**3GPP TSG-RAN WG2 Meeting #115-e R2-210xxxx**

Online, Aug 16 – Aug 27, 2021

Agenda Item: 8.1.3.2

Source: Samsung

**Title: Report of [AT115-e][048][MBS] Notifications**

Document for: Discussion and decision

# Introduction

In this offline discussion, we invite companies to share their views on L3 Centric notifications, as described below.

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| * [AT115-e][048][MBS] Notifications (Samsung)   Scope: Treat R2-2108847. Reach agreements as far as possible, can also define FFSes when helpful.  Intended outcome: Agreements, report  Deadline: Wednesday W2 (CB if needed) |

Please share your inputs by Aug 24 UTC 1200 or earlier, to provide sufficient time to prepare final proposals.

Please also kindly provide your contact information in the table below.

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| Company | Name | Email |
| Samsung | Vinay Kumar Shrivastava | shrivastava@samsung.com |
| Ericsson | Mats Folke | mats.folke@ericsson.com |
| MediaTek | Xuelong Wang | Xuelong.wang@mediatek.com |
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# Discussions

## Broadcast Notifications

### DCI/RNTI for MCCH Change Notification

RAN1 made below agreement in RAN1#105-e meeting [23]. Agreement pertains to RNTI/DCI alternatives whereas specific contents of MCCH change notification are up to RAN2 to decide.

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| **Agreement:**  For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, study the following alternatives for MCCH change notification indication due to session start:   * Alt 1: Define a dedicated RNTI to scramble the CRC of a DCI indicating a MCCH change notification; * Alt 2: Use of a field in a DCI format scheduling a MCCH without a dedicated RNTI for MCCH change notification;   Other solutions are not precluded and it is also not precluded whether to support both Alt1 and Alt2.  **Conclusion:**  It is up to RAN2 to decide the specific contents of the MCCH change notification, e.g, whether notification only informs about session start, whether or not notification also informs about session modification/stop or whether or not the notification informs about any other information. |

Contributions [1][4][9][19][20][21] have addressed this issue. Contribution [1] proposes a dedicated RNTI to scramble the CRC of a DCI indicating a MCCH change notification. Contribution [4] specifies that RNTI for MCCH change notification is pending on RAN1 progress. Contribution [9] considers to allow both MCCH-RNTI and G-RNTI used for decoding the MBS configuration change notification in DM2 with either one of them can be used in different scenarios. Contribution [19] observes that MCCH-RNTI based change notification is more beneficial compared with dedicated RNTI for change notification, considering potential miss of notification and proposes to indicate preference to RAN1 by sending an LS. However, contribution [20] proposes no need for optimization regarding missing MCCH change notification irrespective of either of RAN1 alternatives. Contribution [21] thinks only one RNTI used for MCCH scheduling and change notification is sufficient.

Diverse views are expressed by different contributions. Rapporteur understands the decision lies with RAN1 and it has already identified two alternatives and also not precluded support of both. It is proposed:

**Proposal 1: RAN2 waits for RAN1’s final decision on which RNTI/DCI (i.e. Alt1 and/or Alt 2 as identified by RAN1) for MCCH change notification to be adopted.**

**Please provide your views on Proposal 1**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson | Y | We see no need to rush RAN1 in this and we are fine to wait for them. |
| MediaTek | Yes | We can wait for RAN1 conclusion |
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### Contents for MCCH Change Notification

RAN2 agreed following related to contents for MCCH change notification in previous meeting [24] and an LS was sent to RAN1 [25]

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| **Agreement:**   * Indication of an MCCH change due to modification of an ongoing session’s configuration (including session stop) is provided with an explicit notification from the network (provided that RAN1 confirms a separate bit for this purpose can be accommodated in the MCCH change notification DCI, in addition to a bit for session start notification). FFS on whether this notification can be reused for modification of other information carried by MCCH, if any. |

Contributions [1][4][6][9][12][17][21] have addressed this aspect. Contribution [1] proposes to define 8 bits in DCI for MCCH change notification with one bit corresponding to one MBS session Id or MBS session group. Contribution [17] suggests a new field of N bits long with each bit corresponding to one MBS type should be introduced to indicate the configuration information of which MBS type(s) is(are) modified to further reduce power consumption in UE. Contribution [4] considers whether modification bit can be reused for other information (i.e. neighbour cell information) carried by MCCH, depends on SA2 clarification regarding requirement for supporting broadcast via unicast PDU session in non-MBS cell. Contribution [6] proposes a common notification for modification of ongoing session’s configuration and/or modification of other information in MCCH. Contribution [9] has similar view. Contribution [21] also supports notification for neighbour cell list change, if it is supported.

