**3GPP TSG RAN WG1 #108-e R1-220XXXX**

**e-Meeting, February 21st – March 3rd, 2022**

**Agenda item: 8.12.3**

**Source:** Moderator (BBC)

**Title:** Feature lead summary #1 on RAN basic functions for broadcast/multicast for UEs in RRC\_IDLE/ RRC\_INACTIVE states

**Document for:** Discussion and Decision

# Introduction

During TSG RAN #86, 3GPP approved a Release-17 Work Item (WI) to introduce support for Multicast and Broadcast Services in NR (NR MBS) [1]. The NR MBS WI includes the following objective:

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| * Specify RAN basic functions for broadcast/multicast for UEs in RRC\_IDLE/ RRC\_INACTIVE states [RAN2, RAN1]:
	+ Specify required changes to enable the reception of Point to Multipoint transmissions by UEs in RRC\_IDLE/ RRC\_INACTIVE states, with the aim of keeping maximum commonality between RRC\_CONNECTED state and RRC\_IDLE/RRC\_INACTIVE state for the configuration of PTM reception. [RAN2, RAN1].

Note: the possibility of receiving Point to Multipoint transmissions by UEs in RRC\_IDLE/ RRC\_INACTIVE states, without the need for those UEs to get the configuration of the PTM bearer carrying the Broadcast/Multicast service while in RRC CONNECTED state beforehand, is subject to verification of service subscription and authorization assumptions during the WI. |

As announced by the Chair, the email discussion details with check points for agreements are as follows:

[108-e-R17-MBS-03] Email discussion for maintenance on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs – David (BBC)

* 1st check point: February 25
* Final check point: March 3

The aim for this meeting is to try to close all critical issues so far identified for this AI. In addition, discussions on issues with additional RRC impact need to be completed before the end of the first week of the meeting (i.e., 25 Feb).

Given the early stage of maintenance phase, agreements will be made by either:

* Agreement (without a corresponding TP) to be implemented by spec editors
* Endorsing a TP as recommendation to the spec editors
* In some cases, with an agreement + TP

Section 2 includes open issues for discussion. Section 3 includes a list of issues that may or may not be critical for the maintenance of AI 8.12.3, so companies are invited to provide their views on which issues are critical and should therefore be discussed at this meeting. After a short discussion (1-2 days) issues that are considered critical can also be included for discussion at this meeting. Section 4 includes issues that are considered non-critical and it is proposed that these are not discussed at this meeting. Section 5 includes proposals for potential discussion at GTW sessions, although at this meeting online time will be limited and most of the progress should be achieved by email. Section 5, 6 and 7 are for stable proposals during the meeting, summary of agreements at this meeting and relevant references. Annex A includes the set of agreements for this AI at previous RAN1/RANP meetings.

# Issues

## Issue 1: LS from RAN2 on CFR for MCCH/MTCH

### **Background**

The LS in R1-2200882 (cf. annex B) from RAN2 on MBS issues requests RAN1 to answer the following question:

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| **Question:** Currently, RAN2 running RRC design assumes that only a single CFR (indicated by *locationAndBandwidth-Broadcast*) is configured for MCCH/MTCH reception of MBS broadcast and it is common for MCCH and all MTCHs. RAN2 would like to confirm this understanding with RAN1. |

The following agreement for RRC\_IDLE/RRC\_INACTIVE UEs at RAN1#103-e, RAN1#104-e, RAN1#106-e, and RAN1#107-e are relevant for this discussion:

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| 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

Agreement:For RRC\_IDLE/RRC\_INACTIVE UEs, one common frequency resource for group-common PDCCH/PDSCH can be defined/configured.* FFS: whether to define/configure more than one common frequency resources

Agreement:Only one CFR can be configured for group-common PDCCH/PDSCH carrying MCCH for broadcast reception with UEs in RRC\_IDLE/INACTIVE state.Agreement:For broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs can use the same bandwidth configurations for the CFR of GC-PDCCH/PDSCH carrying MCCH and the CFR of GC-PDCCH/PDSCH carrying MTCH.* FFS: use of different bandwidth configurations for the CFR of GC-PDCCH/PDSCH carrying MCCH and the CFR of GC-PDCCH/PDSCH carrying MTCH

**Agreement**For broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs:* The CFR frequency resources used for MCCH and MTCH are configured by SIBx;
* PDCCH-config/PDSCH-config for broadcast reception with GC-PDCCH/PDSCH carrying MCCH is configured by SIBx
* PDCCH-config/PDSCH-config for broadcast reception with GC-PDCCH/PDSCH carrying MTCH is configured by MCCH. If the PDCCH-config/PDSCH-config for MTCH is not configured, the PDCCH-config/PDSCH-config for GC-PDCCH/PDSCH carrying MCCH configured by SIBx is reused for GC-PDCCH/PDSCH carrying MTCH.
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### **Tdoc analysis**

***Number of CFRs for MTCH and size of frequency resources of the CFR for MCCH/MTCH***

* In [R1-2201340, CATT]
	+ Proposal 1：Confirm RAN2’s understandings that only a single CFR (indicated by *locationAndBandwidth-Broadcast*) is configured for MCCH/MTCH reception of MBS broadcast and it is common for MCCH and all MTCHs.
* In [R1-2201259, OPPO]
	+ Proposal 1: For broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs, up to one CFR is configured for GC-PDCCH/PDSCH carrying MTCH via MCCH.
	+ Proposal 2: For broadcast reception, the frequency resources of the CFR for MTCH are same as that of the CFR for MCCH.
* In [R1-2201498, NTT DOCOMO]
	+ Proposal 1: Support at most one CFR for broadcast MTCH for RRC\_IDLE/RRC\_INACTIVE UEs.
	+ Proposal 2: Use the same frequency resources for CFR for MCCH and CFR for broadcast MTCH for RRC\_IDLE/RRC\_INACTIVE UEs.
* In [R1-2201597, TD Tech]
	+ Proposal 3: If the bandwidth of the CFR for broadcast mode is far greater than the initial DL BWP, it can be divided into several sub-CFRs, where each sub-CFR contains the initial DL BWP. The CFR or a sub-CFR can be used for a G-RNTI/G-CS-RNTI. In other word, the CFR is configured per broadcast session.
* In [R1-2201788, Apple]
	+ Proposal 2: The frequency resources of the CFR for MTCH are same as that of the CFR for MCCH.
	+ Proposal 3: Only one CFR for MTCH can be configured via MCCH.
* In [R1-2201932, Xiaomi]
	+ Proposal 2: Only one CFR can be configured for group-common PDCCH/PDSCH carrying MTCH for broadcast reception with UEs in RRC\_IDLE/INACTIVE state.
* In [R1-2202081, MediaTek]
	+ Proposal 1: For broadcast reception, the frequency resources of the CFR for MTCH are same as that of the CFR for MCCH.
	+ Proposal 3: The number of CFR for broadcast is no more than one in Rel-17 MBS.
* In [R1-2202162, Qualcomm]
	+ *Discuss:* Whether the CFR for MCCH and CFR for MTCH always have same *locationAndBandwidth-Broadcast* was discussed in last RAN1 meeting. We think the same BW for MCCH and MTCH can be the basic function for broadcast RRC\_IDLE/INACTIVE UEs. One CFR for MTCH can be configured via MCCH, where different G-RNTIs share the same configuration parameters for group-common PDCCH and PDSCH. We suggest to send LS reply to RAN2 to clarify the CFR configuration for MCCH/MTCH*.*
	+ Proposal 2: Send reply to RAN2 on LS R2-2201830:
		- For RRC\_IDLE/INACTIVE UEs,
			* Only one CFR for MCCH with one PDCCH-Config-MCCH and one PDSCH-Config-MCCH can be configured via SIBx.
				+ The search space for MCCH is configured in PDCCH-Config-MCCH.
			* Only one CFR for MTCH with one PDCCH-Config-MTCH and one PDSCH-Config-MTCH can be configured via MCCH.
				+ The search space for MTCH is configured in PDCCH-Config-MTCH.
			* The frequency resources of the CFR for MTCH are same as that of the CFR for MCCH.
* In [R1-2202229, Lenovo]
	+ Proposal 1: For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, only one CFR is configured/defined for receiving MCCH and MTCH.
	+ Proposal 2: For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, only same CFR for MCCH and MTCH is supported.
* In [R1-2202398, Ericsson]
	+ Observation 1: There is no significant power saving by using different CFR frequency ranges for MCCH and MTCH.
	+ Observation 2: There is no significant power saving by using different CFR frequency ranges for different MTCH services.
	+ Proposal 1 (Based on the FL’s Proposal 2.5-1v6, but updated for clarity):
		- For broadcast reception, only one CFR for MTCH can be configured via MCCH.
		- When MCCH configures a CFR for MTCH, MTCH does not use the CFR configured by SIBx.
		- The frequency resources of the CFR for MTCH are the same as those of the CFR configured by SIBx.
* In [R1-2201719, Intel]
	+ *Discuss*: As seen from the last agreement in 2.1.1, RAN1 has agreed that the frequency resources for CFR for MTCH/MCCH is configured via SIBx. However, the agreement does not state whether the frequency resources for CFR for MTCH and MCCH are identical. Additionally, we have also agreed that PDCCH-config and PDSCH-config for MTCH can be configured by MCCH. In general, there may be a use case for MTCH having larger frequency resources than MCCH, therefore we propose to first agree on the following and then send an appropriate LS reply to RAN2 clarifying the RAN1 agreement.
	+ Proposal 1: The frequency resources of the CFR for MTCH can be configured by SIBx to the same or larger than that of the CFR for MCCH.
* In [R1-2201878, CMCC]
	+ *Discuss*: From our perspective, the agreement is very clear to say that the same CFR frequency resources are used for MCCH and MTCH. In last RAN1 meeting, some companies proposed the CFRs can be different between MCCH and MTCH, which is the overturn of previous agreement. In addition, there are also some drawbacks of two CFRs. Considering the mandatory UE feature is supporting two CORESETs, if the two smaller CORESETs have been configured in the CFR for MCCH, UE can not be configured with another larger CORESET in the CFR for MTCH. Vice versa, the larger CORESET configured in CFR for MTCH can not be used for MCCH as well. The simple solution is configuring only one CFR frequency resource for MCCH and MTCH, e.g., Case C, which both CORESET 0 and a larger CORESET can be used for MCCH and MTCH. Thus, we support the CFR resources are the same for MCCH and MTCH.
	+ Proposal 2. For broadcast reception, only one CFR for MTCH can be configured via MCCH. The frequency resources of the CFR for MTCH are same as that of the CFR for MCCH.

### **FL Assessment**

The two aspects discussed by the contributions above, i) number of CFRs for MTCH and ii) size of frequency resources of the CFR for MCCH/MTCH, have been discussed at previous RAN1 meetings; and RAN2 has sent a question to RAN1 to clarify these two issues.

***Size of frequency resources of the CFR for MCCH/MTCH***

[OPPO, NTT DOCOMO, Apple, Xiamoi, MediaTek, Qualcomm, Lenovo, Ericsson, CMCC] support that the frequency resources of the CFR for MTCH are the same as those of the CFR for MCCH. While [Ericsson] discusses that there is limited power saving by using different frequency ranges for MCCH and MTCH, [CMCC] further highlights limitations on the support of two CORESETs.

On the other hand, [TD Tech, Intel] support that the frequency resources of the CFR for MTCH can be larger than those of the CFR for MCCH.

***Number of CFRs for MTCH***

[CATT, OPPO, NTT DOCOMO, Apple, Xiaomi, MediaTek, Qualcomm, Lenovo, Ericsson, CMCC] support only one CFR configuration for MTCH via MCCH, while multiple CFRs for MTCH is only supported/discussed by [TD Tech].

Given the strong majority to support that the frequency resources of the CFR for MCCH and the CFR for MTCH are the same, and that only one CFR for MTCH can be configured via MCCH, the following proposal is put forward for discussion as well as sending the corresponding LS to RAN2 to reply to their question.

