**3GPP TSG-RAN WG2 Meeting #113bis-eR2-210xxxx**

**Electronic, 12th - 20th April, 2021**

Agenda Item: 8.1.3

Source: Huawei, HiSilicon

**Title: Report of offline discussion: [AT113bis-e][032][MBS17] MCCH scheduling and Change notification (Huawei)**

Document for: Discussion and decision

# Introduction

This documents aims at gathering and summarizing companies views for the following offline discussion:

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| * [AT113bis-e][032][MBS17] MCCH scheduling and Change notification (Huawei)

Scope: Progress remaninig proposals from R2-2103909 to reach agreements and FFS points. Make an LS to RAN1 based on agreements and provided comments (e.g. consider whether some info on MTCH need to be provided).  Intended outcome: Report, Agreements, Approved LS out.  Deadline: Report/Agreements Friday April 16, LS out Monday April 19 1800 UTC |

Based on the e-mail discussion summary in [1], the following agreements were made during an online session of RAN2#113bis-e meeting:

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| * The MCCH transmission window is defined by MCCH repetition period, MCCH window duration and radio frame/slot offset.
* New RNTI is defined for scheduling MCCH.
* The concept of MCCH transmission window, similar to the one used for LTE SC-PTM, is used for NR MCCH scheduling. The exact parameters to define the window are FFS (discussed in the following proposals).
* Common search space is needed for MCCH scheduling. RAN2 should request RAN1 to discuss the details of CSS for MCCH.
* R2 assumes PDCCH occasions for MCCH search space are associated with SSBs in a pre-defined manner so that the UE can receive MCCH scheduling on PDCCH occasions according to its detected SSB.
* R2 assumes, In case searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the mapping between PDCCH occasions and SSBs is the same as for SIB1.
* R2 assumes that If common search space other than searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the PDCCH monitoring occasions for MCCH message which are not overlapping with UL symbols are sequentially numbered from one in the MCCH transmission window and mapped to SSBs using the similar rule as defined for OSI in TS 38.331.
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Previous RAN2 and RAN1 agreements relevant for this discussion are also copied below for convenience:

* **RAN2#113e**

Agreements

* The two-step based approach (i.e. BCCH and MCCH) as adopted by LTE SC-PTM is reused for the transmission of PTM configuration for NR MBS delivery mode 2.
* Assume it is possible to reuse LTE SC-PTM mechanism for the CONNECTED UEs to receive the PTM configuration for NR MBS delivery mode 2, i.e. broadcast based manner.
* Assume that MCCH change notification mechanism is used to notify the changes of MCCH configuration due to session start for delivery mode 2 of NR MBS (other cases FFS, if any).
* **RAN1-103e and RAN1-104e**

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|  Agreements**:** For RRC\_IDLE/RRC\_INACTIVE UEs, CSS is supported for group-common PDCCH.* FFS: reuse current CSS type, define a new CSS type, etc.
* FFS other details.

Agreements: For RRC\_IDLE/RRC\_INACTIVE UEs, define/configure common frequency resource(s) for group-common PDCCH/PDSCH.* the UE may assume the initial BWP as the default common frequency resource for group-common PDCCH/PDSCH, if a specific common frequency resource is not configured.
* FFS: the relation of the common frequency resource(s) (if configured) and initial BWP.
* FFS: whether to configure one/more common frequency resources
* FFS: configuration and definition details of the common frequency resource

Agreements**:** For RRC\_IDLE/RRC\_INACTIVE UEs, CSS is supported for group-common PDCCH.* FFS: reuse current CSS type, define a new CSS type, etc.
* FFS other details.

Agreements: For RRC\_IDLE/RRC\_INACTIVE UEs, a CORESET can be configured within the common frequency resource for group-common PDCCH/PDSCH. CORESET0 is used by default if the common frequency resource for group-common PDCCH/PDSCH is the initial BWP and the CORESET is not configured.* FFS: configuration details of the CORESET for group-common PDCCH/PDSCH

Agreement:For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, the UE may assume that group-common PDCCH/PDSCH is QCL’d with SSB.* It is up to UE implementation whether UE monitors monitoring occasions corresponding to all SSB indexes or monitoring occasions corresponding to a subset of all SSB indexes.
* FFS: association rules between SSB indexes and UE monitoring occasions.
* FFS: group-common PDCCH/PDSCH is QCl’d with TRS if configured

