**3GPP TSG RAN WG1 #107bis-e R1-220XXXX**

**e-Meeting, January 17th – 25th, 2022**

**Agenda item: 8.12.3**

**Source:** Moderator (Qualcomm)

**Title:** FL summary #1 on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs

**Document for:** Discussion and Decision

# Introduction

During TSG RAN #86, 3GPP approved a Release-17 Work Item (WI) to introduce support for Multicast and Broadcast Services in NR (NR MBS) [RP-201038]. The NR MBS WI includes the following objective:

|  |
| --- |
| * Specify RAN basic functions for broadcast/multicast for UEs in RRC\_IDLE/ RRC\_INACTIVE states [RAN2, RAN1]:   + Specify required changes to enable the reception of Point to Multipoint transmissions by UEs in RRC\_IDLE/ RRC\_INACTIVE states, with the aim of keeping maximum commonality between RRC\_CONNECTED state and RRC\_IDLE/RRC\_INACTIVE state for the configuration of PTM reception. [RAN2, RAN1].   Note: the possibility of receiving Point to Multipoint transmissions by UEs in RRC\_IDLE/ RRC\_INACTIVE states, without the need for those UEs to get the configuration of the PTM bearer carrying the Broadcast/Multicast service while in RRC CONNECTED state beforehand, is subject to verification of service subscription and authorization assumptions during the WI. |

The agreements for AI 8.12.3 on Basic functions for broadcast/multicast for RRC\_IDLE/ RRC\_INACTIVE UEs in previous RAN1 and RAN Plenary meetings are listed in the Annex A of this document.

In this document, the Feature Lead (FL) presents a list of open Issues in 8.12.3 based on tdocs submitted to RAN1#107b-e.

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

[107b-e-NR-MBS-03] Email discussion/approval on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs with checkpoints for agreements on January 17 and 25 – Le (Qualcomm)

* 1st check point: January 20
* Final check point: January 25

# Issues

## Broadcast reception on SCell or non-serving cell

### **Tdoc analysis**

At RAN1#107-e, RAN2 requests RAN1 [R1-2200009] to investigate and provide feedback, considering agreements made by RAN2 as indicated in the LS:

|  |  |
| --- | --- |
| During RAN2#116-e meeting, RAN2 discussed MBS broadcast reception on SCell and non-serving cell respectively by the UE in RRC Connected state and reached the following agreements:   |  | | --- | | * From RAN2 point of view, the UE may receive MBS broadcast service from SCell in intra-PLMN case and if supported this may be a separate UE capability. Send an LS to RAN1 to ask to check the feasibility of MBS broadcast reception on SCell. * From RAN2 point of view, the connected UE may if supported receive MBS broadcast service from non-serving cell in intra-PLMN case, under the condition this does not have any impact to operation on serving cell(s). This may be a separate UE capability. Send an LS to RAN1 to ask to check the feasibility. |  * + Based on the above, RAN2 would like to request RAN1 to check the feasibility of MBS broadcast reception on SCell and non-serving cell and do the required work, if feasible/needed. |

* [R1-2200029, Huawei]
  + ***Proposal 4: Adopt the following text proposal to TS 38.213 to support PDCCH monitoring for broadcast in SCell in addition to PCell***

----------------------------------------------------Text proposal starts--------------------------------------------------

10.1 UE procedure for determining physical downlink control channel assignment

A set of PDCCH candidates for a UE to monitor is defined in terms of PDCCH search space sets. A search space set can be a CSS set or a USS set. A UE monitors PDCCH candidates in one or more of the following search spaces sets

- a Type0-PDCCH CSS set 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, on the primary cell of the MCG, or by *searchSpaceZero* in *PDCCH-ConfigCommon* when *pdcch-Config-MCCH* or *pdcch-Config-MCCH* is not provided, for a DCI format 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-Config-MCCH* and *pdcch-Config-MTCH* for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI

< Unchanged parts are omitted >

----------------------------------------------------Text proposal ends---------------------------------------------------

* [R1-2200596, CMCC]
  + **Proposal 1. Support broadcast reception on SCell and the TP suggestion for TS 38.213 section 10.1 is as the following:**

