**3GPP TSG RAN WG1 #109-e**  **R1-22xxxxx**

**e-Meeting, May 9th – 20th, 2022**

**Agenda item:** 8.12.2

**Source:** Moderator (CMCC)

**Title:** Summary# on mechanisms to support broadcast/multicast for RRC\_CONNECTED/RRC\_IDLE/RRC\_INACTIVE UEs

**Document for:** Discussion/decision

# Introduction

In the RAN1#109-e meeting preparation discussion phase, we summarized the related issues based on the contributions submitted in RAN1#109-e for Rel-17 NR MBS maintenance and the final summary is R1-2205129.

For AI 8.12.2, the following email thread is announced by chairman in RAN1#109-e:

[109-e-R17-MBS-04] Email discussion for maintenance on mechanisms to support broadcast/multicast for RRC\_CONNECTED/RRC\_IDLE/RRC\_INACTIVE UEs, for issues #2-1, 2-2/3-1, 2-3, 2-4, 2-5, 2-6/2-7, 2-12, 3-3, 2-23, 2-13/3-2 in R1-2205129 – Tuo (CMCC)

* 1st check point: May 13 (any RRC impact by May 12)
* Final check point: May 18

The following sections are structured as follows: The section 2 and 3 are issues to be discussed in this meeting. In each section, we first provide the background and related proposals submitted in this meeting in sub-section X.1, then sub-issues and related proposals are identified by moderator in subsequent sub-sections. In each sub-section, one table is provided after proposals to collect company views during the email discussion. In section 4, some proposals will be selected for discussion in the GTW session. In section 5, some proposals will be selected for email approval.

# GC-PDSCH related issues

## Background and submitted proposals

### Issue#2-1) SPS collision handling

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| **Company** | **Proposals** |
| **ZTE** | **Proposal 1: If a UE reports capability of FDMed reception of unicast/multicast PDSCH in a slot, it can at most receive one multicast SPS PDSCH and one unicast SPS PDSCH no mather they are FMDed or TDMed.**  Proposal 2: If a UE supports FDM reception between unicast SPS PDSCH and multicast SPS PDSCH in a slot, and if more than one PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot, Alt1 is support, i.e.,   * **if the PDSCHs include both unicast SPS PDSCH(s) and multicast SPS PDSCH(s),**    + **the UE resolves collisions among unicast SPS PDSCHs resulting in one unicast SPS PDSCH and collisions among multicast SPS PDSCHs resulting in one multicast SPS PDSCH as in Rel-16, respectively. If the resulting unicast SPS PDSCH and multicast SPS PDSCH overlap in both time and frequency, the UE receives the one with lower configured sps-ConfigIndex; else, the UE receives both PDSCHs.** |
| **vivo** | **Proposal 1:**  **If a UE supports FDM reception between unicast SPS PDSCH and multicast SPS PDSCH in a slot, and if more than one PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot,**   * **if the PDSCHs include both unicast SPS PDSCH(s) and multicast SPS PDSCH(s), the UE resolves collisions among unicast SPS PDSCHs resulting in one unicast SPS PDSCH and collisions among multicast SPS PDSCHs resulting in one multicast SPS PDSCH as following**   + **Step 0: *Q* is the set of activated PDSCHs without corresponding PDCCH transmissions within the slot.**   + **Step 1: A UE receives one PDSCH with the lowest configured *sps-ConfigIndex* within *Q*. Designate the received PDSCH as survivor PDSCH.**   + **Step 2: If the survivor PDSCH in step 1 is unicast PDSCH, a UE receives one multicast PDSCH with the lowest configured *sps-ConfigIndex* within *Q* (if any), where the multicast PDSCH and the survivor PDSCH in step 1 are FDMed in frequency. If the survivor PDSCH in step 1 is multicast PDSCH, a UE receives one unicast PDSCH with the lowest configured *sps-ConfigIndex* within *Q* (if any), where the unicast PDSCH and the survivor PDSCH in step 1 are FDMed in frequency*.*** * **if the PDSCHs only include unicast SPS PDSCH(s) or only include multicast SPS PDSCH(s), the legacy procedure is applied.** * **FFS: how to resolve the collision when further considering DG PDSCH(s).** |
| **CMCC** | **Proposal 1. Adopt the following TP for TS 38.214 section 5.1:**   * **Reason for change: To reflect the agreement that RRC\_CONNECTED UE can support FDMed between unicast PDSCH and broadcast PDSCH.** * **Summary of change: Add UE capable of receiving FDMed unicast PDSCH and broadcast PDSCH per slot per carrier.** * **Consequences if not approved: RRC\_CONNECTED UE can not support FDMed between unicast PDSCH and broadcast PDSCH.**   **<**Unchanged text is omitted>  The maximum number of PDSCHs scheduled per slot per component carrier with C-RNTI/CS-RNTI and G-RNTI/G-CS-RNTI that the UE shall be able to decode is the same as the indicated UE capability for the number of unicast PDSCHs per slot per component carrier. If the UE is capable of receiving FDMed unicast and multicast/broadcast PDSCH per slot per carrier, the UE shall be able to decode a PDSCH scheduled with C-RNTI/CS-RNTI and a PDSCH scheduled with G-RNTI/G-CS-RNTI/MCCH-RNTI that partially or fully overlap in time in non-overlapping PRBs  **<**Unchanged text is omitted>  **Proposal 2. For RRC\_CONNECTED UEs, the FDMed between unicast DG PDSCH and multicast SPS PDSCH or the FDMed between unicast SPS PDSCH and multicast/broadcast DG PDSCH are not supported.**  **Proposal 3. For RRC\_CONNECTED UEs,**   * **FDM between unicast PDSCH and group-common PDSCH includes:**    + **Case A: the unicast DG PDSCH and the multicast/broadcast DG PDSCH in a slot are overlapping in time domain and non-overlapping in frequency domain, and the unicast SPS PDSCH and the multicast SPS PDSCH in a slot are overlapping in time domain and non-overlapping in frequency domain.** * **TDM between unicast PDSCH and group-common PDSCH includes:**    + **Case B: the unicast DG PDSCH and the multicast/broadcast DG PDSCH in a slot are non-overlapping in time domain and non-overlapping in frequency domain, and the unicast SPS PDSCH and the multicast SPS PDSCH in a slot are non-overlapping in time domain and non-overlapping in frequency domain.**   + **Case C: the unicast DG PDSCH and the multicast/broadcast DG PDSCH in a slot are non-overlapping in time domain and overlapping in frequency domain, and the unicast SPS PDSCH and the multicast SPS PDSCH in a slot are non-overlapping in time domain and overlapping in frequency domain.**   **Proposal 4. For RRC\_CONNECTED UEs,**   * **If a UE only reports the capability to support FDM between unicast PDSCH and group-common PDSCH, only Case A scheduling is admitted.** * **If a UE only reports the capability to support TDM between unicast PDSCH and group-common PDSCH, only Case B and Case C scheduling are admitted.** * **If a UE both reports the capability to support FDM and TDM between unicast PDSCH and group-common PDSCH, Case A, Case B and Case C scheduling are admitted.**   Proposal 5. If more than one PDSCH include both unicast SPS PDSCH(s) and multicast SPS PDSCH(s) on a serving cell each without a corresponding PDCCH transmission are in a slot, and if a UE supports FDM reception between unicast SPS PDSCH and multicast SPS PDSCH in a slot,   * **Step 1: the UE resolves collisions among unicast SPS PDSCHs resulting in one unicast SPS PDSCH and collisions among multicast SPS PDSCHs resulting in one multicast SPS PDSCH as in Rel-16, respectively.** * **Step 2:**    + **If the resulting unicast SPS PDSCH and multicast SPS PDSCH are overlapping in both time and frequency, the UE receives the one with lower configured *sps-ConfigIndex*;**   + **else if the resulting unicast SPS PDSCH and multicast SPS PDSCH are non-overlapping in time but UE doesn’t support TDM reception between unicast SPS PDSCH and multicast SPS PDSCH in a slot, the UE receives the one with lower configured *sps-ConfigIndex*;**   + **else, the UE receives both PDSCHs.**   **Adopt the following TP for TS 38.214 section 5.1:**   * **Reason for change: The UE behaviour of collision handling of FDMed unicast SPS PDSCH and multicast SPS PDSCH is missed in current TS 38.214.** * **Summary of change: Add UE behaviour of collision handling of FDMed unicast SPS PDSCH and multicast SPS PDSCH.** * **Consequences if not approved: Mis-alignment between gNB and UE about the collision handling of FDMed unicast SPS PDSCH and multicast SPS PDSCH.**   **<**Unchanged text is omitted>  If more than one unicast PDSCH or multicast PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot, or more than one unicast and multicast PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot and a UE is not capable of receiving FDMed unicast and multicast PDSCH, after resolving overlapping with symbols in the slot indicated as uplink by *tdd-UL-DL-ConfigurationCommon*, or by *tdd-UL-DL-ConfigurationDedicated*, a UE receives one or more PDSCHs without corresponding PDCCH transmissions in the slot as specified below.  ‒ Step 0: set *j=0*, where *j* is thenumber of selected PDSCH(s) for decoding. *Q* is the set of activated PDSCHs without corresponding PDCCH transmissions within the slot  ‒ Step 1: A UE receives one PDSCH with the lowest configured *sps-ConfigIndex* within *Q*, set *j=j+1*. Designate the received PDSCH as survivor PDSCH.  ‒ Step 2: The survivor PDSCH in step 1 and any other PDSCH(s) overlapping (even partially) with the survivor PDSCH in step 1 are excluded from *Q*.  ‒ Step 3: Repeat step 1 and 2 until *Q* is empty or *j* is equal to the number of unicast/multicast PDSCHs in a slot supported by the UE  If more than one unicast and multicast PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot and a UE is capable of receiving FDMed unicast and multicast PDSCH, after resolving overlapping with symbols in the slot indicated as uplink by *tdd-UL-DL-ConfigurationCommon*, or by *tdd-UL-DL-ConfigurationDedicated*, the UE receives one or more PDSCHs without corresponding PDCCH transmissions in the slot as specified below.  ‒ Step 0: *Q1* is the set of activated unicast PDSCHs without corresponding PDCCH transmissions within the slot. *Q2* is the set of activated multicast PDSCHs without corresponding PDCCH transmissions within the slot.  ‒ Step 1: Designate one PDSCH with the lowest configured *sps-ConfigIndex* within *Q1* as survivor unicast PDSCH. Designate one PDSCH with the lowest configured *sps-ConfigIndex* within *Q2* as survivor multicast PDSCH.  ‒ Step 2: If the survivor unicast PDSCH and survivor multicast PDSCH overlap in both time and frequency, or if the survivor unicast PDSCH and survivor multicast PDSCH not overlap in time but the UE is not capable of receiving one unicast PDSCH and one multicast PDSCH non-overlapping in time in one slot, the UE receives one PDSCH with lower configured *sps-ConfigIndex*, else the UE receives both the survivor unicast PDSCH and survivor multicast PDSCH.  **<**Unchanged text is omitted>  **Proposal 6. For RRC\_CONNECTED UEs, the unicast/multicast/broadcast DG PDSCH and unicast/multicast SPS PDSCH can not be overlapped partially or fully in time, except if the PDCCH scheduling the PDSCH ends at least 14 symbols before the earliest starting symbol of the SPS PDSCH(s) and UE receives the DG PDSCH in this case.**  **Adopt the following TP for TS 38.214 section 5.1:**   * **Reason for change: The UE behaviour of collision handling of unicast/multicast/broadcast DG PDSCHs and unicast/multicast SPS PDSCHs is missed in current TS 38.214.** * **Summary of change: Add UE behaviour of collision handling of unicast/multicast/broadcast DG PDSCHs and unicast/multicast SPS PDSCHs.** * **Consequences if not approved: Mis-alignment between gNB and UE about the collision handling of unicast/multicast/broadcast DG PDSCHs and unicast/multicast SPS PDSCHs.**   **<**Unchanged text is omitted>  The UE is not expected to decode a PDSCH in a serving cell scheduled by a PDCCH with C-RNTI, CS-RNTI, MCS-C-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI and one or multiple PDSCH(s) required to be received according to this Clause in the same serving cell without a corresponding PDCCH transmission if the PDSCHs partially or fully overlap in time except if the PDCCH scheduling the PDSCH ends at least 14 symbols before the earliest starting symbol of the PDSCH(s) without the corresponding PDCCH transmission, where the symbol duration is based on the smallest numerology between the scheduling PDCCH and the PDSCH, in which case the UE shall decode the PDSCH scheduled by the PDCCH.  **<**Unchanged text is omitted> |
| **Xiaomi** | **Proposal1: FDM between multicast PDSCH and unicast PDSCH and TDM between multicast/unicast PDSCHs cannot be supported simultaneously in a slot.**  Proposal 2: If a UE supports FDM reception between unicast SPS PDSCH and multicast SPS PDSCH in a slot, and if more than one PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot,   * **If the PDSCHs include both unicast SPS PDSCH(s) and multicast SPS PDSCH(s),**   + **the UE resolves collisions among unicast SPS PDSCHs resulting in one unicast SPS PDSCH and collisions among multicast SPS PDSCHs resulting in one multicast SPS PDSCH as in Rel-16, respectively. If the resulting unicast SPS PDSCH and multicast SPS PDSCH overlap in both time and frequency, the UE receives the one with lower configured *sps-ConfigIndex*; else, the UE receives both PDSCHs.** |
| **Samsung** | **Proposal 1: If a UE does not support FDM unicast/multicast PDSCH receptions, the UE resolves collisions among unicast PDSCHs and multicast PDSCHs by reusing Rel-16 rules.**  **Proposal 2: If a UE supports only FDM PDSCH receptions per slot on a cell,** **the UE first separately resolves collisions among unicast SPS PDSCHs resulting in up to 1 unicast SPS PDSCH and among multicast SPS PDSCHs resulting in up to 1 unicast SPS PDSCH as in Rel-16. If the resulting unicast and multicast SPS PDSCHs overlap in both time and frequency domain, the UE receives the unicast SPS PDSCH.**  **Proposal 3: If a UE supports only FDM PDSCHs per slot on a cell, if a DG PDSCH overlaps with a SPS PDSCH in both time and frequency,** **the UE receives only the DG PDSCH if the timeline condition is satisfied. If a UE would receive both unicast SPS PDSCH and multicast SPS PDSCH in a slot after resolving collisions among SPS PDSCHs and is scheduled to receive a DG PDSCH in the slot then, for a cast type, the UE receives only the DG PDSCH if the timeline condition is satisfied.**  **Observation 1: FDM and TDM multicast/unicast PDSCH receptions are beyond the WI scope and would require additional rules (on top of Rel-16) for resolving collisions.** |

### Issue#2-2/3-1) PDSCH simultaneous reception/restriction for RRC\_CONNECTED/RRC\_IDLE/RRC\_INACTIVE UEs

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| **Company** | **Proposals** |
| **CMCC** | **Proposal 7. For RRC\_CONNECTED UEs,**   * **a UE is not required to support reception of FDMed broadcast MCCH PDSCH and broadcast MTCH PDSCH in one slot.** * **a UE is not required to support reception of FDMed multiple broadcast MTCH PDSCHs in one slot.**   **Adopt the following TP for TS 38.214 section 5.1:**   * **Reason for change: The RRC\_CONNECTED UE cannot support reception of FDMed MCCH PDSCH and MTCH PDSCH, or FDMed multiple MTCH PDSCHs which is missed in current TS 38.214.** * **Summary of change: Add UE behaviour of RRC\_CONNECTED UE cannot support reception of FDMed MCCH PDSCH and MTCH PDSCH, or FDMed multiple MTCH PDSCHs.** * **Consequences if not approved: Mis-alignment between gNB and UE about the FDMed broadcast MCCH PDSCH and broadcast MTCH PDSCH reception and FDMed multiple broadcast MTCH PDSCHs reception.**   **<**Unchanged text is omitted>  For UE in RRC\_IDLE and RRC\_INACTIVE modes, it is not expected to support reception of FDMed MCCH PDSCH and MTCH PDSCH, or FDMed multiple MTCH PDSCHs, or FDMed MCCH/MTCH PDSCH and SIB PDSCH in Pcell that partially or fully overlap in time in non-overlapping PRBs.  For UE in RRC\_CONNECTED mode, it is not expected to support reception of FDMed MCCH PDSCH and MTCH PDSCH, or FDMed multiple MTCH PDSCHs that partially or fully overlap in time in non-overlapping PRBs.  **<**Unchanged text is omitted>  **Proposal 8. For RRC\_CONNECTED UEs, a UE is not expected to decode a multicast or broadcast PDSCH overlapped with another PDSCH scheduled with RA-RNTI or MSGB-RNTI in time.**  **Adopt the following TP for TS 38.214 section 5.1:**   * **Reason for change: The UE behaviour of MBS PDSCH and RAR PDSCH collision handling is missed in current TS 38.214.** * **Summary of change: Add UE behaviour of is not expected to decode a multicast or broadcast PDSCH overlapped with another PDSCH scheduled with RA-RNTI or MSGB-RNTI in time.** * **Consequences if not approved: Mis-alignment between gNB and UE that whther UE can decode a multicast or broadcast PDSCH overlapped with another PDSCH scheduled with RA-RNTI or MSGB-RNTI in time.**   **<**Unchanged text is omitted>  The UE is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI if another PDSCH in the same cell scheduled with RA-RNTI or MSGB-RNTI partially or fully overlap in time.  **<**Unchanged text is omitted>  **Proposal 9. For RRC\_CONNECTED UEs, the simultaneously reception of SIB PDSCH and multicast/broadcast PDSCH reuse** **the same rule as Rel-15/16 simultaneously reception of SIB PDSCH and unicast PDSCH.**  **Adopt the following TP for TS 38.214 section 5.1:**   * **Reason for change: The UE behaviour of MBS PDSCH and SIB PDSCH collision handling is missed in current TS 38.214.** * **Summary of change: Add UE behaviour of UE can decode multicast/broadcast dynamic PDSCH during a process of autonomous SI acquisition. But for P-RNTI triggered SIB PDSCH reception, RRC\_CONNECTED UE can not decode multicast/broadcast dynamic PDSCH on FR1 with Capability 2 processing time or FR2.** * **Consequences if not approved: Mis-alignment between gNB and UE about whether UE can decode a MBS PDSCH overlapped with another SIB PDSCH in time.**   **<**Unchanged text is omitted>  On a frequency range 1 cell, the UE shall be able to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI and, during a process of P-RNTI triggered SI acquisition, another PDSCH scheduled with SI-RNTI that partially or fully overlap in time in non-overlapping PRBs, unless the PDSCH scheduled with C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI requires Capability 2 processing time according to clause 5.3 in which case the UE may skip decoding of the scheduled PDSCH with C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI.  On a frequency range 2 cell, the UE is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI if in the same cell, during a process of P-RNTI triggered SI acquisition, another PDSCH scheduled with SI-RNTI partially or fully overlap in time.  The UE is expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or MCCH-RNTI during a process of autonomous SI acquisition.  **<**Unchanged text is omitted> |
| **Huawei** | **Proposal 1: For allowing broadcast reception in RRC\_CONNECTED based on past agreements, adopt the following text proposal TP#1 to TS 38.214:**   * **Reason for change:**   + **The agreements/specifications restrict the expected/unexpected channel combinations for UEs receiving MBS broadcast in the RRC\_IDLE/INACTIVE states specifically, which however should be applied to UEs receiving MBS broadcast in RRC\_CONNECTED state as well.** * **Summary of change:**   + **Replace “The UE in RRC\_IDLE and RRC\_INACTIVE modes” by “The UE receiving MBS broadcast”.** * **Consequences if not approved:**   + **The expected/unexpected channel combinations for UEs receiving MBS broadcast are only restricted to UEs in the RRC\_IDLE/INACTIVE states and UE behavior in RRC\_CONNECTED state for such channel combinations are unclear.**  |  | | --- | | **-----------------------------------------------------TP#1: TS 38.214 v17.1.0----------------------------------------------------**  5 Physical downlink shared channel related procedures  5.1 UE procedure for receiving the physical downlink shared channel  < Unchanged parts are omitted >  The UE in RRC\_IDLE and RRC\_INACTIVE modes shall be able to decode two PDSCHs each scheduled with SI-RNTI, P-RNTI, RA-RNTI or TC-RNTI, with the two PDSCHs partially or fully overlapping in time in non-overlapping PRBs.  The UE receiving MBS broadcast:  - is expected to decode PDSCH scheduled with MCCH-RNTI and PBCH in Pcell that partially or fully overlaps in time in non-overlapping PRBs  - is not expected to decode PDSCH scheduled with broadcast G-RNTI and PBCH in Pcell that partially or fully overlaps in time in non-overlapping PRBs.  On a frequency range 1 cell, the UE shall be able to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI and, during a process of P-RNTI triggered SI acquisition, another PDSCH scheduled with SI-RNTI that partially or fully overlap in time in non-overlapping PRBs, unless the PDSCH scheduled with C-RNTI, MCS-C-RNTI, or CS-RNTI requires Capability 2 processing time according to clause 5.3 in which case the UE may skip decoding of the scheduled PDSCH with C-RNTI, MCS-C-RNTI, or CS-RNTI.  < Unchanged parts are omitted >  If the UE is configured by higher layers to decode a PDCCH with its CRC scrambled by a CS-RNTI or G-CS-RNTI, the UE shall receive PDSCH transmissions without corresponding PDCCH transmissions using the higher-layer-provided PDSCH configuration for those PDSCHs.  For UE receiving MBS broadcast, it is not expected to support reception of FDMed MCCH PDSCH and MTCH PDSCH, or FDMed multiple MTCH PDSCHs, or FDMed MCCH/MTCH PDSCH and SIB PDSCH in Pcell that partially or fully overlap in time in non-overlapping PRBs.  < Unchanged parts are omitted >  **-----------------------------------------------------TP#1: TS 38.214 v17.1.0----------------------------------------------------** |   **Proposal 2: For allowing broadcast reception in RRC\_CONNECTED based on past agreements, adopt the following text proposal TP#2 to TS 38.213:**   * **Reason for change:**   + **The agreements/specifications restrict the expected/unexpected channel combinations for UEs receiving MBS broadcast in the RRC\_IDLE/INACTIVE states specifically, which however should be applied to UEs receiving MBS broadcast in RRC\_CONNECTED state as well.** * **Summary of change:**   + **delete “in the RRC\_IDLE state or in the RRC\_INACTIVE state”.** * **Consequences if not approved:**   + **The expected/unexpected channel combinations for UEs receiving MBS broadcast are only restricted to UEs in the RRC\_IDLE/INACTIVE states and UE behavior in RRC\_CONNECTED state for such channel combinations are unclear.**  |  | | --- | | **-----------------------------------------------------TP#2: TS 38.213 v17.1.0----------------------------------------------------**  18 Multicast Broadcast Services  < Unchanged parts are omitted >  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 is not required to simultaneously receive PDSCHs for MCCH or MTCH on two serving cells. A UE is not required to simultaneously receive on a serving cell  - PDSCHs for MCCH and MTCH, or  - more than one MTCH PDSCHs, or  - PDSCH for MTCH and PBCH, or  - PDSCH for MCCH or MTCH and PDSCH scheduled by a DCI format 1\_0 with CRC scrambled by SI-RNTI or by P-RNTI  < Unchanged parts are omitted >  **-----------------------------------------------------TP#2: TS 38.213 v17.1.0----------------------------------------------------** |   **Proposal 5: UE in RRC\_IDLE/INACTIVE modes is NOT required to support reception of FDMed MCCH/MTCH PDSCH and RAR PDSCH in PCell.**  **Proposal 6: UE in RRC\_CONNECTED is NOT required to support reception of FDMed multicast PDSCHs in PCell or SCell.**  **Proposal 7: UE in RRC\_CONNECTED is NOT required to support reception of FDMed multicast PDSCH and PBCH in PCell.**  **Proposal 8: UE in RRC\_CONNECTED is NOT required to support reception of FDMed multicast PDSCH and SIB (including SIB1 and other SIBs) PDSCH in PCell.**  **Proposal 9: UE in RRC\_CONNECTED is NOT required to support reception of FDMed multicast PDSCH and Paging PDSCH in PCell.**  **Proposal 10: UE in RRC\_CONNECTED is NOT required to support reception of FDMed multicast PDSCH and MCCH/MTCH for broadcast in PCell or SCell.** |