Agreement:For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, further study the following cases of a configured/defined specific common frequency resource (CFR) for group-common PDCCH/PDSCH, and identify which case(s) will be supported:* [Case E] the case where a CFR is defined based on a configured BWP.
	+ In particular, study the following:
		- whether a configured BWP for MBS is needed or not.
		- whether BWP switching is needed or not.
	+ In this study, the configured BWP has the following properties:
		- The configured BWP is different than the initial BWP where the frequency resources of this initial BWP are configured smaller than the full carrier bandwidth.
		- The CFR has the frequency resources identical to the configured BWP.
		- The configured BWP needs to fully contain the initial BWP in frequency domain and has the same SCS and CP as the initial BWP.
	+ Note: The configured BWP is not larger than the carrier bandwidth
* the case where the initial BWP fully contains the CFR in the frequency domain.
	+ In this study the following sub-cases are considered:
		- [Case B] A CFR with smaller size than the initial BWP, where the initial BWP has the same frequency resources as CORESET0. In this case the CFR has the frequency resources confined within the initial BWP and have the same SCS and CP as the initial BWP.
		- [Case D] A CFR with smaller size than the initial BWP, where the initial BWP has the frequency resources configured by SIB1. In this case the CFR has the frequency resources confined within the initial BWP and have the same SCS and CP as the initial BWP.
	+ In particular, study the following:
		- Whether the considered two options with a CFR with smaller size than the initial BWP are needed or not for MBS.
* the case where the initial BWP has same size as the CFR in the frequency domain.
	+ In this study the following two sub-cases are considered:
		- [Case A] A CFR with the same size as the initial BWP, where the initial BWP has the same frequency resources as CORESET0. In this case the CFR has the same frequency resources and same SCS and CP as the initial BWP.
		- [Case C] A CFR with same size as the initial BWP, where the initial BWP has the frequency resources configured by SIB1. In this case the CFR has the same frequency resources and same SCS and CP as the initial BWP.
	+ In particular, study the following:
		- Whether the considered two options with a CFR with the same size as the initial BWP are needed or not for MBS.
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In Section 3, companies are requested to raise any issues with the remaining proposals from [1].

In Section 4, companies are rquested to provide their views on the additional contents of an LS to RAN1.

# Company contact details

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| Company | Email |
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# Remaining proposals from the “[Post113-e][053][MBS17] MCCH scheduling and MCCH change notification” e-mail discussion

The following proposals, which result from the “[Post113-e][053][MBS17] MCCH scheduling and MCCH change notification” e-mail discussion as summarized in [1], were not discussed during the online session due to lack of time:

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| **Proposal 7: Working assumption (pending RAN1 disucssions and decisions): the transmission bandwidth for MCCH shall be configured in the way allowing the UE to monitor Paging/SI and to receive MCCH simultaneously without BWP switch.** **Proposal 9: Request RAN1 to discuss the details of the configuration of the bandwidth for MCCH reception.** **Proposal 10: As a baseline, a new RNTI different from MCCH-RNTI and P-RNTI is introduced for MCCH change notification and no additional information (such as the 8 bits bitmap in LTE) is needed. The details of DCI design can be left for RAN1 to discuss.****Proposal 11: There is no change notification for session stop or MCCH message modification for ongoing services and the UE which is receiving MBS session is required to monitor at least one MCCH repetition period in every MCCH modification period.****Proposal 12: The modification period is defined for NR MCCH and NR MCCH contents are only allowed to be modified at each modification period boundary.****Proposal 13: The updated MCCH message should be sent in the same MCCH modification period where the change notification is sent.** |

The goal is to attempt agreeing them via the offline discussion. Therefore, companies are requested to indicate whether any of the above proposals is not agreeable to them. Companies are requested to consider other companies views and the summary of the e-mail discussion as provided in [1] .

