3GPP TSG-RAN WG2 Meeting #118-e ***R2-220wxyz***

Electronic Meeting, May 9–20, 2022

**Agenda item: 6.1.4**

**Source: MediaTek**

**Title: [AT118-e][033][MBS] UE capabilities (MediaTek)**

**Document for:**  **Discussion**

# 1. Introduction

This paper is to trigger the following email discussion of UE capabilities in MBS:

* [AT118-e][033][MBS] UE capabilites (MediaTek)

 Scope: Treat R2-2204625, R2-2204907, R2-2205541, R2-2205746, R2-2205750, R2-2205855, R2-2205939, R2-2206114. Collect one round of comments, pave the way for on-line agreement (identify agreeable points, discussion points),

 Intended outcome: Report

 Deadline: For online CB W1 Thursday

## 1.1 Contacts

Contact person for each participating company:

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| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Martin van der Zee | martin.van.der.zee@ericsson.com |
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# 2. Discussion

## 2.1 Mandatory UE capabilities for broadcast reception

In the last RAN2 meeting, the ROHC capability have been discussed for MBS broadcast and the following agreements are made：

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| * P12: RoHC is mandatory for UEs supporting MBS broadcast:

**• At least profiles 0x0000, 0x0001, 0x0002 are supported. FFS other profiles.****• FFS how many RoHC context sessions the UE has to mandatorily support. The number between 2 and 16 should be chosen.*** **RoHC profile 0x0006 is not used / configurable for broadcast MRB.**
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However, It is still FFS for the mandatory ROHC profiles and how many RoHC context sessions are mandatory for UE supporting broadcast.

### 2.1.1 ROHC context session

According to the contributions, the number of ROHC context sessions is proposed with the range of 2 to 16. Some companies prefer a default value of maxCID(i.e. 15) to be the mandatory capability of ROHC context sessions, while other companies indicated a smaller number (e.g. 2 or 8).

Meanwhile, the company tdoc in [7] indicates that the broadcast can reuse the current CONNECTED mode capability signaling for ROHC profile support, and the ROHC context session is considered as a limit across the total number of supported RBs.

#### Question 1: Do companies agree to introduce a capability for ROHC context session for MBS broadcast?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| Ericsson | No | As proponent of [7] we think that re-using the connected mode capability is sufficient.  |
| Huawei, HiSilicon | Yes | We need to define a minimum capability for MBS broadcast UEs as agreed already:* **P12: RoHC is mandatory for UEs supporting MBS broadcast:**

**• At least profiles 0x0000, 0x0001, 0x0002 are supported. FFS other profiles.****• FFS how many RoHC context sessions the UE has to mandatorily support. The number between 2 and 16 should be chosen.****- RoHC profile 0x0006 is not used / configurable for broadcast MRB.**The capability signalling does not help for MBS broadcast where the UEs are receiving the service in RRC ILDE and RRC INACTIVE.  |
| Samsung | No | Capability bit for broadcast is not so useful, since NW may not be fully aware of UE capability. |
| CATT | No strong view | We follow the majority view |
| Qualcomm | No | Broadcast-capable UE can receive broadcast in IDLE/INACTIVE state, so there is no benefit of UE capability signalling. Instead a conditional mandatory capability without signalling (conditional on support of broadcast) should be introduced for Broadcast UEs on number of RoHC context sessions. |
| Nokia | Neutral | Proposal in [7] seems to be also working i.e. we just reuse existing capability for connected mode and limit is common for all RBs |
| OPPO | No strong view |  |
| Xiaomi | No strong view | It seems that we can re-use the connected mode capability. |
| MediaTek | Yes  | To define a basic capability for MBS broadcast UEs |
| Intel | Yes | Same view as Huawei: we prefer to define a minimum capability for ROHC context session for broadcast, **without** capability signalling. |
| vivo | No | No separate capability bit is needed for RoHC context session. In our understanding, once MBS broadcast is supported, then the RoHC capability (e.g. profile and max. context session) of the minimum will be inherently supported by the UE, so that all the UE capabilities about MBS broadcast can be aligned within a broadcast coverage region. |
| Spreadtrum |  Yes | A minimum capability for MBS broadcast UE is needed. |
| Futurewei | Yes | We support to define a basic ROHC capability for MBS without need of signaling. |
| Lenovo | Yes | It could be better to define a minimum capability for ROHC for broadcast.  |
| LGE | Yes |  |
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If the answer to Q1 is yes, please provide the further views on the number of ROHC context sessions .