**<**Unchanged text is omitted>

- a Type0B-PDCCH CSS set configured by *searchSpaceBroadcast* in *pdcch-Config-MCCH* and *pdcch-Config-MTCH* for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI

**<**Unchanged text is omitted>

* [R1-2200119, ZTE]
  + ***Proposal 2****: Reply RAN2 LS [3] R1-2200009 with the following response.*
    - *From RAN1 perspective, UE can receive MBS broadcast reception on SCell assuming that RAN2 provides the necessary signalling support.*
    - *If UE doesn’t require the network to guarantee the scheduling doesn’t exceed UE’s capability on the serving cell, then receiving MBS broadcast service from non-serving cell (in intra-PLMN case) is agnostic to network. Otherwise, UE may need to indicate some necessary information (e.g., UE capability sharing information) for network.*
* [R1-2200308, Qualcomm]
* **Proposal 10: For RRC\_CONNECTED UEs,**
  + **It is up to UE implementation to receive MBS broadcast service from non-serving cell in intra-PLMN case, with no spec impact.**
  + **It is subject a separate UE capability to receive the MBS broadcast service from SCell in intra-PLMN case, in a similar way as that of the MBS multicast service from SCell in intra-PLMN case with self-scheduling.**
    - **The RRC\_CONNOECTED UE, if capable of receiving MBS in SCell, can be configured to monitor the CSS configured for broadcast/multicast DCI formats in SCell via unicast RRC signaling.**
    - **Notes:** 
      * **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.**

### **1st round FL proposals**

Considering the following guideline suggested by Chair, we will not discuss this issue in 8.12.3.

“Use separate email thread [107bis-e-R17-MBS-04] under agenda item 8.12.1 to discuss whether it is feasible from RAN1 point of view and possible response LS to RAN2.”

## Broadcast PDSCH reception in PCell

### **Tdoc analysis**

As part of the discussion for the CR on TS 38.202 [R1-2112960], companies discussed multiplexing of MCCH/MTCH and other PDCCH/PDSCH for RRC idle/inactive UE states. In Table 6.2.1 on Downlink “Reception Types”, D5 and D6 are the reception type for MCCH and MTCH, respectively. Table 6.2-2 on Downlink “Reception Type” combinations in TS 38.202 CR [R1-211960] shows the comment from the Editor highlighting that more discussion is needed for the scenarios for which D5 and D6 are applicable.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| "Reception Type" | Physical Channel(s) | Monitored RNTI | Associated Transport Channel | Comment |
| D5 | PDCCH+PDSCH | MCCH-RNTI | DL-SCH | Note 8 |
| D6 | PDCCH+PDSCH | G-RNTI | DL-SCH | Note 9 |
| Note 8: This is for broadcast MCCH  Note 9: This is for broadcast MTCH | | | | |

* [R1-2200029, Huawei]
  + ***Proposal 9: Adopt the following text proposal to TS 38.202:***

**-----------------------------------------Text proposal for TS 38.214 starts--------------------------------------**

6.2 Downlink

< Unchanged parts are omitted >

**Table 6.2-2: Downlink "Reception Type" combinations**

|  |  |  |  |
| --- | --- | --- | --- |
| Supported Combinations | | | Comment |
| PCell | PSCell | SCell |
| 1. RRC\_IDLE | | | |
| A + (B and/or C1 and/or D0) + F0 + (D5 or D6) |  |  | Note 1 |
| 2. RRC\_INACTIVE | | | |
| A + (B and/or C1 and/or D0) + F0 + (D5 or D6) |  |  | Note 1 |
| 3. RRC\_CONNECTED | | | |
| (A + C0 + (B and/or (D0 or (m1\*D1+m2\*D2+m3\*D3+m4\*D4+(m5\*D5 and/or m6\*D6)))) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + L0 + L1 + M + N + P) | (A + (D0 or (m1\*D1+m2\*D2+( m5\*D5 and/or m6\*D6))) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + N + P) | m1\*D1 + m2\*D2 + (m5\*D5 and/or m6\*D6) + 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 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: The values of m3 ≥ 0 and m4≥0 are subject to UE capability and applicable to RRC connected UEs. | | | |

**-----------------------------------------Text proposal for TS 38.214 ends----------------------------------------**

* In [R1-2200119, ZTE]

it is feasible to allow simultaneous reception of MCCH and PDSCHs scrambled with SI-RNTI, P-RNTI, RA-RNTI or TC-RNTI.