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| **Company** | **Objected proposal** | **Clarification and alternative proposal** |
| TCL Communication LTD. | Proposal 10 | In our view, we should not preclude the support of additional information (i.e., 8 bits bitmap option) since this is related to whether multiple MCCHs are to be supported or not which is agreed to be handled later during the last email discussion. In addition, we also see that even if single MCCH (i.e., one MCCH with diverse instances of modification periods and repetition periods, etc.) is agreed to handle the diverse scheduling requirements of different MBS service, the additional bitmap may also be required to differentiate the notification changes configurations of different MCCH instances configured for different MBS services. **Alternative 1:** P10: As a baseline, a new RNTI different from MCCH-RNTI and P-RNTI is introduced for MCCH change notification. The details of DCI design can be left for RAN1 to discuss and the details of supporting additional information (e.g., 8 bit bitmap) is FFS. |
| Qualcomm | P7, P10,P11 | **P7:** We think this can be discussed after RAN1 progress. It depends on CFR discussion in RAN1, whether it is part of Initial BWP, same as BWP or seprate from Initial BWP, how UE can monitor both Initial BWP and separate MBS BWP if they are not overlapping etc.**P10:** for Multiple MCCH, we think multiple bits in DCI can be used (option 2) or use seprate RNTIs for each MCCH (option 1). We should not restrict design to single MCCH only. Alternatively, we can agree to change proposal to “As a baseline, a new RNTI different from MCCH-RNTI and P-RNTI is introduced for MCCH change notification ~~and no additional information (such as the 8 bits bitmap in LTE) is needed.~~ The details of DCI design can be left for RAN1 to discuss.”**P11:** we prefer Option 3 insted of Option 1. MCCH change notification be used to indicate Session Start/Stop/Change and UE is not required to read MCCH all the time when receiving Broadcast service and helps UE to save some power and processing resources. |
| MediaTek | P7, P10 | We have some comments on both P7 and P10.. P7: Currently RAN1 discusses CFR for MBS reception. However from RAN2 perspective, we see no harm to show RAN2 view to RAN1: no BWP switching is expected when the UE simultenously monitor Paging/SI and receive MCCH. Then we agree to keep P7 as is.  P10: We agree with Qualcomm on the wording update to make it open to support multiple MCCHs. In any case, the details of DCI design is up to RAN1. |
| CATT | P7,P10 | P7:it is a pure RAN1 issue and is under discussion by RAN1,we do not see the necessaity to make such working assumption in RAN2.P10:Agree with QC and MTK to remove the wording “**no additional information (such as the 8 bits bitmap in LTE) is needed,** **The details of DCI design can be left for RAN1 to discuss.**”How to use the bitmap in DCI design may also need to be decided by RAN2. |

# Details of the LS to RAN1

In addition to progressing the proposals as in Section 2, the intention of the offline discussion is to agree on the contents of the LS to be sent to RAN1. The proposals themselves will have to be obviously included, but it was also raised during the discussion that RAN1 would benefit from additional explanations about the overall MBS framework and the channel structure of MBS as agreed in RAN2 so far. Considering the companies comments and overall RAN2 progress, the rapporteur believes, RAN1 would benefit from the explanations on the following points:

* MBS delivery modes as being defined by RAN2, i.e. DM1/DM2.
* MBS channel definitions

Some proposals were already included draft LS(s) provided in [2] and in the Annex of [3]. Based on these and based on the online comments, the rapporteur would like to suggest the following explanations to be included in RAN1 LS.

**Logical channel definitions:**

* RAN2 defines two types of logical channel used for MBS:
	+ MTCH: A point-to-multipoint downlink channel for transmitting traffic data from the network to the UE using MBS transmission. This channel is utilized for delivery of MBS data for both multicast and broadcast sessions.
	+ MCCH: A point-to-multipoint downlink channel used for transmismitting MBS control information from the network to the UE, for one or several MTCH(s) associated with broadcast session(s).

**Question 1: Do you agree with the above high-level, working definitions of MTCH and MCCH.**

*NOTE: These definitions are intended for inclusion in RAN1 LS, but if agreed could be also captured in the running stage-2 CR.*

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| **Company** | **Yes/No** | **If no, please raise you concerns and propose alternative wording** |
| TCL Communication LTD. | No | The difiniaiton give some sort of indication or sense that the MTCH is shared channel for delivery of both multicast and broadcast sessions at the same time. Alternative: MTCH: A point-to-multipoint downlink channel for transmitting traffic data from the network to the UE using MBS transmission. This channel is utilized for delivery of MBS data for multicast or broadcast session |
| TD Tech&Chengdu TD Tech | Yes | Comments：1. Delivery modes 1 and 2 need to be defined before MCCH an MTCH.
2. MTCH is traffic channel while MCCH is control channel.
3. MTCH is used for both multicast session and broadcast session.
4. Hope the definitions can be updated as below.