### **1st round FL proposals for Issue 1**

#### Proposal 2.1-1

For broadcast reception with RRC\_IDLE/INACTIVE UEs:

* Only one CFR for MCCH with one PDCCH-Config-MCCH and one PDSCH-Config-MCCH can be configured via SIBx.
* Only one CFR for MTCH with one PDCCH-Config-MTCH and one PDSCH-Config-MTCH can be configured via MCCH.
* The frequency resources of the CFR for MTCH are same as the frequency resources of the CFR for MCCH.
* Send reply to RAN2 on LS R1-2200882

**Please provide your answers in the table below. Do you agree with Proposal 2.1-1?**

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| **company** | **comments** |
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## Issue 2: FDM reception of MCCH/MTCH PDSCH and PBCH

### **Background**

The following agreements at RAN1#107bis-e are relevant for the discussion of this issue:

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| **Agreement**For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed MCCH PDSCH and MTCH PDSCH in PCell.**Agreement**For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed multiple MTCH PDSCHs in PCell.**Agreement**For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed MCCH/MTCH PDSCH and SIB1 or Paging PDSCH in PCell.* + FFS: PBCH and other SIBs

**Agreement**For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed MCCH/MTCH PDSCH and SIB PDSCH in PCell. |

### **Tdoc analysis**

* In [R1-2201172, ZTE]
	+ *Discuss:* As shown in the following table, since Rel-15, UE is allowed to receive PDSCH overlapping with SSB, where the PDSCH includes the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, P-RNTI, TC-RNTI, C-RNTI, MCS-C-RNTI, CS-RNTI, or PDSCHs with SPS.
	When it comes to MCCH/MTCH, it is just a PDSCH, which is the same as PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, P-RNTI or TC-RNTI. From our perspective, there is no clear motivation to preclude the overlapping (or FDMed reception) of MCCH/MTCH PDSCH and SSB. Thus, we have the following proposal and corresponding text proposal.
	+ Proposal 1: For RRC\_IDLE/INACTIVE UEs, a UE can support reception of MCCH/MTCH PDSCH that is overlapping with SSB in PCell, in which case the UE shall assume that the PRBs containing SSB transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.
		- Adopt the following TP for Section 5.1.4 of TS38.214.

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| 5.1.4 PDSCH resource mappingWhen receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 0, the UE shall assume that no SS/PBCH block is transmitted in REs used by the UE for a reception of the PDSCH.When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, MSGB-RNTI, P-RNTI, ~~or~~ TC-RNTI, MCCH-RNTI or G-RNTI for MTCH, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst*, and if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.**<Unchanged parts are omitted>** |

* In [R1-2201788, Apple]
	+ *Discuss*: In legacy release, UE can receive PBCH and other channels in the same slot, except SS/PBCH block and CORESET multiplexing pattern 1. For RRC\_IDLE/INACTIVE UEs, UE could acquire the PBCH information before the broadcast service reception. Thus, if the PBCH and PDSCH for MCCH/MTCH transmit in the same slot, the position of PRBs for PBCH was known by the UE. There could be no additional effort for UE to receive the MCCH/MTCH PDSCH with PBCH in FDM manner.
	+ Proposal 1: For UE in RRC\_IDLE/INACTIVE mode, FDMed reception of MCCH/MTCH PDSCH and PBCH can be considered.
	+ The additional standard impacts are showing in below table.

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| **5.1.4 PDSCH resource mapping**When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 0, the UE shall assume that no SS/PBCH block is transmitted in Res used by the UE for a reception of the PDSCH.When receiving the PDSCH scheduled with SI-RNTI and the system information indicator in DCI is set to 1, RA-RNTI, MSGB-RNTI, P-RNTI, ~~or~~ TC-RNTI, MCCH-RNTI or G-RNTI for broadcast, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst*, and if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources the UE shall assume that the PRBs containing SS/PBCH block transmission resources are not available for PDSCH in the OFDM symbols where SS/PBCH block is transmitted.A UE expects a configuration provided by *ssb-PositionsInBurst* in *ServingCellConfigCommon* to be same as a configuration provided by *ssb-PositionsInBurst* in *SIB1*. |

* In [R1-2201878, CMCC]
	+ *Discuss*: It is noted that for SSB and CORESET 0 multiplexing pattern 3, the PDSCH and SSB are FDMed. If the CORESET 0 is used for broadcast, it can not avoid the FDMed simultaneous reception between PBCH and MCCH/MTCH is this case. Thus, we support UE is required to support reception of FDMed MCCH/MTCH PDSCH and PBCH in PCell at least for SSB and CORESET#0 multiplexing pattern 3.
	+ Proposal 1. For RRC\_IDLE/INACTIVE UEs, a UE is required to support reception of FDMed MCCH/MTCH PDSCH and PBCH in PCell at least for SSB and CORESET#0 multiplexing pattern 3.
* In [R1-2202162, Qualcomm]
	+ *Discuss*: It is still FFS whether UE is required to support reception of FDMed MCCH/MTCH and PBCH in PCell. From our point of view, there is no latency requirement for MCCH/MTCH, therefore it can be scheduled TDMed with PBCH. It is not an essential feature for UE to support FDMed PBCH and MCCH/MTCH for broadcast RRC\_IDLE/INACTIVE UEs.
	+ Proposal 1: For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed MCCH/MTCH PDSCH and PBCH in PCell.

### **FL Assessment**

[ZTE, Apple, CMCC] support the FDMed reception of MCCH/MTCH PDSCH and PBCH in PCell. [ZTE, Apple] discuss that, for some cases, legacy UEs are allowed to receive PDSCH and PBCH in the same slot. [CMCC] proposes to support it at least for SSB and CORESET#0 multiplexing pattern 3.

[Qualcomm] discuss that since there are no latency requirements for MCCH/MTCH, FDM of SSB and MCCH/MTCH PDSCH is not an essential feature.

More companies support that UEs can FDM the MCCH/MTCH PDSCH and PBCH, although not many companies have discussed this issue. The starting point for the discussion is for UEs to support FDM of the MCCH/MTCH PDSCH and PBCH. Depending on the progress on this discussion, an additional TP for TS 38.214 could be included for discussion.

### **1st round FL proposals for Issue 2**

#### Proposal 2.2-1

For RRC\_IDLE/INACTIVE UEs, a UE is required to support reception of FDMed MCCH/MTCH PDSCH and PBCH in PCell.

**Please provide your answers in the table below. Do you support the proposal above? Please provide reasons and views in general. Please provide any alternate proposals in case you don’t support the proposals.**

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| **company** | **comments** |
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## Issue 3: Proposed TPs for TS 38.214

### **TPs on TDRA table**

#### Tdoc analysis

In [R1-2201172, ZTE] discuss that based on the following agreement at RAN1#107-e:

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| **Agreement**For broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs:* The CFR frequency resources used for MCCH and MTCH are configured by SIBx;
* PDCCH-config/PDSCH-config for broadcast reception with GC-PDCCH/PDSCH carrying MCCH is configured by SIBx
* PDCCH-config/PDSCH-config for broadcast reception with GC-PDCCH/PDSCH carrying MTCH is configured by MCCH. If the PDCCH-config/PDSCH-config for MTCH is not configured, the PDCCH-config/PDSCH-config for GC-PDCCH/PDSCH carrying MCCH configured by SIBx is reused for GC-PDCCH/PDSCH carrying MTCH.
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the following TP is proposed:

**Proposal 3**: Adopt the following TP for Section 5.1.2.1 of TS38.214.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| MCCH-RNTI  | Type 0/0B common for broadcast | 1 | No | - | No | - | Default A |
| 2 | No | - | No | - | Default B |
| 3 | No | - | No | - | Default C |
| 1,2,3 | Yes | - | No | - | pdsch-TimeDomainAllocationList provided in PDSCH-ConfigCommon |
| 1,2,3 | No/Yes | - | Yes | - | pdsch-TimeDomainAllocationList provided in pdsch-Config-MCCH |
| G-RNTI for broadcast | Type 0/0B common for broadcast | 1 | No | - | No | - | Default A |
| 2 | No | - | No | - | Default B |
| 3 | No | - | No | - | Default C |
| 1,2,3 | Yes | - | No | - | pdsch-TimeDomainAllocationList provided in PDSCH-ConfigCommon |
| 1,2,3 | No/Yes | - | Yes | - | pdsch-TimeDomainAllocationList provided in PDSCH-Config-MTCH if configured, otherwise, TimeDomainAllocationList provided in PDSCH-Config-MCCH |
| ~~1,2,3~~ | ~~No/Yes~~ | ~~-~~ | ~~Yes~~ | ~~-~~ | ~~pdsch-TimeDomainAllocationList provided in PDSCH-Config-MTCH~~ |

#### FL Assessment

The TP above is put forward for discussion.

### **1st round FL proposals for Issue 3**

#### Proposal 2.3-1

Adopt TP-2.3-1 for Section 5.1.2.1 of TS38.214.

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| **TP-2.3-1 for TS 38.214*****----------------------------------------------------Text proposal starts----------------------------------------------*****Table 5.1.2.1.1-1: Applicable PDSCH time domain resource allocation for DCI formats 1\_0, 1\_1, 4\_0, 4\_1 and 4\_2**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| MCCH-RNTI  | Type 0/0B common for broadcast | 1 | No | - | No | - | Default A |
| 2 | No | - | No | - | Default B |
| 3 | No | - | No | - | Default C |
| 1,2,3 | Yes | - | No | - | pdsch-TimeDomainAllocationList provided in PDSCH-ConfigCommon |
| 1,2,3 | No/Yes | - | Yes | - | pdsch-TimeDomainAllocationList provided in pdsch-Config-MCCH |
| G-RNTI for broadcast | Type 0/0B common for broadcast | 1 | No | - | No | - | Default A |
| 2 | No | - | No | - | Default B |
| 3 | No | - | No | - | Default C |
| 1,2,3 | Yes | - | No | - | pdsch-TimeDomainAllocationList provided in PDSCH-ConfigCommon |
| 1,2,3 | No/Yes | - | Yes | - | pdsch-TimeDomainAllocationList provided in PDSCH-Config-MTCH if configured, otherwise, TimeDomainAllocationList provided in PDSCH-Config-MCCH |
| ~~1,2,3~~ | ~~No/Yes~~ | ~~-~~ | ~~Yes~~ | ~~-~~ | ~~pdsch-TimeDomainAllocationList provided in PDSCH-Config-MTCH~~ |

< Unchanged parts are omitted >***----------------------------------------------------Text proposal ends-----------------------------------------------*** |

**Please provide your answers in the table below. Do you support the TP above? Please provide reasons and views in general.**

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| **company** | **comments** |
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## Issue 4: Proposed TPs for TS 38.213

### **TPs on *searchSpaceZero* and *PDCCH-ConfigCommon***

#### Tdoc analysis

* In [R1-2201008, Nokia]
	+ Proposal-1: The endorsed TP from RAN1#107bis-e may create confusion. Thus, it is proposed the TP in Table-1 to avoid the confusion.

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| **10.1 UE procedure for determining physical downlink control channel assignment** A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets- a Type0-PDCCH CSS set on the primary cell of the MCG configured by- *pdcch-ConfigSIB1* in *MIB* or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI, or - *searchSpaceZero* in *PDCCH-ConfigCommon*, when *pdcch-Config-MCCH* *or when both pdcch-Config-MCCH* and *pdcch-Config-MTCH* ~~are~~is not provided, for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI- a Type0A-PDCCH CSS set configured by *searchSpaceOtherSystemInformation* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI on the primary cell of the MCG---------------------------- Other parts are omitted. ---------------------------- |

* In [R1-2202162, Qualcomm]
	+ Proposal 4: Endorse TP#1 for TS38213 to fix the typo of using SS#0 for MCCH/MTCH.

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| TP#1 for TS38.21310.1 UE procedure for determining physical downlink control channel assignment A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets- a Type0-PDCCH CSS set on the primary cell of the MCG configured by- *pdcch-ConfigSIB1* in *MIB* or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI, or - *searchSpaceZero* in *PDCCH-ConfigCommon*, when *pdcch-Config-MCCH* and *pdcch-Config-MTCH* are not provided, for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI\*\*\* Unchanged text is omitted \*\*\* |

* In [R1- 2201116, vivo]
	+ *Discuss*: In RAN2 last meeting, it has decided to include MCCH/MTCH search space configuration of MBS broadcast as part of PDCCH-ConfigCommon [2], and thus, the corresponding changes are needed to replace pdcch-Config-MCCH and pdcch-Config-MTCH in 38.213 [1].