#### Question 2: Please provide your views on the number of ROHC context sessions that should be supported for MBS broadcast.

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| **Company** | **Answer (Yes/No)** | **Comments** |
| Ericsson |  | If a default value for the number of RoHC context sessions for MBS broadcast needs to be defined, we prefer a MaxCID of 15. |
| Huawei, HiSilicon | Up to 16 | Up to 16 is acceptable to us, but we are OK with lower value as well. |
| Samsung | 15 | Same as default maxCID value |
| CATT | 15 |  |
| Qualcomm | Max 8 | Since this is conditional mandatory UE capability, it is not expected to be same as Unicast. In order to reduce UE’s mandatory support, we strongly prefer a maximum of 8. |
| Nokia | - | We should not have arbitrarily small number as then it is impossible to have ROHC for any MBS services used as the network cannot know if all UEs would be able to receive MBS. Anyway if UE has limitation to receive multiple MBS broadcast services with ROHC then the limitation should be that UE does not “listen” to so many MBS services and NW can use ROCH for any/all MBS services. So we would even say that the ROHC limit is the limit of UEs ability to receive multiple MBS services not just ROHC.So we are not sure how critical this discussion is – Anyway Network needs to use ROHC for almost all MBS services. |
| OPPO | - | Not all. At least, it is not mandatory for connected mode UE to support all. |
| Xiaomi | 15 |  |
| MediaTek | Smaller than default |  |
| Intel | 15 | We think default value (15) is OK. It should be noted that the requirement (15 ROHC context sessions) should be *per broadcast MRB*, not per UE. The reason is that gNB is not aware whether a UE in RRC\_IDLE/INACTIVE state is receiving a particular broadcast MRB or not, therefore only per MRB capability can work. |
| vivo | 15 | Same as the legacy. |
| Spreadtrum | 15 |  |
| Futurewei |  | Wouldn’t this is a minimum required capability? Then it would be a much smaller number than default…? |
| Lenovo | 15 |  |
| LGE | 15 | We prefer the default value of maxCID (i.e. 15). |
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### 2.1.2 ROHC profiles

According to the contributions submited, some companies suggest to keep the minimum set of ROHC profiles as agreed in the previous meeting(i.e. 0x0000, 0x0001 and 0x0002, which are mandatory at least for voice over IMS) for broadcast.

As proposed in [R2-2205541](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_118-e/Docs/R2-2205541.zip), the profile 0x0004 should be supported for broadcast, since it is mainly a simplification of UDP/IP profile (0x0002), and it may not require much complexity while providing compression gain for services where only IP is used.

#### Question 3: Do you think the ROHC profile 0x0004 can be kept in the ROHC profile list for broadcast MRB? (please clarify if you think any additional profile is needed)

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| **Company** | **Answer (Yes/No)** | **Comments** |
| Ericsson | Yes | Agree with the motivation provided by Intel ([R2-2205541](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_118-e/Docs/R2-2205541.zip)). |
| Huawei, HiSilicon | No | We think there is no need to introduce IP only profile since it is not a common case in real deployments, e.g. due to limiatations for NAT usage (Network Address Translation). It is not widely deployed in network and UEs. We think the profiles agreed already are sufficient. |
| Samsung | No | We prefer minimum set, since there’s no optional profile. But no strong view. |
| CATT | No |  |
| Qualcomm | Maybe No | But no strong view. |
| Nokia | Yes | 0x0004 seems useful and it would be preferred if it could be supported by UEs |
| OPPO | No  |  |
| Xiaomi | No | If companies really want to introduce 0x0004, we would like to have an IoT bit for this profile. |
| MediaTek | No | Ok to follow majority view |
| Intel | Yes | Proponent of [R2-2205541](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_118-e/Docs/R2-2205541.zip). |
| vivo | No | 0x0000, 0x0001 and 0x0002 are sufficient for the most common deployment cases.  |
| Spreadtrum | No | We follow majority view. |
| Futurewei | No |  |
| Lenovo |  | No strong view |
| LGE | No | We prefer keeping the minimum set. But, if majority companies support to introuduce 0x0004, we can accept it. |
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### 2.1.3 Minimum number of broadcast MRBs