Whereas contribution [12] assumes modified configuration should be applied from next modification period and start/stop should be applicable in same modification period. Hence, it proposes MCCH change notification with one bit for start/stop and another bit for session modification. It seems same view is not expressed by any other contribution.

It is proposed:

**Proposal 2: MCCH change notification can be reused for modification of other information carried by MCCH.**

**Further, for the other information carried by MCCH, MCCH change notification includes**

1. **Change of neighbour cell information (reuse of 2nd DCI bit of MCCH change notification) [Assuming support of neighbour cell information in MCCH]**
2. **Modification of configuration of MBS Session Id or Session group (extension of DCI bits of MCCH change notification)**
3. **Both**

**Please provide your views on Proposal 2 and the other information**

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| **Company** | **Agree [Y/N]** | **Other Information [a/b/c]** | **Comments** |
| Ericsson | N | - | It seems the FFS hinges on the presence of fields in DCI. Until RAN1 has decided those fields exist, we think this discussion can wait. |
| MediaTek | No |  | Can anyone clarify the scenario where there is frequent change of neighbour cell information for MBS? In general we would like to understand the motivation for MCCH change. |
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### UE Missing MCCH Change Notification

RAN2 has following agreement from previous meeting [24]

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| **Agreement:**   * FFS whether the possibility of UE missing an MCCH change notification needs to be addressed or can be left to UE implementation. |

Contributions [4][6][11][12][18][20][21] propose that it is up to UE implementation to resolve MCCH notification missing issue. Contribution [9] further specifies some UE actions when decoding errors are detected or no change of MCCH over pre-determined period of time. Further on this issue, contribution [19] also assumes that problem of missed notification is more relevant with dedicated RNTI based notification approach, as UE may not be able to distinguish the situation when the change notification was not received as the network did not send it or because a UE simply failed to detect. However, for this assumption it may need be further checked that even when there is no change, network may send change notification (with DCI bit(s) set to 0).

Majority of contributions have supported UE implementation based addressing for issue of missing MCCH change notification. It is proposed:

**Proposal 3: Do not specify any mechanism to address the possibility of UE missing an MCCH change notification and it is left to UE implementation.**

**Please provide your views on Proposal 3**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson | Y |  |
| MediaTek | Yes |  |
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## Multicast Session Group Notification

In previous meeting, RAN2 agreed the following for multicast session group notification approach [24].

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| **Agreements:**   * Use PCCH for Multicast activation notification (also for MBS supporting nodes). * Confirm that we convey the MBS session ID in the notification. * Use of paging in all (legacy) PO with PRNTI is the baseline assumption (can still discuss other variants) |

### PO for multicast session group notification

Contributions [3][7][16] propose to do paging for multicast activation notification in all legacy POs. [7] reasons that there is large N2 signalling overhead for providing subscribed UE information to RAN. Whereas contributions [6][14][19][21] propose to restrict the paging to the relevant legacy POs for UEs with deactivated multicast session(s) in order to save paging resources. Contribution [14] further proposes that list of UE Paging Identity of the UEs in the multicast group and corresponding Paging DRX should also be provided by AMF to the gNB for POs calculation. Contribution [19] further mentions that the signalling overhead is less as same paging related information can be applicable for multiple UEs and an LS can be sent to RAN3 and SA2 to request specifying the required network signaling. On other hand, contribution [18] argues that group ID is used as the UE identity with paging, i.e. the group ID determines the PO that is used for paging. Contribution [17] has similar view but suggests to use TMGI to determine the PO for the multicast session activation notification.

Majorly there seem two approaches (i.e. paging in all legacy POs and paging in relevant legacy POs) as proposed by contributions, RAN2 should discuss and decide on POs for paging for multicast activation notification.