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| 10.1 UE procedure for determining physical downlink control channel assignment< Unchanged parts are omitted >A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets- a Type0-PDCCH CSS set on the primary cell of the MCG configured by- *pdcch-ConfigSIB1* in *MIB* or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI, or - *searchSpaceZero* in *PDCCH-ConfigCommon*, when *searchSpaceBroadcast* is not provided in *PDCCH-ConfigCommon*, for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI- a Type0A-PDCCH CSS set configured by *searchSpaceOtherSystemInformation* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI on the primary cell of the MCG- a Type0B-PDCCH CSS set configured by *searchSpaceBroadcast* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI- a Type1-PDCCH CSS set configured by *ra-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a RA-RNTI, a MsgB-RNTI, or a TC-RNTI on the primary cell- a Type1A-PDCCH CSS set configured by *sdt-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a C-RNTI or a CS-RNTI on the primary cell as described in clause 19.1- a Type2-PDCCH CSS set configured by *pagingSearchSpace* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a P-RNTI on the primary cell of the MCG- a Type2A-PDCCH CSS set configured by *peiSearchSpace* in *DownlinkConfigCommonSIB* for a DCI format 2\_7 with CRC scrambled by a RNTI on the primary cell of the MCG- a Type3-PDCCH CSS set configured by - *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by INT-RNTI, SFI-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, TPC-SRS-RNTI, or CI-RNTI and, only for the primary cell, C-RNTI, MCS-C-RNTI, CS-RNTI(s), or PS-RNTI, or - *SearchSpace-Multicast* in *PDCCH-Config-Multicast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI, or- < Unchanged parts are omitted >If a UE monitors PDCCH candidates for DCI formats with CRC scrambled by a C-RNTI and the UE is provided a non-zero value for *searchSpaceID* in *PDCCH-ConfigCommon* for a Type0/0A/2-PDCCH CSS set, or monitors PDCCH candidates for DCI formats with CRC scrambled by a MCCH-RNTI or a G-RNTI and the UE is provided a non-zero value for *searchSpaceBroadcast* in *PDCCH-ConfigCommon* for a Type0/0B-PDCCH CSS set, the UE determines monitoring occasions for PDCCH candidates of the Type0/0A/2-PDCCH CSS set, or of the Type0/0B-PDCCH set, respectively, based on the search space set associated with the value of *searchSpaceID*. |

#### FL Assessment

[Noka, Qualcomm] TPs try to address a typo in the latest draft CR for TS 38.213. Based on the past RAN1 agreements: SIBx configures MCCH (including its search space in pdcch-config-mcch), MCCH configures MTCH (including its search space in pdcch-config-mtch), but if MCCH does not include the configuration for MTCH, then MTCH reuses the confirmation in SIBx. Then the possibilities for configuration are that: i) only pdcch-config-mcch is configured in SIBx, or ii) that both pdcch-config-mcch and pdcch-config-mtch are configured in SIBx and MCCH, respectively.

The TP from [vivo] based on the latest RAN2 agreements and information provided in the LS (R1-2200882), where RAN2 has decided to include MCCH/MTCH search space configuration of MBS broadcast as part of PDCCH-ConfigCommon to have a unified configuration framework for all common search spaces, provides text modifications that would also address the typo identified by [Nokia, Qualcomm]. Therefore, TP-2.4-1 is based on the TP from [vivo], however, with some changes to the following change in vivo’s TP “*searchSpaceBroadcast in pdcch-Config-MCCH and pdcch-Config-MTCH on a secondary cell for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI, and*”, which the FL interprets as a potential typo.

### **TPs on *searchSpaceBroadcast***

#### Tdoc analysis

* In [R1-2201008, Nokia]
	+ Proposal-2: Latest update is mixed of “*searchSpaceBroadcast*” and “*searchSpace-Broadcast*”, and it is better to align all to the agreed RRC parameter “*searchSpaceBroadcast*”.

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| ---------------------------- Other parts are omitted. ----------------------------A UE does not expect to be configured CSS sets, except for CSS sets provided by *~~searchSpace-Broadcast~~ searchSpaceBroadcast* or by *searchSpace-Multicast*, that result to corresponding total, or per scheduled cell, numbers of monitored PDCCH candidates and non-overlapped CCEs per slot, per group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or per span that exceed the corresponding maximum numbers per slot, or per group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or per span, respectively.For same cell scheduling or for cross-carrier scheduling, a UE does not expect a number of PDCCH candidates, and a number of corresponding non-overlapped CCEs per slot or per span on a secondary cell to be larger than the corresponding numbers that the UE is capable of monitoring on the secondary cell per slot or per span, respectively. If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for the primary cell, except the first span of each slot, the UE does not expect a number of PDCCH candidates and a number of corresponding non-overlapped CCEs per span on the primary cell to be larger than the corresponding numbers that the UE is capable of monitoring on the primary cell per span. For cross-carrier scheduling, the number of PDCCH candidates for monitoring and the number of non-overlapped CCEs per span or per slot are separately counted for each scheduled cell.For all search space sets within a slot $n$, or within a group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or within a span in slot $n$, denote by $S\_{css}$ a set of CSS sets, except for CSS sets provided by *~~searchSpace-Broadcast~~* *searchSpaceBroadcast* or by *searchSpace-Multicast*, with cardinality of $I\_{css}$ and by $S\_{uss}$ a set of USS sets and CSS sets provided by *searchSpace-Broadcast* or by *searchSpace-Multicast* with cardinality of $J\_{uss}$. The location of search space sets $s\_{j}$, $0\leq j<J\_{uss}$, in $S\_{uss}$ is according to an ascending order of the search space set index. ---------------------------- Other parts are omitted. ---------------------------- |

#### FL Assessment

The TP above is put forward for discussion as TP-2.4-2 where one additional *searchSpace-Broadcast* has been replaced by *searchSpaceBroadcast* at the end of the last paragraph.

### **TPs on section 18**

#### Tdoc analysis

* In [R1-2201008, Nokia]
	+ Proposal-3: The paragraph shown in below Table-3 should be removed.

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| **18 Multicast Broadcast Services**---------------------------- Other parts are omitted. ----------------------------A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].~~A UE can be configured by~~ *~~cfr-Config-Broadcast~~*~~, an MBS frequency resource within the initial DL BWP for PDCCH and PDSCH receptions [4, TS 38.211]. If~~ *~~cfr-Config- Broadcast~~* ~~does not include~~ *~~locationAndBandwidth-Broadcast~~*~~, the MBS frequency resource is the initial DL BWP. A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1.~~---------------------------- Other parts are omitted. ---------------------------- |

* In [R1- 2201116, vivo]
	+ *Discuss*: Currently, there are duplicated descriptions on broadcast CFR in 38.213 [1] by using cfr-Config-MCCH-MTCH and cfr-Config-Broadcast for CFR configuration, the duplication should be removed. The potential modification is provided below:

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| 18 Multicast Broadcast Services< Unchanged parts are omitted >A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1. In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331]. |

* In [R1-2201172, ZTE]
	+ Proposal 2: Adopt the following TP for Section 18 of TS38.213.

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| **18 Multicast Broadcast Services**---------------------------- Other parts are omitted. ----------------------------A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].~~A UE can be configured by~~ *~~cfr-Config-Broadcast~~*~~, an MBS frequency resource within the initial DL BWP for PDCCH and PDSCH receptions [4, TS 38.211]. If~~ *~~cfr-Config- Broadcast~~* ~~does not include~~ *~~locationAndBandwidth-Broadcast~~*~~, the MBS frequency resource is the initial DL BWP. A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1.~~---------------------------- Other parts are omitted. ---------------------------- |

* In [R1-2201719, Intel]
	+ *Discuss*: Based on the highlighted parts, it appears that there are two possible CFR configurations for broadcast i.e., cfr-Config-MCCH-MTCH and cfr-Config-Broadcast which would be a cause for confusion for UEs which receive both configurations. From the current specification, it is not clear which CFR should be used for broadcast reception. Since CONNECTED mode UEs can also receive cfr-Config-MCCH-MTCH, two configurations are unnecessary.
	+ In addition, the last agreement which states that the PDDCH-Config and PDSCH-Config for MTCH can be provided by MCCH and if not provided is the same as that provided in cfr-Config-MCCH-MTCH. This needs to be captured in the specification. Therefore, we propose the following:

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| **TP for TS 38.213**18 Multicast Broadcast Services\*\*\* Unchanged text is omitted \*\*\*A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; If *cfr-Config-MCCH-MTCH* does not contain *locationAndBandwidth-Broadcast,* the MBS frequency resource is the initial DL BWP configured by SIB-1. If initial DL BWP is not configured by SIB-1, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. MCCH can provide the PDCCH-Config-MTCH and PDSCH-Config-MTCH for MTCH reception; if not provided by MCCH, the MTCH reception uses the PDCCH-Config-MCCH and PDSCH-Config-MCCH provided by *cfr-Config-MCCH-MTCH in SIBx.* In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].~~A UE can be configured by~~ *~~cfr-Config-Broadcast~~*~~, an MBS frequency resource within the initial DL BWP for PDCCH and PDSCH receptions [4, TS 38.211]. If~~ *~~cfr-Config- Broadcast~~* ~~does not include~~ *~~locationAndBandwidth-Broadcast~~*~~, the MBS frequency resource is the initial DL BWP. A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1.~~ |

* In [R1-2201878, CMCC]
	+ *Discuss*: As for the review of TS 38.213 h00, there are two redundant paragraphs to describe the CFR configuration for broadcast in current TS 38.213 section 18 as the following.
	+ *Discuss*: We don’t have any agreement to define the default broadcast CFR bandwidth value if locationAndBandwidth-Broadcast is not be included in the CFR configuration. From RAN1’s perspective, we only agreed that the CFR size can be equal to CORESET 0 (Case A) or SIB-1 configured initial DL BWP (Case C) and UE can receive broadcast service in the frequency range of CORESET 0 if the CFR is not configured. Thus the first paragraph has covered all the broadcast CFR configuration cases and the second paragraph can be deleted.
	+ Proposal 3. The suggested TP for TS 38.213 section 18 is as the following:

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| **<**Unchanged text is omitted>A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].**<**Unchanged text is omitted> |

* In [R1-2202229, Lenovo]
	+ *Discuss*: From RAN1’s perspective, RAN1 has only agreed that the CFR size can be configured equal to CORESET 0 (Case A) or SIB-1 configured initial DL BWP (Case C) and if the CFR is not configured, UE can receive broadcast service in the frequency range of CORESET 0. The current two paragraphs haven’t explicitly mentioned the agreements of supporting Case A and Case C. We see the two paragraphs can be merged to avoid any duplication.

	So far the default broadcast CFR bandwidth has not be specified if locationAndBandwidth-Broadcast is not included in the CFR configuration. So we suggest removing it.

	Based on above discussion, we have below TP and proposals:
	+ Proposal 3. One TP for TS38.213 Section 18 is listed below:

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| **<**Unchanged text is omitted>A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource same to the frequency resource of the CORESET with index 0 or the initial DL BWP for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].**<**Unchanged text is omitted> |

#### FL Assessment

All tdocs above propose to only remove one the paragraphs to remove any ambiguity in the specification. TP2.4-3 is a combination of TPs above.

[vivo] further includes a clarification on “*A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1*”, which is included in the TP-2.4-3.

[Intel] proposes two additional changes: first, using a CFR with resources with same range as initial BWP SIB1 configured as default option, however, the FL understands that based on the agreements only the frequency range of CORESET#0 is used as default option; the second change is related to the pdcch/pdsch-configs, which is included in TP-2.4-3.

[Lenovo] proposes to clarify CFR cases (case A and Case C) in the text proposal, however, the agreed CFR cases seem to be further detailed in reference [12, TS 38.331] of the current text, so this change has not been included.

### **TPs on QCL-TypeD property of PDCCH in Type-0B/ Type-1**

#### Tdoc analysis

* In, [R1-2201817, Spreadtrum]
	+ *Discuss*: For Rel-15/Rel-16, for single cell operation or for operation with carrier aggregation in a same frequency band, when the QCL-TypeD property of PDCCH in Type-0/0A/2/3 CSS or USS set are different from the QCL-TypeD property of PDCCH in Type-1 CSS and, and both PDCCHs or associated PDSCH are overlapping or partially overlapping in time, a UE does not expect to monitor the PDCCH in a Type-0/0A/2/3 CSS or USS set.

