3GPP TSG-RAN WG2 #115-e R2-21xxxxx

Online, 16-27 August 2021

Agenda Item: xx

Source: Xiaomi Communications

**Title: Summary of [Post114-e][073][MBS] Service continuity for Delivery Mode 2 (Xiaomi)**

Document for: Discussion, decision

# 1 Introduction

This document is a report on the following email discussion, initiated after RAN2#114-e:

* [Post114-e][073][MBS] Service continuity for Delivery Mode 2 (Xiaomi)

Scope: Service continuity for Delivery Mode 2, including cell selection/reselection prioritization, The need for enablers for connected mode including MBS interest indication

Intended outcome: Report

Deadline: Long

Email discussion deadline: August 5th, 0900 UTC

Note: silent period is July 5-30 (may be updated during TSG RAN)

The email discussion deadline for company feedbacks is one day earlier than the tdoc submission deadline (i.e. August 6th) of RAN2#115-e, so as to allow the email discussion rapporteur to have extra time to provide the summary of the email discussion.

In general, the function of service continuity of MBS reception is to keep the UE in the cell/frequency where the MBS service(s) of UE interest is provided when the UE moves from one cell to another, as not all frequencies or cells will provide the MBS service(s) of UE interest. In LTE, the IDLE/CONNECTED service continuity of MBMS service is based on the MBS service continuity information provided by the eNB and the UE. The UE (which could be capable of receiving MBMS service via serving cell or non-serving cell) is allowed to prioritize a MBMS frequency in IDLE when the UE can only receive the MBMS service while camping on the frequency on which the MBMS service is provided, and is allowed to indicate the MII (i.e. *MBMSInterestIndication*) message in CONNECTED when the UE is able to receive the MBMS service(s) simultaneously on the corresponding MBMS frequencies. According to the NR MBS discussion, the RAN2 agreements related to the service continuity of the Delivery Mode 2 are listed as follows:

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| RAN2#113e meeting agreements:   * Assume that MBS Interest Indication is supported for UEs in connected mode for Broadcast service (assume that as usual there is no mandatory network requirement, network action is up to network). * MBS Interest Indication is NOT supported for UEs in idle/inactive mode for NR MBS delivery mode 2. * Assume that some information for purpose of service continuity can be provided for NR MBS delivery mode 2. (FFS what - need to be revisited, e.g. based on progress in other groups, e.g. USD, SAI/TMGI etc) * FFS whether support UE awareness of MBS services on frequency basis for service continuity for NR MBS delivery mode 2 (i.e. Reuse LTE SC-PTM mechanism). * FFS Support frequency prioritization during cell reselection for service continuity for NR MBS delivery mode 2 (i.e. Reuse LTE SC-PTM mechanism). |

# 2 Contact Points

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Xiaomi (rapporteur) | Yumin Wu | wuyumin@xiaomi.com |
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# 3 Discussion

## 3.1 IDLE/INACTIVE service continuity

### 3.1.1 Cell reselection priority

According to the IDLE UE mobility for LTE SC-PTM [20], the UE can autonomously set the MBS frequency as the highest priority, when following 2 conditions are all fulfilled:

* Condition 1: The reselected cell is broadcasting MBS SIB (i.e. LTE SIB20) carrying MCCH configuration.
* Condition 2: when either of the following conditions is fulfilled:
  + Condition 2.1: If MBS service continuity information is provided in SIB (i.e. LTE SIB15), the SAI associated with the MBS frequency indicated in MBS SIB matches the SAI associated with the same MBS frequency indicated in USD.
  + Condition 2.2: If MBS service continuity information is not provided in SIB (i.e. LTE SIB15), the MBS frequency is provided in USD.

The MBS service continuity information in LTE SIB15 provides the mapping between the SAI and the MBS frequency. In general, the IDLE/INACTIVE service continuity for MBS reception should allow the UE to autonomously prioritize the MBS frequency.

