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

Online, Aug 16 – Aug 27 2021

**Agenda item: 8.1.3.2**

**Source: Samsung**

**Title: Summary of L3 Centric Notifications**

**Document for: Discussion and Decision**

# Introduction

This document is targeted to provide a summary of contributions on notification aspects for Broadcast and Multicast. Below-listed 22 contributions, submitted under AI 8.1.3.2 for RAN2#115-e meeting, addressing the issues and impacts of notifications for Multicast and Broadcast, and potential solutions are summarized:

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

Summary also refers to these other sources and documents:

1. Draft Report of 3GPP TSG RAN WG1 meeting #105-e v0.2.0
2. Draft Report of 3GPP TSG RAN WG2 meeting #114-e v2
3. R2-2106544, LS on update for MCCH design

# Summary on Notifications for Multicast and Broadcast

## Broadcast Session Notification

### 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.

|  |
| --- |
| **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.

**Rapporteur’s Summary:**

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. Therefore, 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.**

### 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]

|  |
| --- |
| **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.

**Rapporteur’s Summary:**

(3/6) contributions supported indication for modification for other information in MCCH. While 1 other contribution consider dependency on SA2 for need of other information in MCCH (i.e. neighbour cell information). However, it does not consider neighbour cell information for cell reselection for service continuity. Other 2 contributions have not addressed this point specifically. It is proposed that RAN2 should discuss and confirm FFS part of previous agreement related to other information in MCCH.

**Proposal 2: MCCH change notification can be reused for modification of other information. The possible candidate of the other information may include:**

**Option 2.1: each MBS type (group) has a bit to indicate whether or not the corresponding MBS type (group) has updated configuration information.**

**Option 2.2: change of neighbour cell list is indicated on MCCH**

**Option 2.3: others**

### UE Missing MCCH Change Notification

RAN2 has following agreement from previous meeting [24]

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

**Rapporteur’s Summary:**

Majority of contributions have supported UE implementation based addressing for issue of missing MCCH change notification. Accordingly, 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.**

## Multicast Session Group Notification

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

|  |
| --- |
| **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 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.

**Rapporteur’s Summary:**

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.

**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 POs for the UEs with deactivated multicast session(s). How to calculate the relevant POs can be selected between:** 
  + **Option 2.1: use TMGI to calculate the PO.**
  + **Option 2.2: us group 5G S-TMSI to calculate the PO**
  + **Option 2.2: others**

**Proposal 5: If RAN2 agrees for paging only in the relevant POs for the UEs, RAN2 should send an LS to RAN3 and SA2 to request specifying required network signalling.**

### 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]

An example for paging message extension is given in [2]

|  |
| --- |
| Paging ::= SEQUENCE {  pagingRecordList PagingRecordList OPTIONAL, -- Need N  lateNonCriticalExtension OCTET STRING OPTIONAL,  nonCriticalExtension Paging-v17xy-IEs OPTIONAL  }  Paging-v17xy-IEs ::= SEQUENCE {  pagingRecordListMBS-r17 PagingRecordListMBS-r17 OPTIONAL, -- Need N  nonCriticalExtension SEQUENCE{} OPTIONAL  }  PagingRecordListMBS-r17 ::= SEQUENCE (SIZE(1..maxNrofTMGIPerCell)) OF PagingRecordMBS-r17  PagingRecordMBS-r17 ::= SEQUENCE {  MBS-Identity TMGI,  ...  } |

**Rapporteur’s Summary:**

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. Hence, it is proposed RAN2 should discuss and confirm if this can be a potential paging message structure.

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

### 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.

**Rapporteur’s Summary:**

Only two contributions have addressed this issue. However, it seems relevant for RAN2 to discuss and clarify this issue for supporting RRC\_IDLE and RRC\_INACTIVE UEs. Hence it is proposed:

**Proposal 7: RAN2 to discuss and 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**

### 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]

**Rapporteur’s Summary:**

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

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

### Impact on PRACH capacity

RAN2#113bis-e meeting made the below agreement

|  |
| --- |
| **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.

**Rapporteur’s Summary:**

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 online.

**Proposal 9: RAN2 to discuss whether PRACH capacity issue due to group notifications needs to be handled.**

### 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.

**Rapporteur’s Summary:**

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

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

**Proposal 10a: RAN2 to discuss the collision scenario where N multicast activation notifications and M=0/1 unicast paging collide.**

**Proposal 11: RAN2 to discuss and define the establishment cause and resume cause upon multicast activation notification.**

### 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

**Rapporteur’s Summary:**

Only two contributions have addressed this issue. RAN2 should further discuss on the potentiality of issue and need for addressing the same. It is marked as open issue for further discussion.

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

### 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.

**Rapporteur’s Summary:**

Only one contribution has raised this issue. Apparently, it is also not priority issue to address. It is marked as open issue for further discussion.

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

# Conclusion

Contribution is summarized as follows:

[Proposals P1-P3 and P6 may be easy agreeable, P4, P5, P7-P11 may need online discussion and P12-P13 may need further discussions]

**Proposals for online discussion**

Broadcast Session Notification

**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.**

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

**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.**

Multicast Session Group Notification

**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 POs for the UEs with deactivated multicast session(s).**

**Proposal 5: If RAN2 agrees for paging only in the relevant POs for the UEs, RAN2 should send an LS to RAN3 and SA2 to request specifying required network signalling.**

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

**Proposal 7: RAN2 to discuss and 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**

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

**Proposal 9: RAN2 to discuss whether PRACH capacity issue due to group notifications needs to be handled.**

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

**Proposal 11: RAN2 to discuss and define the establishment cause and resume cause upon multicast activation notification.**

**Open issues for further discussion**

Multicast Session Group Notification

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

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