In Rel-17 MBS, in addition to common search space Type-0, common search space Type-0B has been introduced for broadcast MBS in latest specification. During previous meetings, the principle that MBS can be the same or even lower priority than unicast seems to be common understanding among people. For example, we have already agreed that for PDCCH overbooking, the monitoring priority of Type-0B CSS is determined based on the search space set indexes of the Type-0B CSS set for MBS and USS sets. Thus, in our understanding, the above solution to collision issue of the QCL-Type D property also applied to the case when the QCL-TypeD property of PDCCH in Type-0B CSS are different from the QCL-TypeD property of PDCCH in Type-1 CSS and, and both PDCCHs or associated PDSCH are overlapping or partially overlapping in time. Thus, we have the following proposal:

* + Proposal 1: Suggest to adopt the following text proposal in 38.213.

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| --- |
| ------------------------------------------Start of Text Proposal#1 for TS 38.213--------------------------------------**10.1 UE procedure for determining physical downlink control channel assignment** -----------------------------Unchanged part omitted--------------------------For single cell operation or for operation with carrier aggregation in a same frequency band, a UE does not expect to monitor a PDCCH in a Type0/0A/0B/2/3-PDCCH CSS set or in a USS set if a DM-RS for monitoring a PDCCH in a Type1-PDCCH CSS set is not configured with same *qcl-Type* set to 'typeD' properties [6, TS 38.214] with a DM-RS for monitoring the PDCCH in the Type0/0A/0B/2/3-PDCCH CSS set or in the USS set, and if the PDCCH or an associated PDSCH overlaps in at least one symbol with a PDCCH the UE monitors in a Type1-PDCCH CSS set or with an associated PDSCH. ------------------------------------------End of Text Proposal#1 for TS 38.213-------------------------------------- |

#### FL Assessment

The TP above is put forward for discussion as TP-2.4-4.

### **1st round FL proposals for Issue 4**

#### Proposal 2.4-1

Adopt TP-2.4-1 for Section 10.1 of TS 38.213.

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| **TP-2.4-1 for TS 38.213*****----------------------------------------------------Text proposal starts----------------------------------------------*****10.1 UE procedure for determining physical downlink control channel assignment** A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets- a Type0-PDCCH CSS set on the primary cell of the MCG configured by- *pdcch-ConfigSIB1* in *MIB* or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI, or - *searchSpaceZero* in *PDCCH-ConfigCommon*, when *searchSpaceBroadcast* is not provided in *PDCCH-ConfigCommon*, for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI- a Type0A-PDCCH CSS set configured by *searchSpaceOtherSystemInformation* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI on the primary cell of the MCG- a Type0B-PDCCH CSS set configured by *searchSpaceBroadcast* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI- a Type1-PDCCH CSS set configured by *ra-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a RA-RNTI, a MsgB-RNTI, or a TC-RNTI on the primary cell- a Type1A-PDCCH CSS set configured by *sdt-SearchSpace* in *PDCCH-ConfigCommon* for a DCI format with CRC scrambled by a C-RNTI or a CS-RNTI on the primary cell as described in clause 19.1- a Type2-PDCCH CSS set configured by *pagingSearchSpace* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a P-RNTI on the primary cell of the MCG- a Type2A-PDCCH CSS set configured by *peiSearchSpace* in *DownlinkConfigCommonSIB* for a DCI format 2\_7 with CRC scrambled by a RNTI on the primary cell of the MCG- a Type3-PDCCH CSS set configured by - *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *common* for DCI formats with CRC scrambled by INT-RNTI, SFI-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI, TPC-SRS-RNTI, or CI-RNTI and, only for the primary cell, C-RNTI, MCS-C-RNTI, CS-RNTI(s), or PS-RNTI, or - *SearchSpace-Multicast* in *PDCCH-Config-Multicast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI, or- *searchSpaceBroadcast* in *PDCCH-ConfigCommon* on a secondary cell for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI, and< Unchanged parts are omitted >If a UE monitors PDCCH candidates for DCI formats with CRC scrambled by a C-RNTI and the UE is provided a non-zero value for *searchSpaceID* in *PDCCH-ConfigCommon* for a Type0/0A/2-PDCCH CSS set, or monitors PDCCH candidates for DCI formats with CRC scrambled by a MCCH-RNTI or a G-RNTI and the UE is provided a non-zero value for *searchSpaceBroadcast* in *PDCCH-ConfigCommon* for a Type0/0B-PDCCH CSS set, the UE determines monitoring occasions for PDCCH candidates of the Type0/0A/2-PDCCH CSS set, or of the Type0/0B-PDCCH set, respectively, based on the search space set associated with the value of *searchSpaceID*.< Unchanged parts are omitted >***----------------------------------------------------Text proposal ends-----------------------------------------------*** |

#### Proposal 2.4-2

Adopt TP-2.4-2 for Section 10.1 of TS 38.213.

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| **TP-2.4-2 for TS 38.213*****----------------------------------------------------Text proposal starts----------------------------------------------***< Unchanged parts are omitted >A UE does not expect to be configured CSS sets, except for CSS sets provided by *~~searchSpace-Broadcast~~ searchSpaceBroadcast* or by *searchSpace-Multicast*, that result to corresponding total, or per scheduled cell, numbers of monitored PDCCH candidates and non-overlapped CCEs per slot, per group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or per span that exceed the corresponding maximum numbers per slot, or per group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or per span, respectively.For same cell scheduling or for cross-carrier scheduling, a UE does not expect a number of PDCCH candidates, and a number of corresponding non-overlapped CCEs per slot or per span on a secondary cell to be larger than the corresponding numbers that the UE is capable of monitoring on the secondary cell per slot or per span, respectively. If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for the primary cell, except the first span of each slot, the UE does not expect a number of PDCCH candidates and a number of corresponding non-overlapped CCEs per span on the primary cell to be larger than the corresponding numbers that the UE is capable of monitoring on the primary cell per span. For cross-carrier scheduling, the number of PDCCH candidates for monitoring and the number of non-overlapped CCEs per span or per slot are separately counted for each scheduled cell.For all search space sets within a slot $n$, or within a group of $X\_{s}$ slots for a corresponding combination $\left(X\_{s},Y\_{s}\right)$, or within a span in slot $n$, denote by $S\_{css}$ a set of CSS sets, except for CSS sets provided by *~~searchSpace-Broadcast~~* *searchSpaceBroadcast* or by *searchSpace-Multicast*, with cardinality of $I\_{css}$ and by $S\_{uss}$ a set of USS sets and CSS sets provided by *~~searchSpace-Broadcast~~* *searchSpaceBroadcast* or by *searchSpace-Multicast* with cardinality of $J\_{uss}$. The location of search space sets $s\_{j}$, $0\leq j<J\_{uss}$, in $S\_{uss}$ is according to an ascending order of the search space set index.< Unchanged parts are omitted >***----------------------------------------------------Text proposal ends-----------------------------------------------*** |

#### Proposal 2.4-3

Adopt TP-2.4-3 for Section 18 of TS 38.213.

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| **TP-2.4-3 for TS 38.213*****----------------------------------------------------Text proposal starts----------------------------------------------***18 Multicast Broadcast Services< Unchanged parts are omitted >A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. MCCH can provide the *PDCCH-Config-MTCH* and *PDSCH-Config-MTCH* for MTCH reception; if not provided by MCCH, the MTCH reception uses the *PDCCH-Config-MCCH* and *PDSCH-Config-MCCH* provided by *cfr-Config-MCCH-MTCH* in SIBx. A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1. In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].< Unchanged parts are omitted >***----------------------------------------------------Text proposal ends-----------------------------------------------*** |

#### Proposal 2.4-4

Adopt TP-2.4-4 for Section 18 of TS 38.213.

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| --- |
| **TP-2.4-4 for TS 38.213*****----------------------------------------------------Text proposal starts----------------------------------------------*****10.1 UE procedure for determining physical downlink control channel assignment** < Unchanged parts are omitted >For single cell operation or for operation with carrier aggregation in a same frequency band, a UE does not expect to monitor a PDCCH in a Type0/0A/0B/2/3-PDCCH CSS set or in a USS set if a DM-RS for monitoring a PDCCH in a Type1-PDCCH CSS set is not configured with same *qcl-Type* set to 'typeD' properties [6, TS 38.214] with a DM-RS for monitoring the PDCCH in the Type0/0A/0B/2/3-PDCCH CSS set or in the USS set, and if the PDCCH or an associated PDSCH overlaps in at least one symbol with a PDCCH the UE monitors in a Type1-PDCCH CSS set or with an associated PDSCH. < Unchanged parts are omitted >***----------------------------------------------------Text proposal ends-----------------------------------------------*** |

**Please provide your answers in the table below. Do you support the TPs above? Please provide reasons and views in general.**

|  |  |
| --- | --- |
| **company** | **comments** |
|  |  |

# Issues for prioritisation discussion

The following issues may or may not address critical issues for the maintenance of AI 8.12.3. These are listed below and companies are invited in section 3.9 to provide their views on which issues are critical for the maintenance of AI 8.12.3 and should therefore be discussed at this meeting.

## Issue 5: G-RNTI for broadcast

### **Tdoc analysis**

* In [R1-2202081, MediaTek] propose:
	+ *Discuss*: It has introduced multiple RNTIs for MBS feature (e.g., multiple multicast G-RNTIs/G-CS-RNTIs, broadcast MCCH-RNTI), however, a total number RNTI supported by UE is limited, which has potential hardware impact from UE’s perspective. Considering the broadcast UE in RRC IDLE/INACTIVE state cannot report the UE capability and RAN2 has agreed that one-to-many mapping between G-RNTI and MBS sessions is supported, we suggest only one G-RNTI is supported for broadcast.
	+ Proposal 4: Only one broadcast G-RNTI is supported in Rel-17 MBS.

### **FL comments**

It is not clear whether this issue is critical or whether this should be discussed at RAN2.

## Issue 6: HARQ process for broadcast

### **Tdoc analysis**

* In [R1-2200950, Huawei]
	+ Proposal 1: UE would expect different HARQ processes are used for the scheduling if repetition is configured and more than one group-common PDSCH for MBS broadcast is scheduled in the same slot.
	+ *Discuss*: Since the maximum number of HARQ processes are shared by unicast, multicast and broadcast, from UE perspective, knowing the HARQ process ID used for MBS broadcast scheduling can simplify UE implementation. It has been agreed that HARQ process ID is not indicated in DCI format 4\_0 for both MCCH and MTCH. Configuring the HPID for MBS broadcast by higher layer signaling can be considered.
	+ Proposal 2: The HARQ process ID for MBS broadcast is configured by higher layer signaling.

### **FL comments**

It is not clear whether this issue is critical for maintenance. This issue seems to have potential RRC impact if such a proposal would be agreed.

## Issue 7: DCI processing capability

### **Tdoc analysis**

* In [R1-2200950, Huawei]
	+ *Discuss*: Regarding the capability of processing MBS broadcast DCI, as proposed to sharing the maximum number of HARQ processes for unicast and broadcast to avoid potential impact to UE hardware, it is preferred from UE perspective to treat the broadcast DCI as unicast DCI following the FG3-1/3-5a/3-5b [2] especially for UE in RRC\_CONNECTED state.
	+ Proposal 3: Regarding the number of DCIs that a UE can process in a slot or span, MBS broadcast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b.

### **FL comments**

It is not clear whether this issue is critical for maintenance.