In the previous meeting, RAN2 has agreed the default number of multicast MRBs shares the common limitation with DRBs that MRBs+DRBs=16 without capability signaling. However, it is not concluded on whether broadcast can share the same limitation with unicast. Considering the use cases and limited UE performance in idle/inactive state, the capability for minimum number of MRBs supported for broadcast may be different.

Meanwhile, some companies in their contribution propose that there is no need to define new requirement for broadcast MRB, since maxNumberROHC-ContextSessions can be considered as a limit across the total number of supported RBs, and the gNB does not configure broadcast MRB for one particular UE.

#### Question 4: Do companies agree to introduce a UE capability for minimum number of MRBs supporting by broadcast UE? If yes, please provide the minimum number you preferred.

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| **Company** | **Answer (Yes/No)** | **Comments** |
| Ericsson | No | We do not see the need for new capability signalling, but if the UE supports MBS broadcast service, the UE should at least support one session e.g. at minimum 4 MBRs. But we are not sure if this is needed in addition to any agreement on the minimum number of RoHC context sessions that the UE is required to support for MBS broadcast.  |
| Huawei, HiSilicon | Yes | It is beneficial to introduce a separate requirements for broadcast MRBs to avoid impact on unicast services when both unicast and MBS broadcast is used in RRC CONNETCED state. We think 4 broadcast MRBs is a reasonable number and no capability signalling is needed for this. We are not sure what is the linkage between this question and the number of ROHC sessions. |
| Samsung | Yes, 4 | gNB may not exactly know which and how many broadcast MRBs are configured. Thus, it’s better to have #MRB-broadcast restriction independently. |
| CATT | No | Typically UE receive broadcast in idle/inactive state. There is no on-going unicast/multicast services in idle/inactive state,so it will affect nothing .Therefore,we do not think it is motivated to define such capability. |
| Qualcomm | Yes, 4 | Conditional mandatory without singalling. |
| Nokia | No | As said in ROHC discussion part basically ROHC limit = MRB limit (and vice versa). Existing agreement is fine for us. |
| OPPO | Yes, 4 |  |
| Xiaomi | Yes, 4 |  |
| MediaTek | Yes, 4 |  |
| Intel | No | Broadcast MRBs can be received by UEs in all RRC states. For UEs in RRC\_IDLE/INACTIVE, since gNB is not aware of the broadcast sessions that UEs are interested in, defining minimum number of broadcast MRBs that UE can support does not help gNB when configuring broadcast MRBs. For UEs in RRC\_CONNECTED, *MBSInterestIndication* is provided from UE to gNB about the MBS frequencies of interest and the services of interest. *MBSInterstIndication* is helpful for gNB to configure CA/DC properly. But given that gNB does not explicitly configure broadcast MRB for one particular UE, it is not clear whether defining minimum number of broadcast MRBs that UE can support can help gNB to configure broadcast MRBs, which are applicable to UEs in all RRC states. |
| vivo | Comments | We understand that a new capability bit is not needed. Instead, we prefer to introduce a mandatory capability (without signalling) that includes the minimum requirements of MRBs for broadcast. Further, 4 minimum broadcast MRBs should be considered. |
| Spreadtrum | Yes, 4 |  |
| Futurewei | Yes, 4 |  |
| Lenovo | Yes 4 |  |
| LGE | No | Given the max 16 RB limitation, there is no need to introduce an assumption on the minimum number of broadcast MRB supported by UE. So, the minimum capability is not needed. |
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## 2.2 Broadcast reception on non-serving cell

According to the contributions submited, some companies suggest to introduce UE capability for Broadcast reception via non-serving cell. However, at meeting RAN2#117e, there was a discussion on whether it is optional (with UE capabilities) to support the broadcast reception on non-serving cell, and majorities agree that the reception in non-serving cell can be fully up to UE implementation without spec change. Rapporteur would like to check again if this is the majority views.