Regarding MTCH reception, we think it can be regarded as unicast reception. Note that, multicast PDSCH can also be regarded as unicast reception. Thus, the ‘G-RNTI’ in the TP below refers to both MTCH reception and multicast reception.

***Proposal 3****: Adopt the following TP for Section 5.1 of TS38.214.*

|  |
| --- |
| **5.1 UE procedure for receiving the physical downlink shared channel**  ---------------------------- Other 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 or MCCH-RNTI, with the two PDSCHs partially or fully overlapping 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 or G-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 or G-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 or G-RNTI.  On a frequency range 2 cell, the UE is not expected to decode a PDSCH scheduled with C-RNTI, MCS-C-RNTI, ~~or~~ CS-RNTI or G-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.  ---------------------------- Other parts are omitted. ---------------------------- |

* [R1-2200310, Qualcomm]
  + **Proposal 5: For NR broadcast MCCH/MTCH**
    - **RRC\_IDLE/INACTIVE UEs are not required to support FDMed MCCH/MTCH and PBCH/SIB/Paging in PCell.**
    - **RRC\_CONNECTED UEs,** 
      * **Shall be able to support FDMed one PDSCH (for MCCH/MTCH, multicast, or unicast) and PBCH/SIB in a DL CC.**
      * **Whether to support FDMed one PDSCH (for MCCH/MTCH) and one PDSCH for unicast in a DL CC is subject to UE capability**
      * **Whether to support FDMed one PDSCH (for MCCH/MTCH), one PDSCH for multicast and unicast in a DL CC is subject to UE capability.**
* [R1-2200429, Apple]
  + **Proposal 1: For UE in RRC\_IDLE/INACTIVE mode,** 
    - **Supporting slot level TDM reception between G-RNTIs, or between G-RNTI and MCCH-RNTI**
    - **Supporting slot level TDM reception of broadcast with SIB/paging/RA response**
  + **Proposal 2: For UE in RRC\_CONNECTED mode, FDMed reception of MCCH/MTCH with SIB/paging/unicast/multicast is supported and up to UE capability.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TP for TS38.2026.2 Downlink <Omitted>  Table 6.2-2: Downlink "Reception Type" combinations   |  |  |  |  | | --- | --- | --- | --- | | Supported Combinations | | | Comment | | PCell | PSCell | SCell | | 1. RRC\_IDLE | | | | | A + (B and/or C1 and/or D0) + F0 |  |  | Note 1 | | D5 or D6 |  |  |  | | 2. RRC\_INACTIVE | | | | | A + (B and/or C1 and/or D0) + F0 |  |  | Note 1 | | D5 or D6 |  |  |  | | 3. RRC\_CONNECTED | | | | | (A + C0 + (B and/or (D0 or (m1\*D1+m2\*D2+m3\*D3+m4\*D4+m5\*(D5 or D6)))) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + L0 + L1 + M + N) | (A + (D0 or (m1\*D1+m2\*D2)) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + N) | m1\*D1 + m2\*D2 + E + n\*F1 + G + H  + J0 + J1 + J2 + K + O + L0 + L1 + M | Note 2, Note 3, Note 4, Note 5, Note 6, Note 7, Note 8, Note 9  Note X | | 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: The values of m3 ≥ 0 and m4≥0 are subject to UE capability and applicable to RRC connected UEs  Note X: m5=1 for MBS UE supporting broadcast in RRC connected mode, otherwise m5=0. | | | |   <Omitted> |

* [R1-2200598, CMCC]

**Proposal 1. The suggested TP for TS 38.214 section 5.1 is as the following:**

**<**Unchanged text is 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, TC-RNTI, MCCH-RNTI or G-RNTI with the two PDSCHs partially or fully overlapping in time in non-overlapping PRBs.