## Issue 8: TRS as QLC source

### **Tdoc analysis**

* In [R1-2200950, Huawei]
	+ *Discuss*: TRS as QCL source can be beneficial for channel estimation in SFN manner where SSB per cell is not workable properly. Depending on the expected SFN operation performance and the SFN area to be implemented, from network perspective, either SSB or TRS is configured as QCL source for broadcast transmission. Hence, the presence of TRS will be optional as agreed in RAN#93-e.
	+ Proposal 4: Periodic TRS can be configured as QCL source for MTCH transmission especially for RRC\_IDLE/INACTIVE UEs. The configuration is included in SIBx or MCCH.
		- UE may assume that the DMRS of GC-PDCCH/PDSCH is QCL’d with periodic TRS if configured for MTCH.
		- UE may expect the quasi co-location type is 'typeC' with an SS/PBCH block.
	+ Proposal 5: For RRC\_IDLE/INACTIVE UEs, the configuration of TRS at least supports:
		- a list of periodic NZP CSI-RS resource sets for TRS can be configured for the same cell group serving one or more G-RNTIs in a CFR-Config-Broadcast.
		- The number of NZP CSI-RS resource sets in the list of NZP CSI-RS resource sets for TRS can be configurable for each cell group, similarly as specified in NZP-CSI-RS-ResourceSetList.
* In [R1-2201719, Intel]
	+ *Discuss*: We do not think we need TRS configuration for broadcast and in general do not support this proposal at this late stage of this work item. Introducing TRS can lead to other related work which is not acceptable. For broadcast we can assume that CORESET#0 provides the default beam which is QCL’d with an SSB.
* In [R1-2202162, Qualcomm]
	+ *Discuss*: If broadcast is transmitted from the SFNed multiple cells, the channel estimation for GC-PDCCH/PDSCH using the QCL-source SSB is not correct, especially for the cell-edge UEs. It should be periodic TRS with the multiple cells. The time delay spread of multi-cell transmission is different from that of serving cell’s SSB. We need to configure a periodic TRS transmitted from the multiple SFNed cells in a broadcast CFR. The TRS can still be QCL-ed with SSB at least in terms of timing, doppler shift.
	+ On the other hand, the GC-PDSCH for MTCH may be transmitted in the CFR with much wider bandwidth than SSB (e.g., Case A, C and E) and configured with modulation higher than QPSK. Even if the broadcast is transmission from single cell, the TRS is beneficial for the link budget of the broadcast demodulation.
	+ Proposal 3: A list of periodic NZP CSI-RS resource sets for TRS can be configured in a CFR-Config-Broadcast for RRC\_IDLE/INACTIVE UEs.
		- UE may assume that the GC-PDCCH/PDSCH is QCL’d with periodic TRS if configured for broadcast.
		- The TRS can be QCL-ed with SSB at least in terms of timing, doppler via SSB/MCCH.
* In [R1-2202351, LGE]
	+ Observation 1: Assuming that low MCS is usually used for broadcast transmission, it is not clear how much we achieve better performance with TRS.
	+ Proposal 1: If TRS is agreed to be supported, RAN1 is requested to agree the following proposals:
		- Proposal 1A: a list of NZP CSI-RS resource sets for TRS can be configured for the same cell group serving one or more G-RNTIs.
		- Proposal 1B: QCL-Info is associated with a NZP CSI-RS resource set for TRS and configured to be Type C QCLed with SSB (i.e. Doppler shift, average delay) via SIBx or MCCH.
		- Proposal 1C: The number of NZP CSI-RS resource sets in the list of NZP CSI-RS resource sets for TRS can be configurable for each cell group, similarly as specified in NZP-CSI-RS-ResourceSetList.
	+ Proposal 2: For broadcast GC-PDCCH, UE assumes that a PDCCH Monitoring Occasion (MO) is associated with one NZP-CSI-RS-ResourceSet for TRS which is QCLed with the SSB-index mapped to the MO.
		- UE uses the TRS associated with the MO where GC-DCI scheduling GC-PDSCH is received for determining GC-PDSCH antenna port quasi co-location.
		- Proposal 3: If a same SSB index can be associated with more than one NZP CSI-RS resource sets for TRS e.g. in NZP-CSI-RS-ResourceSetPerSSB,
		- for the [x×N+K]th PDCCH monitoring occasion(s) for MTCH in the scheduling window, the number of PDCCH monitoring occasions in MTCH transmission window is greater than N i.e. the number of actual transmitted SSBs; and
		- the same SSB index can be mapped to multiple MOs of which each is associated with one NZP CSI-RS resource set for TRS e.g. in NZP-CSI-RS-ResourceSetPerSSB.

### **FL comments**

This issue has been discussed multiple times at previous meeting without resolution. The inputs submitted to this meeting are also mixed. This issue may have potential RRC impact.

## Issue 9: PDCCH: CORESET for MCCH and MTCH

### **Tdoc analysis**

* In [R1-2200950, Huawei]
	+ Proposal 6: When the CFR for MCCH/MTCH is configured with the same size as SIB1 configured initial BWP, in addition to CORESET#0, the other CORESET larger than CORESET#0 can be configured.
	+ Proposal 7: Up to RAN2 how to configure up to two CORESETs for broadcast scheduling from the following three candidates:
		- CORESET0
		- Smaller than CORESET0
		- Larger than CORESET0
* In [R1-2201259, OPPO]
	+ The same CORESET is used for GC-PDCCH of scheduling GC-PDSCH of MCCH and MTCH.
* In [R1-2201597, TD Tech]
	+ Proposal 6: Support the following CORESETs/CSSs for MCCH/MTCH.
		- The CORESETs/CSSs specific for MCCH are configured on SIB x.
		- If a CORESET/CSS configured on SIB x is also used by MTCH, the index of the CORESET/CSS is indicated on MCCH.
		- The CORESETs/CSSs specific for MTCH are configured on MCCH.
		- If a CORESET/CSS for SIB1/Other SIB/Paging is reused for MCCH, the index of the CORESET/CSS is indicated on SIB x.
		- If a CORESET/CSS for SIB1/Other SIB/Paging is reused for MTCH, the index of the CORESET/CSS is indicated on MCCH.
* In [R1-2201932, Xiaomi]
	+ Proposal 3: For RRC\_IDLE/RRC\_INACTIVE UEs, the same CORESET is used for MCCH and MTCH in the same CFR.
* In [R1-2202229, Lenovo]
	+ Proposal 5: For RRC\_IDLE/RRC\_INACTIVE UEs, same CORESET is used for receiving MCCH and MTCH.

### **FL comments**

It is not clear whether this issue is critical for maintenance. The following agreement at previous RAN1 meeting is relevant for this discussion:

|  |
| --- |
| Agreement:For Rel-17, for broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs do not exceed the maximum number of CORESETs mandatorily (in the minimum capability) supported for Rel-15/Rel-16 UEs, i.e., 2 CORESETs. * If the CFR has the same frequency range as the initial BWP, where the initial BWP has the same frequency resources as CORESET0 or where the initial BWP has the frequency resources configured by SIB1, RRC\_IDLE/RRC\_INACTIVE UEs can be configured with the following options:
	+ CORESET#0 (default option if CFR is the initial BWP and CORESET is not configured); or
	+ CORESET configured by *commonControlResourceSet;* or
	+ CORESET#0 and CORESET configured by *commonControlResourceSet*.
 |

Currently, based on this agreement the FL understanding is that 2 CORESETs can be configured and there are no further limitations.

## Issue 10: Rate matching

### **Tdoc analysis**

* In [R1-2201498, NTT DOCOMO]
	+ *Discuss*: Both RB symbol level rate matching and RE level rate matching can be applied to multicast GC-PDSCH. RE level rate matching will also be useful to improve scheduling flexibility for broadcast GC-PDSCH for RRC\_IDLE/RRC\_INACTIVE UEs. In particular, rate matching around LTE CRS will be essential to provide broadcast services for RRC\_IDLE/RRC\_INACTIVE UEs in DSS carrier. If it is not supported, it will impose significant constraints on the scheduling of broadcast GC-PDSCH for RRC\_IDLE/RRC\_INACTIVE UEs in DSS carrier.
	+ Proposal 3: *RateMatchPatternLTE-CRS* can be configured in PDSCH-Config-MCCH or PDSCH-Config-MTCH for RRC\_IDLE/RRC\_INACTIVE UEs.

### **FL comments**

It is not clear whether this issue is critical for maintenance.

## Issue 11: ZP CSI-RS

### **Tdoc analysis**

* In [R1-2202398, Ericsson]
	+ Observation 3: If a broadcast UE is not aware of non-broadcast CSI-RSs overlapping with the broadcast resource assignment, broadcast reception will be negatively impacted.
	+ Proposal 4: For UEs in all RRC states receiving broadcast, the UE may be configured with ZP-CSI-RS.
		- Configuration is up to RAN2
		- Update broadcast configuration parameters with ZP-CSI-RS and send LS to RAN2
		- Inclusion of ZP-CSI-RS triggers in broadcast DCI
			* FFS details

### **FL comments**

It is not clear whether this issue is critical for maintenance. This issue could have potential impact on RRC signalling.

## Issue 12: On case E

* In [R1-2201008, Nokia]
	+ Observation-1: CFR Case E is supported based on RAN2 outcome agreement.
	+ Observation-2: the configured single CFR for broadcast reception is considered as a common frequency resource in addition to the CORESET#0 initial BWP for RRC\_IDLE/INACTIVE UEs.
* In [R1-2202036, Samsung]
	+ *Discuss*: As supporting Case E, the following restrictions are recommended: The MBS-BWP uses the same SCS and CP length as the initial BWP, and also includes all the PRBs belonging to the initial BWP. This enables UEs to decode MBS PDSCH and SIBs without BWP switching.
	+ Proposal 1: The MBS-BWP uses the same SCS and CP length as the initial BWP, and also includes all the PRBs belonging to the initial BWP.
* In [R1-2202398, Ericsson]
	+ Proposal 2: Include support for Case E in the RAN1 list of agreements for Rel-17 MBS
	+ Proposal 3: RAN1 to inform RAN2 about the agreement of Case E and associated required configurations.

### **FL comments**

It is not clear whether this issue is critical for maintenance. The restrictions proposed by Samsung seem that have been included in the RAN2#116bis-e agreements.

## Prioritisation discussion

Please provide in the following table for each of Issues 5 to Issue 12 whether they are critical or not (**yes/no**) for the maintenance of AI 8.12.3 and should therefore be discussed at this meeting. You are also invited to provide more detailed comments (if any) on why you think the issues are critical or not in the second table below.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Issues/company** | **Issue 5** | **Issue 6** | **Issue 7** | **Issue 8** | **Issue 9** | **Issue 10** | **Issue 11** | **Issue 12** |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

Please provide any other detail comments on why you think the issues are critical or not:

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |
|  |  |

# Other non-critical Issues

The following Issues the FL considers that either are non-critical for maintenance, are already part of existing agreements or are in the scope of other working groups. It is proposed that these are not discussed at this meeting.

## HARQ feedback for RRC\_IDLE/RRC\_INACTIVE UE states

### **Tdoc analysis**

* In [R1-2201259, OPPO]
	+ Proposal 5: It is proposed for RRC idle and inactive state UEs to provide HARQ feedback in order to meet reliability requirement of MBS application/service.
		- Only NACK feedback is needed since the number of RRC idle and inactive state UEs may not be accurately known by the network.
	+ Proposal 6: To support “only NACK” HARQ feedback for idle and inactive UEs, it should be further consider using PUCCH or PRACH.

## PDSCH: Semi Persistent Scheduling

### **Tdoc analysis**

* In [R1-2201259, OPPO]
	+ SPS for MTCH in broadcast can be considered in the future release of NR MBS.
* In [R1-2201932, Xiaomi]
	+ Proposal 4: For broadcast reception with UEs in RRC\_IDLE/INACTIVE states, support SPS GC-PDSCH carrying MTCH.
* In [R1-2202351, LGE]
	+ Proposal 4: For reliable group common SPS activation/deactivation for broadcast, (de)activation DCI can be repeated in association with same/different SSB indexes in a window, as previously agreed for mapping between MO and SSB.
	+ Proposal 5: For activation DCI with G-CS-RNTI for a group common SPS configuration, G-CS-RNTI indicates a broadcast service associated with the SPS configuration, as agreed for multicast.

## multi-layer MIMO support for broadcast

### **Tdoc analysis**

* In [R1-2201597, TD Tech]
	+ Proposal 4: Only one layer and only one antenna port are supported for the GC-PDSCH of a broadcast session.
	+ Proposal 5: Only one layer and only one antenna port are supported for the GC-PDSCH of MCCH.