It is proposed:

**Proposal 4: RAN2 to agree one of the following options:**

* **Option 1: Paging for multicast activation notification is used in all legacy POs.**
* **Option 2: Paging for multicast activation notification is used in the relevant legacy POs for the UEs with deactivated multicast session(s).**

**Please provide your views on Proposal 4**

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| **Company** | **Agree [Y/N]** | **POs alternatives [Option 1 / Option 2]** | **Comments** |
| Ericsson | N | - | Contributions highlight the impact on the network. Understanding network complexity is the expertise of RAN3 and therefore we think they should make this decision. |
| MediaTek |  | Option 2 | By the way, our understanding on the PO selection for Multicast activation notification is actually network implementation |
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**Proposal 5: If RAN2 agrees for paging only in the relevant legacy POs for the UEs with deactivated multicast sessions, RAN2 should send an LS to RAN3 and SA2 to request specifying required network signalling.**

**Please provide your views on Proposal 5**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson | Y | As this option has network impact it is important to let at least RAN3 know. But as argued in the previous question we think RAN3 should ultimately decide which option to choose. |
| MediaTek | - | It is not clear why SA2 should be involved in this discussion |
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### Paging message structure

Several contributions addressed the paging message structure for group activation notification as follows:

* Extend the paging message to include a new paging record list for MBS [2][3][16]
* RAN2 to discuss shared or separate paging message for MBS [5]
* Per UE paging record for UE to check its interested multicast session Id [7]
* Add new paging identity to the paging message to indicate multicast paging (e.g. MBS session ID) [15]
* The group ID (5G S-TMSI or an MBS session ID) is used as the UE identity for Paging [18]

Majority of contributions have considered same paging message for unicast and MBS. As remarked in some contributions, extending paging message to include a new paging record list can be a clean solution and does not impact legacy UE. Note that MBS running RRC CR [27] is also considering extension of unicast paging message.

It is proposed:

**Proposal 6: Confirm extending the unicast paging message to include a new paging record list for group activation notification of multicast sessions.**

**Please provide your views on Proposal 6**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson | Y | We think the 5G S-TMSI or an MBS session ID is used for UE identity, in which case the paging record list must be extended. |
| MediaTek | - | We are open for both new message and new paging message. Meanwhile we need probably more discussion to know the content within the said “new paging record list” |
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### Release of MBS Session

Contributions [3] [6] have addressed this issue. [3] proposes to discuss about avoiding unnecessary activation notification monitoring after multicast session is released by CN and if needed, sending a LS to SA2. Contribution [6] also proposes RAN2 to define a clear behaviour for UE with regard to multicast session release for RRC\_IDLE and RRC\_INACTIVE states. Some of the options mentioned include considering whether UE is expected to indefinitely monitor for activation notification or whether UE is provided with release notification or whether UE is provided with some specified or configured inactivity timer to terminate session or initiate a session release.

It seems relevant for RAN2 to clarify this issue for supporting RRC\_IDLE and RRC\_INACTIVE UEs. Hence it is proposed:

**Proposal 7: RAN2 to clarify the behaviour for RRC\_IDLE and RRC\_INACTIVE UEs for monitoring of activation notification after multicast session is released by CN. Some of the options for consideration are**

* **Option 1: UE is expected to indefinitely monitor for activation notification**
* **Option 2: UE is provided with release notification. If so, RAN2 should consult SA2**
* **Option 3: UE is provided with some specified or configured inactivity timer to terminate session or initiate a session release**

**Please provide your views on Proposal 7**

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| **Company** | **Agree [Y/N]** | **Alternatives [Option1 / Option 2 / Option 3]** | **Comments** |
| Ericsson | Y | Option 1 | Option 1 makes it sound like the UEs would monitor until the end of time. This is not the case. If the session ends, the network can page the relevant UEs and release the sessions with dedicated signalling. Option 2 and 3 sound like unnecessary optimizations which only two companies addressed. |
| MediaTek | Y | Option 1 | Option 1 is the normal PO monitoring behaviour |
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### Impact on legacy UEs or UE w/o MBS configuration

Contributions [2][3][5][8] have addressed the impact of paging for group notification on legacy UE or UE w/o MBS configuration

* The paging WUS can be used to notify the paging is MBS only paging or not and further notify which MBS session triggers the MBS paging [2]
* Send an LS to RAN1 to check the possibility of achieving this via reserved state ‘00’ of short message indicator, or any other potential means [3]
* The network uses unicast Paging to notify UEs RRC\_CONNECTED state through Short messages with associated Paging message [5]
* Add a Multicast activation notification indication in Short Message to indicate whether MBS session ID is contained in the corresponding paging message [8]

