**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].

## Company contact details

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| --- | --- |
| **Company** | **Name / e-mail** |
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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?**

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| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
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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?**

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| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
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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?**

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| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | No | TCP is intended for reliable unicast delivery. Broadcast will not use TCP/IP. |
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 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.**

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| **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.**  |
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## 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.)**

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| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | No | We assume R17 broadcast service is served primarily by MN only. |
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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)?**

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| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | No |  |
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## 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)?**

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| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
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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)?**

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| **Company** | **Yes/No** | **Justification / comments** |
| Qualcomm | Yes |  |
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## 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:

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| 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.**

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| **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.  |
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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?**

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| --- | --- | --- |
| **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).  |
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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.**

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| Company | Yes/No | Justification / comments |
| Qualcomm | No | We prefer to support solution 2 optimization, which avoids additional delay caused by solution 1. |
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##  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**

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| --- | --- | --- |
| **Company** | **Preferred option** | **Justification / comments** |
| Qualcomm | Option 1 | If some Broadcast UEs does not support then network can’t use ROHC. |
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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.**

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| --- | --- | --- | --- |
| **Company** | **Number of context sessions** | **Profiles** | **Justification / comments** |
| Qualcomm | 15 | Except profile 0x0006 |  |
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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:

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| * **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)**

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| **Company** | **Yes / no** | **Justification / comments** |
| Qualcomm | Yes  |  |
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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?**

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| --- | --- | --- |
| **Company** | **Per UE, BC, FS, FSPC?** | **Justification / comments** |
| Qualcomm | Feature Set per CC |  |
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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 signaling.*

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 |  |
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# 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