## Beam Sweeping for MCCH and MTCH

### **Tdoc analysis**

* In [R1-2201597, TD Tech]
	+ Proposal 7: For a CSS for MTCH, if a G-RNTI has a DRX mode configured, the DRX mode is used to determine the starting point and period of the MTCH scheduling window within the CSS. Otherwise, the MTCH scheduling window is determined by the PDCCH monitoring offset and period of the CSS. Within the MTCH scheduling window, the following agreement on the association between the PDCCH monitoring occasions and SSB is applied.

## Cross-cell scheduling

### **Tdoc analysis**

* In [R1-2201597, TD Tech]
	+ Proposal 8: The source cell and target cell can have the same PTM configuration information for a broadcast session.
	+ Proposal 9: Send an LS to RAN2 with the following information included:
		- RAN1 supports the source cell and target cell have the same PTM configuration information for a broadcast session.
		- In order to reduce the broadcast session reception interruption time, for a broadcast session in the source cell and for each neighbour cell providing the broadcast session, RAN1 expects an additional bit is added to indicate whether or not the neighbour cell has the same PTM configuration information as the source cell.
		- RAN1 hopes RAN2 can confirm
		- For a broadcast session in the source cell and each neighbour cell providing the broadcast session, RAN2 can add an additional bit to indicate whether or not the neighbour cell has the same PTM configuration information as the source cell.

Please provide comments in the table below if you have concerns:

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |

# Proposals for Discussion at GTW sessions

This section will include proposals for potential discussion at the different GTW scheduled for NR MBS at RAN1#108-e.

# Stable Proposals

# Summary of Agreements

This section includes the agreements for RAN1#108-e.

# References

1. RP-201038 Revised Work Item on NR Multicast and Broadcast Services, Huawei, HiSilicon

**Relevant tdoc from RAN#93-e**

1. RP-212559 Moderator's summary for email discussion [93e-19-MBS-WI] 3GPP RAN1 WG Vice-Chair

**Relevant tdoc from RAN#94-e**

1. RP-213675 Moderator’s summary of discussion [94e-42-R17-MBS-Scope] RAN2 Chair (MediaTek Inc)

**Relevant tdoc from AI 5**

1. R1-2200882 LS on MBS issues RAN2, Huawei

**Relevant tdocs from AI 8.12.3**

1. R1-2200950 Discussion on UE receiving broadcast in RRC IDLE/INACTIVE state Huawei, HiSilicon
2. R1-2201008 Remaining Issues on Broadcast / Multicast for RRC\_IDLE / RRC\_INACTIVE Ues Nokia, Nokia Shanghai Bell
3. R1-2201116 Remaining issues on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs vivo
4. R1-2201172 Maintenance of Functions for Broadcast or Multicast for RRC\_IDLE or RRC\_INACTIVE UEs ZTE
5. R1-2201259 Discussion on remaining issues of basic functions for RRC\_IDLE/RRC\_INACTIVE UEs OPPO
6. R1-2201340 Remaining issues on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs CATT
7. R1-2201498 Remaining issues on basic functions for broadcast NTT DOCOMO, INC.
8. R1-2201597 Discussion on basic functions for broadcast mode TD Tech, Chengdu TD Tech
9. R1-2201719 Broadcast for RRC\_IDLE/INACTIVE UEs Intel Corporation
10. R1-2201788 Remaining issues on MBS for RRC\_IDLE/RRC\_INACTIVE UEs Apple
11. R1-2201817 Basic Functions for Broadcast or Multicast for RRC\_IDLE or RRC\_INACTIVE UEs Spreadtrum Comm
12. R1-2201878 Remaining issues on NR MBS in RRC\_IDLE/RRC\_INACTIVE states CMCC
13. R1-2201932 Remaining issues on broadcast and multicast for RRC\_IDLERRC\_INACTIVE UEs Xiaomi
14. R1-2202036 Maintenance on broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE Ues Samsung
15. R1-2202081 Remaing issues on MBS broadcast reception for RRC\_IDLE and INACTIVE UEs MediaTek Inc.
16. R1-2202162 Maintenance on group scheduling for Broadcast RRC\_IDLE/INACTIVE UEs Qualcomm Incorporated
17. R1-2202229 Remaining issues on basic functions for broadcast/multicast in idle/inactive states Lenovo, Motorola Mobility
18. R1-2202351 Basic function for broadcast/multicast LG Electronics
19. R1-2202398 Support for NR multicast reception in RRC Inactive/Idle Ericsson

# Annex A: Agreements in previous RAN1 meetings

## RAN1#103-e agreements

Agreements: For RRC\_IDLE/RRC\_INACTIVE UEs, support group-common PDCCH with CRC scrambled by a common RNTI to schedule a group-common PDSCH, where the scrambling of the group-common PDSCH is based on the same common RNTI.

* FFS details

Agreements:

* For RRC\_IDLE/RRC\_INACTIVE Ues, beam sweeping is supported for group-common PDCCH/PDSCH.
	+ FFS: Details for support of beam sweeping for group-common PDCCH/PDSCH.

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: From physical layer perspective, for broadcast reception, 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.

* FFS details.

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

## RAN1#104-e agreements

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, one common frequency resource for group-common PDCCH/PDSCH can be defined/configured.

* FFS: whether to define/configure more than one common frequency resources

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 broadcast reception, 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 when UE-specific active BWP of RRC\_CONNECTED UE contains the common frequency resource of RRC\_IDLE/INACTIVE UEs and the SCS and CP are the same.

* FFS: the case when UE-specific active BWP of RRC\_CONNECTED UE does not contain the common frequency resource of RRC\_IDLE/INACTIVE UEs.

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.

## RAN1#105-e agreements

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, both searchSpace#0 and common search space other than searchSpace#0 can be configured for GC-PDCCH scheduling MCCH.

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, DCI format 1\_0 is used as baseline for GC-PDCCH of MCCH and MTCH.

* FFS details of FDRA.

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, RAN1 confirms the following assumptions made by RAN2

* RAN2 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.
* RAN2 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.

Agreement:

For broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs support the same CSS type for MCCH and MTCH.

* FFS support of different CSS types for MCCH and MTCH channels for broadcast reception.

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.

Agreement:

For broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs can use a configured/defined CFR with the same size as the initial BWP, where the initial BWP has the same frequency resources as CORESET0 (i.e., Case A), to receive GC-PDCCH/PDSCH carrying MCCH.

* Note: GC-PDCCH/PDSCH transmission within a narrower portion of the Initial BWP (where the initial BWP has the same frequency resources as CORESET0) is possible by implementation via appropriate scheduling.

Agreement:

For broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs can use a configured/defined CFR with the same size as the initial BWP, where the initial BWP has the same frequency resources as CORESET0 (i.e., Case A), to receive GC-PDCCH/PDSCH carrying MTCH.

* Note: GC-PDCCH/PDSCH transmission within a narrower portion of the Initial BWP (where the initial BWP has the same frequency resources as CORESET0) is possible by implementation via appropriate scheduling.

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, the CORESET index can be the same for GC-PDCCH of MCCH and MTCH.

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, the same beam can be used for group-common PDCCH and the corresponding scheduled group-common PDSCH for carrying MCCH or MTCH.

* UE may assume that DMRS ports of the group-common PDCCH/PDSCH for MCCH is QCL’d with SSB.
* UE may assume that DMRS ports of the group-common PDCCH/PDSCH for MTCH is QCL’d with SSB.
* FFS: group-common PDCCH/PDSCH for MTCH is QCL’d with periodic TRS if configured

Agreement:

For Rel-17, for broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs do not exceed the maximum number of CORESETs mandatorily (in the minimum capability) supported for Rel-15/Rel-16 UEs, i.e., 2 CORESETs.

* If the CFR has the same frequency range as the initial BWP, where the initial BWP has the same frequency resources as CORESET0 or where the initial BWP has the frequency resources configured by SIB1, RRC\_IDLE/RRC\_INACTIVE UEs can be configured with the following options:
	+ CORESET#0 (default option if CFR is the initial BWP and CORESET is not configured); or
	+ CORESET configured by *commonControlResourceSet;* or
	+ CORESET#0 and CORESET configured by *commonControlResourceSet*.

## RAN1#106-e agreements

Agreement:

From RAN1 perspective, the CFR for broadcast reception of RRC\_IDLE/INACTIVE UEs, includes at least the following configurations:

* One set of parameters configured for PDSCH for broadcast reception with GC-PDSCH
* One set of parameters configured for PDCCH for broadcast reception with GC-PDCCH
* FFS: whether some parameters configured for PDSCH/PDCCH are optional/needed for the supported cases of CFR.
* FFS: If necessary, depending on the cases supported, starting PRB and the number of PRBs
	+ The reference for starting PRB is Point A. (Following the same approach to determine reference for starting PRB as that defined in AI8.12.1.)

Conclusion:

There is no specification support in Rel-17 for broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs with configured/defined CFRs for group-common PDCCH/PDSCH with smaller size than the initial BWP, where the initial BWP has the same frequency resources as CORESET0 (i.e., Case B).

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, if searchSpace#0 is configured for MTCH, the mapping between PDCCH occasions and SSBs is the same as for SIB1.

Agreement:

Study and reach an agreement by RAN1#106b-e on whether Alt1 and Alt2 for MCCH change notification indication can accommodate at least 2 bits for the notification of MCCH configuration changes due to a session start and the notification of MCCH configuration changes of an ongoing session (including session stop).

Agreement:

The DCI format for GC-PDCCH scheduling a GC-PDSCH carrying MCCH/MTCH at least includes the following fields for broadcast reception with UEs in RRC\_IDLE/INACTIVE state:

* FDRA field
* TDRA field
* Modulation and coding scheme
* Redundancy version
* FFS:
	+ MCCH change notification (if supported and only for MCCH),
	+ RB numbering starts from the lowest RB of the CFR and support of resource allocation with granularity of single or multiple RBs.
	+ HARQ process number and New data indicator
	+ VRB-to-PRB mapping
	+ other fields if needed.

Agreement:

Only one CFR can be configured for group-common PDCCH/PDSCH carrying MCCH for broadcast reception with UEs in RRC\_IDLE/INACTIVE state.

Agreement:

For broadcast reception with UEs in RRC\_IDLE/INACTIVE state, the DCI size of GC-PDCCH scheduling a GC-PDSCH carrying MCCH/MTCH is aligned with DCI format 1\_0 with CRC scrambled by C-RNTI in the CSS.

Agreement:

For broadcast reception, RRC\_IDLE/RRC\_INACTIVE UEs can use the same bandwidth configurations for the CFR of GC-PDCCH/PDSCH carrying MCCH and the CFR of GC-PDCCH/PDSCH carrying MTCH.

* FFS: use of different bandwidth configurations for the CFR of GC-PDCCH/PDSCH carrying MCCH and the CFR of GC-PDCCH/PDSCH carrying MTCH

Conclusion:

For broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs, there is no specification support in Rel-17 of different CSS types for GC-PDCCH scheduling MCCH and MTCH.

Agreement:

Study whether the Type-x CSS supported for multicast in RRC\_CONNECTED can be reused as baseline for broadcast in RRC\_IDLE/RRC\_INACTIVE for GC-PDCCH scheduling MCCH and MTCH.

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs with broadcast reception, if common search space other than searchSpace#0 is configured for MTCH, the mapping of PDCCH monitoring occasions to SSBs can be configured with a rule.

* The existing rule defined for OSI in TS 38.331 is used as starting point to define the above rule.

## RAN#93-e agreements

Agreement:

* The following aspects can be considered to be within the scope of the Rel-17 MBS WID and can be further discussed in the WGs with the aim of minimizing specification impacts:
	+ Configurable scrambling sequence initialization for PDCCH/PDSCH and DMRS sequence generator initialization for PDCCH/PDSCH for broadcast transmission (as supported for RRC\_CONNECTED UE).
	+ Configuring TRS as QCL sources for broadcast transmission (as supported for RRC\_CONNECTED UE).
* Note: For broadcast transmission, the presence of TRS would be optional from a network perspective.
* Note: Any SFN operation is transparent to the UE

Agreement (Updated proposal from RAN1#106e):

For a configured/defined CFR for GC-PDCCH/PDSCH carrying MCCH and MTCH for broadcast reception with UEs in RRC IDLE/INACTIVE state.