#### Question 1: Is the UE allowed to prioritize the MBS frequency of interest **ONLY** when the reselected cell provides MBS SIB carrying the MCCH configuration, as LTE SC-PTM?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes | We prefer to reuse LTE SC-PTM mechanism |
| Kyocera | Yes | We assume the intention of Q1 is not to consider SAI in USD. So, we’re fine with Q1 at this point, while we think it may be reconsidered due to other WG’s input, if any. |
| OPPO | Yes with clarification… | 1. In NR, the SIB can be on-demand transmission and can also be area specific SIB. The reselected cell may have no MBS SIB transmission and UE also does not need to request the SIB due to the stored MBS SIB is valid, e.g. within the SIB area. 2. The condition should also consider the UE is receiving or interested to the MBS on the serving frequency…..   =======  If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:  1) Either:  - the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or  - the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;  2) Either:  - SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or  - SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service. |
| Huawei, HiSilicon | Yes | There is no use of prioritizing the MBS frequency in case the reselected cell does not provide MBS service anyway. |
| CATT | - | 1. Before discussing the details on how to do the frequency prioritization for MBS service continuity, we should firstly decide whether to support frequency prioritization during cell reselection for service continuity for NR MBS delivery mode 2,which is FFS for now.   |  | | --- | | * FFS Support frequency prioritization during cell reselection for service continuity for NR MBS delivery mode 2 (i.e. Reuse LTE SC-PTM mechanism). |   2.agree with OPPO that the rapporteur’s description on SC-PTM mechanism is not complete, for example, it seems a critical precondition is missed,   |  | | --- | | //36.304  If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided,  …… | |
| vivo | Yes | We can understand the intention of this question. And we think the LTE SC-PTM mechanism can be used as the baseline. |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes | Agree with OPPO comments and LTE SC-PTM mechanism is baseline. Ofcourse UE prioritizes a frequency during idle cell reslection if UE desired service is available on specific frequnecies of neighbor cells. |
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Figure 2: IDLE/INACTIVE UE MBS reception capability

According to the LTE SC-PTM, the IDLE UE can optionally receive MBS on non-serving cell. Alike the LTE SC-PTM, the IDLE/INACTIVE UE of NR could have the following two different reception capabilities for MBS:

* Type-1 capability (i.e. serving cell reception of MBS) of IDLE UE: The UE can only receive the MBS service while camping on the MBS frequency of interest
* Type-2 capability (i.e. non-serving cell reception of MBS) of IDLE UE: The UE can camp on another frequency while receiving MBS services on the MBS frequency simultaneously.

For Type-1 UE, the UE is required to prioritize the MBS frequency as the UE can only receive the MBS service by camping on the MBS frequency of interest. For Type-2 UE, the UE does not need to prioritize the MBS frequency when the UE camping on another frequency can receive the MBS via the non-serving MBS frequency of interest.

#### Question 2: Is the IDLE/INACIVE UE allowed to prioritize the MBS frequency of interest when the UE is only capable of receiving the MBS service by camping on the MBS frequency, as LTE SC-PTM?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes | We prefer to reuse LTE SC-PTM mechanism |
| Kyocera | Yes | We think it’s same with LTE SC-PTM. |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes | If the UE is able to receive the service while camping on its current frequency, then there is no need for the UE to prioritize MBS frequency. Otherwise, the UE should prioritize the frequency in order to be able to receive a service. |
| CATT | Yes | The MBS specified frequency prioritization should only be performed when it is necessary, i.e.,for CA-capable UEs or DC-capable UEs, this seems unnecessary. |
| vivo | Yes |  |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes |  |
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According to LTE SC-PTM [20], the UE is allowed to set “cell reselection candidate frequencies at which it cannot receive the MBMS service to be of the lowest priority during the MBMS session”. As such the MBS frequency of interest would have the highest frequency compared with other frequencies.

#### Question 3: Is the IDLE/INACIVE UE allowed to set cell reselection candidate frequencies at which it cannot receive the MBS service to be of the lowest priority during the MBS session, as LTE SC-PTM?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes | We prefer to reuse LTE SC-PTM mechanism |
| Kyocera | Yes | We think it’s same with LTE SC-PTM. |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes | UE should avoid camping at the frequencies where it cannot receive MBS service of interest whenever possible. |
| CATT |  | It is straightforward to reuse SC-PTM mechanism. |
| vivo | Yes |  |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes |  |
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### 3.1.2 Assistance information for service continuity



Figure 1: Determination of MBS frequency of interest

Although this discussion is under the section for the IDLE/INACTIVE service continuity, the assistance information provided by the gNB or upper layer can be used for both IDLE/INACTIVE service continuity and CONNECTED service continuity.