#### Question 5: Do companies agree to that the reception in non-serving cell can be fully up to UE implementation without spec change?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| Ericsson | Yes | Capability signalling can indicate if the UE is capable to receive MBS broadcast via non-serving cell, but does not indicate if the UE currently wants to receive MBS via non-serving cell, nor which service the UE is interested in. Furthermore the expected NW actions are not clear to us, i.e. in our understanding MII signalling + SCell capability can be used to configure SCell. What use case is missing?  |
| Huawei, HiSilicon | No | Question is rather unclear. Obviously, the reception on non-serving cell is up to UE implementation. The main point for introducing the capability signalling is to let the network know that the UE can receive a service on a non-serving cell so that the UE does not have to be configured with a PCell or an SCell on this frequency. Without the capability signalling, even if the UE supports reception on non-serving cell, the network will have to configure a serving cell which makes the feature rather useless. We are not sure what the issue with introducing the capability signalling is. And of course the network needs to consider MII together with UE capabilities. @Ericsson: The case you are missing is, e.g. MII + non-serving cell reception capability means that the network does not have to configure SCell. |
| Samsung | Yes |  |
| CATT | No | Agree with Huawei that capability signalling on non-serving cell is necessary,same as in LTE SC-PTM. |
| Qualcomm | No | We also think question is unclear/confusing. We assume the question is about capability, so there is impact – to introduce the UE capability. As per RAN1 discussions, Broadcast UEs can receive Broadcast service via non-serving cell and is based on UE capability. R17 UEs supporting Broadcast service reception via non-serving cell has to be based on capability because depending on UEs interested broadcast service reported via MBS Interest Indication and UE’s indicated capability on broadcast service reception on non-serving cell, network can decide whether to configure a specific frequency as SCell or not. I.e., no other spec impact. |
| Nokia | Yes | UE is allowed to receive MBS from any cell as long as it does not interfere specified UE behaviour. |
| OPPO  | Yes  |  |
| Xiaomi | No | We share the same view with Huawei and Qualcomm. |
| MediaTek | Yes | According to the agreement of RAN2:* If supported by the UE implementation, the idle/inactive UE may receive MBS broadcast service from non-serving cell (no network impact).

It is assumed the UE receiving non-serving cell is fully up to UE implementation. In that case, UE receives broadcast service as idle/inactive UE without signaling, and network is not aware of the existence of UE. If we introduce capability signling, it is not only the UE’s behavior, but also with network impact, and extra MII reporting/scell receiving may be introduced. This go against with the previous RAN2 agreement.Any enhancement of broadcast reception on non-serving cell can be discussed in Rel-18. |
| Intel | See comments | Whilte MBS reception on non-serving cell is up to UE implementation, the capability signalling is needed so that gNB can configure CA/DC properly. This is similar to LTE, which defined these capabilities: *mbms-NonServingCell-r11*, and *scptm-NonServingCell-r13*.  |
| vivo | No | We agree with Qualcomm. |
| Spreadtrum | No | We agree with Qualcomm. |
| Futurewei | Yes | In the scenario that there is broadcast service already existing on the cells of the coverage and the UE is capable to listen the broadcast service at a neighboring non-serving cell. The UE can go ahead to listen the service by itself. This is purely depending on the implemented UE capability. No spec enhancement is needed. The network would decide the broadcast coverage based on other factors such as user density rather than UE capability on SCell broadcast reception. |
| Lenovo | Yes | The UE receiving non-serving cell is fully up to UE implementation. |
| LGE | See comments | The reception in non-serving cell is up to UE implementation, which is already clear. If we are discussing the capability similar to *mbms-NonServingCell-r11 and scptm-NonServingCell-r13 for LTE, we think such capability is beneficial because network can decide whether to configure SCell necessarily or not on the frequency of UE’s interest based on the capability.* At the same time, it may be good to clarify the difference w.r.t. UE capabilities between case A and B, where * Case A: For MBS reception on a frequency, SCell shal be configured on that freuqency,
* Case B: For MBS reception on a frequency, SCell does not have to be configured on that frequency.
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## 2.3 Broadcast reception without capability signaling

According to R2-2205750, the proponet suggests to introduce MBS broadcast reception in idle, inactive and connected mode (FG33-1) to chapter 5 of 38.306 as an optional feature without capability signalling (since there is no UE capability signalling for FG33-1). Companies are invited to provided their views on whether such UE capability should be added to chapter 5 in 38.306.