### Issue#2-3) TPs for TS 38.202

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| **Company** | **Comment** |
| **Ericsson** | [Proposal 1 Clarify note 9 in table 6.2-2 of 38.202 as follow:](#_Toc101797499)  [ For a UE supporting MBS multicast reception, The values of 1≥m3 ≥0 and m4≥0 are subject to UE capability and applicable to RRC connected UEs. For the case when the UE does not support FDM or TDM unicast and multicast, if m3=1, then m1≤1. Otherwise, if the UE supports either the FDM or the TDM of multicast and unicast, m1+m3≤2](#_Toc101797500)  [Proposal 2 Include G-RNTI as part of reception type D4 in 38.202 and add DL-SCH as the associated channel.](#_Toc101797501)  [Proposal 3 Include G-RNTI as part of a separate reception type for broadcast PDCCH in 38.202 and add DL-SCH as the associated channel.](#_Toc101797502)  6.2 Downlink  The tables 6.2-1, 6.2-2 describe the possible combinations of physical channels that can be received simultaneously in the downlink by one UE. Table 6.2-1 introduces notation for a "Reception Type" which represents a physical channel and any associated transport channel. Table 6.2-2 describes the combinations of these "Reception Types" which are supported by the UE depending on capabilities [8, TS 38.306], and enumerates how many of each can be received simultaneously. The UE shall be able to receive all TBs according to the indication on PDCCH. Any subset of the combinations specified in table 6.2-2 is also supported.   * **Table 6.2-1: Downlink "Reception Types"**  |  |  |  |  |  | | --- | --- | --- | --- | --- | | **"Reception Type"** | **Physical Channel(s)** | **Monitored RNTI** | **Associated Transport Channel** | **Comment** | | A | PBCH | N/A | BCH |  | | B | PDCCH+PDSCH | SI-RNTI | DL-SCH | Note 1 | | C0 | PDCCH | P-RNTI | N/A | Note 1, Note 2 | | C1 | PDCCH+PDSCH | P-RNTI | PCH | Note 1 | | D0 | PDCCH+PDSCH | RA-RNTI or Temporary C-RNTI or MsgB-RNTI | DL-SCH | Note 3 | | D1 | PDCCH+PDSCH | C-RNTI, CS-RNTI, MCS-C-RNTI | DL-SCH |  | | D2 | PDCCH | C-RNTI, CS-RNTI, MCS-C-RNTI | DL-SCH |  | | D3 | PDCCH+PDSCH | G-RNTI, G-CS-RNTI | DL-SCH | Note 6 | | D4 | PDCCH | G-CS-RNTI, G-RNTI | ~~N/A~~ DL-SCH | Note 7 | | D5 | PDCCH+PDSCH | MCCH-RNTI | DL-SCH | Note 8 | | D6 | PDCCH+PDSCH | G-RNTI | DL-SCH | Note 9 | | E | PDCCH | C-RNTI | N/A | Note 4 | | F0 | PDCCH | Temporary C-RNTI | UL-SCH | Note 3 | | F1 | PDCCH | C-RNTI, CS-RNTI, MCS-C-RNTI | UL-SCH |  | | G | PDCCH | SFI-RNTI | N/A |  | | H | PDCCH | INT-RNTI | N/A |  | | J0 | PDCCH | TPC-PUSCH-RNTI | N/A |  | | J1 | PDCCH | TPC-PUCCH-RNTI | N/A |  | | J2 | PDCCH | TPC-SRS-RNTI | N/A |  | | K | PDCCH | SP-CSI-RNTI | N/A |  | | L0 | PDCCH | SL-RNTI | SL-SCH |  | | L1 | PDCCH | SL-CS-RNTI | SL-SCH |  | | M | PDCCH | SL Semi-Persistent Scheduling V-RNTI | SL-SCH | Note 5 | | N | PDCCH | PS-RNTI | N/A |  | | O | PDCCH | AI-RNTI | N/A |  | | P | PDCCH | CI-RNTI | N/A |  | | Note 1: These are received from PCell only.  Note 2: In some cases UE is only required to monitor the short message within the DCI for P-RNTI.  Note 3: These are received from PCell or PSCell.  Note 4: This corresponds to PDCCH-ordered PRACH.  Note 5: This corresponds to PDCCH scheduling LTE PC5.  Note 6: This is for multicast in RRC connected state  Note 7: This corresponds to DL Semi-Persistent Scheduling release for multicast in RRC connected state.  Note 8: This is for broadcast MCCH  Note 9: This is for broadcast MTCH | | | | |  * **Table 6.2-2: Downlink "Reception Type" combinations** |

### Issue#2-4) TPs for GC-PDSCH Rate matching

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| **Company** | **Proposals** |
| **Qualcomm** | **Proposal 3: For multicast RRC\_CONNECTED UEs,**   * **The procedure for PDSCH scheduled by PDCCH with DCI format 4\_1 is similar as that of DCI format 1\_0, by applying the parameters of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*, *sp-ZP-CSI-RS-ResourceSetsToAddModList* and *p-ZP-CSI-RS-ResourceSet* configured in PDSCH-Config-Multicast.** * **Adopt the TP#1 for TS 38.214.**   ----------------- Start of TP#1 for TS 38.214 ----------------  **<**Unchanged text is omitted> 5.1.4.2 PDSCH resource mapping with RE level granularity The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*.  The procedures for PDSCH scheduled by PDCCH with DCI format 1\_0 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_1 and the procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config-Multicast* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config*.  **<**Unchanged text is omitted>  ----------------- end of TP#1 for TS 38.214 ---------------- |
| **Huawei** | **Proposal 3: For allowing broadcast reception in RRC\_CONNECTED based on past agreements, adopt the following text proposal TP#3 to TS 38.214:**   * **Reason for change:**   + **The agreement/specification restrict the RateMatchPatternLTE-CRS being configured to UEs receiving MBS broadcast in the RRC\_IDLE/INACTIVE states specifically, which however should be applied to UEs receiving MBS broadcast in RRC\_CONNECTED state as well.** * **Summary of change:**   + **delete “in RRC\_IDLE and RRC\_INACTIVE modes”.** * **Consequences if not approved:**   + **RateMatchPatternLTE-CRS is not to be used by network for MBS broadcast transmission because RateMatchPatternLTE-CRS is not supported by UEs in RRC\_CONNECTED state.**  |  | | --- | | **----------------------------------------------------TP#3: TS 38.214 v17.1.0----------------------------------------------------**  5.1.4.2 PDSCH resource mapping with RE level granularity  The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*. The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config-Multicast* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config*.  A UE may be configured with any of the following higher layer parameters:  *-* REs indicated by the '*RateMatchPatternLTE-CRS*'in *lte-CRS-ToMatchAround* in *ServingCellConfig* or *ServingCellConfigCommon* configuring cell-specific RS, in 15 kHz subcarrier spacing applicable only to 15 kHz subcarrier spacing PDSCH, of one LTE carrier in a serving cell are declared as not available for PDSCH.  *-* REs indicated by *'RateMatchPatternLTE-CRS'* in *lte-CRS-PatternList1-r16* in *ServingCellConfig* configuring cell-specific RS, in 15 kHz subcarrier spacing applicable only to 15 kHz subcarrier spacing PDSCH, of one LTE carrier in a serving cell are declared as not available for PDSCH.  - For the UE for broadcast reception, REs indicated by *'RateMatchPatternLTE-CRS'* in *PDSCH-Config-MCCH* or *PDSCH-Config-MCCH* configuring cell-specific RS, in 15 kHz subcarrier spacing applicable only to 15 kHz subcarrier spacing PDSCH, of one LTE carrier in a serving cell are declared as not available for PDSCH.  - Each *RateMatchPatternLTE-CRS* configuration contains *v-Shift* consisting of LTE-CRS-vshift(s), *nrofCRS-Ports* consisting of LTE-CRS antenna ports 1, 2 or 4 ports, *carrierFreqDL* representing the offset in units of 15 kHz subcarriers from (reference) point A to the LTE carrier centre subcarrier location, *carrierBandwidthDL* representing the LTE carrier bandwidth, and may also configure *mbsfn-SubframeConfigList* representing MBSFN subframe configuration. A UE determines the CRS position within the slot according to Clause 6.10.1.2 in [15, TS 36.211], where slot corresponds to LTE subframe.  < Unchanged parts are omitted >  **-----------------------------------------------------TP#3: TS 38.214 v17.1.0----------------------------------------------------** |   **Proposal 4: Adopt the following text proposal TP#4 to TS 38.214:**   * **Reason for change:**   + **UE can be configured with separate rateMatchPatternToAddModList, rateMatchPatternGroup1 and rateMatchPatternGroup2 configured in PDSCH-Config-Multicast. However, it is unclear how many RateMatchPattern(s) can be configured per BWP for UE receiving MBS multicast.** * **Summary of change:**   + **Adding “The RateMatchPattern(s) configured for MBS multicast is counted into the ones that are configured per BWP.”** * **Consequences if not approved:**   + **UE is required to support additional number of RateMatchPattern(s) for MBS multicast reception configured per BWP in addition to the “up to 4” RateMatchPattern(s) per BWP for receiving unicast.**  |  | | --- | | **----------------------------------------------------TP#4: TS 38.214 v17.1.0----------------------------------------------------**  5.1.4.1 PDSCH resource mapping with RB symbol level granularity  The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *rateMatchPatternGroup1DCI-1-2*, *rateMatchPatternGroup2DCI-1-2* instead of *rateMatchPatternGroup1* and *rateMatchPatternGroup2*.  The procedures for PDSCH scheduled by PDCCH with DCI format 1\_0 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_1, and the procedures for PDSCH scheduled by DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2 by applying the parameters of *rateMatchPatternToAddModList, rateMatchPatternGroup1* and *rateMatchPatternGroup2* configured in *PDSCH-Config-Multicast*.  A UE may be configured with any of the following higher layer parameters indicating REs declared as not available for PDSCH:  - *rateMatchPatternToAddModList* given by *PDSCH-Config, PDSCH-Config-Multicast,* by *ServingCellConfig* or by *ServingCellConfigCommon*, or by *PDSCH-Config-MCCH or PDSCH-Config-MTCH* and configuring up to 4 *RateMatchPattern(s)* per BWP and up to 4 *RateMatchPattern(s)* per serving-cell. The *RateMatchPatterns* configured for MBS multicast are counted into the ones that are configured per BWP. The *RateMatchPattern(s)* configured for MBS broadcast is counted into the ones that are configured per serving-cell. A *RateMatchPattern* may contain:  < Unchanged parts are omitted >  **-----------------------------------------------------TP#4: TS 38.214 v17.1.0----------------------------------------------------** | |
| **Spreadtrum** | **Proposal 4: Suggest to endorse the Text Proposal#2 in TS 38.214**  ------------------------------------------Start of Text Proposal#2 for TS 38.214-------------------------------------- 5.1.4.2 PDSCH resource mapping with RE level granularity ------------------------------------------unchanged part omitted--------------------------------------  - Within a BWP, the UE can be configured with one or more ZP CSI-RS resource set configuration(s) for aperiodic, semi-persistent and periodic time-domain behaviours (higher layer parameters *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList,*  *sp-ZP-CSI-RS-ResourceSetsToAddModList* and *p-ZP-CSI-RS-ResourceSet* respectively comprised in *PDSCH-Config*), with each ZP CSI-RS resource set consisting of at most 16 ZP CSI-RS resources (higher layer parameter *ZP-CSI-RS-Resource*) in numerology of the BWP. The REs indicated by *p-ZP-CSI-RS-ResourceSet* are declared as not available for PDSCH. The REs indicated by *sp-ZP-CSI-RS-ResourceSetsToAddModList* and aperiodic-ZP-CSI-RS-ResourceSetsToAddModList are declared as not available for PDSCH when their triggering and activation are applied, respectively. The following parameters are configured via higher layer signaling for each ZP CSI-RS resource configuration:  - *zp-CSI-RS-ResourceId* in *ZP-CSI-RS-Resource* determines ZP CSI-RS resource configuration identity.  - *nrofPorts* in *CSI-RS-ResourceMapping* defines the number of CSI-RS ports, where the allowable values are given in Clause 7.4.1.5 of [4, TS 38.211].  - *cdm-Type* in *CSI-RS-ResourceMapping* defines CDM values and pattern, where the allowable values are given in Clause 7.4.1.5 of [4, TS 38.211].  - *resourceMapping* in *ZP-CSI-RS-Resource* defines the OFDM symbol and subcarrier occupancy of the ZP CSI-RS resource within a slot that are given in Clause 7.4.1.5 of [4, TS 38.211].  - *periodicityAndOffset* in*ZP-CSI-RS-Resource* defines the ZP-CSI-RS periodicity and slot offset for periodic/semi-persistent ZP CSI-RS.  - For the UE in RRC\_CONNECTED mode for multicast reception, *p-ZP-CSI-RS-ResourceSet* can be configuredin *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. The REs indicated by *p-ZP-CSI-RS-ResourceSet* are declared as not available for GC-PDSCH. The REs indicated by *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCH and the REs indicated by *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCH. The total number of periodic *ZP-CSI-RS-Resources* that a UE can be configured with is the same as for unicast in Rel-16. If *p-ZP-CSI-RS-ResourceSet* is configured in both *PDSCH-Config* and *PDSCH-Config-Multicast*, it is subject to UE capability whether the *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* can be different from the *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config*.  - For the UE in RRC\_CONNECTED mode for multicast reception, s*p-ZP-CSI-RS-ResourceSet* can be configuredin *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. The REs indicated by s*p-ZP-CSI-RS-ResourceSet* are declared as not available for GC-PDSCH when their triggering and activation delivered by unicast PDSCH are applied. The REs indicated by s*p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCH and the REs indicated by s*p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCH. The total number of semi-persistent *ZP-CSI-RS-Resources* that a UE can be configured with is the same as for unicast.  ------------------------------------------End of Text Proposal#2 for TS 38.214-------------------------------------- |

### Issue#2-5) Other TPs for GC-PDSCH

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| **Company** | **Proposals** |
| **NTT DOCOMO** | **Proposal 4: Adopt the following text proposal in clause 5.1.3.2 of TS 38.214 to define the condition for disabling TB in DCI format 4\_2 and to correct a missing description.**  ----------------------------------- **Start of Text proposal to 5.1.3.2 of 38.214** ------------------------------------------------  5.1.3.2 Transport block size determination  In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *PDSCH-Config* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 1\_1 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *PDSCH-Config-Multicast* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 4\_2 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. If both transport blocks are enabled, transport block 1 and 2 are mapped to codeword 0 and 1 respectively. If only one transport block is enabled, then the enabled transport block is always mapped to the first codeword.  For the PDSCH assigned by a PDCCH with DCI format 4\_0, format 4\_1, format 4\_2 or format 1\_2 with CRC scrambled by C-RNTI, MCS-C-RNTI, TC-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI or SI-RNTI, if Table 5.1.3.1-2 is used and *,* else if Table 5.1.3.1-4 used and or a table other than Table 5.1.3.1-2 and Table 5.1.3.1-4 is usedand *,* the UE shall, except if the transport block is disabled in DCI format 1\_1 or 4\_2, first determine the TBS as specified below:  <Unchanged text is omitted>  ----------------------------------- **End of Text proposal to 5.1.3.2 of 38.214** ------------------------------------------------  **Proposal 5: Adopt the following text proposal in clause 5.1.5 of TS 38.214 to clarify the condition for the existence of TCI field in DCI format 4\_2.**  ----------------------------------- **Start of Text proposal to 5.1.5 of 38.214** ------------------------------------------------  <Unchanged text is omitted>  If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled'for the CORESET scheduling the PDSCH, the UE assumes that the TCI field is present in the DCI format 1\_1 of the PDCCH transmitted on the CORESET. If a UE is configured with the higher layer parameter *tci-PresentDCI-1-2* for the CORESET scheduling the PDSCH, the UE assumes that the TCI field with a DCI field size indicated by *tci-PresentDCI-1-2* is present in the DCI format 1\_2 of the PDCCH transmitted on the CORESET. If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled'for the CORESET scheduling the multicast PDSCH, the UE assumes that the TCI field is present in the DCI format 4\_2 of the PDCCH transmitted on the CORESET. If the PDSCH is scheduled by a DCI format not having the TCI field present, and the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable, where the threshold is based on reported UE capability [13, TS 38.306], for determining PDSCH antenna port quasi co-location, the UE assumes that the TCI state or the QCL assumption for the PDSCH is identical to the TCI state or QCL assumption whichever is applied for the CORESET used for the PDCCH transmission within the active BWP of the serving cell.  <Unchanged text is omitted>  ----------------------------------- **End of Text proposal to 5.1.5 of 38.214** ------------------------------------------------ |

### Issue#2-6/2-7) Maximum data rate and LLR buffering for FDMed unicast and MBS

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| **Company** | **Proposals** |
| **Qualcomm** | **Proposal 1: In addition to legacy scaling factor for calculating max data rate per CC of unicast only, UE can report an additional scaling factor for the max data rate per CC when there is FDMed multicast and unicast in a CC of the CC group.**  **Proposal 2: The UE is not expected to handle any transport blocks (TBs) in a 14 consecutive-symbol duration for normal CP (or 12 for extended CP) ending at the last symbol of the latest PDSCH transmission within an active BWP on a serving cell whenever**   * **where**    + **{*X*, TBSLBRM} is the max MIMO layers and max TBS for unicast.**   **=0 for a slot without FDMed unicast and MBS PDSCHs and for a slot with FDMed unicast and MBS PDSCHs with subject to UE capability** |
| **Ericsson** | 1. The overall data rate across CCs for multicast UE should not increase compared to rel16. 2. TDM multicast can re-use the rel16 definitions of overall max data rate and max data rate per CC 3. Support a separate max data rate scaling factor and FG component for FDM multicast, for the purpose of computing max data rate per CC. The overall max data rate calculation should be based on the unicast scaling factor. |

### Issue#2-23) Determination of repetition number for PTM SPS PDSCH retransmission

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| **Company** | **Proposals** |
| **Samsung** | **Proposal 6: For PTM based SPS PDSCH retransmission, the repetition number is determined by *pdsch-AggregationFactor* in *SPS-Config*.** |

## Issue#2-1) SPS collision handling

### Summary

This issue was discussed in RAN1#107b-e and RAN1#108-e with no conclusion. We have agreed to support the following cases according to the previous meetings’ agreements:

* FDM between one unicast PDSCH and one GC-PDSCH in a slot
* TDM between one unicast PDSCH and one GC-PDSCH in a slot
  + Case 1: TDM between M (M>1) TDMed unicast PDSCHs and one GC-PDSCH in a slot
  + Case 2: TDM among N (N>1) GC-PDSCHs in a slot
  + Case 3: TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed GC-PDSCHs

But we never agree the following:

* Case 4: FDM between multiple TDMed unicast PDSCHs and multiple TDMed GC-PDSCHs in a slot
* Case 5: FDM among multiple GC-PDSCHs in a slot
* Case 6: FDM between multiple TDMed unicast PDSCHs and one GC-PDSCH in a slot

During the email discussion in RAN1#108-e meeting, companies are not aligned with the definition of FDM capability. If a UE reports FDM capability, it can support case 1 in the following figure undoubtedly, but whether case 2/3 can also be supported are diverged among companies.