For the IDLE/INACTIVE service continuity, after selecting its interested MBS service (e.g. LTE TMGI) by using the USD (User Service Description) file which provides the SAI and the frequency of the MBS service, the UE knows the SAI and the frequency of its interested MBS service. For Condition 2.1, to support the prioritization of MBS frequency, the gNB provides the mapping between frequency and MBS service via SIB15. The UE determines its MBS frequency of interest when the SAI and the frequency of the USD match the SAI and the frequency of SIB15. For Condition 2.2, as the gNB does not provide the SIB15, the UE determines its MBS frequency of interest only based on the MBS frequency information provided in the USD. According to the LTE MBMS service continuity discussion, the SAI and the frequency information in USD was determined and asked by RAN2. As an example, the mapping between frequency (including intra-frequency and inter-frequency) and MBS service in LTE SIB15 is quoted as follows:

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| 36.331:  mbms-SAI-IntraFreq-r11 MBMS-SAI-List-r11 OPTIONAL, -- Need OR  mbms-SAI-InterFreqList-r11 MBMS-SAI-InterFreqList-r11 OPTIONAL, -- Need OR |

#### Question 4: Is the mapping between frequency and MBS service provided in upper layer signalling (e.g. USD), as LTE SC-PTM?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes | Meanwhile we may need to check the status of the discussion at SA2/SA4 to verify if the same content of USD and the concept of SAI are agreed for NR MBS. |
| Kyocera | No | We don’t think USD needs to provide the mapping of MBS services to frequencies, since it restricts the gNB implementations, e.g., it may change the frequency for an MBS service due to congestion. |
| OPPO | Yes | Share the same view with MediaTek. |
| Huawei, HiSilicon | Yes | This is useful for the services, which utilize homogenous frequency allocation across system or for inter-PLMN service reception. |
| CATT | Yes | Agree with MediaTek. |
| vivo | Yes | By providing the mapping between frequency and MBS service in upper layer signaling, even though the MBS-specific SIB is not broadcast, UE can still prioritize the frequency indicated during cell reselection. |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes | Agree with MediaTek comments. |
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#### Question 5: Is the mapping between frequency and MBS service provided in SIB, as LTE SC-PTM?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes |  |
| Kyocera | Yes | We think the mapping between frequencies and MBS services is provided in SIB. |
| OPPO | Yes | New SIB is preferred. |
| Huawei, HiSilicon | Yes | The mapping provided by SIB should not be a direct TMGI to MBS frequency mapping as it would cause too large overhead, i.e. a concept such as/similar to SAI from LTE should be employed. |
| CATT | Yes, but | Does the question assume that there is SAI in NR MBS? Please note that SAI is under discussion in RAN3 and it is FFS for now.   |  | | --- | | * + Support of MBMS frequency layer prioritization     - Pending to RAN2 progress     - FFS for SAI/ group ID | |
| vivo | Yes | We share a similar view with Huawei. Whether the LTE SAI mechanism can be reused for NR MBS should be confirmed by SA WG. |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes but | We share same view as CATT. We need to check with SA2 about whether to use TMGI or MBS Session ID or are they defining SAI for service continuity purpose. |
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To enable the service continuity for IDLE/INACTIVE/CONNECED UE, the network needs to provide the MBS service continuity information (i.e. mapping between SAI and frequency) via SIB. In LTE SC-PTM, SIB15 is designed independently from other MBMS related SIBs to only carry the mapping between SAI and frequency, which can be used to control the MII reporting for the CONNECTED UE. Note that even cells not supporting/deploying LTE eMBMS transmission can also broadcast SIB15 and then allow the UE to report MII for service continuity purpose. If the NR MBS service continuity information is not carried in an independent SIB, RAN2 may need to find another way to broadcast the information for the cell not supporting MBS transmission.

#### Question 6: Is the mapping between frequency and MBS service allowed to be sent in cells not supporting MBS transmission, as LTE SC-PTM?

(This question is provided by assuming that the mapping between frequency and MBS service is provided via SIB.)

