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).
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# 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 |
| MediaTek | Xuelong Wang | xuelong.wang@mediatek.com |
| Kyocera | Masato Fujishiro | masato.fujishiro.fj@kyocera.jp |
| OPPO | Shukun Wang | wangshukun@oppo.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. |
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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  |  |
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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  |  |
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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. |
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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.  |
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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  |  |
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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.  |
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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. |
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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-r13PCI-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  |  |
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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  |  |  |
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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  |  |
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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.
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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. |
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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.* |
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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. |
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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.  |
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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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