Short message based prior indication for multicast activation notification can be beneficial. However, this may need more discussion and analysis in RAN2. It is proposed:

**Proposal 8: RAN2 to agree that short message based indication for multicast activation notification in corresponding paging message is used.**

**Please provide your views on Proposal 8**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson | 1 bit: FFS  2 bits: No | It is beneficial to limit the impact on legacy UEs. The way the proposal is described in [8] we cannot understand how the 2-bit signal would work as a legacy UE would not comprehend the value "11" and would thus not decode the PDSCH. The paper states: "If the value of the indication is 11, all types of UEs will read the following corresponding paging message to acquire the MBS session id and/or UE-record-list."  As the number of bits in the Short message is very limited RAN2 should be very careful in using them. We think the 2-bit option should not be explored, but further discussion on *potentially* using 1 bit would be welcome. |
| MediaTek | Yes | Our understanding is that one code point should be used |
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### Impact on PRACH capacity

RAN2#113bis-e meeting made the below agreement

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| **Agreement:**   * It is FFS whether RAN2 needs to handle PRACH capacity issues due to group notifications |

Contributions [3][8][19][20] consider PRACH capacity issue due to group notifications as insignificant or unnecessary to handle. One reasoning is the distribution of the UEs across different POs for multicast group activation notifications. Whereas, [6][10][15][16][17][22] see PRACH capacity issue as real due to large number of UEs for multicast and have indicated different approaches like UAC, back off timer, providing more temporary resources, distributing access in time, spreading PRACH transmission in frequency/time domain etc.

There is no clear majority as (4/10) contributions see PRACH capacity issue due to group notifications as insignificant while (6/10) contributions support addressing PRACH capacity issue. RAN2 should discuss this issue.

It is proposed:

**Proposal 9: RAN2 to agree on one of the following for addressing of PRACH capacity issue due to group notification.**

1. **No need to address PRACH capacity issue**
2. **Need to address PRACH capacity issue**

**Please provide your views on Proposal 9**

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| **Company** | **Agree [Y/N]** | **Alternatives [a / b]** | **Comments** |
| Ericsson | Y | A | We think this is not important at the moment. RAN2 can consider it as second priority. |
| MediaTek | Y | a | Agree with Ericsson |
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### Access Control

Contributions [6][10][13][22] consider MBS specific UAC approach. Further, [10] specifies two options for configurations viz. Option 1: The mapping table between the MBS session and AC/AI for the access control is defined in NAS/CT spec or configured by NW and Option 2: The MBS session specific ACB parameters is broadcasted in SIB1. Whereas [2] proposed that no UAC is applied for RRC connection setup/resume for MBS reception if triggered by MBS paging. Contribution [20] sees no need to introduce new Access Categories and new establishment cause for multicast. Contribution [10] proposes MBS specific establishment cause and resume cause; whereas contributions [11][13][14] propose establishment cause and resume cause as “MT-Access”. Contribution [17] discusses the collision scenario where N multicast activation notifications and M=0/1 unicast paging collide for a UE and the related solution is suggested.

Many companies think considering network congestion, MBS specific UAC approach can be beneficial. RAN2 should discuss this aspect.

It is proposed:

**Proposal 10: RAN2 to agree to introduce MBS specific UAC.**

**Please provide your views on Proposal 10**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson |  | RAN2 should at least investigate the area if there are any issues. We are concerned if MC-PTT UEs would be paged and use mt-access as establishment cause for example. Not applying UAC in combination with a crude paging mechanism does not seem viable. |
| MediaTek |  | We did not see the need to introduce MBS specific UAC. The motivation should be clarified |
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**Proposal 11: RAN2 to define the establishment cause and resume cause for MBS upon multicast activation notification.**

**Please provide your views on Proposal 11.**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson |  | We think this can be FFS. |
| MediaTek |  | We did not see the need to define the establishment cause and resume cause for MBS upon multicast activation notification. The motivation should be clarified |
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### Paging Repetitions

Contributions [6][10] have addressed potential loss of activation notification for UE. Contribution [6] proposes that paging based group notification approach includes paging repetitions to support UEs which may miss session notification. Some examples given include temporary service or coverage loss, notification decoding issue, MUSIM switching gap. Contribution [10] considers the scenario wherein the multicast session activation notification is sent when UE is outside the multicast service area, UE will miss the multicast session activation notification and cannot receive the multicast service after coming into the multicast service area

Only two contributions have addressed this issue. RAN2 should further discuss on the potentiality of issue and need for addressing the same.