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes | We prefer to reuse LTE SC-PTM mechanism |
| Kyocera | Yes | We think the word in Q6, i.e., “cells not supporting MBS transmission”, is a bit ambiguous. We assume it means that the cell supports MBS functionality, but it does not send MBS data via PTM. Assuming so, we don’t think the restriction is needed, i.e., the cell can send MBS-SIB including the mapping between frequencies and MBS services. It allows the UE to send MBS Interest Indication, which may assist the gNB to decide handover this UE to the cell transmitting the MBS data of interest via PTM. |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes | Such information is useful for the UE to reselect to the frequency providing MBS transmission, and should be allowed. |
| CATT | - | Agree with Kyocera.” cells not supporting MBS transmission” can be changed to “MBS-capable cell without MBS deployment” |
| vivo | Yes |  |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes |  |
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#### Question 7: Is the mapping between frequency and MBS service provided in a new SIB different from the MBS SIB providing the MCCH configuration, as LTE SC-PTM?

(This question is provided by assuming that the mapping between frequency and MBS service is provided via SIB.)

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes | We prefer to reuse LTE SC-PTM mechanism |
| Kyocera | No | We don’t see any significant benefit to separate the SIB for service continuity from MBS SIB. |
| OPPO | Yes | New SIB is preferred. |
| Huawei, HiSilicon | Yes | We think this information should be separated from the basic NR MBS configuration, i.e. MCCH configuration, as the mapping may also need to be provided in a cell not supporting MBS transmission (i.e. not supporting MCCH). Therefore we support introducing another SIB for carrying service continuity related information for NR MBS DM2, which seems to be the simplest way. |
| CATT | Yes | It is straightforward to reuse SC-PTM pattern. |
| vivo | Yes | WE prefer to follow the LTE mechanism. |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes | Same view as Huawei |
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[1] proposes to use a group ID (alike LTE SAI) of MBS services in SIB and USD for the UE to determine its interested MBS frequency. From rapporteur’s understanding, if we provide the TMGI information in SIB, the SIB not supporting segmentation may not be able to contain a large number of TMGIs, as the size of one TMGI could be more than 48bits as quoted below.

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| 36.331:  TMGI-r9 ::= SEQUENCE {  plmn-Id-r9 CHOICE {  plmn-Index-r9 INTEGER (1..maxPLMN-r11),  explicitValue-r9 PLMN-Identity  },  serviceId-r9 OCTET STRING (SIZE (3))  } |

#### Question 8: Is a group ID (alike LTE SAI) of MBS services needed in SIB and USD, as LTE SC-PTM?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes |  |
| Kyocera | - | We think it needs input from other WG. |
| OPPO | Yes | Not sure whether RAN2 can decide it or not. |
| Huawei, HiSilicon | Yes | A concept such as SAI is needed as otherwise the overhead related to TMGI transmission on air interface would be very high. A new SIB has to contain information for all MBS services supported in the whole system, including both ongoing and deactivated services for all frequencies. The number of individual TMGIs to be signalled would be then very high and it is unrealistic to assume they can be broadcasted one by one. Even though other WGs need to be involved in specifying SAI, RAN2 should inform them about the signalling overhead issue and the need of such mechanism. |
| CATT | Yes | Agree with the intention, but SAI or a new defined group ID should be decided by other WGs and it is under discussion in RAN3. |
| vivo | Yes | We support to reused the LTE SAI mechanism and RAN2 should confirm this with SA WG. |
| NEC | Yes |  |
| QC | Yes but | Wait for discussion in SA2 and RAN3. |
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As mentioned in [1], the SC-MCCH message in LTE “indicates a list of neighbour cells where ongoing MBMS sessions provided via SC-MRB in the current cells are also provided” [21]. When the UE reselects to a neighbour cell not providing the UE’s interested MBS service, the IDLE UE may decide to trigger RRC connection establishment in advance, so as to reduce the service interruption.

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| 36.331:  SCPTM-NeighbourCellList-r13 ::= SEQUENCE (SIZE (1..maxNeighCell-SCPTM-r13)) OF PCI-ARFCN-r13  PCI-ARFCN-r13 ::= SEQUENCE {  physCellId-r13 PhysCellId,  carrierFreq-r13 ARFCN-ValueEUTRA-r9 OPTIONAL  } |