* Case 1: One unicast PDSCH and one multicast PDSCH, where the two PDSCHs are overlapped in time domain but non-overlapped frequency domain
* Case 2: One unicast PDSCH and one multicast PDSCH, where the two PDSCHs are non-overlapped in both time domain and frequency domain
* Case 3: One unicast PDSCH and one multicast PDSCH, where the two PDSCHs are non-overlapped in time domain but overlapped in frequency domain

U

M



Case 1

 

Case 2 Case 3

Based on the contributions, two companies [ZTE, vivo] think if UE reports FDM capability, it can support all case 1, 2, and 3. But another two companies [Samsung, Xiaomi] propose one UE can only support FDM or TDM which FDM only includes case 1. One company [CMCC] thinks if one UE only reports FDM capability, it can only support case 1, if only TDM capability is reported, this UE can only support case 2 and 3 and if the UE reports both TDM and FDM capability, it can support call case 1, 2, and 3.

Considering the situation, moderator thinks the best way to solve this problem is restrict FDM capability only includes case 1 and UE cannot support both TDM and FDM capability, that is UE can only report one of FG 33-3-2 or FG33-3-3. In addition, it should be clarified that these two FGs are applied for both DG and SPS. Although it may be not a solution to accommodate all companies’ views, it is a simplest way to solve this issue and complete the spec to support FDMed SPS collision case.

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| 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot. | [33-1, 33-2] |
| 33. NR\_MBS | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC 3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC 4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC 5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.    * Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). | [33-1, 33-2] |

Based on the prerequisite that one UE cannot support both TDM and FDM capability, it is clear that if one UE reports FG 33-3-3, the UE resolves collisions among unicast SPS PDSCHs and multicast SPS PDSCHs by reusing Rel-16 rules. If one UE reports FG 33-3-2, a new rule needs to be defined, for example, the UE first separately resolves collisions among unicast SPS PDSCHs resulting in up to 1 unicast SPS PDSCH and among multicast SPS PDSCHs resulting in up to 1 unicast SPS PDSCH as in Rel-16. If the resulting unicast and multicast SPS PDSCHs overlap in both time and frequency domain, the UE receives the unicast SPS PDSCH. Based on these analyses, moderator suggests **initial proposal 1-1** and corresponding **initial proposal 1-2**.

Regarding the collision between SPS and DG, two companies [CMCC, Samsung] propose this issue that UE will receive the DG PDSCH if the time restriction is satisfied when DG PDSCH and SPS PDSCH are overlapped. As the above discussion in initial proposal 1-1, moderator suggests UE can only support TDM capability and FDM capability and the SPS and DG collision rule can be categorized as the following:

* For UE only supports TDM capability, if the DG PDSCH (including unicast, multicast and broadcast) is overlapped with SPS PDSCH(s) (including unicast and multicast) in time, the UE receives only the DG PDSCH if the timeline condition is satisfied similar to Rel-15/16 unicast DG and unicast SPS collision handling rule.
* For UE only supports FDM capability, the cases are more complicated:
  + Case 1: If a DG PDSCH overlaps with a SPS PDSCH in both time and frequency, the UE receives only the DG PDSCH if the timeline condition is satisfied.
  + Case 2: If a UE would receive both unicast SPS PDSCH and multicast SPS PDSCH in a slot after resolving collisions among SPS PDSCHs and is scheduled to receive a DG PDSCH in the slot then, the UE receives only the DG PDSCH if the timeline condition is satisfied.

Based on these analyses, moderator suggests **initial proposal 1-3.**

In addition, one company [CMCC] proposes that the FDMed between unicast and broadcast GC-PDSCH should also captured in TS 38.214. In current UE feature, both FG 33-1 and FG 33-2 are the prerequisite FG of FG 33-3-2 and FG 33-3-3 but in brackets, considering this moderator suggests **initial proposal 1-4** to check companies’ views.

### 1st Round Proposals

**Initial Proposal 1-1:**

gNB is not expected that UE reports both FG 33-3-2 and FG 33-3-3.

**Initial Proposal 1-2:**

* If a UE does not support FDM unicast SPS PDSCH and multicast SPS PDSCH in a slot, and more than one PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot, the UE resolves collisions among unicast SPS PDSCHs and multicast SPS PDSCHs by reusing Rel-16 rules.
* If a UE supports FDM reception between unicast SPS PDSCH and multicast SPS PDSCH in a slot, and more than one PDSCH on a serving cell each without a corresponding PDCCH transmission are in a slot,
* the UE resolves collisions among unicast SPS PDSCHs resulting in one unicast SPS PDSCH and collisions among multicast SPS PDSCHs resulting in one multicast SPS PDSCH as in Rel-16, respectively. If the resulting unicast SPS PDSCH and multicast SPS PDSCH overlap in both time and frequency, the UE receives the one with lower configured sps-ConfigIndex; else, the UE receives both PDSCHs.

**Initial Proposal 1-3:**

* If a UE does not support FDM unicast PDSCH and group-common PDSCH in a slot, the DG PDSCH and SPS PDSCH(s) can not be overlapped partially or fully in time, except if the PDCCH scheduling the PDSCH ends at least 14 symbols before the earliest starting symbol of the SPS PDSCH(s) and UE receives the DG PDSCH in this case.
  + Note 1: DG PDSCH including unicast, multicast and broadcast and SPS PDSCH including unicast and multicast.
  + Note 2: The case between unicast DG PDSCH and unicast SPS PDSCH has been supported in Rel-15/16.
* If a UE supports FDM unicast PDSCH and group-common PDSCH in a slot,
  + The DG PDSCH and multicast SPS PDSCH(s) can not be overlapped partially or fully both in time and frequency, except if the PDCCH scheduling the PDSCH ends at least 14 symbols before the earliest starting symbol of the SPS PDSCH(s) and UE receives the DG PDSCH in this case.
  + If the UE would receive both unicast SPS PDSCH and multicast SPS PDSCH in a slot after resolving collisions among SPS PDSCHs, a DG PDSCH can not be scheduled in the same slot with two SPS PDSCHs, except if the PDCCH scheduling the PDSCH ends at least 14 symbols before the earliest starting symbol of the SPS PDSCHs and UE receives the DG PDSCH in this case.
  + Note 1: DG PDSCH including unicast, multicast and broadcast.

**Initial Proposal 1-4:**

For the FDMed or TDMed unicast PDSCH and group-common PDSCH capability of RRC\_CONNECTED UE, the group-common PDSCH can be multicast group-common PDSCH or broadcast group-common PDSCH.

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

## Issue#2-2/3-1) PDSCH simultaneous reception/restriction for RRC\_CONNECTED/RRC\_IDLE/RRC\_INACTIVE UEs

### Summary

Two companies [CMCC. Huawei] propose the PDSCH simultaneous reception/restriction issue for RRC\_CONNECTED/RRC\_IDLE/RRC\_INACTIVE UEs.

In RAN1#107b-e and RAN1#108-e meeting, the following agreements are achieved for RRC\_IDLE/INATCIVE UEs.

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

For RRC\_IDLE/INATCIVE UEs, one remaining issue is the requirement for UE receiving MBS broadcast and RAR, and one company [Huawei] proposes that UE is not required to support FDM-ed MCCH/MTCH with RAR in PCell, since UE in RRC\_IDLE and RRC\_INACTIVE modes is required able to decode two PDSCHs each scheduled with SI-RNTI, P-RNTI, RA-RNTI or TC-RNTI. Moderator suggests **initial proposal 2-1.**

For RRC\_CONNEDTED UEs, the following PDSCH simultaneous reception/restriction cases should be discussed:

* Case 1: MCCH PDSCH and MTCH PDSCH
* Case 2: Multiple MTCH PDSCHs
* Case 3: MCCH/MTCH PDSCH and SIB PDSCH
* Case 4: MCCH/MTCH PDSCH and PBCH
* Case 5: MCCH/MTCH PDSCH and paging PDSCH
* Case 6: MCCH/MTCH PDSCH and RAR PDSCH
* Case 7: multicast PDSCH and SIB PDSCH
* Case 8: multicast and PBCH
* Case 9: multicast PDSCH and paging PDSCH
* Case 10: multicast and RAR PDSCH
* Case 11: multiple multicast PDSCHs
* Case 12: MCCH/MTCH PDSCH and multicast PDSCH

Regarding case 1 and case 2, both two companies [CMCC, Huawei] propose to extend agreements to RRC\_CONNECTED state, thus moderator suggests **initial proposal 2-2**.

Regarding case 6 and case 10, one company [CMCC] proposes not support the FDMed reception, since RRC\_CONNECTED UE cannot receive FDMed unicast and RAR. Moderator suggest **initial proposal 2-3** which is also aligned with RRC\_IDLE/INACTIVE UEs’ behaviour.

Regarding case 11 and 12, since we never agreed to support FDMed multiple GC-PDSCHs as the Case 5 in the following agreement in RAN1#103 e-meeting, which means we have excluded it in Rel-17 and no further agreement is needed.

|  |
| --- |
| Agreements:Further study the following cases for simultaneous reception of unicast PDSCH and group-common PDSCH in a slot based on UE capability for RRC\_CONNECTED UEs.   * Case 1: support TDM between multiple TDMed unicast PDSCHs and one group-common PDSCH in a slot * Case 2: support TDM among multiple group-common PDSCHs in a slot * Case 3: support TDM between multiple TDMed unicast PDSCHs and multiple TDMed group-common PDSCHs in a slot * Case 4: support FDM between multiple TDMed unicast PDSCHs and multiple TDMed group-common PDSCHs in a slot * Case 5: support FDM among multiple group-common PDSCHs in a slot * FFS: maximum number of PDSCHs in a slot simultaneous received per UE |

Regarding case 3, case 4, case 5, case 7, case 9, one company [Huawei] proposes to reuse the agreement of RRC\_IDLE/INATCIVE UEs, but one company [CMCC] proposes to reuse the same rule as Rel-15/16 simultaneously reception of SIB PDSCH and unicast PDSCH, that UE can decode multicast/broadcast PDSCH during a process of autonomous SI acquisition. For P-RNTI triggered SIB PDSCH reception, RRC\_CONNECTED UE can decode multicast/broadcast PDSCH on FR1, but cannot decode multicast/broadcast PDSCH on FR2.

Regarding case 5 and case 9, from moderator’s understanding, a RRC\_CONNECTED UE doesn’t need to decode Paging PDSCH, that is case 5 and case 9 don’t exist for RRC\_CONNECTED UEs.

Regarding case 4 and case 8, from moderator’s understanding, a RRC\_CONNECTED UE can decode FDMed PBCH and unicast PDSCH according to current TS 38.302.

Considering the views are diverged for these cases, moderator proposes **initial question 2-4** to collect other companies’ views.

### 1st Round Proposals

**Initial proposal 2-1:**

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

**Initial proposal 2-2:**

For RRC\_CONNECTED UEs,

* a UE is not required to support reception of FDMed MCCH PDSCH and MTCH PDSCH in PCell or SCell.
* a UE is not required to support reception of FDMed multiple MTCH PDSCHs in PCell or SCell.

**Initial proposal 2-3**:

For RRC\_CONNECTED UEs, a UE is not required to support reception of FDMed MCCH/MTCH/multicast PDSCH and RAR PDSCH in PCell**.**

**Initial question 2-4:**

Which set of proposals do you prefer?

* Set 1: For RRC\_CONNECTED UEs,
* a UE is not required to support reception of FDMed MCCH/MTCH/multicast PDSCH and SIB PDSCH in PCell.
* a UE is required to support reception of FDMed MCCH PDSCH and PBCH in PCell.
* a UE is not required to support reception of FDMed MTCH PDSCH and PBCH in PCell.
* a UE is not required to support reception of FDMed multicast PDSCH and PBCH in PCell.
* Set 2: For RRC\_CONNECTED UEs,
* a UE is required to support reception of FDMed MCCH/MTCH/multicast PDSCH and SIB PDSCH during a process of P-RNTI triggered SI acquisition on FR1 in PCell.
* a UE is not required to support reception of FDMed MCCH/MTCH/multicast PDSCH and SIB PDSCH during a process of P-RNTI triggered SI acquisition on FR2 in PCell.
* a UE is required to decode MCCH/MTCH/multicast PDSCH during a process of autonomous SI acquisition in PCell.
* a UE is required to support reception of FDMed MCCH/MTCH/multicast PDSCH and PBCH in PCell.

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

## Issue#2-3) TPs for TS 38.202

### Summary

One company [Ericsson] proposes to clarify note 9 about the TDM and FDM capability in table 6.2-2 of 38.202.

For FG 33-3-2, UE only supports one FDMed unicast PDSCH and one GC-PDSCH that is m1+m3≤2. But for FG 33-3-3, UE can also support TDM among N (N>1) group-common PDSCHs in a slot per CC and the UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b which group-common PDSCH(s) are counted as unicast PDSCH(s), that is it is possible for m>1 and m3>1 for TDM case.

Considering this, moderator suggest **initial TP-3-1** to clarify that m3 can larger than 1 and only in FDMed case m1+m3 ≤2.

|  |  |  |
| --- | --- | --- |
| 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot. |
| 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC 3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC 4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC 5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.    * Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). |

In addition, one company [Ericsson] also proposes the inclusion of G-RNTI as part of reception type D4 in 38.202 and add DL-SCH as the associated channel, considering it is possible the cross-slot scheduling is applied for multicast by gNB, the adding of G-RNTI and DL-SCH similar to D2 seems reasonable. But considering the mandatory UE feature is only support k0=0 and k0=1 for type-1 CSS, the cross-slot scheduling can be applied for broadcast MCCH/MTCH PDSCH for all UEs. Thus, moderator suggests the **initial TP-3-2** to add G-RNTI and DL-SCH for type 4 multicast reception.

### 1st Round Proposals

**Initial TP 3-1:**

Adopt the following TP for Clause 6.2 in TS 38.202:

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

Table 6.2-2: Downlink "Reception Type" combinations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Supported Combinations | | | | Comment |
| PCell | PSCell | SCell | |
| 1. RRC\_IDLE | | | | |
| 1.1 All UEs | | | | |
| A + (B and/or (C1 or Q) and/or D0) + F0 |  |  | | Note 1 |
| 1.2 UEs supporting MBS broadcast reception | | | | |
| A+D5 |  |  |  | |
| 2. RRC\_INACTIVE | | | | |
| 2.1 All UEs | | | | |
| A + (B and/or (C1 or Q) and/or D0) + F0 |  |  | | Note 1 |
| 2.2 UEs supporting MBS broadcast reception | | | | |
| A+D5 |  |  |  | |
| 3. RRC\_CONNECTED | | | | |
| (A + C0 + (B and/or (D0 or (m1\*D1+m2\*D2+m3\*D3+m4\*D4))) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + L0 + L1 + M + N + P) | (A + (D0 or (m1\*D1+m2\*D2)) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + N + P) | m1\*D1 + m2\*D2 + (m3\*D3+m4\*D4) + E + n\*F1 + G + H  + J0 + J1 + J2 + K + O + L0 + L1 + M + P | | Note 2, Note 3, Note 4, Note 5, Note 6, Note 7, Note 8, Note 9, Note 10 |
| Note 1: UE is not required to decode more than two PDSCH simultaneously, and decoding prioritization when more than two are received is up to UE implementation.  Note 2: For PCell, UE is not required to decode SI-RNTI PDSCH simultaneously with C-RNTI PDSCH, unless in FR1.  Note 3: Supported combinations are subject to UE capabilities for dual connectivity, carrier aggregation, receiving of group TPC commands, pre-emption indication and dynamic SFI monitoring.  Note 4: The values of m2 ≥ 0 and n≥ 0 in the supported combinations are subject to the UE capability.  Note 5: Support of monitoring PDCCH with SL-RNTI, SL-CS-RNTI, SL Semi-Persistent Scheduling V-RNTI are subject to UE capability.  Note 6: The values of m1 ≥ 1 in the supported combinations are subject to the UE capability.  Note 7: In Active time, a UE is not expected to monitor the DCI format for the PDCCH scrambled by PS-RNTI.  Note 8: The PDCCH scrambled by PS-RNTI can only be configured on the PCell and PSCell.  Note 9: For a UE supporting MBS multicast reception, the values of ~~1 ≥~~ m3 ≥ 0 and m4 ≥ 0 are subject to UE capability and applicable to RRC connected UEs. For the case when the UE does not support FDM or TDM unicast and multicast, ~~I~~if m3 = 1, then m1 ≤ 1. Otherwise, if the UE supports the FDM of multicast and unicast, m1+m3≤2.  Note 10: For a UE supporting MBS multicast reception, the UE is not expected to be configured simultaneously with more than one component carrier for multicast reception. | | | | |

**<**Unchanged text is omitted>

----------------- End of TP ----------------

**Initial TP 3-2:**

Adopt the following TP for Clause 6.2 in TS 38.202:

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

Table 6.2-1: Downlink "Reception Types"

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| "Reception Type" | Physical Channel(s) | Monitored RNTI | Associated Transport Channel | Comment |
| A | PBCH | N/A | BCH |  |
| B | PDCCH+PDSCH | SI-RNTI | DL-SCH | Note 1 |
| C0 | PDCCH | P-RNTI | N/A | Note 1, Note 2 |
| C1 | PDCCH+PDSCH | P-RNTI | PCH | Note 1 |
| D0 | PDCCH+PDSCH | RA-RNTI or Temporary C-RNTI or MsgB-RNTI | DL-SCH | Note 3 |
| D1 | PDCCH+PDSCH | C-RNTI, CS-RNTI, MCS-C-RNTI | DL-SCH |  |
| D2 | PDCCH | C-RNTI, CS-RNTI, MCS-C-RNTI | DL-SCH |  |
| D3 | PDCCH+PDSCH | G-RNTI, G-CS-RNTI | DL-SCH | Note 6 |
| D4 | PDCCH | G-CS-RNTI, G-RNTI | ~~N/A~~ DL-SCH | Note 7 |
| D5 | PDCCH+PDSCH | MCCH-RNTI | DL-SCH | Note 8 |
| D6 | PDCCH+PDSCH | G-RNTI | DL-SCH | Note 9 |
| E | PDCCH | C-RNTI | N/A | Note 4 |
| F0 | PDCCH | Temporary C-RNTI | UL-SCH | Note 3 |
| F1 | PDCCH | C-RNTI, CS-RNTI, MCS-C-RNTI | UL-SCH |  |
| G | PDCCH | SFI-RNTI | N/A |  |
| H | PDCCH | INT-RNTI | N/A |  |
| J0 | PDCCH | TPC-PUSCH-RNTI | N/A |  |
| J1 | PDCCH | TPC-PUCCH-RNTI | N/A |  |
| J2 | PDCCH | TPC-SRS-RNTI | N/A |  |
| K | PDCCH | SP-CSI-RNTI | N/A |  |
| L0 | PDCCH | SL-RNTI | SL-SCH |  |
| L1 | PDCCH | SL-CS-RNTI | SL-SCH |  |
| M | PDCCH | SL Semi-Persistent Scheduling V-RNTI | SL-SCH | Note 5 |
| N | PDCCH | PS-RNTI | N/A |  |
| O | PDCCH | AI-RNTI | N/A |  |
| P | PDCCH | CI-RNTI | N/A |  |
| Q | PDCCH | PEI-RNTI | N/A | Note 1 |
| Note 1: These are received from PCell only.  Note 2: In some cases UE is only required to monitor the short message within the DCI for P-RNTI.  Note 3: These are received from PCell or PSCell.  Note 4: This corresponds to PDCCH-ordered PRACH.  Note 5: This corresponds to PDCCH scheduling LTE PC5.  Note 6: This is for multicast in RRC connected state.  Note 7: This is for multicast in RRC connected state.~~corresponds to DL Semi-Persistent Scheduling release for multicast in RRC connected state~~.  Note 8: This is for broadcast MCCH.  Note 9: This is for broadcast MTCH. UE is not required to decode more than one PDSCH for MTCH simultaneously. | | | | |

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

## Issue#2-4) TPs for GC-PDSCH Rate matching

### Summary

One company [Qualcomm] proposes the procedure for PDSCH scheduled by PDCCH with DCI format 4\_1 is similar as that of DCI format 1\_0, by applying the parameters of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*, *sp-ZP-CSI-RS-ResourceSetsToAddModList* and *p-ZP-CSI-RS-ResourceSet* configured in PDSCH-Config-Multicast. Moderator suggests **initial proposal 4-1** to reflect it.

One company [Huawei] proposes the *RateMatchPatternLTE-CRS* being configured to UEs receiving MBS broadcast in the RRC\_IDLE/INACTIVE states should also be applied to RRC\_CONNECTED state. Since the broadcast is shared by RRC\_IDLE/INACTIVE UEs and RRC\_CONNECTED UEs, moderator suggests **initial proposal 4-2**.

In last RAN1 meeting, we agreed that SP-ZP-CSI-RS can be configured in PDSCH-config-multicast, but TS 38.213 h10 has not captured it, thus one company [Spreadtrum] proposes the corresponding TP. Moderator suggests **initial TP 4-3**.

|  |
| --- |
| Agreement  For multicast RRC\_CONNECTED UEs, *sp-ZP-CSI-RS-ResourceSetsToAddModList* can be configured in *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. For PDSCH resource mapping with RE symbol level granularity,   * the REs indicated by *sp-ZP-CSI-RS-ResourceSetsToAddModList* configured in *PDSCH-Config-Multicast* are declared as not available for GC-PDSCH when their activation delivered by unicast PDSCH is applied. * *sp-ZP-CSI-RS-ResourceSetsToAddModList* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCHs. * *sp-ZP-CSI-RS-ResourceSetsToAddModList* in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCHs. * The total number of semi-persistent *ZP-CSI-RS-ResourceSet* that a UE can be configured with is the same as for unicast in Rel-16   Also include this agreement in an LS to RAN2. |

Regarding the rate-matching pattern configuration number, one company [Huawei] proposes the *RateMatchPattern(s)* configured for MBS multicast is counted into the ones that are configured per BWP which is similar to the *RateMatchPattern(s)* configured for MBS broadcast is counted into the ones that are configured per serving-cell. Since not impact UE hardware is one of the scope in this WI, moderator suggests **initial proposal 4-4**.