* Support Case-C
* Support at least one of Case D and Case E.
	+ Down-selection to be made at RAN1#106b-e
* Note: Case C, D and E are defined in previous agreements

## RAN1#106bis-e agreements

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, both searchSpace#0 and common search space other than searchSpace#0 can be configured for GC-PDCCH scheduling MTCH.

Agreement:

The PDCCH/PDSCH parameters for broadcast reception with GC-PDCCH/PDSCH, which are not configured, use as default the value of the PDCCH/PDSCH parameters for the configuration of the Rel-15/Rel-16 initial BWP for RRC\_IDLE/RRC\_INACTIVE UEs.

Agreement:

For initializing scrambling sequence generator for GC-PDCCH for MCCH/MTCH for broadcast,

* $n\_{ID}$ equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in a CFR used for the GC-PDCCH for MCCH/MTCH;$n\_{ID}=N\_{ID}^{cell}$ otherwise.
* $n\_{RNTI}=0$.

Agreement:

For broadcast reception with UEs in RRC\_IDLE/INACTIVE states, support slot-level repetition for MTCH.

Agreement:

For initializing scrambling sequence generator for GC-PDSCH for MCCH/MTCH for broadcast,

* $n\_{ID}$ equals the higher layer parameter *dataScramblingIdentityPDSCH* if it is configured in a CFR used for GC-PDSCH for MCCH/MTCH and the RNTI equals the G-RNTI or MCCH-RNTI;$n\_{ID}=N\_{ID}^{cell}$ otherwise.
* $n\_{RNTI}$ corresponds to the RNTI associated with the GC-PDSCH transmission.

Agreement:

For initializing sequence generator for DMRS of GC-PDCCH for MCCH/MTCH for broadcast,

* $N\_{ID}$ equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in a CFR used for the GC-PDCCH for MCCH/MTCH; $N\_{ID}=N\_{ID}^{cell}$ otherwise.

Agreement:

For initializing sequence generator for DMRS of GC-PDSCH for MCCH/MTCH for broadcast,

* $N\_{ID}^{0} $equals the higher-layer parameters *scramblingID0* if it is configured in the *DMRS-DownlinkConfig*IE in a CFR used for GC-PDSCH for MCCH/MTCH; $N\_{ID}^{\overbar{n}\_{SCID}^{\overbar{λ}}}=N\_{ID}^{cell} $ otherwise.

Working assumption:

Alt 2 (from previous agreement) is supported for broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs for the notification of MCCH configuration changes.

* Send an LS to RAN2 with the mechanism agreed in RAN1

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs for broadcast reception, MTCH scheduling is associated with a window defined by the MTCH monitoring periodicity and the starting of the periodicity

* FFS: the window is associated to one or multiple or all G-RNTI.

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs for broadcast reception, at least support that within the MTCH scheduling window, the association between the PDCCH monitoring occasions and SSB is defined as:

* the [*x*×*N*+*K*]th PDCCH monitoring occasion(s) for MTCH in the scheduling window corresponds to the *K*th transmitted SSB, where *x* = 0, 1, ...*X*-1, *K* = 1, 2, …*N*, *N* is the number of actual transmitted SSBs determined according to *ssb-PositionsInBurst* in SIB1 and *X* is equal to CEIL(*number of PDCCH monitoring occasions in MTCH transmission window*/*N*).
* For the purpose of associating PDCCH monitoring occasion for MTCH and SSB,the UE assumes that, in the MTCH scheduling window, PDCCH for an MTCH scrambled by G-RNTI is transmitted in at least one PDCCH monitoring occasion corresponding to each transmitted SSB.

## RAN1#107-e agreements

**Agreement**

Confirm the working assumption made at RAN1#106bis-e:

Working assumption:

Alt 2 (from previous agreement) is supported for broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs for the notification of MCCH configuration changes.

* Send an LS to RAN2 with the mechanism agreed in RAN1

R1-2112645 [DRAFT] Reply LS on MCCH change notification Moderator (BBC)

Final LS is endorsed in R1-2112646

**Agreement**

For GC-PDSCH scheduled with DCI format 1\_0 for broadcast reception, RB numbering starts from the lowest RB of the CFR.

**Conclusion**

For broadcast reception, the DCI 1\_0 format for GC-PDCCH scheduling a GC-PDSCH does not include the field TB scaling.

**Agreement**

For broadcast reception, the following options is supported for VRB-to-PRB mapping field in the DCI format 1\_0 for GC-PDCCH scheduling a GC-PDSCH

* Opt-1: DCI includes the VRB-to-PRB mapping field with 1 bit according to Table 7.3.1.2.2-5 in TS 38.212
	+ Note: DL resource allocation type 0 is not supported in DCI format 1\_0

**Working assumption**

For FDRA determination of the DCI format 1\_0 for GC-PDCCH for broadcast reception:

* is the size of CORESET 0if CORESET 0 is configured for the cell; and the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.
* If the size of CFR (i.e.$N\_{CFR}$)is larger than the size of CORESET0/initial DL bandwidth part, the resource indication value (*RIV*) is defined as in section 5.1.2.2.2 in TS38.214, where *K* is the maximum value from set {1, 2, 4, 6, 8, 10, 12} which satisfies $K\leq \left⌊N\_{CFR}/N\_{BWP}^{initial}\right⌋$*;*otherwise*,* $K=1.$

**Agreement**

For broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs:

* The CFR frequency resources used for MCCH and MTCH are configured by SIBx;
* PDCCH-config/PDSCH-config for broadcast reception with GC-PDCCH/PDSCH carrying MCCH is configured by SIBx
* PDCCH-config/PDSCH-config for broadcast reception with GC-PDCCH/PDSCH carrying MTCH is configured by MCCH. If the PDCCH-config/PDSCH-config for MTCH is not configured, the PDCCH-config/PDSCH-config for GC-PDCCH/PDSCH carrying MCCH configured by SIBx is reused for GC-PDCCH/PDSCH carrying MTCH.

**Agreement**

Adding the following PDSCH TDRA table determination rule for broadcast to Table 5.1.2.1.1-1 of TS38.214.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **RNTI** | **PDCCH search space** | **SS/PBCH block and CORESET multiplexing pattern** | **pdsch-ConfigCommon includes pdsch-TimeDomainAllocationList** | **pdsch-Config includes pdsch-TimeDomainAllocationList** | **pdsch-Config-broadcast includes pdsch-TimeDomainAllocationList** | **PDSCH time domain resource allocation to apply** |
| MCCH\_RNTI, G\_RNTI for broadcast | Type-x Common for broadcast | 1 | No | - | - | Default A |
| 2 | No | - | - | Default B |
| 3 | No | - | - | Default C |
|  |  |  |  |  |
| 1,2,3 | Yes | - | No | pdsch-TimeDomainAllocationList provided in pdsch-ConfigCommon |
| 1,2,3 | No/Yes | - | Yes | pdsch-TimeDomainAllocationList provided in pdsch-Config-broadcast |

**Agreement**

The definition of the broadcast CFR frequency resources reuses the legacy definition of BWP frequency resources for unicast using the combination of Point A, *offsetToCarrier* and *locationAndBandwidth* to indicate the exact location of the CFR with respect to the carrier starting RB.

* Note: for Case A and Case C, the above parameters (Point A, *offsetToCarrier* and *locationAndBandwidth*) can be derived from the configurations in MIB and SIB1, respectively.

**Agreement**

For RRC\_IDLE/INACTIVE UEs, for slot-level repetition for MTCH, support:

* (Config A) UE can be configured with *pdsch-AggregationFactor* per G-RNTI, applied to DCI format 1\_0 with the G-RNTI.
* (Config B) UE can be configured with TDRA table with *repetitionNumber* as part of the TDRA table in *PDSCH-Config-Broadcast*
* If UE is configured with Config B, UE does not expect to be configured with Config A for the same GC-PDSCH.

**Agreement**

The following agreements for RRC\_CONECTED UEs also apply for broadcast reception with UEs in RRC\_IDLE/ RRC\_INACTIVE states, with the following updates:

Agreement:

For LBRM and TBS determination for GC-PDSCH:

* The maximum number of layers can be provided by *maxMIMO-Layers* in *PDSCH-Config* for MBS in CFR; if not provided, a default value is defined.
	+ FFS the default value.
* The maximum modulation order can be determined from *mcs-Table* in PDSCH-Config for MBS in CFR;
	+ FFS: if *mcs-Table* in *PDSCH-Config* for MBS is not configured in CFR, a value determined from *mcs-Table* in *PDSCH-Config* for unicast in the active DL BWP is used; if the *mcs-Table* in *PDSCH-Config* for unicast is not configured, Table 5.1.3.1-1 in TS38.214 is used (similar as the default value in R16).
* xOverhead can be provided in PDSCH-Config for MBS in CFR; if not provided, a default value of zero is used.
* The number of PRBs is determined based on the size of CFR.

Agreement:

For LBRM and TBS determination for GC-PDSCH, the default value of the maximum number of layers is 1 if *maxMIMO-Layers* in *PDSCH-Config* for MBS in CFR is not configured.

Agreement:

For determination of maximum modulation order for LBRM and TBS determination for GC-PDSCH,

* if *mcs-Table* in *PDSCH-Config* for MBS is not configured in CFR, Table 5.1.3.1-1 in TS38.214 is used (similar as the default value in R16).

For LBRM and TBS determination for GC-PDSCH for broadcast reception:

* the maximum number of layers is 1
* the maximum modulation order can be determined from *mcs-Table* in *PDSCH-Config* for broadcast.
* If *mcs-Table* in *PDSCH-Config* is not configured in CFR for broadcast, Table 5.1.3.1-1 in TS38.214 is used.

**Agreement**

Confirm the following working assumption with the following note:

* Note: Confirming this WA does not have impact on the down-selection decision for CFR cases

Working assumption

For FDRA determination of the DCI format 1\_0 for GC-PDCCH for broadcast reception:

* is the size of CORESET 0if CORESET 0 is configured for the cell; and the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.
* If the size of CFR (i.e.$N\_{CFR}$)is larger than the size of CORESET0/initial DL bandwidth part, the resource indication value (*RIV*) is defined as in section 5.1.2.2.2 in TS38.214, where *K* is the maximum value from set {1, 2, 4, 6, 8, 10, 12} which satisfies $K\leq \left⌊N\_{CFR}/N\_{BWP}^{initial}\right⌋$*;*otherwise*,* $K=1.$

**Conclusion**

RAN1 cannot get consensus on the support of Case D and/or Case E.

**Conclusion**

Is up to RAN2 decision:

* the configuration of the MTCH scheduling window parameters: monitoring periodicity and the starting of the periodicity:
* whether the MTCH scheduling window is associated to one or multiple or all G-RNTIs

Send an LS to RAN2 to inform about RAN1 conclusion

R1-2112850 LS on MTCH scheduling window

## RAN1#107bis-e agreements

**Agreement**

For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed MCCH PDSCH and MTCH PDSCH in PCell.

**Agreement**

For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed multiple MTCH PDSCHs in PCell.

**Agreement**

For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed MCCH/MTCH PDSCH and SIB1 or Paging PDSCH in PCell.

* + FFS: PBCH and other SIBs

**Conclusion**

Additional HARQ process(es) is(are) not introduced for Rel-17 MBS broadcast reception on serving cell.