#### Question 9: Can the gNB indicate a list of neighbour cells where ongoing MBS service provided in the current cells are also provided, as LTE SC-PTM?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes |  |
| Kyocera | Yes | We think the neighbour cell list is useful for service continuity, as same with LTE SC-PTM. |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes | This is useful for the UE trigger the transition to RRC Connected earlier to establish a unicast connection to the server when leaving the area where the service is provided via MBS. |
| CATT | No | In SC-PTM, the neighbour cells is used to support MBMS reception via unicast PDU session on cell not providing the MBMS service,   |  | | --- | | For each MBMS service provided using SC-PTM, E-UTRAN indicates in the SC-MCCH the list of neighbour cells providing this MBMS service so that the UE can request unicast reception of the service before changing to a cell not providing the MBMS service using SC-PTM. |   But please note that in NR MBS, receiving broadcast when UE is out of Broadcast MBS service area(i.e. receiving broadcast via PDU session) is not supported, according to SA2 TS 23.247,  So why we need adopt the related SC-PTM mechanism in NR MBS?   |  | | --- | | NOTE: When the UE moves out the Broadcast MBS service area, how the UE get the same content via application level is out scope of 3GPP. | |
| vivo | Yes with comments | To make UE clearly know which neighbor cells provide which MBMS service, we think the configuration such as *sc-mtch-neighbourCell* in LTE should be also included. |
| NEC | Yes | We prefer to reuse LTE SC-PTM mechanism |
| QC | Yes but | It is useful for UE know which MBS service is available in neighbor cell or not. Based on our understanding, in LTE SC-PTM, for group communication services (GCS) UE App layer can request service in Unicast manner when cell does not support SC-PTM delivery. But for other Broadcast services, it is upto App layer behaviour and is not in 3GPP scope. |
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## 3.2 CONNECTED service continuity

### 3.2.1 Content of MII

According to the LTE SC-PTM [21], the CONNECTED UE could indicate the following information via the *MBMSInterestIndication*:

* mbms-FreqList-r11 (a list of frequencies): MBS frequency(ies) of interest
* mbms-Priority-r11 (1bit per UE): Reception priority between MBS reception and unicast reception
* mbms-Services-r13 (a list of TMGI(s)): MBS service(es) of interest

For mbms-FreqList-r11, the frequency is determined when the SAI of the frequency in the SIB matches the SAI in the USD. For mbms-Priority-r11, the priority between MBS reception and unicast reception is indicated when the UE is not able to receive MBS bearer and unicast bearer simultaneously due to the limited UE processing capability. For mbms-Services-r13, the MBMS service ID (i.e. TMGI) is indicated as a supplement information to mbms-FreqList-r11. The TMGI is determined when the SAI of the TMGI in USD matches the SAI in SIB.

#### Question 10: Which of the following MBS interest information is indicated by the CONNECTED UE?

* Option 1: MBS frequency, as LTE SC-PTM
* Option 2: priority between MBS bearer and unicast bearer, as LTE SC-PTM
* Option 3: MBS service ID (i.e. TMGI), as LTE SC-PTM
* Option 4: Other information

(Multiple selection is allowed. Companies selecting Option 4 are encouraged to provide the information details in the “Comments” column.)

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| **Company** | **MBS frequency**  **(Yes/No)** | **Priority between MBS and unicast**  **(Yes/No)** | **TMGI**  **(Yes/No)** | **Other Information**  **(Yes/No)** | **Comments** |
| MediaTek | Yes | Yes | Yes |  |  |
| Kyocera | Yes | Yes | Yes | No |  |
| OPPO | Yes | Yes | Yes |  |  |
| Huawei, HiSilicon | Yes | Yes | Yes |  | TMGI is useful for the ongoing services so that gNB can consider this for scheduling. Additionally, MBS frequency can be used by the gNB to allow the UE reception of a certain frequency where the serving gNB might not yet be aware of the TMGI to frequency mapping (e.g. for non-ongoing services or for the handover).  Priority needs to be known in case the network has no possibility to provide the UE with both unicast and multicast as per UE capabilities. |
| CATT | Yes | Yes | Yes |  |  |
| vivo | No strong view | Yes | Yes | No | In our understanding, the gNB is assumed to know which frequency provides which TMGI. In this sense, MBS frequency may not be needed. Instead, the indicated MBS service ID can implicitly indicate UE’s simultaneous reception capability for reported TMGIs and UE’s interest priority for decreasing order of interest TMGIs. Do we misunderstand something? |
| NEC | Yes | Yes | Yes |  |  |
| QC | Yes | Yes | Yes |  |  |
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According to LTE SC-PTM, when the UE indicates a list of frequencies, the gNB may not be able to configure all frequencies for the UE, due to the different radio conditions (e.g. congestion) on different frequencies. Then the frequencies indicated via MII is sorted by decreasing order of interest.