### 1st Round Proposals

**Initial proposal 4-1:**

* For multicast RRC\_CONNECTED UEs, the procedure for PDSCH scheduled by PDCCH with DCI format 4\_1 is similar as that of DCI format 1\_0, by applying the parameters of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*, *sp-ZP-CSI-RS-ResourceSetsToAddModList* and *p-ZP-CSI-RS-ResourceSet* configured in PDSCH-Config-Multicast.
* Adopt the following TP for Clause 5.1.4.2 in TS 38.214.

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

**5.1.4.2 PDSCH resource mapping with RE level granularity**

The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*.

The procedures for PDSCH scheduled by PDCCH with DCI format 1\_0 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_1 and ~~T~~the procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config-Multicast* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config*.

**<**Unchanged text is omitted>

----------------- End of TP----------------

**Initial proposal 4-2:**

* *RateMatchPatternLTE-CRS* configured in PDSCH-Config-MCCH or PDSCH-Config-MTCH can also be applied for RRC\_CONNECTED UEs*.*
* Adopt the following TP for Clause 5.1.4.2 in TS 38.214.

----------------- Start of TP ----------------

**5.1.4.2 PDSCH resource mapping with RE level granularity**

**<**Unchanged text is omitted>

A UE may be configured with any of the following higher layer parameters:

*-* REs indicated by the '*RateMatchPatternLTE-CRS*'in *lte-CRS-ToMatchAround* in *ServingCellConfig* or *ServingCellConfigCommon* configuring cell-specific RS, in 15 kHz subcarrier spacing applicable only to 15 kHz subcarrier spacing PDSCH, of one LTE carrier in a serving cell are declared as not available for PDSCH.

*-* REs indicated by *'RateMatchPatternLTE-CRS'* in *lte-CRS-PatternList1-r16* in *ServingCellConfig* configuring cell-specific RS, in 15 kHz subcarrier spacing applicable only to 15 kHz subcarrier spacing PDSCH, of one LTE carrier in a serving cell are declared as not available for PDSCH.

- For the UE ~~in RRC\_IDLE and RRC\_INACTIVE modes~~ for broadcast reception, REs indicated by *'RateMatchPatternLTE-CRS'* in *PDSCH-Config-MCCH* or *PDSCH-Config-MCCH* configuring cell-specific RS, in 15 kHz subcarrier spacing applicable only to 15 kHz subcarrier spacing PDSCH, of one LTE carrier in a serving cell are declared as not available for PDSCH.

- Each *RateMatchPatternLTE-CRS* configuration contains *v-Shift* consisting of LTE-CRS-vshift(s), *nrofCRS-Ports* consisting of LTE-CRS antenna ports 1, 2 or 4 ports, *carrierFreqDL* representing the offset in units of 15 kHz subcarriers from (reference) point A to the LTE carrier centre subcarrier location, *carrierBandwidthDL* representing the LTE carrier bandwidth, and may also configure *mbsfn-SubframeConfigList* representing MBSFN subframe configuration. A UE determines the CRS position within the slot according to Clause 6.10.1.2 in [15, TS 36.211], where slot corresponds to LTE subframe.

**<**Unchanged text is omitted>

----------------- End of TP----------------

**Initial TP 4-3:**

Adopt the following TP for Clause 5.1.4.2 in TS 38.214.

----------------- Start of TP ----------------

**5.1.4.2 PDSCH resource mapping with RE level granularity**

**<**Unchanged text is omitted>

- Within a BWP, the UE can be configured with one or more ZP CSI-RS resource set configuration(s) for aperiodic, semi-persistent and periodic time-domain behaviours (higher layer parameters *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList,*  *sp-ZP-CSI-RS-ResourceSetsToAddModList* and *p-ZP-CSI-RS-ResourceSet* respectively comprised in *PDSCH-Config*), with each ZP CSI-RS resource set consisting of at most 16 ZP CSI-RS resources (higher layer parameter *ZP-CSI-RS-Resource*) in numerology of the BWP. The REs indicated by *p-ZP-CSI-RS-ResourceSet* are declared as not available for PDSCH. The REs indicated by *sp-ZP-CSI-RS-ResourceSetsToAddModList* and aperiodic-ZP-CSI-RS-ResourceSetsToAddModList are declared as not available for PDSCH when their triggering and activation are applied, respectively. The following parameters are configured via higher layer signaling for each ZP CSI-RS resource configuration:

- *zp-CSI-RS-ResourceId* in *ZP-CSI-RS-Resource* determines ZP CSI-RS resource configuration identity.

- *nrofPorts* in *CSI-RS-ResourceMapping* defines the number of CSI-RS ports, where the allowable values are given in Clause 7.4.1.5 of [4, TS 38.211].

- *cdm-Type* in *CSI-RS-ResourceMapping* defines CDM values and pattern, where the allowable values are given in Clause 7.4.1.5 of [4, TS 38.211].

- *resourceMapping* in *ZP-CSI-RS-Resource* defines the OFDM symbol and subcarrier occupancy of the ZP CSI-RS resource within a slot that are given in Clause 7.4.1.5 of [4, TS 38.211].

- *periodicityAndOffset* in *ZP-CSI-RS-Resource* defines the ZP-CSI-RS periodicity and slot offset for periodic/semi-persistent ZP CSI-RS.

- For the UE in RRC\_CONNECTED mode for multicast reception, *p-ZP-CSI-RS-ResourceSet* can be configuredin *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. The REs indicated by *p-ZP-CSI-RS-ResourceSet* are declared as not available for GC-PDSCH. The REs indicated by *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCH and the REs indicated by *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCH. The total number of periodic *ZP-CSI-RS-Resources* that a UE can be configured with is the same as for unicast in Rel-16. If *p-ZP-CSI-RS-ResourceSet* is configured in both *PDSCH-Config* and *PDSCH-Config-Multicast*, it is subject to UE capability whether the *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* can be different from the *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config*.

- For the UE in RRC\_CONNECTED mode for multicast reception, s*p-ZP-CSI-RS-ResourceSet* can be configuredin *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. The REs indicated by s*p-ZP-CSI-RS-ResourceSet* are declared as not available for GC-PDSCH when their triggering and activation delivered by unicast PDSCH are applied. The REs indicated by s*p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCH and the REs indicated by s*p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCH. The total number of semi-persistent *ZP-CSI-RS-Resources* that a UE can be configured with is the same as for unicast.

**<**Unchanged text is omitted>

----------------- End of TP----------------

**Initial proposal 4-4:**

* The RateMatchPattern(s) configured for MBS multicast is counted into the ones that are configured per BWP.
* Adopt the following TP for clause 5.1.4.1 in TS 38.214.

----------------- Start of TP ----------------

**5.1.4.1 PDSCH resource mapping with RB symbol level granularity**

**<**Unchanged text is omitted>

The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *rateMatchPatternGroup1DCI-1-2*, *rateMatchPatternGroup2DCI-1-2* instead of *rateMatchPatternGroup1* and *rateMatchPatternGroup2*.

The procedures for PDSCH scheduled by PDCCH with DCI format 1\_0 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_1, and the procedures for PDSCH scheduled by DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2 by applying the parameters of *rateMatchPatternToAddModList, rateMatchPatternGroup1* and *rateMatchPatternGroup2* configured in *PDSCH-Config-Multicast*.

A UE may be configured with any of the following higher layer parameters indicating REs declared as not available for PDSCH:

- *rateMatchPatternToAddModList* given by *PDSCH-Config, PDSCH-ConfigMulticast,* by *ServingCellConfig* or by *ServingCellConfigCommon*, or by *PDSCH-Config-MCCH or PDSCH-Config-MTCH* and configuring up to 4 *RateMatchPattern(s)* per BWP and up to 4 *RateMatchPattern(s)* per serving-cell. The *RateMatchPatterns* configured for MBS multicast are counted into the ones that are configured per BWP. The *RateMatchPattern(s)* configured for MBS broadcast is counted into the ones that are configured per serving-cell. A *RateMatchPattern* may contain:

**<**Unchanged text is omitted>

----------------- End of TP----------------

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

## Issue#2-5) Other TPs for GC-PDSCH

### Summary

We have agreed that DCI format 4\_2 can support maximum two TBs. In unicast, when there are DCI fields for two TBs in DCI format 1\_1, the corresponding TB is disabled when MCS=26 and RV=1. One company [NTT DOCOMO] proposes to apply the same rule to DCI format 4\_2 as to DCI format 1\_1 as the condition for disabling TB in DCI format 4\_2. In addition, MCCH-RNTI is missed in the clause 5.1.3.2 TBS size determination. Moderator suggests **initial proposal 5-1**.

[NTT DOCOMO] also proposes a text proposal in clause 5.1.5 of TS 38.214 to clarify the condition for the existence of TCI field in DCI format 4\_2 which using the same rule as for DCI format 1\_1. Because Clause 7.3.1.5.3 of 38.212 states that the existence condition for the TCI field in DCI format 4\_2 is defined in clause 5.1.5 of 38.214. However, 5.1.5 of 38.214 does not yet have a corresponding description. Moderator suggests **initial proposal 5-2**.

### 1st Round Proposals

**Initial proposal 5-1:**

* The condition for disabling TB in DCI format 4\_2 uses the same rule as for DCI format 1\_1.
* Adopt the following TP for clause 5.1.3.2 in TS 38.214:

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

**5.1.3.2 Transport block size determination**

In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *PDSCH-Config* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 1\_1 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* in *PDSCH-Config-Multicast* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 4\_2 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. If both transport blocks are enabled, transport block 1 and 2 are mapped to codeword 0 and 1 respectively. If only one transport block is enabled, then the enabled transport block is always mapped to the first codeword.

For the PDSCH assigned by a PDCCH with DCI format 4\_0, format 4\_1, format 4\_2 or format 1\_2 with CRC scrambled by C-RNTI, MCS-C-RNTI, TC-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI, MCCH-RNTI or SI-RNTI, if Table 5.1.3.1-2 is used and *,* else if Table 5.1.3.1-4 used and or a table other than Table 5.1.3.1-2 and Table 5.1.3.1-4 is usedand *,* the UE shall, except if the transport block is disabled in DCI format 1\_1 or 4\_2, first determine the TBS as specified below:

**<**Unchanged text is omitted>

----------------- End of TP ----------------

**Initial proposal 5-2:**

* The condition for the existence of TCI field in DCI format 4\_2 uses the same rule as for DCI format 1\_1.
* Adopt the following TP for clause 5.1.5 in TS 38.214:

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled'for the CORESET scheduling the PDSCH, the UE assumes that the TCI field is present in the DCI format 1\_1 of the PDCCH transmitted on the CORESET. If a UE is configured with the higher layer parameter *tci-PresentDCI-1-2* for the CORESET scheduling the PDSCH, the UE assumes that the TCI field with a DCI field size indicated by *tci-PresentDCI-1-2* is present in the DCI format 1\_2 of the PDCCH transmitted on the CORESET. If a UE is configured with the higher layer parameter *tci-PresentInDCI* that is set as 'enabled'for the CORESET scheduling the multicast PDSCH, the UE assumes that the TCI field is present in the DCI format 4\_2 of the PDCCH transmitted on the CORESET. If the PDSCH is scheduled by a DCI format not having the TCI field present, and the time offset between the reception of the DL DCI and the corresponding PDSCH of a serving cell is equal to or greater than a threshold *timeDurationForQCL* if applicable, where the threshold is based on reported UE capability [13, TS 38.306], for determining PDSCH antenna port quasi co-location, the UE assumes that the TCI state or the QCL assumption for the PDSCH is identical to the TCI state or QCL assumption whichever is applied for the CORESET used for the PDCCH transmission within the active BWP of the serving cell.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

## Issue#2-6/2-7) Maximum data rate and LLR buffering for FDMed unicast and MBS

### Summary

During last RAN1#108-e meeting, whether to support a new scaling factor parameter for the max data rate of UE supporting FDM of unicast and multicast with a slot was discussed without consensus. In this meeting, two companies [Qualcomm, Ericsson] propose UE can report an additional scaling factor for the max data rate per CC when there is FDMed multicast and unicast, which can brow some maximum date rate from other CCs but the overall data rate across CCs for UE is not increased. Because they think the max data rate of FDMed unicast and multicast may be higher than that of the max value of unicast only and multicast only.

But during the discussion in last meeting, some companies are not convinced by the motivation and they think the maximum date rate is not increased in FDM/TDM unicast and multicast cases than unicast only since the DL bandwidth is not increased.

From moderator’s understanding, the total maximum date rate across CCs is not increased as the following formula using for each CC.

And for the j-th CC, the maximum unicast date rate is

If the , which the UE supported maximum unicast date rate is equals to the theoretical maximum TBS calculated based on the maximum MIMO layer, the maximum modulation order and the largest bandwidth. And in this case the maximum date rate of FDMed unicast and multicast case is equal to the unicast only case since gNB cannot schedule a larger TB.

But if the , the UE supported maximum unicast date rate is smaller than the theoretical maximum TBS calculated based on the maximum MIMO layer, the maximum modulation order and the largest bandwidth. In FDMed unicast and multicast case if UE can brow some maximum date rate from other CC for multicast transmission in j-th CC, the unicast transmission maximum date rate in j-th CC may not be impacted but the unicast maximum data rate will be reduced in other CCs except the j-th CC. Considering this issue is not discussed through all the time in RAN1#108-e meeting and some companies are not clear about the motivation, moderator suggests **initial proposal 6-1** to further check other companies’ views.

Similar to maximum date rate calculation, one company [Qualcomm] also proposes to increase the upper limit of PDSCH LLR buffering for FDMed unicast and MBS case. The following words are cited from [Qualcomm]’s contribution:

“*As specified in Clause 5.1.3 of TS38.214, the UE is not expected to handle any transport blocks (TBs) in a 14 consecutive-symbol duration for normal CP (or 12 for extended CP) ending at the last symbol of the latest PDSCH transmission within an active BWP on a serving cell whenever*

*where, for the serving cell,*

*- S is the set of TBs belonging to PDSCH(s) that are partially or fully contained in the consecutive-symbol duration*

*- for the ith TB*

*- Ci' is the number of scheduled code blocks for as defined in [5, 38.212].*

*- Li is the number of OFDM symbols assigned to the PDSCH*

*- xi is the number of OFDM symbols of the PDSCH contained in the consecutive-symbol duration*

*- based on the values defined in Clause 5.4.2.1 [5, TS 38.212]*

*- is the starting location of RV for the th transmission*

*- of the scheduled code blocks for the transmission*

*- is the circular buffer length*

*- is the current (re)transmission for the ith TB*

*- corresponds to the subcarrier spacing of the BWP (across all configured BWPs of a carrier) that has the largest configured number of PRBs*

*- in case there is more than one BWP corresponding to the largest configured number of PRBs, µ' follows the BWP with the largest subcarrier spacing.*

*- corresponds to the subcarrier spacing of the active BWP*

*- RLBRM = 2/3 as defined in Clause 5.4.2.1 [5, TS 38.212]*

*- TBSLBRM as defined in Clause 5.4.2.1 [5, TS 38.212]*

*- X as defined for downlink in Clause 5.4.2.1 [5, TS 38.212].*

*For legacy UE without MBS, X and TBSLBRM are the max MIMO layers and max TBS configured for unicast. For a UE supporting unicast and MBS, there are different parameters for X and TBSLBRM specified in Clause 5.4.2.1 of TS 38.212:*

* *and  are max MIMO layers and max TBS configured for unicast PDSCH*
* *and are max MIMO layers and max TBS configured for broadcast GC-PDSCH (scheduled by DCI format 4\_0)*
* *and are max MIMO layers and max TBS configured for multicast GC-PDSCH (scheduled by DCI format 4\_1/4\_2)*

*RAN1 needs to discuss which parameter should be used in different cases:*

* *Case 1 (same as legacy Rel16): in a slot without MBS PDSCH(s), the UE is not expected to handle any transport blocks (TBs) within an active BWP on a serving cell whenever*
* *Case 2: in a slot with MBS broadcast GC-PDSCH(s) only, the UE is not expected to handle any transport blocks (TBs) within an active BWP on a serving cell whenever*
* *Case 3: in a slot with MBS multicast GC-PDSCH(s) only, the UE is not expected to handle any transport blocks (TBs) within an active BWP on a serving cell whenever*
* *Case 4: in a slot with TDMed unicast PDSCH(s) and MBS GC-PDSCH(s), if supported, the UE is not expected to handle any transport blocks (TBs) within an active BWP on a serving cell whenever*
  + *where is typically same or larger than that of MBS.*
* *Case 5: in a slot with FDMed unicast PDSCH and MBS GC-PDSCH, if supported, the UE is not expected to handle any transport blocks (TBs) within an active BWP on a serving cell whenever*
  + *where the upper limit of PDSCH LLR buffering can be increased for FDMed unicast PDSCH and MBS GC-PDSCH by a scaling factor with and may be subject**to UE capability.”*

Moderator thinks if we agree the initial proposal 6-1, it is reasonable also to increase the the upper limit of PDSCH LLR buffer since the maximum TBS is also increased in the j-th CC and suggests the **initial proposal 6-2** to collect more views from companies.

### 1st Round Proposals

**Initial proposal 6-1:**

UE can report an additional scaling factor for the max data rate per CC when there is FDMed multicast and unicast in a CC of the CC group. The overall max data rate calculation across CCs should be based on the unicast scaling factor.

**Initial proposal 6-2:**

The UE is not expected to handle any transport blocks (TBs) in a 14 consecutive-symbol duration for normal CP (or 12 for extended CP) ending at the last symbol of the latest PDSCH transmission within an active BWP on a serving cell whenever

* where
  + {*X*, TBSLBRM} is the max MIMO layers and max TBS for unicast.
  + =0 for a slot without FDMed unicast and MBS PDSCHs and for a slot with FDMed unicast and MBS PDSCHs with subject to UE capability

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

## Issue#2-23) Determination of repetition number for PTM SPS PDSCH retransmission

### Summary

One company [Samsung] proposes that the repetition number is determined based on *pdsch-AggregationFactor* for unicast SPS PDSCH retransmission with repetitions. But for multicast, the corresponding parameter *pdsch-AggregationFactorMulticast* is configured per G-RNTI and there can be multiple G-RNTIs. Therefore, for PTM based SPS PDSCH retransmission with repetitions, *pdsch-AggregationFactorMulticast* cannot be used. Then, using the *pdsch-AggregationFactor* configured in the SPS-Config-Multicast is reasonable to address the multiple G-RNTI issues and moderator suggests the **initial proposal 7-1**.

### 1st Round Proposals

**Initial proposal 7-1:**

For PTM based SPS PDSCH retransmission, the repetition number is determined by *pdsch-AggregationFactor* in SPS-Config-Multicast.