**<**Unchanged text is omitted>

**Proposal 2. The suggested TP for TS 38.202 section 6.2 is as the following:**

**<**Unchanged text is omitted>

Table 6.2-2: Downlink "Reception Type" combinations

|  |  |  |  |
| --- | --- | --- | --- |
| Supported Combinations | | | Comment |
| PCell | PSCell | SCell |
| 1. RRC\_IDLE | | | |
| A + (B and/or C1 and/or D0 and/or D5 and/or D6) + F0 |  | D5 and/or D6 | Note 1 |
| 2. RRC\_INACTIVE | | | |
| A + (B and/or C1 and/or D0 and/or D5 and/or D6) + F0 |  | D5 and/or D6 | Note 1 |
| 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) | (A + (D0 or (m1\*D1+m2\*D2)) + E + F0 + n\*F1 + G + H + J0 + J1 + J2 + K + O + N) | m1\*D1 + m2\*D2 + E + n\*F1 + G + H  + J0 + J1 + J2 + K + O + L0 + L1 + M | Note 2, Note 3, Note 4, Note 5, Note 6, Note 7, Note 8, Note 9 |
| 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: The values of m3 ≥ 0 and m4≥0 are subject to UE capability and applicable to RRC connected UEs | | | |

**<**Unchanged text is omitted>

### **1st round FL proposals**

Summary of the companies’ views:

* For RRC\_IDLE/INACTIVE UEs,
  + whether to support FDMed MCCH/MTCH and PBCH/SIB/Paging in PCell
    - Yes: ZTE (MCCH), CMCC (up to 2 PDSCHs), Huawei
    - No: ZTE (MTCH), QC, Apple
  + Whether to support FDMed MCCH and MTCH in PCell
    - Yes:
    - No: QC, Apple, Huawei, [ZTE]
  + Whether to support FDMed MTCH and MTCH in PCell
    - Yes:
    - No: QC, Apple, Huawei
* [May be discussed in 8.12.1] For RRC\_CONNECTED UEs, it is subject to UE capability.

#### Proposal 2.2-1

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

#### Proposal 2.2-2

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

#### Proposal 2.2-3

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

|  |  |
| --- | --- |
| **Company** | **comments** |
| Lenovo, Motorola Mobility | 2.2-1: Support  2.2-2: is there “FDMed” missed in the proposal?   * **For RRC\_IDLE/INACTIVE UEs, a UE** **is not required to support FDMed reception of MCCH PDSCH and MTCH PDSCH in PCell.**   If the intention is same as our modification, support.  2.2-3: Support. |
| Huawei, HiSilicon | Ok with the proposals with adding FDM in proposal 2.2-2 as Lenovo spotted out. |
| OPPO | We support the three proposals, and 2.2-2 can be modified as proposed by Lenovo. |
| CMCC | Support the proposals with update “FDMed” in 2.2-2. |

## Broadcast HARQ process/combining

### **Tdoc analysis**

What RAN1 has agreed is that, for UE to support multicast reception, the maximum number of HARQ processes per cell is kept unchanged and it is up to gNB how to allocate HARQ processes between unicast and multicast. However, it is unclear whether/which HARQ process the broadcast transmission will take.