#### Question 11: Is the MBS frequencies indicated sorted by decreasing order of interest, as LTE SC-PTM?

(This question is provided by assuming that the frequencies are indicated in MII.)

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes |  |
| Kyocera | Yes |  |
| OPPO | Yes |  |
| Huawei, HiSilicon | Yes | This is useful in case it is not possible to provide the UE with all the services it is interested in. |
| CATT | Yes |  |
| vivo | Yes |  |
| NEC | Yes |  |
| QC | Yes |  |
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According to the LTE SC-PTM, when indicating the support of *scptm-NonServingCell-r13*, the CONNECTED UE can include the non-serving frequency(ies) in the MII message, when the serving frequency(ies) and the non-serving frequency(ies) belong to the same *supportedBandCombination*. The support of *scptm-NonServingCell-r13* reuses the CA capability (i.e. *supportedBandCombination* and network synchronization properties of CA) as the baseline for the MBS reception of non-serving cell. When indicating the support of *scptm-AsyncDC-r13*, the UE reuses the async-DC capability (i.e. *supportedBandCombination* and network synchronization properties of aync-DC in which the MCG and the SCG are not synchronized) as the baseline for the MBS reception of non-serving cell. Thus if the UE is capable of receiving MBS via non-serving cell, the gNB does not need to configure the UE with the serving cell for MBS reception when the gNB receives the MII indicating the MBS reception interest of a non-serving frequency. When the UE reports a list of frequencies in MII, the set of MBS frequencies of interest needs to fulfil the following conditions:

* Condition 1: The UE is capable of simultaneously receiving MBS on the set of MBS frequencies of interest.
* Condition 2: At least one band combination includes the set of MBMS frequencies of interest.

#### Question 12: When a list of frequencies are indicated in MII, should the UE be capable of simultaneously receiving MBS on the set of MBS frequencies of interest (regardless of whether a serving cell is configured on each of these frequencies or not), as LTE SC-PTM?

(Note that the capability bit for the non-serving cell reception of MBS can be discussed separated from this question.)

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes |  |
| Kyocera | No | We think *mbms-FreqList-r11* in MII was also used for the handover decision at gNB in LTE eMBMS, i.e., not limited to simultaneous reception from non-serving cell. So, we don’t think the conditions in Q12 are needed at this point. We also wonder if the discussion of UE capability is needed first. |
| OPPO | Yes with comments | 1. In NR, we should also consider the active BWP for unicast and MBS reception. We also think RAN4 should be involved. 2. We also have same concern as Kyocera. It is for HO purpose, we are not sure whether the simultaneous reception is mandatory or not. |
| Huawei, HiSilicon | Yes | As in LTE SC-PTM, the UE should only consider MBS frequencies it can simultaneously receive when sending MII. The conditions are needed also because:   1. In addition to the usage for handover assistance, this information can be used by the network to decide whether to configure SCell for the UE which is capable of MBS reception on configured SCell. So these frequencies reported by UE need to compile with the UE capability for CA. 2. The point of these conditions is also to filter out the frequencies that UE cannot receive simultaneously from reporting as this would be useless information to the network. E.g. if the UE is interested to receive F1, F2 and F3, but can only receive F1+F2 or F1+F3, but not F1+F2+F3, and it prioritizes F2>F3, then it only makes sense that UE reports F1 and F2, but not F3. |
| CATT | - | Maybe it is too early to discuss.  This is related to receiving MBS on scell for CA scenario.As far as we know,RAN1 has not discuss whether to support MBS reception on scell for CA scenario.maybe we should request RAN1 to discuss it firstly. |
| vivo | Yes | From RAN2 perspective, we think this LTE mechanism can be reused. RAN2 can request RAN1 to discuss whether this can be supported in terms of UE capability. |
| NEC | Yes | I have to clarify that we are discussing the simultaneously receiving MBS on the set of MBS frequencies, not BWPs for unicast and multicast. When the UE is being served by the serving cell, the only thing UE needs to do is to report *mbms-FreqList-r11* in MII, and leave the handover decision to serving gNB. |
| QC | Yes | Freq list in MII can be used by gNB for HO decision. Following LTE RRC text should also be applicable for NR MII freq list.  Whether UE can support simultaneous reception of MBS services from non-serving cell can be based on UE capability. Support of Broadcast service reception in SCell should also be possible and requires RAN1 confirmation as well.  From LTE RRC, Section 5.8.5.3  *2> the UE is capable of simultaneously receiving MRBs and/or is capable of simultaneously receiving SCMRBs on the set of MBMS frequencies of interest, regardless of whether a serving cell is configured on each of these frequencies or not; and* |
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#### Question 13: When a list of frequencies are indicated in MII, should the set of MBS frequencies of interest be part of a band combination of the UE, as LTE SC-PTM?