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

# GC-PDCCH related issues

## Background and submitted proposals

### Issue#2-12) Whether to include broadcast and MCCH-RNTI in at most 16 PDCCH receiving capability for RRC\_CONNECTED UEs

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| **ZTE** | **Proposal 4: For RRC\_CONNECTED UEs, a MCCH/MTCH PDCCH cannot be considered as a unicast PDCCH and it should be a UE implementation on how to guarantee the PDCCH monitoring budget. For example, MCCH/MTCH PDCCH will be dropped if the number of PDCCH has reached monitoring budget.** |
| **Huawei** | **Proposal 11: Adopt the following text proposal TP#5 to TS 38.213:**   * **Reason for change:**   + **Regarding the most number of PDCCHs UE can buffer and process before receiving PDSCH, the DCI scheduling MBS broadcast is not counted into the maximum number of 16.** * **Summary of change:**   + **Adding “MCCH-RNTI, G-RNTI for broadcast”.** * **Consequences if not approved:**   + **It could be misleading that UE has additional capability of handling DCI scheduling MCCH and G-RNTI for broadcast on top of the maximum number of 16, which contradicts the agreement that additional HARQ process(es) is(are) not introduced for Rel-17 MBS broadcast reception.**  |  | | --- | | **-----------------------------------------------------TP#5: TS 38.213 v17.1.0----------------------------------------------------**  10.1 UE procedure for determining physical downlink control channel assignment  < Unchanged parts are omitted >  If a UE  - is configured for single cell operation or for operation with carrier aggregation in a same frequency band, and  - monitors PDCCH candidates in overlapping PDCCH monitoring occasions in multiple CORESETs where none of the CORESETs has TCI-states configured with *qcl-Type* set to 'typeD',  the UE is required to monitor PDCCH candidates in overlapping PDCCH monitoring occasions for search space sets associated with different CORESETs.  For a scheduled cell and at any time, if a UE is provided a C-RNTI, the UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, MCS-C-RNTI, MCCH-RNTI, G-RNTI for broadcast, G-RNTI for multicast, or G-CS-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.  < Unchanged parts are omitted >  **-----------------------------------------------------TP#5: TS 38.213 v17.1.0----------------------------------------------------** | |
| **Qualcomm** | **Proposal 4: For RRC\_CONNECTED UEs,**   * **A PDCCH with a G-RNTI for the interested MTCH is counted as a unicast DCI scheduling PDSCH; but a PDCCH with MCCH-RNTI for MCCH is not counted as a unicast DCI scheduling PDSCH.** * **In case of NR-CA or NR-DC operation, a PDCCH with a G-RNTI or a G-CS-RNTI is also counted as a unicast DCI scheduling PDSCH.** * **Adopt the TP#2 for TS 38.213.**   ----------------- Start of TP#2 for TS 38.213 ---------------- 10.1 UE procedure for determining physical downlink control channel assignment **<**Unchanged text is omitted>  For a scheduled cell and at any time, if a UE is provided a C-RNTI, the UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, MCS-C-RNTI, G-RNTI, or G-CS-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.  If a UE is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for any serving cell, and  - is not configured for NR-DC operation and indicates through *pdcch-BlindDetectionCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for all serving cells*,* and  - is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell and is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell,and  - is not configured for NR-DC operation, and indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  If a UE is provided serving cells with SCS configuration for the active DL BWP, is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.  If a UE is provided *monitoringCapabilityConfig* = *r17monitoringcapability* for at least one serving cell, is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for at least one serving cell, is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for any serving cell, is not configured for NR-DC operation, indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and UE is configured with downlink cell or uplink cells, the UE expects to have respectively received  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*  If a UE is provided *monitoringCapabilityConfig* = *r17monitoringcapability* for at least one serving cell, is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell, is not provided *monitoringCapabilityConfig* = *r15monitoringcapability* for any serving cell, is not configured for NR-DC operation, indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cells or uplink cells  the UE expects to have respectively received  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*  If a UE is provided *monitoringCapabilityConfig* = *r17monitoringcapability* for at least one serving cell, is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell, and *monitoringCapabilityConfig* = *r15monitoringcapability* for at least one serving cell, is not configured for NR-DC operation, indicates a capability to monitor PDCCH candidates for downlink cells, , and downlink cells, and is configured with downlink cells or uplink cells  the UE expects to have respectively received  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*  **<**Unchanged text is omitted>  ----------------- end of TP#2 for TS 38.213 ---------------- |
| **LGE** | **Observation 1: It is beneficial for gNB to know which MO among multiple PDCCH MOs in a window the UE will actually monitor in the window in order to ensure that the UE receives at most 16 PDCCHs.**  **Proposal 1: The TCI state determined for monitoring unicast PDCCHs as specified in 38.213 is used for a connected UE to determine a PDCCH MO among multiple MOs in a MCCH/MTCH window for reception of broadcast PDCCHs.** |
| **Ericsson** | Proposal 11 Adopt the following changes to 38.213  ----------------- Start of TP ----------------  10.1 UE procedure for determining physical downlink control channel assignment  **<**Unchanged text is omitted>  For a scheduled cell and at any time, a UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, G-RNTI ~~for multicast~~, G-CS-RNTI or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.  **<**Unchanged text is omitted>  ----------------- End of TP ---------------- |

### Issue#2-13/3-2) Multicast and broadcast search space configuration RRC signaling alignment between TS 38.213 and TS 38.331

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| **CMCC** | **Proposal 10. Adopt the following TP for TS 38.213 section 10.1:**   * **Reason for change: The RRC IEs for multicast and broadcast search space configuration in TS 38.213 are not aligned with TS 38.331.** * **Summary of change: To correct the RRC IEs for multicast and broadcast search space configuration.** * **Consequences if not approved: UE can not be configured with multicast and broadcast search space using wrong RRC IEs.**   **<**Unchanged text is 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 *searchSpaceMCCH* and *searchSpaceMTCH* are 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  - a Type0B-PDCCH CSS set configured by *searchSpaceMCCH* and *searchSpaceMTCH* for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI, on the primary cell of the MCG  - 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* in *PDCCH-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI, or  - *searchSpaceMCCH* and *searchSpaceMTCH* on a secondary cell for a DCI format 4\_0 with CRC scrambled by a MCCH-RNTI or a G-RNTI, and  - a USS set configured by  - *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), SL-RNTI, SL-CS-RNTI, or SL Semi-Persistent Scheduling V-RNTI, or  - *sdt-CG-SearchSpace* for DCI formats with CRC scrambled by C-RNTI or CS-RNTI as described in clause 19.1.  **<**Unchanged text is omitted>  If the active DL BWP and an MBS frequency resource provided by *cfr-Config-MCCH-MTCH* for a UE have same SCS and same CP length and the active DL BWP includes all RBs of the MBS frequency resource, and if the UE is provided *searchSpaceMCCH or searchSpaceMTCH* for Type0B-PDCCH CSS set on the primary cell or for Type3-PDCCH CSS set on a secondary cell, the UE monitors PDCCH for detection of broadcast DCI formats, as described in clause 18, on the active DL BWP.  **<**Unchanged text is omitted>  A UE does not expect to be configured CSS sets, except for CSS sets provided by *searchSpaceMCCH, searchSpaceMTCH* or by *SearchSpace* in *PDCCH-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI, that result to corresponding total, or per scheduled cell, numbers of monitored PDCCH candidates and non-overlapped CCEs per slot, per group of slots for a corresponding combination , or per span that exceed the corresponding maximum numbers per slot, or per group of slots for a corresponding combination , 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 that a UE monitors PDCCH on the primary cell within a slot , or within a group of slots for a corresponding combination , or within a span in slot , denote by a set of CSS sets, except for CSS sets provided by *searchSpaceMCCH, searchSpaceMTCH* or by *SearchSpace* in *PDCCH-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI, with cardinality of and by a set of USS sets and CSS sets provided by *searchSpaceMCCH, searchSpaceMTCH* or by *SearchSpace* in *PDCCH-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI with cardinality of for scheduling on the primary cell. The location of search space sets , , in is according to an ascending order of the search space set index.  **<**Unchanged text is omitted> |
| **vivo** | \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*Start of TP\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  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*.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*End of TP\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |

## Issue#2-12) Whether to include broadcast and MCCH-RNTI in at most 16 PDCCH receiving capability for RRC\_CONNECTED UEs

### Summary

In last RAN1#108-e meeting, we had the following agreement that the multicast GC-PDCCH is treated as unicast PDCCH for RRC\_CONNECTED UEs, but whether to include broadcast PDCCH/MCCH-RNTI has no consensus.

**Agreement**

For RRC\_CONNECTED UEs, a multicast PDCCH to schedule a multicast PDSCH is counted as a unicast DCI to schedule a unicast PDSCH.

* Adopt the following TP for Clause 10.1 in TS 38.213:

----------------- Start of TP ----------------

10.1 UE procedure for determining physical downlink control channel assignment

**<**Unchanged text is omitted>

For a scheduled cell and at any time, a UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, G-RNTI for multicast, G-CS-RNTI or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Based on the contribution, one company [ZTE] proposes both MCCH and MTCH PDCCH are **not** considered as unicast PDCCH, two companies [Huawei, LGE] propose both MCCH and MTCH PDCCH are considered as unicast PDCCH, and another two companies [Qualcomm, Ericsson] propose only MTCH PDCCH is considered as unicast PDCCH.

During the last RAN1 meeting, the argument bout MCCH is that slot-repetition is not supported for MCCH without need a HARQ process. Considering the situation and diverged views among companies, moderator suggests the **initial TP 8-1** to only include MTCH.

In addition, one company [Qualcomm] also proposes in case of NR-CA or NR-DC operation, a PDCCH with a G-RNTI or a G-CS-RNTI is also counted as a unicast DCI scheduling PDSCH. moderator suggests the **initial TP 8-2**.

### 1st Round Proposals

**Initial TP 8-1:**

Adopt the following TP for Clause 10.1 in TS 38.213:

----------------- Start of TP ----------------

10.1 UE procedure for determining physical downlink control channel assignment

**<**Unchanged text is omitted>

For a scheduled cell and at any time, if a UE is provided a C-RNTI, the UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, MCS-C-RNTI, G-RNTI ~~for multicast~~, or G-CS-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

**Initial TP 8-2:**

Adopt the following TP for Clause 10.1 in TS 38.213:

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

If a UE is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for any serving cell, and

- is not configured for NR-DC operation and indicates through *pdcch-BlindDetectionCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or

- is configured with NR-DC operation and for a cell group with downlink cells or uplink cells

the UE expects to have respectively received at most PDCCHs for

- DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells

- DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells

If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for all serving cells*,* and

- is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or

- is configured with NR-DC operation and for a cell group with downlink cells or uplink cells

the UE expects to have respectively received at most PDCCHs for

- DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells

- DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.

If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell and is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell,and

- is not configured for NR-DC operation, and indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cells or uplink cells, or

- is configured with NR-DC operation and for a cell group with downlink cells or uplink cells

the UE expects to have respectively received

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*

If a UE is provided serving cells with SCS configuration for the active DL BWP, is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, the UE expects to have respectively received at most PDCCHs for

- DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells

- DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.

If a UE is provided *monitoringCapabilityConfig* = *r17monitoringcapability* for at least one serving cell, is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for at least one serving cell, is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for any serving cell, is not configured for NR-DC operation, indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and UE is configured with downlink cell or uplink cells, the UE expects to have respectively received

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*

If a UE is provided *monitoringCapabilityConfig* = *r17monitoringcapability* for at least one serving cell, is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell, is not provided *monitoringCapabilityConfig* = *r15monitoringcapability* for any serving cell, is not configured for NR-DC operation, indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cells or uplink cells

the UE expects to have respectively received

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*

If a UE is provided *monitoringCapabilityConfig* = *r17monitoringcapability* for at least one serving cell, is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell, and *monitoringCapabilityConfig* = *r15monitoringcapability* for at least one serving cell, is not configured for NR-DC operation, indicates a capability to monitor PDCCH candidates for downlink cells, , and downlink cells, and is configured with downlink cells or uplink cells

the UE expects to have respectively received

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r15monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI, or a G-RNTI, or a G-CS-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*

- at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells with *monitoringCapabilityConfig* = *r17monitoringcapability*

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

## Issue#2-13/3-2) Multicast and broadcast search space configuration RRC signaling alignment between TS 38.213 and TS 38.331

### Summary

2 companies [CMCC, vivo] propose this issue. In TS 38.331 h00, RAN2 has decided that the MCCH and MTCH search space on PCell/SCell are configured by *searchSpaceMCCH* and *searchSpaceMTCH* in *PDCCH-ConfigCommon* and thus, the corresponding changes are needed to replace *pdcch-Config-MCCH* and *pdcch-Config-MTCH* in TS 38.213*.*

***PDCCH-ConfigCommon* information element**

-- ASN1START

-- TAG-PDCCH-CONFIGCOMMON-START

PDCCH-ConfigCommon ::= SEQUENCE {

[[

searchSpaceMCCH-r17 SearchSpaceId OPTIONAL, -- Need R

searchSpaceMTCH-r17 SearchSpaceId OPTIONAL, -- Need S

commonSearchSpaceListExt2-r17 SEQUENCE (SIZE(1..4)) OF SearchSpaceExt2-r17 OPTIONAL -- Need R

]]

}

-- TAG-PDCCH-CONFIGCOMMON-STOP

-- ASN1STOP

In addition, there is also no *SearchSpace-Multicast* IE in TS 38.331 h00, which *SearchSpace* in *PDCCH-ConfigMulticast* is used to configure the multicast search space.

In order to align the RRC signaling for multicast and broadcast search space configuration, moderator suggest **initial TP 9-1**.

### 1st Round Proposals

**Initial TP 9-1:**

Adopt the following TP for Clause 10.1 in TS 38.213:

----------------- Start of TP ----------------

**<**Unchanged text is 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 *searchSpaceMCCH~~pdcch-Config-MCCH~~* and *searchSpaceMTCH~~pdcch-Config-MTCH~~* are 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

- a Type0B-PDCCH CSS set configured by *searchSpaceMCCH~~searchSpaceBroadcast~~* ~~in~~ *~~pdcch-Config-MCCH~~* and *searchSpaceMTCH~~pdcch-Config-MTCH~~* for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI, on the primary cell of the MCG

- 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

- *searchSpaceMCCH~~searchSpaceBroadcast~~* ~~in~~ *~~pdcch-Config-MCCH~~* and *searchSpaceMTCH~~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

- a USS set configured by

- *SearchSpace* in *PDCCH-Config* with *searchSpaceType* = *ue-Specific* for DCI formats with CRC scrambled by C-RNTI, MCS-C-RNTI, SP-CSI-RNTI, CS-RNTI(s), SL-RNTI, SL-CS-RNTI, or SL Semi-Persistent Scheduling V-RNTI, or

- *sdt-CG-SearchSpace* for DCI formats with CRC scrambled by C-RNTI or CS-RNTI as described in clause 19.1.

**<**Unchanged text is omitted>

If the active DL BWP and an MBS frequency resource provided by *cfr-Config-MCCH-MTCH* for a UE have same SCS and same CP length and the active DL BWP includes all RBs of the MBS frequency resource, and if the UE is provided *searchSpaceMCCH or searchSpaceMTCH~~searchSpaceBroadcast~~* for Type0B-PDCCH CSS set on the primary cell or for Type3-PDCCH CSS set on a secondary cell, the UE monitors PDCCH for detection of broadcast DCI formats, as described in clause 18, on the active DL BWP.

**<**Unchanged text is omitted>

A UE does not expect to be configured CSS sets, except for CSS sets provided by *searchSpaceMCCH, searchSpaceMTCH~~searchSpaceBroadcast~~* or by *SearchSpace* in *PDCCH-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI*~~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 slots for a corresponding combination , or per span that exceed the corresponding maximum numbers per slot, or per group of slots for a corresponding combination , 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 that a UE monitors PDCCH on the primary cell within a slot , or within a group of slots for a corresponding combination , or within a span in slot , denote by a set of CSS sets, except for CSS sets provided by *searchSpaceMCCH, searchSpaceMTCH~~searchSpaceBroadcast~~*or by *SearchSpace* in *PDCCH-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI*~~searchSpace-Multicast~~*, with cardinality of and by a set of USS sets and CSS sets provided by *searchSpaceMCCH, searchSpaceMTCH~~searchSpaceBroadcast~~*or by *SearchSpace* in *PDCCH-ConfigMulticast* for DCI formats with CRC scrambled by G-RNTI, or G-CS-RNTI*~~searchSpace-Multicast~~* with cardinality of for scheduling on the primary cell. The location of search space sets , , in is according to an ascending order of the search space set index.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Companies are encouraged to provide comments in the table below.

|  |  |
| --- | --- |
| **Company** | **Comment** |
|  |  |

### 2nd Round Proposals

To be added……

# Proposals for GTW session

# Proposals for email approval

# References

1. R1-2203195 Maintenance of other issues for broadcast and multicast ZTE
2. R1-2203288 Remaining Issues for NR MBS Nokia, Nokia Shanghai Bell
3. R1-2203315 Discussion on the remaining issues for MBS Spreadtrum Communications
4. R1-2203527 Maintenance on NR Multicast and Broadcast Services vivo
5. R1-2203700 Remaining issues on group scheduling mechanism for RRC\_CONNECTED UEs Lenovo
6. R1-2203776 Other remaining issues for multicast and broadcast xiaomi
7. R1-2203875 Maintenance on group scheduling for RRC\_CONNECTED UEs Samsung
8. R1-2204189 Discussion on MBS SPS activation validation ASUSTeK
9. R1-2204283 Maintenance on group scheduling mechanisms for NR multicast and broadcast services CMCC
10. R1-2204355 Remaining issues on group scheduling mechanisms for MBS NTT DOCOMO, INC.
11. R1-2204623 Other remaining issues for MBS LG Electronics
12. R1-2204891 Remaining issues for multicast and broadcast scheduling Huawei, HiSilicon, CBN
13. R1-2204946 Remaining issues for group scheduling of NR MBS Ericsson
14. R1-2204995 Other remaining issues for Rel-17 MBS Qualcomm Incorporated

# Appendix 1: Agreements in #102 e-meeting

**RAN1#102-e**

Agreements:

For RRC\_CONNECTED UEs, HARQ-ACK feedback is supported for multicast and no additional evaluation is needed to justify this.

* + FFS: The detailed HARQ-ACK feedback solutions, e.g., ACK/NACK based, NACK-only based.
  + FFS: HARQ-ACK feedback can be optionally disabled and/or enabled.

Agreements:

For RRC\_CONNECTED UEs, at least 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.

o   FFS: whether to support UE-specific PDCCH to schedule a PDSCH for MBS.

Agreements:

* For RRC\_CONNECTED UEs, define/configure common frequency resource for group-common PDSCH.
  + FFS: whether to reuse the BWP framework or not
  + FFS: the relation between the common frequency resource and UE dedicated BWP, e.g., the common frequency resource is a MBS specific BWP, or the common frequency resource is confined within UE’s dedicated BWP, etc.
  + FFS: whether more than one common frequency resource can be configured per UE

Agreements:

* For RRC\_CONNECTED UEs, at least support FDM between unicast PDSCH and group-common PDSCH in a slot based on UE capability.
  + FFS: TDM or SDM in a slot.

Agreements:

* For RRC\_CONNECTED UEs, at least support slot-level repetition for group-common PDSCH.
  + FFS: whether enhancement is needed

Agreements:

* For RRC\_CONNECTED UEs, existing CSI feedback can be used for multicast transmission.
  + FFS: whether enhancement is needed

# Appendix 2: Agreements in #103 e-meeting

**RAN1#103-e**

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

**Agreements:** For convenience of discussion, consider the following clarification as RAN1 common understanding.

* **PTP transmission**: For RRC\_CONNECTED UEs, use UE-specific PDCCH with CRC scrambled by UE-specific RNTI (e.g., C-RNTI) to schedule UE-specific PDSCH which is scrambled with the same UE-specific RNTI.
* **PTM transmission scheme 1**: For RRC\_CONNECTED UEs in the same MBS group, use group-common PDCCH with CRC scrambled by group-common RNTI to schedule group-common PDSCH which is scrambled with the same group-common RNTI. This scheme can also be called group-common PDCCH based group scheduling scheme.
* **PTM transmission scheme 2**: For RRC\_CONNECTED UEs in the same MBS group, use UE-specific PDCCH with CRC scrambled by UE-specific RNTI (e.g., C-RNTI) to schedule group-common PDSCH which is scrambled with group-common RNTI. This scheme can also be called UE-specific PDCCH based group scheduling scheme.
* Note: The ‘UE-specific PDCCH / PDSCH’ here means the PDCCH / PDSCH can only be identified by the target UE but cannot be identified by the other UEs in the same MBS group with the target UE.
* Note: The ‘group-common PDCCH / PDSCH’ here means the PDCCH / PDSCH are transmitted in the same time/frequency resources and can be identified by all the UEs in the same MBS group.
* FFS whether or not to have additional definition of transmission scheme(s)

Agreements**:** For RRC\_CONNECTED UEs, if initial transmission for multicast is based on PTM transmission scheme 1, at least support retransmission(s) can use PTM transmission scheme 1.

* FFS: whether to support PTP transmission for retransmission(s).
* FFS: whether to support PTM transmission scheme 2 for retransmission(s).
* FFS: How to indicate the association between PTM scheme 1 and PTP transmitting the same TB.
* FFS: If multiple retransmission schemes are supported, then can different retransmission schemes be supported simultaneously for different UEs in the same group?

**Working assumption:**

For multicast of RRC-CONNECTED UEs, a common frequency resource for group-common PDCCH / PDSCH is confined within the frequency resource of a dedicated unicast BWP to support simultaneous reception of unicast and multicast in the same slot

* Down select from the two options for the common frequency resource for group-common PDCCH/ PDSCH
  + Option 2A: The common frequency resource is defined as an MBS specific BWP, which is associated with the dedicated unicast BWP and using the same numerology (SCS and CP)
    - FFS BWP switching is needed between the multicast reception in the MBS specific BWP and unicast reception in its associated dedicated BWP
  + Option 2B: The common frequency resource is defined as an ‘MBS frequency region’ with a number of contiguous PRBs, which is configured within the dedicated unicast BWP.
    - FFS: How to indicate the starting PRB and the length of PRBs of the MBS frequency region
* FFS whether UE can be configured with no unicast reception in the common frequency resource
* FFS on details of the group-common PDCCH / PDSCH configuration
* FFS whether to support more than one common frequency resources per UE / per dedicated unicast BWP subjected to UE capabilities

Agreements: Support TDM between one unicast PDSCH and one group-common PDSCH in a slot based on UE capability for RRC\_CONNECTED UEs.

Agreements: Support SPS group-common PDSCH for MBS for RRC\_CONNECTED UEs

* FFS: use group-common PDCCH or UE-specific PDCCH for SPS group-common PDSCH activation/deactivation
* FFS: whether to support more than one SPS group-common PDSCH configuration per UE
* FFS: whether and how uplink feedback could be configured
* FFS: retransmission of SPS group-common PDSCH

Agreements: For PTM transmission scheme 1, the CORESET for group-common PDCCH is configured within the common frequency resource for group-common PDSCH.

* FFS: number of CORESET(s) for group-common PDCCH within the common frequency resource for group-common PDSCH

Agreements: For search space set of group-common PDCCH of PTM scheme 1 for multicast in RRC\_CONNECTED state, the CCE indexes are common for different UEs in the same MBS group.

Agreements: Down select from the two options for BDs/CCEs limit for Rel-17 MBS

* Option 1: the maximum number of monitored PDCCH candidates and non-overlapped CCEs per slot per serving cell defined in Rel-15 is kept unchanged for Rel-17 MBS.
* Option 2: For UEs supporting CA capability, the budget of BDs/CCEs of an unused CC can be used for group-common PDCCH to count the number of BDs/CCEs, which is similar to the method used for multi-DCI based multi-TRP in Rel-16.

Agreements:For RRC\_CONNECTED UEs, support inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots (mandatory for the UE supporting MBS).

Agreements:Further study the following cases for simultaneous reception of unicast PDSCH and group-common PDSCH in a slot based on UE capability for RRC\_CONNECTED UEs.

