can be fully up to UE implementation without spec change. |
| CATT | Yes | It is natural to confirm the previous RAN2 agreement based on the confirmation from RAN1 LS. |
| ZTE | No | same view with MTK and SS. |
| OPPO | Yes | It is already agreed in both RAN1 and RAN2 to support broadcast reception via SCell or non-serving cell. It also makes sense to define a capability for it? |
| Apple | No | Same view as MTK and Samsung. No additional spec change is expected. |
| Xiaomi | Yes |  |
| Nokia | Yes | It sems difficult to make it mandatory to perform reception on SCell/non-serving cells. |
| Kyocera | Yes, but | We just wonder if the capability is really needed for the reception in non-serving cell, since RAN1 agreed it’s “*up to UE implementation and transparent to the network*”. |
| Ericsson | Yes |  |
| vivo | Yes | We would like to confirm RAN1’s assumption. |
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**Question 15: What should be the granularity of the SCell and non-serving cell reception support from the UE, i.e. per UE, Band Combination, Feature Set or Feature Set per CC?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Per UE, BC, FS, FSPC?** | **Justification / comments** |
| Qualcomm | Feature Set per CC |  |
| MediaTek | No | For the support of non-serving cell MBS broadcast reception, we did not see the need to define any UE capabilities at Rel-17, since this can be seen as a best-efforts behaviour, per UE implementation. |
| Samsung | No |  |
| CATT | Per UE | If it is about UE capabilities, per UE is sufficient, same as SC-PTM. |
| ZTE | No |  |
| OPPO | Per UE | Per UE for SCell  For non-serving case, it is up to UE implementation and no need to define any capability. |
| Apple | No |  |
| XIaomi | Per UE |  |
| Nokia | Per UE | UE already currently signals it CA capabilities and we should assume that whichever band combination UE supports and if UE indicates capability to receive MBS from SCell/non-serving cell it could receive that simultaneously from any cell in the band combination |
| Kyocera | No strong view | We agree with MediaTek that the capability for non-serving cell reception may not be needed. |
| Ericsson | Per UE |  |
| vivo | Per UE | We can reuse the LTE SC-PTM design. |
|  |  |  |

Another point worth noting from the LS from RAN1 are the following assumptions with respect to MBS broadcast reception on SCell:

* + *The UE is not required to monitor DCI formats associated with SI-RNTI, P-RNTI, RA-RNTI in Scell.*
  + *Configuring the search space on Scell for PDCCH monitoring of MBS DCI formats is via unicast RRC ignalling.*

Search space is included in PDCC-ConfigCommon already, so no further changes are required for this. However, the UE should also be provided with SIBx for the Scell as the UE is not required to monitor for SI-RNTI on the Scell. Therefore, it is required that a UE is provided with SIBx of the Scell via dedicated RRC signalling if the UE is interested in MBS broadcast reception over Scell?

**Question 16: Do you agree that SIBx of Scell is provided in dedicated RRC signalling to the UE interested to receive an MBS broadcast reception on Scell?**

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| --- | --- | --- |
| **Company** | **Yes / no** | **Justification / comments / alternative proposal** |
| Qualcomm | Yes |  |
| MediaTek | No | In general, the MCCH configuration is received via SIB by the UE. The UE reads MCCH and obtains transmission configuration of MTCH(s), e.g., G-RNTI.  However, the UE will not read SIB information (e.g., SIBx) in Scell based on the legacy behaviour and as also agreed by RAN1 in the LS, which means the two-step based approach (i.e. BCCH and MCCH) will be not suitable for UE receiving broadcast on Scell.  Within this context, there may be multiple alternatives as below:  Alt 1: UE reads the BCCH (e.g., SIBx) in Pcell and then obtain the MCCH/MTCH information in Scell;  Alt 2: UE reads the BCCH (e.g., SIBx) and MCCH in Pcell and then obtain the MTCH information in Scell;  Alt 3: The network (in Pcell) can reconfigure the information for scheduling MTCH in Scell when Scell for broadcast is added and activated.  RAN2 may need more time to evaluate the different alternatives as shown above before we can agree the Scell based MBS broadcast reception.  Our suggestion is to postpone the discussion to Rel-18 MBS, as there is corresponding objective as listed in Rel-18 MBS WID. |
| Samsung | No | Refer to response to Q14 |
| CATT | Yes | It seems the only way as UE does not monitor SI-RNTI on scell, based on RAN1 agreement |
| ZTE | No | We close Q14 by saying no, and no need for such optimization in following questions. |
| OPPO | Yes | In “*SCellConfig*” |
| Apple | No |  |
| Xiaomi | No | The UE capable of SCell broadcast MBS should be able to read the SCell SIB. |
| Nokia | No | similar view with Xiaomi |
| Kyocera | (No) | We assume it’s expected the least specification impact to use the dedicated signalling. On the other hand, we tend to think MediaTek’s three alternatives are still worth discussing. |
| Ericsson | No | Agree w Xiaomi |
| vivo | No | From RAN2 perspective, the capable UE can monitor SI to require MCCH configuration. And this is all up to UE implementation and transparent to the NW. No normative work is needed, as LTE SC-PTM. |
|  |  |  |

# References

1. R2-2201829, 38.331 running CR for NR MBS, Huawei, HiSilicon
2. R2-2202025, Updated Open issues list for NR MBS, Huawei, HiSilicon
3. R1-2200798, LS reply to MBS broadcast reception on SCell and non-serving cell, Source: RAN1
4. R1-2112850, LS on MTCH scheduling window, Source: RAN1
5. R2-2200818, Discussion on RRC parameters for MCCH and MTCH, Huawei, HiSilicon
6. R2-2201880, Report of [AT116bis-e][019][MBS] Multicast Handover and related reconfigurations (QC), Qualcomm