(The band combination in the above question refers to the UE capability signaling of *supportedBandCombination*.)

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | Yes |  |
| Kyocera | No | We have the same comment as Q12. |
| OPPO | Yes with comments | Same comments as Q12. |
| Huawei, HiSilicon | Yes | The UE should be capable of receiving the frequencies it indicated as MBS frequencies of interest and it does not make sense for the UE to report frequencies it is not capable of receiving simultaneously. As indicated above, in addition to the usage for handover assistance, this information can be used by the network to decide whether to configure SCell for the UE which is capable of MBS reception on configured SCell. So these frequencies reported by UE need to compile with the UE capability for CA. |
| CATT | - | Same comments as Q12. |
| vivo | Yes |  |
| NEC | Yes | Same comments as Q12. |
| QC | Yes. | From LTE RRC, Section 5.8.5.3  *2> the supportedBandCombination the UE included in UE-EUTRA-Capability contains at least one band combination including the set of MBMS frequencies of interest;*  The same applies for NR as well |
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### 3.2.2 MII reporting

Regarding the RRC message used to indicate the UE interest of MBS, we could have the following options:

* Option 1: *UEAssistanceInformation*
* Option 2: New RRC message (e.g. a new *MBSInterestIndication* message)
* Option 3: *RRCSetupComplete* [5]
* Option 4: *SecurityModeComplete* [5]

From the rapporteur’s understanding, it is technically feasible to re-use the *UEAssistanceInformation* message to carry the MBS interest information, and re-using the *UEAssistanceInformation* message would also save some standard efforts as many other information from the UE are also reported via the same message. Besides Option 1, [2] claims that Option 3 can be used to avoid the service interruption due to the BWP switching after the gNB receives *RRCSetupComplete*, as the gNB which does not know the UE’s MBS interest may change the UE’s active BWP (which provides the MBS service of UE interest) to another one (which does not provide the MBS service of UE interest).

#### Question 14: Which message is used to indicate MII?

* Option 1: *UEAssistanceInformation*
* Option 2: New RRC message (e.g. *MBSInterestIndication*)
* Option 3: *RRCSetupComplete* [5]
* Option 4: *SecurityModeComplete* [5]

(Multiple selection is allowed for the above options.)

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| **Company** | **Answer** | **Comments** |
| MediaTek | Option-1 |  |
| Kyocera | Option 2 | We assume MBS SIB controls whether MII can be allowed to be sent, as similar to LTE SC-PTM. It’s different pre-condition from *UEAssistanceInformation*. So, we think a new message like *MBSInterestIndication* is straightforward. |
| OPPO | Option 1 for RRC\_IDLE mode UE | In NR, the BWP concept was introduced. The UE can be configured with up to 4 BWPs per serving cell and there is only one active BWP (including both DL BWP and UL BWP) per serving cell at any given time.  In RAN1#103 meeting, RAN1 agreed that the same group-common PDCCH and the corresponding scheduled group-common PDSCH can be received by both RRC\_IDLE/RRC\_INACTIVE UEs and RRC\_CONNECTED UEs.  In order to avoid frequent BWP switching for broadcast reception and unicast reception on dedicated BWP, it is better for gNB to know the UE is receiving broadcast MBS and configure the dedicated BWP to overlap the broadcast MBS BWP.  🡺For RRC\_IDLE mode UE, *UEAssistanceInformation* can be reused for MBS interesting indication related information reporting. Furthermore, the *UEAssistanceInformation* message will be security protected in NR.  🡺For RRC\_INACTIVE mode UE, *RRCResume* message can be used to configure dedicated BWP and also can perform full configuration as *RRCReconfiguration* did. So it is too late for RRC\_INACTIVE mode UE to report MBS interesting indication related information via *UEAssistanceInformation.* |
| Huawei, HiSilicon | Option-1 | We think reusing an existing message is preferable in order to minimize specifications impact.  The drawback of options 3 and 4 is that they require specifying option 1 or 2 on top anyway. We see no issue with reconfiguring the BWP at the UE after the UE indicates its interest. |
| CATT | Option 2 | A new message is preferred as it is more flexible for this MBS specific functionality. |
| vivo | Option 2 | As the triggering conditions/message content of MMI might be different than the existing RRC message, it is clearer to use a new message. |
| NEC | Option 2 | We agree with Kyocera’s view, MBS SIB controls whether MII can be allowed to be sent. It’s different pre-condition from *UEAssistanceInformation*. So, we think a new message like *MBSInterestIndication* is straightforward. |
| QC | Option 2 | We have same view as Kyocera. It is not just about specification and is more about scenarios of MII trigger, which is different from *UEAssistanceInformation*. |
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In LTE SC-PTM, the MII can be reported (unprotected) prior to security activation. [1] indicates that the MBS services that UEs are receiving or interested in are confidential, and then the MII should be reported after security activation.