* Case 1: support TDM between multiple TDMed unicast PDSCHs and one group-common PDSCH in a slot
* Case 2: support TDM among multiple group-common PDSCHs in a slot
* Case 3: support TDM between multiple TDMed unicast PDSCHs and multiple TDMed group-common PDSCHs in a slot
* Case 4: support FDM between multiple TDMed unicast PDSCHs and multiple TDMed group-common PDSCHs in a slot
* Case 5: support FDM among multiple group-common PDSCHs in a slot
* FFS: maximum number of PDSCHs in a slot simultaneous received per UE

Agreements:For search space set of group-common PDCCH of PTM scheme 1 for multicast in RRC\_CONNECTED state, further study the following options.

* Option 1: Define a new search space type specific for multicast
* Option 2: Reuse the existing CSS type(s) in Rel-15/16
  + FFS: whether modifications are needed for multicast
* Option 3: Reuse the existing USS in Rel-15/16 with necessary modifications for MBS
  + FFS: detailed modifications

Agreements:No specification enhancement in Rel-17 to support SDM between unicast PDSCH and group-common PDSCH in a slot for RRC\_CONNECTED UEs.

Agreements**:** For PTM transmission scheme 1, if Option 2A or Option 2B for common frequency resource for group-common PDCCH/PDSCH is agreed, the FDRA field of group-common PDCCH is interpreted based on the common frequency resource.

Agreements: For search space set of group-common PDCCH of PTM scheme 1 for multicast in RRC\_CONNECTED state, further study the following options for the monitoring priority of search space set

* Option 1: The monitoring priority of search space set for multicast is the same as existing Rel-15/16 CSS
* Option 2: The monitoring priority of search space set for multicast is the same as existing Rel-15/16 USS
* Other options are not precluded
* The monitoring priority is used at least for PDCCH overbooking case
  + FFS for other cases (e.g., to prune PDCCH in terms of whether it’s unicast or multicast, etc.)

# Appendix 3: Agreements in #104 e-meeting

**RAN1#104-e**

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

Agreement:

For multicast of RRC-CONNECTED UEs, a common frequency resource for group-common PDCCH / PDSCH is confined within the frequency resource of a dedicated unicast BWP to support simultaneous reception of unicast and multicast in the same slot

* Down select from the two options for the common frequency resource for group-common PDCCH/ PDSCH
  + Option 2A: The common frequency resource is defined as an MBS specific BWP, which is associated with the dedicated unicast BWP and using the same numerology (SCS and CP)
    - FFS BWP switching is needed between the multicast reception in the MBS specific BWP and unicast reception in its associated dedicated BWP
  + Option 2B: The common frequency resource is defined as an ‘MBS frequency region’ with a number of contiguous PRBs, which is configured within the dedicated unicast BWP.
    - FFS: How to indicate the starting PRB and the length of PRBs of the MBS frequency region
* FFS whether UE can be configured with no unicast reception in the common frequency resource
* FFS on details of the group-common PDCCH / PDSCH configuration
* FFS whether to support more than one common frequency resources per UE / per dedicated unicast BWP subjected to UE capabilities
* FFS whether the use of a common frequency resource for multicast is optional or not
* FFS whether the common frequency resource is applicable for PTM scheme 2 (if supported) or not

Agreement:

* If Option 2B is supported for common frequency resource for multicast of RRC-CONNECTED UEs, the starting PRB and the length of PRBs of the MBS frequency region within a dedicated unicast BWP are configured via UE-specific RRC signaling.
  + The starting PRB is referenced to one of the two options:
    - Option 1: Point A
    - Option 2: the starting PRB of the dedicated unicast BWP
  + FFS the detailed signaling
* If Option 2A is supported for common frequency resource for multicast of RRC-CONNECTED UEs, the configurations of the starting PRB and the length of PRBs of the MBS frequency resource reuse the legacy BWP configuration.

Agreement:

For RRC\_CONNECTED UEs, if ACK/NACK based HARQ-ACK feedback is supported for PTM scheme 1, and if initial transmission for multicast is based on PTM transmission scheme 1, support retransmission(s) using PTP transmission.

* The HARQ process ID and NDI indicated in DCI is used to associate the PTM scheme 1 and PTP transmitting the same TB.

Agreement:

The maximum number of monitored PDCCH candidates and non-overlapped CCEs per slot per serving cell defined in Rel-15 is kept unchanged for Rel-17 MBS.

* FFS whether the budget of BDs/CCEs of an unused CC can be used for group-common PDCCH to count the number of BDs/CCEs for UEs supporting CA capability based on configuration, which is similar to the method used for multi-DCI based multi-TRP in Rel-16.

Working Assumption:

Keep the “3+1” DCI size budget defined in Rel-15 for Rel-17 MBS.

* FFS: Whether the G-RNTI is counted as “C-RNTI” or as “other RNTI” when considering the “3+1” DCI size budget rule for group-common PDCCH.

Agreement:

For RRC\_CONNECTED UEs, more than one SPS group-common PDSCH configuration for MBS can be configured per UE subject to UE capability

* The total number of SPS configurations supported by a UE currently defined for unicast is not increased due to additionally supporting MBS.
* FFS: How to allocate the total SPS configurations between MBS and unicast.

Agreement:

For RRC\_CONNECTED UEs, support HARQ-ACK feedback for SPS group-common PDSCH for MBS

* FFS: The retransmission scheme(s)
* FFS: The HARQ-ACK details for SPS PDSCH and activation/deactivation, which can be discussed in AI 8.12.2

Agreement:

From RAN1 perspective, the CFR (common frequency resource) for multicast of RRC-CONNECTED UEs, which is confined within the frequency resource of a dedicated unicast BWP and using the same numerology (SCS and CP), includes the following configurations:

* Starting PRB and the number of PRBs
* One PDSCH-config for MBS (i.e., separate from the PDSCH-Config of the dedicated unicast BWP)
* One PDCCH-config for MBS (i.e., separate from the PDCCH-Config of the dedicated unicast BWP)
* SPS-config(s) for MBS (i.e., separate from the SPS-Config of the dedicated unicast BWP)
* FFS: Other configurations and details including whether signaling of starting PRB and the length of PRBs is needed when CFR is equal to the unicast BWP
* FFS: Whether a unified CFR design is also used for broadcast reception for RRC\_IDLE/INACTIVE and RRC\_CONNECTED
* FFS: Whether Coreset(s) for CFR in addition to existing Coresets in UE dedicated BWP is needed
* Note: The terminology of CFR is only aiming for RAN1 discussion, and the detailed signaling design is up to RAN2
* Note: This agreement does not negate any previous agreements made on CFR

Agreement:

For search space set of group-common PDCCH of PTM scheme 1 for multicast in RRC\_CONNECTED state, at least support CSS

* FFS: reuse existing CSS type(s) in Rel-15/16 or define a new Type CSS
* FFS: Two options for monitoring priority:
  + Option 1: the monitoring priority is the same as existing Rel-15/16 CSS
  + Option 2: the monitoring priority is determined based on the search space set indexes of search space set(s) for multicast and USS sets.

Working assumption:

For activation/deactivation of SPS group-common PDSCH for MBS in RRC\_CONNECTED state,

* At least group-common PDCCH is supported
  + FFS: Whether and how to address the missed activation and deactivation
* FFS: Whether UE-specific PDCCH is supported for activation/deactivation

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

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.

# Appendix 4: Agreements in #104b e-meeting

**RAN1#104b-e**

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

Agreement:

For group-common PDCCH of Rel-17 MBS, support at least two DCI formats.

* DCI format 1\_0 is used as the baseline for the first DCI format with CRC scrambled with G-RNTI.
* DCI format 1\_1 or 1\_2 is used as the baseline for the second DCI format with CRC scrambled with G-RNTI
  + FFS: Which of DCI format 1\_1 or 1\_2 is used as the baseline
* FFS: Details of the reuse (or not) of DCI format 1\_0, 1\_1 or 1\_2 fields

Agreement:

The same HARQ process ID and NDI are used for PTM scheme 1 (re)transmissions and PTP retransmissions of the same TB.

Agreement:

At least support the following cases for PDSCH reception for MBS in a slot based on UE capability for RRC\_CONNECTED UEs

* Case 1: support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC
  + FFS: the value(s) of M
* Case 2: support TDM among N (N>1) group-common PDSCHs in a slot per CC
  + FFS: the value(s) of N
* Case 3: support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC
  + FFS: the value(s) of K and L

Agreement:

If a CFR is configured for multicast in RRC-CONNECTED state and confined within a dedicated unicast BWP, further study the following options.

* Option 1: the CORESET configured in PDCCH-config for unicast in the dedicated unicast BWP can be used for multicast transmission if the CORESET is fully contained in the CFR in frequency domain, and the CORESET configured in PDCCH-config for MBS in the CFR can be used for unicast transmission.
* Option 2: the CORESET configured in PDCCH-config for unicast in the dedicated unicast BWP cannot be used for multicast transmission even if the CORESET is fully contained in the CFR in frequency domain, and the CORESET configured in PDCCH-config for MBS in the CFR cannot be used for unicast transmission.
* Option 3: the CORESET configured in PDCCH-config for unicast in the dedicated unicast BWP can be used for multicast transmission if the CORESET is fully contained in the CFR in frequency domain, but the CORESET configured in PDCCH-config for MBS in the CFR cannot be used for unicast transmission.
* Option 4: the CORESET configured in PDCCH-config for unicast in the dedicated unicast BWP cannot be used for multicast transmission even if the CORESET is fully contained in the CFR in frequency domain, but the CORESET configured in PDCCH-config for MBS in the CFR can be used for unicast transmission.

Agreement:

One CFR is supported per dedicated unicast BWP for multicast of RRC-CONNECTED UEs.

* FFS: Whether more than one CFR is supported per dedicated unicast BWP
* FFS: Whether multicast can be supported or not in a dedicated unicast BWP when no CFR is configured for that BWP

Agreement:

The retransmission scheme for a given SPS group-common PDSCH can be either PTM scheme 1 or PTP.

* FFS: Whether PTM scheme 1 retransmission and PTP retransmission can be used simultaneously for different UEs in the same MBS group

Agreement:

Define G-CS-RNTI at least for SPS group-common PDSCH and activation/deactivation of SPS group-common PDSCH, different from CS-RNTI for unicast SPS PDSCH.

* G-CS-RNTI is used for PTM scheme 1 based dynamic retransmission of SPS group-common PDSCH
* FFS: Whether CS-RNTI can be used for PTP retransmission of SPS group-common PDSCH.
* FFS: Number of G-CS-RNTI.

Conclusion:

The maximum number of HARQ processes per cell, currently supported for unicast, is kept unchanged for UE to support multicast reception.

* How to allocate HARQ processes between unicast and multicast is up to gNB.

Agreement:

Send an LS to RAN2 regarding at least the following questions:

* Whether RAN1 should take into account the case of UE supporting multiple G-RNTIs?

Agreement:

Include the following in the LS to RAN2:

* Whether RAN1 should consider the case of UE supporting multiple G-CS-RNTIs?
* The agreements related to SPS will also be included in the LS for information

**R1-2104045 LS on G-RNTI and G-CS-RNTI for MBS RAN1, CMCC**

**Decision:** As per email decision posted on April 22nd, the LS is approved.

Agreement:

For CSS of group-common PDCCH of PTM scheme 1 for multicast in RRC\_CONNECTED state, down-select from the following alternatives (to be decided in RAN1#105):

* Alt 1: support Type-3 CSS
  + The monitoring priority of Type-3 CSS for group-common PDCCH is the same as existing Rel-15/16 CSS, regardless of which DCI format of group-common PDCCH is configured in Type-3 CSS
* Alt 2: support a new Type-x CSS
  + The monitoring priority of new Type-x CSS is determined based on the search space set indexes of the new Type-x CSS set and USS sets, regardless of which DCI format of group-common PDCCH is configured in the new Type-x CSS.
* Alt 3: support both Alt 1 and Alt 2

Agreement:

The down-selection of Option 2A and Option 2B for CFR for multicast of RRC-CONNECTED UEs will be made before the end of RAN1#105-e.

Conclusion:

It is based on gNB implementation to schedule unicast on the frequency resources covered by CFR configured for multicast.

Agreement:

For RRC\_CONNECTED UE supporting MBS, support up to 8 configured SPS configurations in a BWP of a serving cell for unicast and MBS in total.

* It is up to gNB implementation to configure the SPS configuration indexes for unicast and MBS, respectively.

Agreement:

Confirm the working assumption:

For activation/deactivation of SPS group-common PDSCH for MBS in RRC\_CONNECTED state,

* At least group-common PDCCH is supported
  + FFS: Whether and how to address the missed activation and deactivation
* FFS: Whether UE-specific PDCCH is supported for activation/deactivation

# Appendix 5: Agreements in #105 e-meeting

**RAN1#105-e**

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

Agreement:

For CSS of group-common PDCCH of PTM scheme 1 for multicast in RRC\_CONNECTED state, Alt 2 is supported:

* Alt 2: support a Type-x CSS
  + The monitoring priority of Type-x CSS is determined based on the search space set indexes of the Type-x CSS set and USS sets, regardless of which DCI format of group-common PDCCH is configured in the Type-x CSS.
* FFS: Whether the Type-x CSS is a Type-3 CSS

Agreement:

For PTP retransmission of SPS group-common PDSCH, CS-RNTI is used for CRC scrambling of PDCCH with the NDI bit set to 1.

Agreement:

As a baseline, reuse existing fields in DCI format 1\_0 with CRC scrambled by C-RNTI for the fields of first DCI format with CRC scrambled with G-RNTI.

* FFS: how to determine the bitlength of FDRA field.
* FFS: Whether ‘Identifier for DCI formats’, ‘TPC command for scheduled PUCCH’ are needed.
* FFS: How to perform DCI size alignment
* FFS: Whether to include new DCI fields
* Note: All of the fields may not be reused and the size of the fields may not be the same

Working assumption:

Option 2B for CFR associated with UE active BWP other than initial BWP is supported at least for multicast of RRC-CONNECTED UEs.

* FFS: CFR associated with initial BWP
* FFS: CFR larger than initial BWP

Agreement:

For multicast of RRC\_CONNECTED UEs, further study

* How the LBRM (Limited buffer rate-matching) for GC-PDSCH TBS is determined.
* How the xOverhead for GC-PDSCH TBS determination is configured.
* Whether MAC-CE over GC-PDSCH is needed for activation/deactivation of semi-persistent ZP CSI-RS resource set if the semi-persistent ZP CSI-RS resource set is configured in PDSCH-Config in CFR.

Agreement:

Confirm the working assumption:

Keep the “3+1” DCI size budget defined in Rel-15 for Rel-17 MBS.

* FFS: Whether the G-RNTI is counted as “C-RNTI” or as “other RNTI” when considering the “3+1” DCI size budget rule for group-common PDCCH.

Agreement:

For Rel-17 MBS UE, the UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.

* Note:   Group-common PDSCH(s) are counted as unicast PDSCH(s).

Agreement:

For reliability of the group-common PDCCH activation of SPS group-common PDSCH, support at least one of the following alternatives.

* Alt 1: retransmit the activation command via group-common PDCCH.
* Alt 2: retransmit the activation command via UE-specific PDCCH.
* Alt 3: retransmit the activation command via MAC-CE.
* FFS other details.
* Note: Down-selection can take into account the HARQ-ACK feedback scheme for SPS activation

Working assumption:

The maximum number of CORESETs per BWP is not increased for support of MBS, and the number of CORESETs configured within the CFR is left to gNB implementation.

Agreement:

As a baseline, reuse existing fields in DCI format 1\_1 for the fields of the second DCI format with CRC scrambled with G-RNTI.

* FFS: whether ‘Identifier for DCI formats’, ‘TPC command for scheduled PUCCH’, ‘Carrier indicator’ and ‘Bandwidth part indicator’ are needed.
* FFS: How to perform DCI size alignment
* FFS: Whether to include new DCI fields for the second DCI format
* Note: All of the fields may not be reused and the size of the fields may not be the same

Agreement:

For HARQ process management, further study whether/how to differentiate the HARQ process ID used for PTP (re)transmission for unicast and PTP retransmission for multicast.

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

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*.

# Appendix 6: Agreements in #106 e-meeting

**RAN1#106-e**

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

Agreement:

Confirm the working assumption with the following update:

Option 2B for CFR associated with UE active BWP other than initial DL BWP is supported at least for multicast of RRC-CONNECTED UEs.

* ~~FFS: CFR associated with initial BWP~~
* ~~FFS: CFR larger than initial BWP~~

Note: The deleted FFSs can be discussed in another AI.

Agreement:

For multicast of RRC-CONNECTED UEs, align the size of the first DCI format for GC-PDCCH with DCI format 1\_0 with CRC scrambled by C-RNTI monitored in CSS.

Agreement:

Confirm the following working assumption:

The maximum number of CORESETs per BWP is not increased for support of MBS, and the number of CORESETs configured within the CFR is left to gNB implementation.

Agreement:

For indication of the starting PRB and the length of PRBs of CFR for multicast of RRC-CONNECTED UEs,

* the starting PRB is referenced to Point A, i.e., the starting PRB is a PRB determined by *subcarrierSpacing* of the associated BWP and *offsetToCarrier* corresponding to this subcarrier spacing, similar as how *locationAndBandwidth* of a BWPis indicated as described in TS 38.331.
* FFS: Indication mechanism.

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:

The first DCI format for GC-PDCCH uses the same fields as DCI format 1\_0 with CRC scrambled by C-RNTI with the following modifications:

* At least ‘Identifier for DCI formats’ is not needed.
  + FFS: Whether the field should be ignored and reserved, or should be removed.
* For FDRA determination, down-select from following options:
  + Option 1:
    -  is given by
      * 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.
    - For resource indication value (*RIV*) of downlink resource allocation type 1, the resource blocks that can be indicated are
      * the resource blocks in the CORESET 0 if CORESET 0 is configured for the cell; and
      * the resource blocks in the initial DL bandwidth part if CORESET 0 is not configured for the cell.
  + Option 2:
    -  is given by
      * 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.
    - For resource indication value (*RIV*) of downlink resource allocation type 1, the similar scheme as for the case that the DCI size for DCI format 1\_0 in USS is derived from the size of DCI format 1\_0 in CSS but applied to an active BWP is used.
      * FFS details, e.g., if the size of CFR (i.e. ) 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, 8} which satisfies ;otherwise,
  + Option 3:  is given by the size of CFR in the active DL BWP

Agreement:

The second DCI format for GC-PDCCH uses the same fields as DCI format 1\_1 with the following modifications:

* At least ‘Identifier for DCI formats’ and ‘SRS request’ are not needed.
  + FFS whether the fields should be ignored and reserved, or should be removed.
* Note: At least the configurable fields in DCI format 1\_1 remain configurable for the second DCI format

Agreement:

For initializing scrambling sequence generator for GC-PDCCH with the second DCI format,

* equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in the CORESET in a CFR used for the GC-PDCCH; otherwise.
* FFS: Values for . Choices include one or more of the following:
  + Alt1: G-RNTI used for the GC-PDCCH.
  + Alt2: 0
  + Alt3: Other fixed values

Agreement:

If a SPS-config for MBS is configured in CFR, one G-CS-RNTI is associated with the SPS-config.

* FFS: Multiple G-CS-RNTIs associated with one SPS-config

Agreement:

For FDRA determination of the first DCI format for GC-PDCCH, down-select from Option 2 and updated Option 3.

* + Option 2:
    -  is given by
      * 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.
    - For resource indication value (*RIV*) of downlink resource allocation type 1, the similar scheme as for the case that the DCI size for DCI format 1\_0 in USS is derived from the size of DCI format 1\_0 in CSS but applied to an active BWP is used.
      * FFS details, e.g., if the size of CFR (i.e. ) 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, 8} which satisfies ;otherwise,
  + Option 3:  is given by the size of CFR in the active DL BWP
    - If the size of the first DCI format for GC-PDCCH prior to truncation is larger than the size of DCI format 1\_0 monitored in CSS, the bit width of the FDRA field in the first DCI format for GC-PDCCH is reduced by truncating the first few most significant bits such that the size of the first DCI format for GC-PDCCH equals the size of DCI format 1\_0 monitored in CSS.
    - FFS: Whether the removed/reserved fields can be repurposed for FDRA
    - FFS: Solution for the case where the size of the first DCI format for GC-PDCCH prior to padding is smaller than the size of DCI format 1\_0 monitored in CSS.

Conclusion:

The specification impact of having a new Type-x CSS for GC-PDCCH in RRC\_CONNECTED state can be studied and discussed further.

Agreement:

For initializing scrambling sequence generator for GC-PDSCH scheduled by the second DCI format for multicast received in Type-x CSS,

* equals the higher layer parameter *dataScramblingIdentityPDSCH* if it is configured in *PDSCH-Config* in a CFR used for GC-PDSCH and the RNTI equals the G-RNTI or G-CS-RNTI; otherwise.
* corresponds to the RNTI associated with the GC-PDSCH transmission (i.e., the G-RNTI used by the scheduling GC-PDCCH, or the G-CS-RNTI used by the SPS GC-PDSCH activation PDCCH)

Agreement:

For initializing sequence generator for DMRS of GC-PDCCH with the second DCI format received in Type-x CSS,

* equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in the CORESET in a CFR used for the GC-PDCCH; otherwise.

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

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.

# Appendix 7: Agreements in RANP#93 e-meeting

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

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

# Appendix 8: Agreements in #106b e-meeting

**RAN1#106b-e**

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

Agreement:

The starting PRB and the length of PRBs of CFR are jointly indicated reusing the RIV indication mechanism in the same way as *locationAndBandwidth* of a BWP.

Agreement:

RBG and PRG for multicast GC-PDSCH in CFR are defined using the same procedure as for unicast PDSCH in DL BWP.

* + - * For RBG, the size is defined based on the starting PRB of the CFR, size of the CFR and the higher layer parameter *rbg-Size* configured by *PDSCH-Config* for multicast in the CFR.
      * For PRG, the size is defined based on the starting PRB of the CFR, size of the CFR and precoding granularity for multicast which can be equal to one of the values among {2, 4, wideband}.
      * Note: Whether the RBG and PRG size for multicast (configured directly or indirectly) is the same as for unicast can be discussed separately.