#### Question 6: Do companies agree to introduce the UE capability for MBS broadcast reception in idle, inactive and connected mode (FG33-1) as an optional feature without capability signalling (to chapter 5 in 38.306)?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| Ericsson | Not sure | It would be good to describe the motivation for broadcast capability signalling. In our understanding the UE capability cannot be used in the transition from Idle to connected, but in case of resume the UE capability could be used in the initial configuration in the setup. But in case the UE is capable to support MBS broadcast, it does not mean that the UE is interested to receive MBS broadcast, nor it indicates which MBS broadcast service the UE is interested in. Also the signalling of both broadcast and SCell support should be clarified. Furthermore SCell continuity requires a reconfiguration.  |
| Huawei, HiSilicon | No | We think the capability signalling is useful in this case so that the network can configure the UE with the ‘MBS broadcast compatible’ configuration as early as possible, i.e. even before MII is sent by the UE. |
| Samsung | Yes |  |
| CATT | Yes |  |
| Qualcomm | Yes |  |
| Nokia | Yes | UE is allowed to receive MBS from any cell as long as it does not interfere specified UE behaviour. |
| Nokia | Yes | MII signaling as such seems to be quite clear indication UE supports broadcast reception. But it seems best to capture MBS broadcast support in chapter 5 to be clear. |
| OPPO | Yes  |  |
| Xiaomi | No strong view |  |
| MediaTek | Yes |  |
| Intel | See comments | We prefer that broadcat reception is an optional feature **without** capability signalling. When UE sends MII, it already informs the gNB that it supports broadcast reception. Therefore explicit UE capability signalling for broadcast reception is not useful. |
| vivo  | Yes |  |
| Spreadtrum | Yes |  |
| Futurewei | Yes |  |
| Lenovo | Yes |  |
| LGE  | Yes |  |
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## 2.4 Impact of MBS broadcast on paging and SIBs

In the contribution R2-2205746, the propent mentioned that UE may need to prioritize paging when the UE does not support the reception of Paging and group common PDSCH in the same slot. This enables the UE to receive paging and SI without any additional delay when paging and SI conflicts with broadcast.

However, it is rapporteur’s understanding that the current agreement from RAN1 has precluded this case:

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| RAN1#107bis-e**Agreement**For RRC\_IDLE/INACTIVE UEs, a **UE is not required to support** reception of FDMed MCCH/MTCH PDSCH and SIB1 or Paging PDSCH in PCell. |

In addition, in rapporteur understanding, the network can ensure that the paging/SIB information and group common PDSCH are not in the same slot.

#### Question 7: Do you think if RAN2 needs to discuss the potential issue for the reception of paging and group common PDSCH in the same slot?

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|  **Company** | **Answer (Yes/No)** | **Comments** |
| Ericsson | Yes | The rapporteur is correct that RAN1 excluded the case, but we think that RAN1 did not discuss the scheduling impact. Furthermore the RAN1 optional UE capability for FDM/TDM-ed is also no solution for UEs in Idle/Inactive for Paging/SI and MBS broadcast service.In our understanding there is going to be more and more system information, and increased paging for MBS group paging and PEI transmissions. The NW would have to schedule MBS broadcast around SI transmissions, and only in case the scheduling is dynamic the Paging PO can be re-used for broadcast PTM transmissions when the UE is not paged. |
| Huawei, HiSilicon | Yes | The network may not always be able to prevent MBS broadcast from overlapping with Paging for each UE. It would be good to clarify that UE should prioritize Paging in this case. |
| Samsung | No | Agree with the rapporteur |
| CATT | No | We agree with rapporteur’s understanding.it is not real case for the reception of paging and group common PDSCH in the same slot according to RAN1 agreement. |
| Qualcomm | Yes | Agree with rapporteur comments above and agree with Huawei comments. |
| Nokia | Discussing is fine :-) | If there is scenario when UE would need to receive paging and group common PDSCH on same slot can be left up to UE implementation. Reasonable UE will most likely prioritize paging if it is not able to receive both but it would be impossible to dictate the rules by RAN2. So better to leave this up to UE implementation but nothing needs to be captured as this can be considered as erroneous NW implementation. |
| OPPO | No  |  |
| Xiaomi | No | This is anyway up to the UE implementation, and a smart UE implementation can achieve a good balance on the reception amongst MBS and paging/SIB. |
| MediaTek | No |  |
| Intel | No | Agree with rapporteur. |
| vivo | No | The network can avoid overlapping as much as possible. If occurred, it can be left to UE implementation (we can ask RAN1 for confirmation if needed).  |
| Spreadtrum | No | Agree with rapporteur. |
| Futurewei | Yes | We think this issue deserves some discussion to have clear resolution.  |
| Lenovo | Yes | Agree with Huawei’s view |
| LGE | No | Given the RAN1 agreement (above) and the existing paging reception requirements that are quite clear, there is no issue to discuss since UE would already prioritize paging reception whenever necessary based on the existing paging monitoring requirements. Therefore, no extra normative requirments should be added. |
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## 2.5 Simultaneous PDSCH processing capability