MTCH: A point-to-multipoint downlink traffic channel for transmitting MBS session data from the network to the UE using Point-to-Multipoint mode.MCCH: A point-to-multipoint downlink control channel used for transmismitting MBS session control information from the network to the UE using Point-to-Multipoint mode, for one or several MTCH(s) associated with delivery mode 2. |
| Qualcomm | Yes but | It is ok to indicate logical channel definitions and we can also indicate “FFS: support for multiple MCCH”. The reason to include this FFS is to let RAN1 DCI impacts if any. |
| MediaTek | Yes | Meanwhile, we also agree with Qualcomm to make the support for multiple MCCHs as FFS |
| CATT | Generally Yes,but | For MCCH,it is not decided yet whether it can be used for the group notification of multicast session activation,which is under discussion offline.so the wording “associated with broadcast session(s)” is accurate at least for now. |

**Delivery modes definitions:**

* RAN2 is working on two MBS delivery modes (DM1 and DM2), summarized as follows:
	+ DM1 is used for multicast session delivery and is applicable to UEs in RRC Connected state (FFS UEs in RRC Inactive). The UE is provided with MBS configuration (including MTCH configuration, e.g. G-RNTI) using dedicated RRC signalling when the UE is in RRC Connected state. This delivery mode does not utilize MCCH channel.
	+ DM2 is used for broadcast session (FFS multicast session) delivery and is applicable to UEs in all RRC states. The UE is provided with MBS configuration using common RRC signalling in a two-step based approach, i.e. a new SIB for MBS will be used to provide the transmission configuration of MCCH. Based on the MCCH configuration received via SIB, UE reads MCCH, which carries configuration of MTCH(s), e.g. G-RNTI. The MTCH configuration acquired from MCCH is applied by the UE for MTCH reception regardless of UE’s RRC state (for RRC\_CONNECTED state, the possibility to receive MTCH can be further subject to UE’s configuration and capabilities).

**Question 2: Do you agree to include the above description of DM1 and DM2 in RAN1 LS?**

*NOTE: DM descriptions above are intented only as clarification for RAN1 LS, there is no intention to agree them as official definitions.*

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| **Company** | **Yes/No** | **If no, please raise you concerns and propose alternative wording** |
| TCL Communication LTD. | Yes/maybe |  |
| TD Tech&Chengdu TD Tech | Yes | Some comments on DM1 and DM2:1. DM1 and DM2 are defined before MTCH and MCCH are defined because MCCH is associated with DM2.
2. For DM1, how to delivery MBS session control information has no agreement.
3. Multicast uses DM1. Wheter or not multicast can use DM2 is not decided yet.
4. Hope the definitions can be updated as below.
	* DM1 is used for multicast session delivery and is applicable to UEs in RRC Connected state (FFS UEs in RRC Inactive). DM1 can use both the PTM bearer and the PTP bearer for multicast session delivery.
	* DM2 is used for broadcast session (FFS multicast session) delivery and is applicable to UEs in all RRC states. DM2 can only use PTM bearer for broadcast session delivery. An MBS specific SIB is introduced to send the MCCH configuration information (FFS: the MCCH change notification related configuration information). MCCH is used to send the PTM bearer configuration information of each MBS session with DM2.
 |
| Qualcomm | May be Yes |  |
| MediaTek | Yes |  |
| CATT | Generally Yes,but | At least for now,regarding DM1,we can not say“This delivery mode does not utilize MCCH channel”.As it is not decided yet which channel(MCCH or PCCH) is used for the group notification of multicast session(i.e. via DM1) activation to UE in idle/inactive. |

Finally, companies are requested to raise any other agreements or issues related to this discussion which they think RAN1 should be informed about.

**Question 3: Are there any other agreements or issues related to MCCH/MTCH delivery that RAN2 should inform RAN1 about at the moment?**

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| **Company** | **Comments** |
| TD Tech&Chengdu TD Tech | 1. MBS session related RNTI: G-RNTI, CS-G-RNIT (for SPS PDSCH), MCCH-RNTI, MCCH-N-RNTI for MCCH change notification, (FFS: group paging for multicast service in RRC\_INACTIVE state?)
 |
| Qualcomm | But we need to inform RAN1 about this agreement as well.* Chair: RAN2 will prioritize Active Multicast support in RRC Connected mode in Rel-17. If time permits Multicast support for RRC Inactive can be considered later (once connected mode Multicast solution, and Broadcast solution has become more mature).
 |

# Conclusion

TBD

# References

1. R2-2103909, Report of e-mail discussion: [Post113-e][053][MBS17] MCCH scheduling and MCCH change notification (Huawei)
2. R2-2103706, LS on delivery mode 2 transmission *(draft)*, CMCC
3. R2-2104509, Report of e-mail discussion: [Post113-e][053][MBS17] MCCH scheduling and MCCH change notification (Huawei)