Agreement:

The number of CFRs for multicast is no more than one per dedicated unicast BWP in Rel-17.

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).

Agreement:

For multicast of RRC\_CONNECTED UEs, the G-RNTI(s) is/are configured

* Opt.2: per serving cell.
* FFS G-CS-RNTI(s)

Agreement:

The ‘TPC command for scheduled PUCCH’ field is not needed for the first DCI format for multicast.

* FFS: Whether the field should be reserved or should be removed.

Agreement:

The ‘TPC command for scheduled PUCCH’ field is not needed for the second DCI format for multicast.

* FFS: Whether the field should be reserved or should be removed.

Agreement:

The first and second DCI formats for multicast can be configured in the same or different search space sets belonging to type-x CSS.

Agreement:

For FDRA determination of the first DCI format for GC-PDCCH, Option 2 is supported.

* + Option 2:
    -  is given by
      * 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.
    - For resource indication value (*RIV*) of downlink resource allocation type 1, the similar scheme as for the case that the DCI size for DCI format 1\_0 in USS is derived from the size of DCI format 1\_0 in CSS but applied to an active BWP is used.
      * If the size of CFR (i.e. ) 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 ;otherwise,

Agreement:

For GC-PDSCH scheduled with the first DCI format for multicast, RB numbering starts from the lowest RB of the CFR.

Agreement:

For initializing scrambling sequence generator for GC-PDCCH with the second DCI format for RRC\_CONNECTED UEs, =0.

Agreement:

For initializing scrambling sequence generator for GC-PDSCH scheduled by the first DCI format for multicast received in Type-x CSS for RRC\_CONNECTED UEs,

* equals the higher layer parameter *dataScramblingIdentityPDSCH* if it is configured in *PDSCH-Config* in a CFR used for GC-PDSCH and the RNTI equals the G-RNTI or G-CS-RNTI; otherwise.
* corresponds to the RNTI associated with the GC-PDSCH transmission (i.e., the G-RNTI used by the scheduling GC-PDCCH, or the G-CS-RNTI used by the SPS GC-PDSCH activation PDCCH)

Agreement:

For initializing sequence generator for DMRS of GC-PDSCH,

* and are given by the higher-layer parameters *scramblingID0* and *scramblingID1*, respectively, in the *DMRS-DownlinkConfig*IE if provided in *PDSCH-Config* in a CFR used for GC-PDSCH and the GC-PDSCH is scheduled by GC-PDCCH using the second DCI format
* is given by the higher-layer parameter *scramblingID0* if provided in *PDSCH-Config* in a CFR used for GC-PDSCH and the GC-PDSCH is scheduled by GC-PDCCH using the first DCI format;
* otherwise;
* FFS: is given by the DM-RS sequence initialization field, if present, in the DCI associated with the GC-PDSCH transmission if second DCI format is used, otherwise .

Agreement:

The association between a G-CS-RNTI and a SPS-Config-Multicast is indicated by the activation GC-PDCCH for SPS GC-PDSCH, i.e., a value of the HARQ process number field in a DCI format indicates an activation for a SPS GC-PDSCH configuration for multicast with a same value as provided by *sps-ConfigIndex* in a *SPS-Config-Multicast.*

Agreement:

For initializing scrambling sequence generator for GC-PDCCH with the first DCI format for RRC\_CONNECTED UEs,

*  equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in the CORESET configured within CFR-Config-Multicast for the GC-PDCCH; otherwise.
*  = 0.

Agreement:

For initializing sequence generator for DMRS of GC-PDCCH with the first DCI format received in Type-x CSS for RRC\_CONNECTED UEs,

*  equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in the CORESET configured within CFR-Config-Multicast for the GC-PDCCH;  otherwise.

Agreement:

Study the following options for the LBRM/TBS determination for PTP retransmission of multicast.

* Option 1: based on the LBRM/TBS determination of the PTM initial transmission using same HPID and NDI.
* Option 2: based on the LBRM/TBS determination of the legacy unicast PDSCH transmission.

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

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,

* equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in a CFR used for the GC-PDCCH for MCCH/MTCH; otherwise.

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,

* 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; otherwise.
* 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,

* equals the higher layer parameter *pdcch-DMRS-ScramblingID* if it is configured in a CFR used for the GC-PDCCH for MCCH/MTCH; otherwise.

Agreement:

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

* 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;  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.

# Appendix 9: Agreements in #107 e-meeting

**RAN1#107-e**

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

Agreement:

For multicast of RRC\_CONNECTED UEs, the G-CS-RNTI(s) is/are configured per serving cell.

Agreement:

For initializing sequence generator for DMRS of GC-PDSCH, are defined using the same procedure as for unicast PDSCH.

* given by

- if the higher-layer parameter *dmrs-Downlink* in the *DMRS-DownlinkConfig* IE in the *PDSCH-Config-Multicast* IE is provided

where λ is the CDM group defined in clause 7.4.1.1.2 in TS38.211.

- otherwise by

* The quantity is given by the DM-RS sequence initialization field, if present, in the DCI associated with the PDSCH transmission if multicast DCI format 1\_1 is used, otherwise .

Agreement:

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by G-RNTI for multicast:

* Frequency domain resource assignment
* Time domain resource assignment – 4 bits as defined in Clause 5.1.2.1 of TS38.214
* VRB-to-PRB mapping – 1 bit according to Table 7.3.1.2.2-5 in TS38.212
* Modulation and coding scheme – 5 bits as defined in Clause 5.1.3 of TS38.214
* New data indicator – 1 bit
* Redundancy version – 2 bits as defined in Table 7.3.1.1.1-2 in TS38.212
* HARQ process number – [4 or 5] bits
* Downlink assignment index – 2 bits as defined in Clause 9.1.3 of TS 38.213, as counter DAI
* PUCCH resource indicator – 3 bits as defined in Clause 9.2.3 of TS38.213
* PDSCH-to-HARQ\_feedback timing indicator – 3 bits as defined in Clause 9.2.3 of TS38.213
* Reserved bits –3 bits
* FFS: Some of the fields may be not useful and can be reserved in some conditions, and FFS the details of the conditions
* FFS: other fields, e.g. for HARQ enabling/disabling

Note: Whether new fields are defined for multicast DCI format 1\_0 can be discussed separately. The reserved bits can be used for new fields if needed.

Agreement:

For the LBRM/TBS determination for PTP retransmission of multicast, Option 2 is supported.

* Option 2: based on the LBRM/TBS determination of the legacy unicast PDSCH transmission
  + Note: The UE is not required to soft combine the PTM initial transmission and the PTP retransmission in case of different circular buffer
    - FFS: spec impact, if any

Conclusion:

For the RRC parameters that can be configured in *PDSCH-Config / PDCCH-Config / SPS-Config* in Rel-15/16, they can also be configured in *PDSCH-Config-Multicast / PDCCH-Config-Multicast / SPS-Config-Multicast*.

* If some of these RRC parameters need changes for multicast reception (e.g., modify the default values, delete some useless parameters), RAN1 will list them explicitly in the RRC parameter list that will be sent to RAN2.
* For other RRC parameters that do not need changes for multicast reception, RAN1 will not list them with postfix ‘-Multicast’ one by one in the RRC parameter list that will be sent to RAN2, and the default values of these parameters are the same as the default values of the corresponding parameters in dedicated unicast BWP.

Agreement:

PRB bundle and VRB bundle for multicast GC-PDSCH in CFR are defined using the same procedure as for unicast PDSCH scheduled with unicast DCI formats 1\_1 in DL BWP as defined in clause 7.3.1.6 in TS38.211. For interleaved mapping of downlink resource allocation type 1,

* the parameter *N*bundle  is interpreted as the number of bundles within the CFR,
* the size of the CFR is used instead of the size of the BWP,
* the starting PRB of the CFR is used instead of the starting PRB of the BWP
* the higher-layer parameter *vrb-ToPRB-Interleaver* in *PDSCH-Config-Multicast* for multicast, if provided, is used instead of the size of the higher-layer parameter *vrb-ToPRB-Interleaver* in *PDSCH-Config* for unicast.

Conclusion:

For multicast of RRC-CONNECTED UEs, support CFR associated with UE active BWP, where UE active BWP can be an RRC reconfigured initial DL BWP (using Option#2 for configuring initial BWP according to the Annex B.2 of TS 38.331).

Agreement:

Multicast DCI format 1\_1 includes all configurable fields of unicast DCI format 1\_1 except

* Identifier for DCI formats, TPC command for scheduled PUCCH, SRS request
* FFS: Scell dormancy indication
* One-shot HARQ-ACK request, PDSCH group index, New feedback indicator, Number of requested PDSCH group(s), ChannelAccess-Cpext
* CBGTI, CBGFI
* Minimum applicable scheduling offset indicator
* FFS: Carrier indicator, BWP indicator, ZP CSI-RS trigger
* FFS: MCS/NDI/RV for TB2

Conclusion:

If a CFR is configured in a dedicated unicast BWP for multicast in RRC-CONNECTED state, it is up to gNB’s configuration whether to use the CORESET configured in *PDCCH-config-Multicast* in the CFR for unicast transmission or PTP retransmission of multicast.

Agreement:

For MCS determination of SPS GC-PDSCH, *mcs-Table* of ‘qam64LowSE’ can be optionally configured in the *SPS-Config-Multicast*.

* If *mcs-Table* of ‘qam64LowSE’ is not configured in the *SPS-Config-Multicast*, the *mcs-Table* of *PDSCH-Config-Multicast* in the same *CFR-Config-Multicast* is used for the SPS GC-PDSCH to determine the MCS.
* If *mcs-Table* of ‘qam64LowSE’ is configured in the *SPS-Config-Multicast*, it is used for the SPS GC-PDSCH to determine the MCS.

Agreement:

A list of up to 8 k1 values can be configured by higher layer parameter *dl-DataToUL-ACK-MulticastDciFormat1\_0* to be applied to multicast DCI format 1\_0 for RRC\_CONNECTED UEs. If the higher layer parameter *dl-DataToUL-ACK-MulticastDciFormat1\_0* is not provided, k1 list {1, 2, 3, 4, 5, 6, 7, 8} is applied to multicast DCI format 1\_0.

* The size of ‘PDSCH-to-HARQ\_feedback timing indicator’ field of multicast DCI format 1\_0 is fixed at 3 bits.

Agreement:

If *locationAndBandwidth-Multicast* is not configured in a *cfr-Config-Multicast*, the default value is the *locationAndBandwidth* of the DL BWP in which the *cfr-Config-Multicast* is configured.

Agreement:

For applicable PDSCH time domain resource allocation for multicast DCI format,

* if *pdsch-TimeDomainAllocationList* in *PDSCH-Config-Multicast* is provided, the *pdsch-TimeDomainAllocationList* in *PDSCH-Config-Multicast* is applied,
* else if *pdsch-TimeDomainAllocationList* in *PDSCH-Config-Multicast* is not providedbut *pdsch-TimeDomainAllocationList* in *PDSCH-ConfigCommon* is provided, the *pdsch-TimeDomainAllocationList* in *PDSCH-ConfigCommon* is applied,
* else if both *pdsch-TimeDomainAllocationList* in *PDSCH-Config-Multicast* and *pdsch-TimeDomainAllocationList* in *PDSCH-ConfigCommon* are not provided, Default A table is applied irrespective of the SS/PBCH block and CORESET multiplexing pattern.

Agreement:

For multicast in RRC\_CONNECTED state,

* Only SPS-Config-Multicast(s) configured in CFR for multicast can be activated/deactivated by GC-PDCCH with G-CS-RNTI.
* SPS-Config-Multicast(s) configured in CFR for multicast cannot be activated by unicast PDCCH with CS-RNTI, but can be deactivated by unicast PDCCH with CS-RNTI.

Agreement:

For multicast of RRC\_CONNECTED UEs in Rel-17,

* DCI format 2\_x cannot be configured in the same CSS configuration with multicast DCI formats.

Agreement:

For multicast, if a UE is configured with a CFR in the active DL BWP, for timer-based active DL BWP switching to a default BWP, option 1 is supported.

* Option 1: UE also starts or restarts BWP-InactivityTimer when it successfully decodes a GC-PDCCH addressed to group-common RNTI (e.g., G-RNTI or G-CS-RNTI) for multicast on/for the active BWP or when a MAC PDU for is received in a configured downlink assignment for multicast.
  + UE does not start or restart BWP-InactivityTimer when it successfully decodes a GC-PDCCH addressed to group-common RNTI (e.g., G-RNTI or G-CS-RNTI) for broadcast.

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

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.)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 *;*otherwise*,*

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.)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 *;*otherwise*,*

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

# Appendix 10: Agreements in #107b e-meeting

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

**Agreement**

DCI format 4\_2 doesn’t include the following fields:

* + Scell dormancy indication
  + BWP indicator

DCI format 4\_2 includes the following field (configurable):

* + MCS/NDI/RV for TB2
    - Support of this field is subject to UE capability

**Agreement**

DCI format 4\_2 includes ‘ZP CSI-RS trigger’ field.

**Agreement**

For DCI size alignment of DCI format 4\_2, the size of DCI format 4\_2 is configured by RRC signaling for RRC\_CONNECTED UEs (similar as the configuration for the size alignment among DCI format 2\_0/2\_1/2\_4/2\_5/2\_6).

**Conclusion**

For multicast of RRC\_CONNECTED UEs, the value range of *sps-ConfigIndex* in *SPS-Config-Multicast* is {0-7}, and *sps-ConfigIndex* in *sps-Config* and *SPS-Config-Multicast* cannot be configured with the same value.

The TP below for Clause 10.1 in TS 38.213v17.0.0 is endorsed.

----------------- Start of TP ----------------

**10.1 UE procedure for determining physical downlink control channel assignment**

**<**Unchanged text is omitted>

A UE does not expect to detect, in a same PDCCH monitoring occasion, a DCI format with CRC scrambled by a SI-RNTI, RA-RNTI, MsgB-RNTI, TC-RNTI, P-RNTI, C-RNTI, CS-RNTI, ~~or~~ MCS-RNTI, MCCH-RNTI, G-RNTI, or G-CS-RNTI and a DCI format with CRC scrambled by a SL-RNTI or a SL-CS-RNTI for scheduling respective PDSCH reception and PSSCH transmission on a same serving cell.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

The TP below for Clause 5.1.2.2 in TS 38.214v17.0.0 is endorsed.

----------------- Start of TP ----------------

**5.1.2.2 Resource allocation in frequency domain**

**<**Unchanged text is omitted>

Two downlink resource allocation schemes, type 0 and type 1, are supported. The UE shall assume that when the scheduling grant is received with DCI format 1\_0, DCI format 4\_0 or DCI format 4\_1, then downlink resource allocation type 1 is used.

If the scheduling DCI is configured to indicate the downlink resource allocation type as part of the '*Frequency domain resource assignment'* field by setting a higher layer parameter *resourceAllocation* in *PDSCH-Config* to 'dynamicSwitch', for DCI format 1\_1 or setting a higher layer parameter *resourceAllocationDCI-1-2* in *PDSCH-Config* to 'dynamicSwitch' for DCI format 1\_2 or setting a higher layer parameter *resourceAllocation* in *PDSCH-Config-Multicast* to 'dynamicSwitch' for DCI format 4\_2, the UE shall use downlink resource allocation type 0 or type 1 as defined by this DCI field. Otherwise the UE shall use the downlink frequency resource allocation type as defined by the higher layer parameter *resourceAllocation* in *PDSCH-Config* for DCI format 1\_1 or by the higher layer parameter *resourceAllocationDCI-1-2* for DCI format 1\_2 or by the higher layer parameter *resourceAllocation* in *PDSCH-Config-Multicast* for DCI format 4\_2.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

The TP below for Clause 5.1.2.3 in TS 38.214v17.0.0 is endorsed.

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

The PRB bundling procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *prb-BundlingTypeDCI-1-2* instead of *prb-BundlingType* as well as *vrb-ToPRB-InterleaverDCI-1-2* instead of *vrb-ToPRB-Interleaver*. The PRB bundling procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2, by applying the parameters of *prb-BundlingType* given by *PDSCH-Config-Multicast* as well as *vrb-ToPRB-Interleaver* given by *PDSCH-Config-Multicast*.

A UE may assume that precoding granularity is  consecutive resource blocks in the frequency domain.  can be equal to one of the values among {2, 4, wideband}.

If  is determined as "wideband", the UE is not expected to be scheduled with non-contiguous PRBs and the UE may assume that the same precoding is applied to the allocated resource associated with a same TCI state or a same QCL assumption.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

**Agreement**

For DMRS of GC-PDSCH,

* + For GC-PDSCH scheduled by a DCI format 4\_0/4\_1, the UE assumes *dmrs-AdditionalPosition* = ‘pos2’, similar as that of DCI format 1\_0.
  + For GC-PDSCH scheduled by a DCI format 4\_2, the UE assumes *dmrs-AdditionalPosition* in *DMRS-Config* if configured in *PDSCH-Config-Multicast*, similar as that of DCI format 1\_1.
  + Adopt the following TP for Clause 5.1.6.2 in TS 38.214:

----------------- Start of TP ----------------

**5.1.6.2 DM-RS reception procedure**

**<**Unchanged text is omitted>

The DM-RS reception procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* instead of *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB*.

The DM-RS reception procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2, by applying the parameters of *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB* in *PDSCH-Config-Multicast* instead of *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB in PDSCH-Config*.

When receiving PDSCH scheduled by DCI format 1\_0, 4\_0, 4\_1 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

- For PDSCH with mapping type A and type B, the UE shall assume *dmrs-AdditionalPosition*='pos2' and up to two additional single-symbol DM-RS present in a slot according to the PDSCH duration indicated in the DCI as defined in Clause 7.4.1.1 of [4, TS 38.211], and

- For PDSCH with allocation duration of 2 symbols with mapping type B, the UE shall assume that the PDSCH is present in the symbol carrying DM-RS.

When receiving PDSCH scheduled by DCI format 1\_1 by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, or CS-RNTI or DCI format 4\_2 by PDCCH with CRC scrambled by G-RNTI or G-CS-RNTI,

- the UE may be configured with the higher layer parameter *dmrs-Type*, and the configured DM-RS configuration type is used for receiving PDSCH in as defined in Clause 7.4.1.1 of [4, TS 38.211].

- the UE may be configured with the maximum number of front-loaded DM-RS symbols for PDSCH by higher layer parameter *maxLength* given by *DMRS-DownlinkConfig.*

- if *maxLength* is set to 'len1', single-symbol DM-RS can be scheduled for the UE by DCI, and the UE can be configured with a number of additional DM-RS for PDSCH by higher layer parameter *dmrs-AdditionalPosition,* which can be set to 'pos0', 'pos1', 'pos2' or 'pos3'.

- if *maxLength* is set to 'len2', both single-symbol DM-RS and double symbol DM-RS can be scheduled for the UE by DCI, and the UE can be configured with a number of additional DM-RS for PDSCH by higher layer parameter *dmrs-AdditionalPosition,* which can be set to 'pos0' or 'pos1'.

- and the UE shall assume to receive additional DM-RS as specified in Table 7.4.1.1.2-3 and Table 7.4.1.1.2-4 as described in Clause 7.4.1.1.2 of [4, TS 38.211].

**<**Unchanged text is omitted>

When receiving PDSCH scheduled by DCI format 1\_0, 4\_0, 4\_1, 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 is omitted>

----------------- End of TP ----------------

**Agreement**

For PDSCH scheduled by a DCI format 4\_1/4\_2, the UE assumes *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA* or *dmrs-DownlinkForPDSCH-MappingTypeB* configured in *PDSCH-Config-Multicast*.

* + Adopt the following TP for Clause 5.1.6.3 in TS 38.214:

----------------- Start of TP ----------------

**5.1.6.3 PT-RS reception procedure**

**<**Unchanged text is omitted>

The procedures on PT-RS reception described in this clause apply to a UE receiving PDSCH scheduled by DCI format 1\_2 configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* or *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* and to a UE receiving PDSCH scheduled by DCI format 1\_0 or DCI format 1\_1 configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA* or *dmrs-DownlinkForPDSCH-MappingTypeB*. The procedures on PT-RS reception described in this clause apply to a UE receiving PDSCH scheduled by DCI format 4\_1 or DCI format 4\_2 configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA* or *dmrs-DownlinkForPDSCH-MappingTypeB* in *PDSCH-Config-Multicast*.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

The TP below for Clause 5.1 in TS 38.214v17.0.0 is endorsed.

----------------- Start of TP ----------------

**5.1 UE procedure for receiving the physical downlink shared channel**

**<**Unchanged text is omitted>

A UE shall upon detection of a PDCCH with a configured DCI format 1\_0, 1\_1, 4\_0, 4\_1, 4\_2 or 1\_2 decode the corresponding PDSCHs as indicated by that DCI. For any HARQ process ID(s) in a given scheduled cell, the UE is not expected to receive a PDSCH that overlaps in time with another PDSCH. The UE is not expected to receive another PDSCH for a given HARQ process until after the end of the expected transmission of HARQ-ACK for that HARQ process, where the timing is given by Clause 9.2.3 of [6]. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* in a given scheduled cell, the UE is not expected to receive a first PDSCH and a second PDSCH, starting later than the first PDSCH, with its corresponding HARQ-ACK assigned to be transmitted on a resource ending before the start of a different resource for the HARQ-ACK assigned to be transmitted for the first PDSCH, where the two resources are in different slots for the associated HARQ-ACK transmissions, each slot is composed of symbols [4] or a number of symbols indicated by *subslotLengthForPUCCH* if provided, and the HARQ-ACK for the two PDSCHs are associated with the HARQ-ACK codebook of the same priority. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and PDCCHs that schedule two PDSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* in a given scheduled cell, the UE is not expected to receive a first PDSCH, and a second PDSCH, starting later than the first PDSCH, with its corresponding HARQ-ACK assigned to be transmitted on a resource ending before the start of a different resource for the HARQ-ACK assigned to be transmitted for the first PDSCH if the HARQ-ACK for the two PDSCHs are associated with HARQ-ACK codebooks of different priorities. For any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start receiving a first PDSCH starting in symbol *j* by a PDCCH ending in symbol *i*, the UE is not expected to be scheduled to receive a PDSCH starting earlier than the end of the first PDSCH with a PDCCH that ends later than symbol *i*. In a given scheduled cell, for any PDSCH corresponding to SI-RNTI, the UE is not expected to decode a re-transmission of an earlier PDSCH with a starting symbol less than *N* symbols after the last symbol of that PDSCH, where the value of *N* depends on the PDSCH subcarrier spacing configuration *m,* with *N*=13 for *m*=0, *N*=13 for *m*=1, *N*=20 for *m*=2, and *N*=24 for *m*=3.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

The TP below for Clause 5.1.3.2 in TS 38.214v17.0.0 is endorsed.