* + Note: The UE is not expected to support hardware for more HARQ processes for receiving broadcast in Rel-17 in addition to the maximum number of HARQ processes supported for receiving unicast in Rel-16, i.e. the HARQ process resources are shared between broadcast, unicast and multicast

The TP below for Section 5.1.2.1 of TS 38.214v17.0.0 is endorsed.

|  |
| --- |
| 5.1.2.1 Resource allocation in time domain< Unchanged parts are omitted >When receiving PDSCH scheduled by DCI format 4\_2 in PDCCH with CRC scrambled by G-RNTI or G-CS-RNTI with NDI=1, if the UE is configured with *pdsch-AggregationFactor* in the *pdsch-Config-Multicast* associated withthe corresponding G-RNTI or in the associated *SPS-Config-Multicast* activated by the DCI format 4\_2 with CRC scrambled by G-CS-RNTI, the same symbol allocation is applied across the *pdsch-AggregationFactor* consecutive slots. When receiving PDSCH scheduled by DCI format 4\_2 for multicast reception in PDCCH with CRC scrambled by G-CS-RNTI with NDI = 0, or PDSCH without corresponding PDCCH transmission using associated [*SPS-Config-Multicast*] and activated by the DCI format 4\_2 in PDCCH with CRC scrambled by G-CS-RNTI, the same symbol allocation is applied across the *pdsch-AggregationFactor*, in associated *SPS-Config-Multicast* if configured, or 1 otherwise, consecutive slots. When receiving PDSCH scheduled by DCI format 4\_0 in PDCCH with CRC scrambled by G-RNTI for MTCH, if the UE is configured with *pdsch-AggregationFactor* in the *pdsch-Config-MTCH*, the same symbol allocation is applied across the *pdsch-AggregationFactor* consecutive slots. |

The TP below for Section 5.1.2.3 of TS 38.214v17.0.0 is endorsed.

|  |
| --- |
| ----------------------------------- **Start of Text proposal to 5.1.2.3 of 38.214** ------------------------------------------------<Unchanged text omitted> If a UE is scheduled a PDSCH with DCI format 1\_0 or DCI format 4\_0, the UE shall assume that  is equal to 2 PRBs.<Unchanged text omitted>----------------------------------- **End of Text proposal to 5.1.2.3 of 38.214** ------------------------------------------------ |

The TP below for Section 5.1.3.1 of TS 38.214v17.0.0 is endorsed.

|  |
| --- |
| 5.1.3.1 Modulation order and target code rate determination< Unchanged parts are omitted >elseif the higher layer parameter *mcs-Table* given by *PDSCH-Config* is set to ‘qam256’, and the PDSCH is scheduled by a PDCCH with DCI format 1\_1 with CRC scrambled by C-RNTI- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate ® used in the physical downlink shared channel. Elseif the higher layer parameter *mcs-Table* given by *PDSCH-Config-Multicast* is set to ‘qam256’, and the PDSCH is scheduled by a PDCCH with DCI format 4\_1 or 4\_2 with CRC scrambled by G-RNTI- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate ® used in the physical downlink shared channel. Elseif the higher layer parameter *mcs-Table* given by *PDSCH-Config-MCCH and PDSCH-Config-MTCH* is set to ‘qam256’, and the PDSCH is scheduled by a PDCCH with DCI format 4\_0 with CRC scrambled by MCCH-RNTI or G-RNTI for MTCH- the UE shall use *IMCS* and Table 5.1.3.1-2 to determine the modulation order (*Qm*) and Target code rate ® used in the physical downlink shared channel.  |

The TP below for Section 5.1.6.2 of TS 38.214v17.0.0 is endorsed.

|  |
| --- |
| ----------------------------------- **Start of Text proposal to 5.1.6.2 of 38.214** ------------------------------------------------<Unchanged text omitted>When receiving PDSCH scheduled by DCI format 1\_0 or DCI format 4\_0 or receiving PDSCH before dedicated higher layer configuration of any of the parameters *dmrs-AdditionalPosition*, *maxLength* and *dmrs-Type,* the UE shall assume that the PDSCH is not present in any symbol carrying DM-RS except for PDSCH with allocation duration of 2 symbols with PDSCH mapping type B (described in clause 7.4.1.1.2 of [4, TS 38.211]), and a single symbol front-loaded DM-RS of configuration type 1 on DM-RS port 1000 is transmitted, and that all the remaining orthogonal antenna ports are not associated with transmission of PDSCH to another UE and in addition<Unchanged text omitted>When receiving PDSCH scheduled by DCI format 1\_0 or DCI format 4\_0, the UE shall assume the number of DM-RS CDM groups without data is 1 which corresponds to CDM group 0 for the case of PDSCH with allocation duration of 2 symbols, and the UE shall assume that the number of DM-RS CDM groups without data is 2 which corresponds to CDM group {0,1} for all other cases.<Unchanged text omitted>----------------------------------- **End of Text proposal to 5.1.6.2 of 38.214** ------------------------------------------------ |

The TP below for Section 5.4.2.1 of TS 38.212v17.0.0 is endorsed.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **5.4.2.1 Bit selection**---------------------------- Other parts are omitted. ----------------------------**Table 5.4.2.1-1: Value of**

|  |  |
| --- | --- |
| Maximum number of PRBs across all configured DL BWPs and UL BWPs of a carrier for DL-SCH and UL-SCH, respectively,orMaximum number of PRBs across all CFRs of a carrier for DL-SCH with PDSCH scheduled by DCI format 4\_0/4\_1/4\_2 |  |
| Less than 33 | 32 |
| 33 to 66 | 66 |
| 67 to 107 | 107 |
| 108 to 135 | 135 |
| 136 to 162 | 162 |
| 163 to 217 | 217 |
| Larger than 217 | 273 |

---------------------------- Other parts are omitted. ---------------------------- |

The TP below for Section 5.4.2.1 of TS 38.212v17.0.0 is endorsed.

|  |
| --- |
| **7.3.1.5.1 Format 4\_0**DCI format 4\_0 is used for the scheduling of PDSCH for broadcast in DL cell. The following information is transmitted by means of the DCI format 4\_0 with CRC scrambled by MCCH-RNTI or G-RNTI for MTCH configured by *MBS-SessionInfo*:- Frequency domain resource assignment – bits where equals to - the size of CORESET 0 if CORESET 0 is configured for the cell; and- the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.<Unchanged text omitted> |

**Agreement**

The *dataScramblingIdentityPDSCH-Broadcast, and scramblingID0-Broadcast* can be separately configured for MCCH-RNTI and for each MTCH G-RNTI.

**Agreement**

For broadcast RRC\_IDLE/INACTIVE UEs, *rateMatchPatternToAddModList* can be configured in *PDSCH-Config-MCCH* or *PDSCH-Config-MTCH* for GC-PDSCH rate matching.

* + Whether UE can receive the GC-PDSCH with rate matching based on the *rateMatchPatternToAddModList* is subject to UE capability.
	+ Rel-15/16 UE capability of the supported maximum number of RE mapping patterns per symbol and per slot are kept unchanged to support rate matching for unicast/multicast/broadcast. The RateMatchPattern configured for MBS broadcast is counted into the ones that are configured per serving-cell.

**Agreement**

For RRC\_IDLE/INACTIVE UEs, a UE is not required to support reception of FDMed MCCH/MTCH PDSCH and SIB PDSCH in PCell.

**Agreement**

New data indicator is not indicated in DCI format 4\_0 for MCCH

**Agreement**

HARQ process ID is not indicated in DCI format 4\_0 for both MCCH and MTCH.

**Agreement**

New data indicator is not indicated in DCI format 4\_0 for MTCH

The TP below for Section 10 of TS 38.213v17.0.0 is endorsed.

|  |
| --- |
| **10.1 UE procedure for determining physical downlink control channel assignment** A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets- a Type0-PDCCH CSS set configured by *pdcch-ConfigSIB1* in *MIB* or by *searchSpaceSIB1* in *PDCCH-ConfigCommon* or by *searchSpaceZero* in *PDCCH-ConfigCommon* for a DCI format 1\_0 with CRC scrambled by a SI-RNTI, or by *searchSpaceZero* in *PDCCH-ConfigCommon* when neither *pdcch-Config-MCCH nor pdcch-Config-MTCH* is not provided, for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI for MTCH, on the primary cell of the MCG---------------------------- Other parts are omitted. ---------------------------- |

**Agreement**

* + If the active DL BWP and the common MBS frequency resource for broadcast have same SCS and same CP length and the active DL BWP includes all RBs of the common MBS frequency resource configured for broadcast and if a UE is provided searchSpace for Type0B-PDCCH CSS set, the UE monitors PDCCH for Type0B-PDCCH CSS set on the DL BWP.
		- Note: It is up to the editor how to capture the above.
	+ The TP below for section 10.1 of TS 38.213v17.0.0 is endorsed

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| --- |
| ***----------------------------------------------------Text proposal starts------------------------------------***10.1 UE procedure for determining physical downlink control channel assignment < Unchanged parts are omitted >For a DL BWP, if a UE is not provided *searchSpaceSIB1* for Type0-PDCCH CSS set by *PDCCH-ConfigCommon*, the UE does not monitor PDCCH candidates for a Type0-PDCCH CSS set on the DL BWP. The Type0-PDCCH CSS set is defined by the CCE aggregation levels and the number of PDCCH candidates per CCE aggregation level given in Table 10.1-1. If the active DL BWP and the initial DL BWP have same SCS and same CP length and the active DL BWP includes all RBs of the CORESET with index 0, or the active DL BWP is the initial DL BWP, or the active DL BWP includes all RBs of the common MBS frequency resource configured for broadcast, the CORESET configured for Type0-PDCCH CSS set has CORESET index 0 and the Type0-PDCCH CSS set has search space set index 0. < Unchanged parts are omitted >***----------------------------------------------------Text proposal ends-------------------------------------*** |

The TP below for Section 7.3.1.5 of TS 38.211v17.0.0 is endorsed.

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| **TP-2.11-1 for TS38.211****7.3.1.5 Mapping to virtual resource blocks**The UE shall, for each of the antenna ports used for transmission of the physical channel, assume the block of complex-valued symbols  conform to the downlink power allocation specified in [6, TS 38.214] and are mapped in sequence starting with  to resource elements  in the virtual resource blocks assigned for transmission which meet all of the following criteria: - they are in the virtual resource blocks assigned for transmission; - the corresponding physical resource blocks are declared as available for PDSCH according to clause 5.1.4 of [6, TS 38.214];- the corresponding resource elements in the corresponding physical resource blocks are- not used for transmission of the associated DM-RS or DM-RS intended for other co-scheduled UEs as described in clause 7.4.1.1.2;- not used for non-zero-power CSI-RS according to clause 7.4.1.5 if the corresponding physical resource blocks are for a PDSCH scheduled by a PDCCH with the CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI for multicast, G-CS-RNTI, ~~MCCH-RNTI,~~ or a PDSCH with SPS, except if the non-zero-power CSI-RS is a CSI-RS configured by the higher-layer parameter *CSI-RS-Resource-Mobility* in the *MeasObjectNR* IE or except if the non-zero-power CSI-RS is an aperiodic non-zero-power CSI-RS resource;- not used for PT-RS according to clause 7.4.1.2;- not declared as 'not available for PDSCH according to clause 5.1.4 of [6, TS 38.214].---------------------------- Other parts are omitted. ---------------------------- |

# Annex B: [R1-2200882] RAN2 LS on MBS issues

R1-2200882 submitted to RAN1#108-e reproduced here for convenience:

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| **3GPP TSG RAN WG1 #108-e R1-2200882****e-Meeting, February 21st – March 3rd, 2022****3GPP TSG RAN2 Meeting #116bis-eR2-2201830****Online, 17 – 25 January 2022****Title:** LS on MBS issues**Response to:** **Release:** Rel-17**Work Item:** NR\_MBS-Core**Source:** RAN2**To:** RAN1**Cc:** -**Contact Person:** **Name:** Dawid Koziol**E-mail:** dawid.koziol@huawei.com **Send any reply LS to: 3GPP Liaisons Coordinator,** **mailto:3GPPLiaison@etsi.org** **1. Overall Description:**RAN2 would like to thank RAN1 for providing the list of L1 parameters to be configured with RRC signalling. RAN2 has discussed some aspects related to this topic and would like to ask RAN1 the following question.**Question:** Currently, RAN2 running RRC design assumes that only a single CFR (indicated by *locationAndBandwidth-Broadcast*) is configured for MCCH/MTCH reception of MBS broadcast and it is common for MCCH and all MTCHs. RAN2 would like to confirm this understanding with RAN1.Furthermore, RAN2 has decided to include MCCH/MTCH search space configuration of MBS broadcast as part of PDCCH-ConfigCommon, to have a unified configuration framework for all common search spaces. **2. Actions:****To RAN1 group:****ACTION:** RAN2 respectfully asks RAN1 to take the above into account and answer the above question.**3. Dates of next TSG-RAN WG2 meetings:**RAN2#117-e 21 February – 3 March 2022 OnlineRAN2#118-e 16 – 27 May 2022 Online |