It is proposed:

**Proposal 12: RAN2 to agree there is a need for reliability and robustness of notification approach (e.g. paging repetitions) for addressing scenario of potential notification loss for UEs.**

**Please provide your views on Proposal 12. Companies can also indicate in the comments how the scenario should be addressed, if any.**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson | N | A UE can go out of coverage at any time. Wouldn't this imply that the network would need to constantly page the UEs informing them that a session as started? With the selected paging solution which uses all capacity we don't see how this can work.  If the UE is configured with a dedicated PUCCH feedback, the absence of feedback can be used as an indication that the UE did not join the session. |
| MediaTek | No | Paging Repetitions can be subject to network implementation |
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### Prioritize cell with MBS/multicast support

Unicast paging is used for a node that does not support MBS. Contribution [3] sees some benefit to prioritize the cells with multicast support (or MBS support) during reselection, to support mobility of UE monitoring multicast activation notification. It may involve some broadcast signalling and some modification to reselection procedure.

It is proposed:

**Proposal 13: RAN2 to agree there is a need to prioritize a cell with MBS/multicast support for idle/inactive UEs that monitor multicast activation notification.**

**Please provide your views on Proposal 13. Companies can also indicate in the comments how this prioritization of cell with multicast support (or MBS support) during reselection should be addressed, if any.**

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| **Company** | **Agree [Y/N]** | **Comments** |
| Ericsson | Y | Wouldn't the agreements made yesterday point in this direction, even though they were made for broadcast? |
| MediaTek | Yes |  |
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# Conclusion

**To be updated**: Based on the discussion in the previous sections we propose the following:

# Reference

1. R2-2107015, Discussion on MCCH change notification, OPPO
2. R2-2107016, Group notification and unicast paging for MBS activation, OPPO
3. R2-2107036, On Multicast Activation Notification, CATT, CBN
4. R2-2107037, Open Issues on MCCH Change Notification, CATT
5. R2-2107051, Notification for Multicast activation, MediaTek Inc.
6. R2-2107235, Considerations on Notifications for Multicast and Broadcast, Samsung
7. R2-2107340, Notifications for NR MBS, ZTE, Sanechips
8. R2-2107365, Discussion on multicast activation notification, Spreadtrum Communications
9. R2-2107530, Further discussion on the MBS group notification in DM2, Futurewei
10. R2-2107578, Access Control for the MBS Service Reception, Apple
11. R2-2107799, Discussion on MBS Notification and MCCH, vivo
12. R2-2107876, MCCH information acquisition, LG Electronics Inc.
13. R2-2107877, RRC connection establishmentresume initiated by group paging, LG Electronics Inc
14. R2-2107922, Notification for Multicast activation, Lenovo, Motorola Mobility
15. R2-2107982, MBS session activation and group paging, Nokia, Nokia Shanghai Bell
16. R2-2108001, Group notification for Delivery mode 1 in NR MBS, Kyocera
17. R2-2108035, Discussion on notificatons for NR MBS, CHENGDU TD TECH LTD.
18. R2-2108078, Aspects on notification, Ericsson
19. R2-2108202, Notifications for Multicast and Broadcast, Huawei, HiSilicon
20. R2-2108455, Multicast activation notification and MCCH change notification, Intel Corporation
21. R2-2108523, Discussion MBS notification schemes, CMCC
22. R2-2108800, PRACH congestion due to multicast paging, Xiaomi Communications
23. Draft Report of 3GPP TSG RAN WG1 meeting #105-e v0.2.0
24. Draft Report of 3GPP TSG RAN WG2 meeting #114-e v2
25. R2-2106544, LS on update for MCCH design
26. R2-2108847, Summary of L3 Centric Notifications (Samsung)
27. [R2-2108205](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_115-e\Docs\R2-2108205.zip), 38.331 running CR for NR MBS, Huawei, HiSilicon