In the contribution R2-2206114, company mentioned several case for simultaneous PDSCH processing capability and suggest RAN2 to clarify the coverage of feature 33-3-2 and 33-3-3. Rapporteur thinks this is more suitable to be discussed in RAN1 and RAN2 can wait for RAN1’s conclusion. Therefore, no question is casted for this issue.

## 2.6 Other issues

#### Question 8: Companies are invited to comment if there are any other issues for MBS UE capabilities that needs to be discussed during this email discussion.

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|  **Company** | **Answer (Yes/No)** | **Comments** |
| Qualcomm | Yes | Multicast capabilities to be discussed : Ref :R2-2204625Proposal 1. Introduce R17 UE capability for Multicast service reception.Proposal 2. Introduce R17 UE capability for Multicast service reception via SCell per FSPC (Feature Set per CC). |
| Xiaomi |  | Regarding our contribution R2-2206114, we are fine to wait for further inputs from RAN1. However we would like to ask companies to double check with their RAN1 colleagues regarding the PDSCH process capabilities, so that we can capture those capabilities correctly in the RAN2 specification.Not sure about the RAN1 discussion process, we are also wondering whether an LS to RAN1 is needed for further clarifications. |
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# 3. Final Summary and Proposal

Based on the email discussion, the following proposals are made for MBS UE capbility, with the easy proposals highlighted in green for online session:

TBD

# 4. Reference

[1] R2-2204625 R17 MBS UE capabilities Qualcomm India Pvt Ltd discussion Rel-17 NR\_MBS-Core

[2] R2-2204907 Discussion on mandatory ROHC support for MBS broadcast MediaTek inc. discussion

[3]R2-2205541 Remaining MBS UE capability open issues Intel Corporation discussion Rel-17

[4]R2-2202786 Draft 306 CR for MBS UE capabilities MediaTek Inc. draftCR Rel-17 38.306 16.7.0 B NR\_MBS-Core

[5] R2-2205746 Impact of MBS broadcast on paging and SIBs Ericsson discussion Rel-17 NR\_MBS-Core

[6] R2-2205750 UE capabilities for MBS Ericsson discussion Rel-17 NR\_MBS-Core

[7] [R2-2205855](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_118-e/Docs/R2-2205855.zip) UE support for ROHC profiles and context sessions Ericsson discussion Rel-17 NR\_MBS-Core

[8] R2-2205939 Discussion on UE capabilities for MBS Huawei, HiSilicon discussion Rel-17 NR\_MBS-Core

[9] R2-2206114 UE capability discussion for MBS Xiaomi Communications discussion Rel-17 NR\_MBS-Core

[10] R2-2205712 Discussion on MRB Configuration Samsung discussion Rel-17 NR\_MBS-Core

[11] R2-2204626 R17 MBS UP remaining issues Qualcomm India Pvt Ltd discussion Rel-17 NR\_MBS-Core

[12] R2-2203343 Report of: [Pre117-e][001][MBS] CP open Issues Input