#### Question 15: Can the MII be reported prior to security activation?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| MediaTek | No | We did not see the need. SA3 can be asked if the companies are not sure on the security aspects of UE interests on MBS services |
| Kyocera | Yes | We assume the same principle as LTE SC-PTM can be still applicable, unless other WG provides their input. |
| OPPO | No | If RAN2 agree MII can be report prior to AS security activation as LTE, the LS to SA3 is necessary. |
| Huawei, HiSilicon | No | The indication of services the UE is interested in can be a sensitive information and it is better to secure it. |
| CATT | Depdends | If the MII is reported after security activation, a dedicated BWP not overlapped with initial BWP may be configured in MSG4, the broadcast reception will be interrupted. We are wondering whether such service interruption is tolerable. |
| vivo | No | The info included in the MII is supposed to be confidential. Besides, for NR MBS reception in CONNECTED UE, we are not sure whether there is a strong use case for MII reporting without security. |
| NEC | No | Agree with Kyocera that MII should have the same principle as LTE SC-PTM can be still applicable, unless SA3 has security concern on it. |
| QC | Yes | Same view as Kyocera. We can send LS to SA3 to clarify if needed. |
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## 3.3 Other issues

For the cell ranking criterion during the cell reselection procedure, [4] proposes to introduce an extra offset to the cell where the MBS service is provided. Then the UE applies the offset only to the cells which provide UE interested MBS services, rather than to all cells on the frequency with highest priority.

#### Question 16: Is the extra offset to cell (which provides the MBS service) needed for the cell ranking criterion?

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| **Company** | **Answer (Yes/No)** | **Comments** |
| Kyocera | Yes | We think it’s same with QoffsetSCPTM in LTE SC-PTM (but for supporting Enhanced coverage). We assume the minimum service area can be one cell in NR MBS, so the offset is useful for such a deployment scenario, i.e., per-cell basis. Needless to say, the network can always decide not to provide the offset, e.g., for the per-frequency basis MBS deployment. |
| Huawei, HiSilicon | No | We think it is dangerous from the perspective of the overall system performance to allow the UE to camp on non-best cell on the certain frequency. |
| CATT | No | It is not applicable to NR MBS.  In SC-PTM, the QoffsetSCPTM is only used for NB-IoT UEs, BL UEs or UEs in enhanced coverage. |
| vivo | No | We are not convinced this optimization is needed. In any case, we should guarantee the unicast reception quality of non-MBS service, which is assumed to be more important than the MBS service. |
| QC | May be Yes | It is optional to configure. It allows UE to prioritize MBS supporting cell and unicast can delivered in any freq, which should not be a problem. |
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# 6 Conclusions

**Rapporteur’s Observation: An LS to RAN1 is expected to discuss the UE capability details on the simultaneous broadcast/multicast/unicast reception on single/multiple cells/frequencies and on the non-serving cell after RAN2 determines the MBS reception requirements for IDLE/INACTIVE/CONNECTED.**

**Rapporteur’s Observation 2: An LS to SA2, SA4 and RAN3 is expected after RAN2 determines the required content in USD and SIB.**

**Rapporteur’s Observation 3: An LS to SA3 may also be needed to confirm the understanding on the security protection on MII reporting if RAN2 agrees to send MII unprotected before security activation.**

Based on the discussion in the above section, we propose the following outcomes:

**Potential easy agreements:**

**Other proposals:**

# 7 References

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