# Annex – Draft LS to RAN1

**3GPP TSG-RAN WG2 Meeting #113bis-e R2-210xxxx**

**E-meeting, 12th – 20th April 2021**

**Title: [DRAFT] LS on MCCH design**

**Response to:**

**Release: Release 17**

**Work Item: NR\_MBS-Core**

**Source: Huawei [To be RAN2]**

**To: RAN1**

**Contact person: Dawid Koziol**

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**Send any reply LS to: 3GPP Liaisons Coordinator,** **mailto:3GPPLiaison@etsi.org**

**Attachments:** **N/A**

1 Overall description

RAN2 discussed the details of broadcast session delivery and the following agreements were made during RAN2#113-e meeting:

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| * **Both idle/inactive UEs and connected mode UEs can receive MBS services transmitted by NR MBS delivery mode 2 (Broadcast service as already agreed, TBD other). The ability for connected mode UEs to receive this may depend on the network provisioning of the service (e.g. which freq), UE connected mode configuration and UE capabilities.**
* **The two-step based approach (i.e. BCCH and MCCH) as adopted by LTE SC-PTM is reused for the transmission of PTM configuration for NR MBS delivery mode 2.**
* **Assume it is possible to reuse LTE SC-PTM mechanism for the CONNECTED UEs to receive the PTM configuration for NR MBS delivery mode 2, i.e. broadcast based manner.**
* **Assume that MCCH change notification mechanism is used to notify the changes of MCCH configuration due to session start for delivery mode 2 of NR MBS (other cases FFS, if any).**
 |

The “two-step based approach” mentioned above means that a new SIB for MBS will be used to provide the transmission configuration of MCCH. Based on the MCCH configuration received via SIB, UE will read MCCH, which will carry configurations of MTCHs carrying data of different MBS services, e.g. G-RNTI. The MTCH acquired from MCCH is applied by the UE for MTCH reception regardless of UE’s RRC state (for RRC\_CONNECTED state, the possibility to receive MTCH can be further subject to UE’s configuration and capabilities).

During RAN2#113bis-e meeting, RAN2 discussed further aspects of MCCH scheduling and MCCH change notification leading to the following agreements with RAN1 impacts [TO BE CONFIRMED BASED ON THE DISCUSSION DURING THE MEETING]:

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| * **Common search space is needed for MCCH scheduling. RAN2 should request RAN1 to discuss the details of CSS for MCCH.**
* **PDCCH occasions for MCCH search space are associated with SSBs in a pre-defined manner so that the UE can receive MCCH scheduling on PDCCH occasions according to its detected SSB.**
* **In case searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the mapping between PDCCH occasions and SSBs is the same as for SIB1.**
* **If common search space other than searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the PDCCH monitoring occasions for MCCH message which are not overlapping with UL symbols are sequentially numbered from one in the MCCH transmission window and mapped to SSBs using the similar rule as defined for OSI in TS 38.331.**
* **Working assumption (pending RAN1 disucssions and decisions): the transmission bandwidth for MCCH shall be configured in the way allowing the UE to monitor Paging/SI and to receive MCCH simultaneously without BWP switch.**
* **Request RAN1 to discuss the details of the configuration of the bandwidth for MCCH reception.**
* **As a baseline, a new RNTI different from MCCH-RNTI and P-RNTI is introduced for MCCH change notification and no additional information (such as the 8 bits bitmap in LTE) is needed. The details of DCI design can be left for RAN1 to discuss.**
 |

The agreements made by RAN2 require further discussions in RAN1. In particular, RAN2 would like to request RAN1 to investigate and provide feedback on the following aspects, considering the above agreements made by RAN2:

* + - 1. Details of Common Search Space design for MCCH channel, e.g. is SS#0 allowed to be configured as a search space for MCCH, is search space other than SS#0 allowed to be configured as a search space for MCCH.
			2. Details of the allowed transmission bandwidth/BWP configurations for MCCH transmission.
			3. Details of the DCI design for carrying MCCH change notifications.

2 Actions

**To RAN1 group:**

**ACTION:**

RAN2 respectfully asks RAN1 to take RAN2 agreements into account and discuss RAN1 aspects of MCCH as requested above.

3 Dates of next RAN2 meetings

TSG-RAN2 Meeting #114-e May 19 – May 27, 2021 E-Meeting