----------------- Start of TP ----------------

**5.1.3.2 Transport block size determination**

**<**Unchanged text is omitted>

In case the higher layer parameter *maxNrofCodeWordsScheduledByDCI* indicates that two codeword transmission is enabled, then one of the two transport blocks is disabled by DCI format 1\_1 if *IMCS* = 26 and if *rvid* = 1 for the corresponding transport block. If both transport blocks are enabled, transport block 1 and 2 are mapped to codeword 0 and 1 respectively. If only one transport block is enabled, then the enabled transport block is always mapped to the first codeword.

For the PDSCH assigned by a PDCCH with DCI format 1\_0, format 1\_1, format 4\_0, format 4\_1, format 4\_2 or format 1\_2 with CRC scrambled by C-RNTI, MCS-C-RNTI, TC-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or SI-RNTI, if Table 5.1.3.1-2 is used and *,* or a table other than Table 5.1.3.1-2 is usedand *,* the UE shall, except if the transport block is disabled in DCI format 1\_1, first determine the TBS as specified below:

**<**Unchanged text is omitted>

----------------- End of TP ----------------

The TP below for Clause 7.3.1.6 in TS 38.211v17.0.0 is endorsed.

----------------- Start of TP ----------------

**7.3.1.6 Mapping from virtual to physical resource blocks**

**<**Unchanged text is omitted>

- for PDSCH transmissions scheduled with DCI format 1\_0 in any common search space in bandwidth part with starting position , other than Type0-PDCCH common search space in CORESET 0 ~~and common search space associated with G-RNTI or G-CS-RNTI~~, the set of virtual resource blocks , where is the size of CORESET 0 if CORESET 0 is configured for the cell and the size of initial downlink bandwidth part if CORESET 0 is not configured for the cell, are divided into virtual resource-block bundles in increasing order of the virtual resource-block number and virtual bundle number and the set of physical resource blocks are divided into physical resource-block bundles in increasing order of the physical resource-block number and physical bundle number, where , is the bundle size, and is the lowest-numbered physical resource block in the control resource set where the corresponding DCI was received.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

The TP below for Clause 5.1.3.1 in TS 38.214v17.0.0 is endorsed.

----------------- Start of TP ----------------

**<**Unchanged text is omitted>

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 (*R*) used in the physical downlink shared channel.

elseif the higher layer parameter *mcs-Table* given by *PDSCH-Config-Multicast* is set to 'qam64LowSE', 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 5.1.3.1-3 to determine the modulation order (*Qm*) and Target code rate (*R*) used in the physical downlink shared channel.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

**Agreement**

For RRC\_CONNECTED UEs receiving broadcast MCCH/MTCH, the Type0B-PDCCH CSS set configured by *searchSpace-Broadcast* in *pdcch-Config-MCCH/pdcch-Config-MTCH* follows the same prioritization rule for search space set overbooking procedure as CSS set(s) configured by *searchSpace-Multicast*.

**Agreement**

Regarding the number of DCIs that a UE can process in a slot or span, multicast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b.

**Agreement**

For multicast RRC\_CONNECTED UEs, *rateMatchPatternToAddModList*, *rateMatchPatternGroup1* and *rateMatchPatternGroup2* can be configured in *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. For PDSCH resource mapping with RB symbol level granularity,

* + The procedure for PDSCH scheduled by PDCCH with DCI format 4\_1is similar as that of DCI format 1\_0 and the procedure for PDSCH scheduled by PDCCH with DCI format 4\_2is similar as that of DCI format 1\_1, by applying the parameters of *rateMatchPatternToAddModList*, *rateMatchPatternGroup1* and *rateMatchPatternGroup2* configured in *PDSCH-Config-Multicast*.
  + *rateMatchPatternToAddModList*, *rateMatchPatternGroup1* and *rateMatchPatternGroup2* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCHs.
  + *rateMatchPatternToAddModList*, *rateMatchPatternGroup1* and *rateMatchPatternGroup2* configured in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCHs.

**Agreement**

PDSCH processing capability 2 is not applied to PDSCH scheduled by PDCCH with DCI format 4\_0/4\_1/4\_2.

**Agreement**

Regarding the size of DCI format 4\_2 for multicast of RRC\_CONNECTED UE,

* + the size is configured per CFR for all G-RNTIs (included in cfr-Config-Multicast).
  + the value range of the size is {[1]..140} (the same as for DCI format 2\_6)

**Agreement**

Regarding the size of DCI format 4\_2 for multicast of RRC\_CONNECTED UE,

* + the value range of the size is {20..140}

The TP below for Clause 5.1.4.1 in TS 38.214v17.0.0 is endorsed.

----------------- Start of TP ----------------

**5.1.4.1 PDSCH resource mapping with RB symbol level granularity**

**<**Unchanged text is omitted>

The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *rateMatchPatternGroup1DCI-1-2*, *rateMatchPatternGroup2DCI-1-2* instead of *rateMatchPatternGroup1* and *rateMatchPatternGroup2*.

The procedures for PDSCH scheduled by PDCCH with DCI format 1\_0 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_1, and the procedures for PDSCH scheduled by DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2 by applying the parameters of *rateMatchPatternToAddModList, rateMatchPatternGroup1* and *rateMatchPatternGroup2* configured in *PDSCH-Config-Multicast*.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

The TP below for Clause 5.1.4.2 in TS 38.214v17.0.0 is endorsed.

----------------- Start of TP ----------------

**5.1.4.2 PDSCH resource mapping with RE level granularity**

The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*. The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 4\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config-Multicast* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList in PDSCH-Config*.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

**Agreement**

From RAN1 perspective, it is feasible for UE in RRC\_CONNECTED state to receive MBS broadcast on an activated SCell as long as UE has capability of supporting MBS broadcast on SCell. From RAN1 perspective, if a UE is to receive MBS broadcast on SCell,

* + The capability of supporting MBS broadcast on SCell is separate capability from the one of CA for unicast.
  + The UE is not required to monitor DCI formats associated with SI-RNTI, P-RNTI, RA-RNTI in SCell.
  + Overbooking for SCell is not supported.
  + MBS broadcast reception on SCell can be supported only for RRC\_CONNECTED UEs only with self-scheduling.
  + Type0-PDCCH CSS set is only configured on the primary cell of the MCG.
  + Configuring the search space on SCell for PDCCH monitoring of MBS DCI formats is via unicast RRC signaling.
  + The UE capability is expected to be defined by RAN2.
    - E.g. the total number of component carriers for receiving broadcast on SCell may be subject to UE capability
  + The UE is not required to receive broadcast on PCell and SCell simultaneously

**Agreement**

From RAN1 perspective, it is feasible for UE in RRC\_CONNECTED state to receive MBS broadcast on non-serving cell, which is up to UE implementation and transparent to the network.

* + It is assumed in RAN1 that UE receiving MBS broadcast on non-serving cell does not have any impact to operation on serving cell(s), e.g., does not require UE to obtain the related configuration from the serving cell, does not require the network to guarantee the scheduling doesn’t exceed UE’s capability on serving cell, etc.
  + RAN1 assumes that receiving MBS broadcast on non-serving cell could be on the same or on a different band, but on a different carrier frequency than a UE’s serving cell
  + No RAN1 spec impact and no optimization is pursued in Rel-17 for MBS broadcast reception on non-serving cell.
  + The UE capability(ies), if any, is(are) expected to be defined by RAN2.

R1-2200785 DRAFT LS reply to MBS broadcast reception on SCell and non-serving cell Moderator (Huawei)

Final LS to RAN2 is endorsed in R1-2200798.

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

**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,  or  Maximum 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

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

|  |
| --- |
| **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 C:\Users\10240317\AppData\Local\Temp\ksohtml7920\wps1.jpg conform to the downlink power allocation specified in [6, TS 38.214] and are mapped in sequence starting with C:\Users\10240317\AppData\Local\Temp\ksohtml7920\wps2.jpg to resource elements C:\Users\10240317\AppData\Local\Temp\ksohtml7920\wps3.jpg 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. ---------------------------- |

# Appendix 11: Agreements in #108 e-meeting

**Mechanisms to support group scheduling for RRC\_CONNECTED UEs**

Agreement

In the reply LS on MBS SPS to RAN2, capture the following for Q1:

* RAN1 confirms that RAN2’s understanding is correct.
* RAN1 thinks that the maximum number of G-CS-RNTI configured for UE should be subject to UE capability.

Agreement

In the reply LS on MBS SPS to RAN2, capture the following for Q2:

* From RAN1 perspective, retransmission scheme (i.e. via PTM or PTP) can be changed per TB per transmission.
  + UE is not expected to receive PTM retransmission after PTP retransmission for the same multicast TB
  + There is no consensus in RAN1 to support PTM retransmission and PTP retransmission simultaneously for different UEs in the same MBS group
* A single CS-RNTI is used for PTP retransmissions of all G-CS-RNTIs.

Agreement

RAN1 thinks that multiple G-CS-RNTIs cannot be mapped to same MBS SPS-config at the same time for a UE.

Drafting the reply LS on MBS SPS (see below [R1-2202591](../Docs/R1-2202591.zip)) that includes the above 3 agreements.

Agreement

Send an LS to inform RAN2 that the following parameters are NOT needed for PDCCH-Config-Multicast:

* + downlinkPreemption
  + tpc-PUCCH
  + tpc-PUSCH
  + tpc-SRS
  + uplinkCancellation-r16
  + monitoringCapabilityConfig-r16 (the default is *R15monitoringcapablity*)
  + searchSpaceSwitchConfig-r16

Agreement

Send an LS to inform RAN2 that the following parameters are NOT needed for PDSCH-Config-Multicast:

* *minimumSchedulingOffsetK0-r16*
* *antennaPortsFieldPresenceDCI-1-2-r16, aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2-r16, aperiodicZP-CSI-RS-ResourceSetsToReleaseListDCI-1-2-r16, dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2-r16, dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2-r16, dmrs-SequenceInitializationDCI-1-2-r16, harq-ProcessNumberSizeDCI-1-2-r16, mcs-TableDCI-1-2-r16, numberOfBitsForRV-DCI-1-2-r16, pdsch-TimeDomainAllocationListDCI-1-2-r16, prb-BundlingTypeDCI-1-2-r16, priorityIndicatorDCI-1-2-r16, rateMatchPatternGroup1DCI-1-2-r16, rateMatchPatternGroup2DCI-1-2-r16, resourceAllocationType1GranularityDCI-1-2-r16, vrb-ToPRB-InterleaverDCI-1-2-r16, referenceOfSLIVDCI-1-2-r16, resourceAllocationDCI-1-2-r16,*
* *dataScramblingIdentityPDSCH2-r16*
* *repetitionSchemeConfig-r16, repetitionSchemeConfig-v1630*

Agreement

If UE supports carrier aggregation for unicast, multicast reception on an activated SCell with self-scheduling is supported subject to UE capability in Rel-17.

* UE is not expected to be configured simultaneously with more than one component carrier for multicast reception.
* Cross-carrier scheduling for multicast reception is not supported in Rel-17.
* The capability of supporting MBS multicast on SCell is a separate capability from the CA capability for unicast.
  + The granularity of UE reporting the capability of supporting MBS multicast reception is per FSPC

Conclusion

When HARQ feedback is disabled, the following fields (if present) of DCI format 4\_1/4\_2 can be assumed to be reserved and UE ignores them:

* PUCCH resource Indicator
* PDSCH-to-HARQ\_feedback timing indicator

Agreement

For RRC\_CONNECTED UEs, a multicast PDCCH to schedule a multicast PDSCH is counted as a unicast DCI to schedule a unicast PDSCH.

* Adopt the following TP for Clause 10.1 in TS 38.213:

----------------- Start of TP ----------------

**10.1 UE procedure for determining physical downlink control channel assignment**

**<**Unchanged text is omitted>

For a scheduled cell and at any time, a UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, G-RNTI for multicast, G-CS-RNTI or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Agreement

* “Initial TP 2-6-2” in section 7 of [R1-2202641](../Docs/R1-2202641.zip) is endorsed for Clause 7.3.1.5.2 in TS 38.212.
* “Initial TP 2-6-2” in section 7 of [R1-2202641](../Docs/R1-2202641.zip) is endorsed for Clause 7.3.1.5.3 in TS 38.212.
* “Initial TP 2-6-3” in section 7 of [R1-2202641](../Docs/R1-2202641.zip) is endorsed for Clause 10.2 in TS 38.213.

Agreement

Regarding rate matching of GC-PDSCH reception, the UE shall assume that both of indicated resources in clauses 5.1.4.1, 5.1.4.2 and the PRBs containing SS/PBCH block transmission resources are not available for the PDSCH scheduled with G-RNTI for multicast.

* Adopt the following TP for Clause 5.1.4 of TS38.214

----------------- Start of TP ----------------

**5.1.4 PDSCH resource mapping**

**<**Unchanged text is omitted>

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, 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*.

When receiving PDSCH scheduled by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI, G-RNTI for multicast or PDSCHs with SPS, the REs corresponding to the configured or dynamically indicated resources in Clauses 5.1.4.1, 5.1.4.2 are not available for PDSCH. Furthermore, the UE assumes SS/PBCH block transmission according to *ssb-PositionsInBurst* if the PDSCH resource allocation overlaps with PRBs containing SS/PBCH block transmission resources, and 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 text is omitted>

----------------- End of TP ----------------

**Decision:** As per email decision posted on Feb 26th,

Agreement

Regarding the number of DCIs that a UE can process in a slot or span, MBS broadcast DCI monitored by the UE is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b for RRC\_CONNECTED UEs.

Agreement

Adopt the following TP for Clause 7.3.1.5.3 in TS 38.212:

----------------- Start of TP ----------------

**7.3.1.5.3 Format 4\_2**

**<**Unchanged text is omitted>

- Rate matching indicator – 0, 1, or 2 bits according to higher layer parameters *rateMatchPatternGroup1* and *rateMatchPatternGroup2* in *PDSCH-Config-Multicast*, where the MSB is used to indicate *rateMatchPatternGroup1* and the LSB is used to indicate *rateMatchPatternGroup2* when there are two groups.

- ZP CSI-RS trigger – 0, 1, or 2 bits as defined in Clause 5.1.4.2 of [6, TS 38.214]. The bitwidth for this field is determined as bits, where is the number of aperiodic ZP CSI-RS resource sets configured in *PDSCH-Config-Multicast* ~~by higher layer~~.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Agreement

Send an LS to inform RAN2 that the following parameters are NOT needed for PDSCH-Config-Multicast:

* zp-CSI-RS-ResourceToAddModList, zp-CSI-RS-ResourceToReleaseList

Agreement

For multicast RRC\_CONNECTED UEs, *p-ZP-CSI-RS-ResourceSet* can be configured in *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. For PDSCH resource mapping with RE symbol level granularity,

* the REs indicated by *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* are declared as not available for GC-PDSCH.
* *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCHs.
* *p-ZP-CSI-RS-ResourceSet* in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCHs.
* The total number of *p-ZP-CSI-RS-ResourceSet* that a UE can be configured with is the same as for unicast in Rel-16

Also include this agreement in an LS to RAN2.

Agreement

For multicast RRC\_CONNECTED UEs, *sp-ZP-CSI-RS-ResourceSetsToAddModList* can be configured in *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. For PDSCH resource mapping with RE symbol level granularity,

* the REs indicated by *sp-ZP-CSI-RS-ResourceSetsToAddModList* configured in *PDSCH-Config-Multicast* are declared as not available for GC-PDSCH when their activation delivered by unicast PDSCH is applied.
* *sp-ZP-CSI-RS-ResourceSetsToAddModList* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCHs.
* *sp-ZP-CSI-RS-ResourceSetsToAddModList* in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCHs.
* The total number of semi-persistent *ZP-CSI-RS-ResourceSet* that a UE can be configured with is the same as for unicast in Rel-16

Also include this agreement in an LS to RAN2.

Agreement

For TCI states activation/deactivation for multicast GC-PDSCH, Alt-1 is supported.

* Alt-1: The unicast PDSCH carrying a ‘TCI States Activation/Deactivation for UE-specific PDSCH MAC CE’ is received by the UE to map up to 8 TCI states configured in *PDSCH-Config* to the TCI codepoints in both unicast DCI format and DCI format 4\_2. The following text in Clause 5.1.5 of TS38.214 is deleted.
  + “The UE can be configured with a list of up to *M’* *TCI-State*configurations within the higher layer parameter *PDSCH-Config-Multicast* to decode PDSCH associated with a G-RNTI or a G-CS-RNTI according to a detected PDCCH with DCI intended for the UE and the given serving cell, where M’ depends on the UE capability.”

Agreement

Adopt the following TP for Clause 10.1 in TS 38.213:

* note: further clarification may be needed for the case of receiving broadcast, and MCCH-RNTI

----------------- Start of TP ----------------

**10.1 UE procedure for determining physical downlink control channel assignment**

**<**Unchanged text is omitted>

For a scheduled cell and at any time, if a UE is provided a C-RNTI, ~~a~~the UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, G-RNTI, G-CS-RNTI or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.

**<**Unchanged text is omitted>

----------------- End of TP ----------------

Agreement

Send the LS reply with the following answer to Q1 from the incoming LS ([R1-2202727](../Docs/R1-2202727.zip)):

* From RAN1 perspective, UE receiving SIBx directly from SCell via BCCH is not feasible since it is legacy procedure that UE is not required to monitor DCI formats associated with SI-RNTI, P-RNTI, RA-RNTI in SCell. Such procedure is expected to be unchanged because of the impact to RAN1 specifications and UE implementation.

Agreement

Send the LS reply with the following answer to Q2 from the incoming LS ([R1-2202727](../Docs/R1-2202727.zip)):

* From RAN1 perspective, UE can receive MCCH directly from SCell and there is no need to provide MCCH to UE with dedicated signalling. There is no dependency between SIBx reception method for SCell (i.e. directly reading from SCell vs. dedicated RRC signalling) and MCCH provision method (i.e. dedicated signalling vs. directly reading from SCell).

Agreement

Update the previous agreement for *p-ZP-CSI-RS-ResourceSet* as below:

For multicast RRC\_CONNECTED UEs, *p-ZP-CSI-RS-ResourceSet* can be configured in *PDSCH-Config-Multicast* for GC-PDSCH rate matching, subject to UE capability. For PDSCH resource mapping with RE symbol level granularity,

* the REs indicated by *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* are declared as not available for GC-PDSCH.
* *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config* for unicast do not apply for GC-PDSCHs.
* *p-ZP-CSI-RS-ResourceSet* in *PDSCH-Config-Multicast* for multicast do not apply for unicast PDSCHs.
* The total number of periodic ZP-CSI-RS-Resources *~~p-ZP-CSI-RS-ResourceSet~~* that a UE can be configured with is the same as for unicast in Rel-16
  + If *p-ZP-CSI-RS-ResourceSet* is configured in both *PDSCH-Config* and PDSCH-Config-Multicast, it is subject to UE capability whether the *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config-Multicast* can be different from the *p-ZP-CSI-RS-ResourceSet* configured in *PDSCH-Config*.

Also include this agreement in an LS to RAN2.

**Basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs**

Agreement

In the reply LS on MBS issues to RAN2, capture the following:

* RAN1 confirm RAN2’s understanding that only a single frequency resource in CFR (indicated by *locationAndBandwidth-Broadcast*) is configured for MCCH/MTCH reception of MBS broadcast and it is common for MCCH and all MTCHs.

Agreement

*RateMatchPatternLTE-CRS* can be configured in PDSCH-Config-MCCH or PDSCH-Config-MTCH for RRC\_IDLE/RRC\_INACTIVE UEs*.*

Agreement

For broadcast reception, if the frequency resources of the CFR for broadcast is larger than CORESET0, a CORESET larger than CORESET0 can be configured in the CFR when no CORESET is configured by c*ommonControlResourceSet.*

Agreement

* TP-2.3-1 (for Section 5.1.2.1 of TS38.214) in section 6 of [R1-2202549](file:///C:\Users\cmcc\AppData\Local\Temp\360zip$Temp\Docs\R1-2202549.zip) is endorsed.
* TP-2.4-2 (for Section 10.1 of TS 38.213) in section 6 of [R1-2202549](file:///C:\Users\cmcc\AppData\Local\Temp\360zip$Temp\Docs\R1-2202549.zip) is endorsed.
* TP-2.4-4 (for Section 18 of TS 38.213) in section 6 of [R1-2202549](file:///C:\Users\cmcc\AppData\Local\Temp\360zip$Temp\Docs\R1-2202549.zip) is endorsed.

Agreement

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

Agreement

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

Agreement

* TP-2.4-3 (for Section 18 of TS 38.213) in section 6 of [R1-2202550](file:///C:\Users\cmcc\AppData\Local\Temp\360zip$Temp\Docs\R1-2202550.zip) is endorsed.