* [R1-2200029, Huawei]
  + ***Proposal 5: Whether UE supports an additional dedicated HARQ process for receiving MBS broadcast that is out of the maximum number of 16 HARQ processes per cell should be subject to a UE capability. If UE does not report such capability, UE is not expected to have additional dedicated HARQ process for MBS broadcast reception on top of the maximum number supported currently.***
  + ***Proposal 6: The HARQ process number for MBS broadcast can be indicated either in DCI format 4\_0 or configured by higher layer parameter.***
* [R1-2200096, vivo]
  + **Proposal 1: HARQ process number and new data indicator should be included in the DCI 1\_0 format for GC-PDCCH scheduling a GC-PDSCH carrying MTCH.**
* [R1-2200159, Nokia]
  + **Proposal-7: Support NDI in the DCI field for broadcast to enable the gNB-triggered HARQ re-transmissions for assisting the UE RV combining.**
  + **Proposal-8: Introduce an additional dedicated HARQ process for all broadcast services associated with different G-RNTIs. And there is no need of including HARQ process number field in the DCI format 1\_0.**
* [R1-2200310, Qualcomm]
  + **Proposal 2: For RRC\_IDLE/INACTIVE UEs, the HARQ combining can be supported by using the available HARQ process(es) not used for unicast/multicast.**
  + **Proposal 3: DCI 4\_0 format for GC-PDCCH scheduling a GC-PDSCH carrying MCCH/MTCH does not include HARQ process ID.**
  + **Proposal 4: DCI 4\_0 format for GC-PDCCH scheduling a GC-PDSCH carrying MTCH includes New Data Indicator.**
    - **Agree on TP#1 for TS38.212.**
* [R1-2200452, Xiaomi]
  + **Proposal 5: Slot level repetition for broadcast/multicast is sufficient and gNB triggered HARQ combination is not supported.**
* [R1-2200473, Lenovo]
  + ***Proposal 4: 1 bit NDI and 4 bits HARQ process number are not included in DCI format 4-0.***
* [R1-2200551, MediaTek]
  + ***Proposal 4: “HARQ process number” field is not supported for MBS broadcast DCI.***
* [R1-2200598, CMCC]
  + **Proposal 5. HARQ process number and New data indicator are not needed in the DCI format 4\_0.**
* [R1-2200665, Ericsson]
  + **Proposal 23: For UEs in RRC CONNECTED receiving broadcast, downselect between the following two solutions:**
    - **Add DL signaling support to allow the UE to reuse one HARQ process buffer for broadcast**
      * **Adding HARQ process ID and NDI in the broadcast DCI**
      * **Not excluding other methods**
    - **Buffering for broadcast is independent of HARQ buffering for unicast/multicast, i.e. addition of broadcast has no impact on HARQ buffers for unicast/multicast**
      * **Note: This may require dedicated additional HW for broadcast buffering to support PDSCH repetition**

### **1st round FL proposals**

Summary of the companies’ views:

* Whether to support additional dedicated HARQ process for broadcast
  + Yes: Nokia
  + No: MTK, QC
  + FFS: Huawei (subject to UE capability for RRC\_CONNECTED UEs), Ericsson
* Whether to indicate HPID in DCI format 4\_0
  + Yes: vivo (for MTCH)
  + No: Nokia, QC, LGE, Lenovo, MTK, CMCC
  + FFS: Huawei, Ericsson
* Whether to indicate NDI in DCI format 4\_0 for MCCH
  + Yes: Nokia
  + No: QC, LGE, CMCC, Lenovo
  + FFS: Ericsson
* Whether to indicate NDI in DCI format 4\_0 for MTCH
  + Yes: vivo, Nokia, QC
  + No: LGE, CMCC, Lenovo
  + FFS: Ericsson

#### Proposal 2.3-1

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

#### Proposal 2.3-2

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

#### Proposal 2.3-3

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

#### Proposal 2.3-4

* **New data indicator is indicated in DCI format 4\_0 for MTCH**

|  |  |
| --- | --- |
| **Company** | **comments** |
| Lenovo, Motorola Mobility | 2.3-1: OK  2.3-2: Ok  2.3-3: OK  2.3-4: not support |
| Huawei, HiSilicon | Ok with the first three proposals and would like to add FFS how to indicate the HARQ process ID for broadcast reception. 2.3-4 is still not justified in our opinion. |
| OPPO | OK with proposal 2.3-1, 2.3-2 and 2.3-3. Not support proposal 2.3-4.  To address the FFS part mentioned by HW/HiSi on how to indicate HPID for broadcast, one suggestion is to consider following Rel-15/16 mechanism (if there is). |
| CMCC | Ok with 2.3-1, 2.3-2 and 2.3-3.  Not support 2.3-4. |

## TRS as QCL source

### **Tdoc analysis**

The following agreement at RAN#93-e clarified that ‘Configuring TRS as QCL sources for broadcast transmission (as supported for RRC\_CONNECTED UE)’ is within the scope of the Rel-17 MBS WID. Companies discussed the TRS configuration for Rel-17 MBS broadcast reception.

* [R1-2200029, Huawei]
  + ***Proposal 16: Periodic TRS can be configured as QCL source for MTCH transmission especially for RRC\_IDLE/INACTIVE UEs. The configuration is included in SIBx or MCCH.*** 
    - ***UE may assume that the DMRS of GC-PDCCH/PDSCH is QCL’d with periodic TRS if configured for MTCH.***
    - ***UE may expect the quasi co-location type is 'typeC' with an SS/PBCH block.***
  + ***Proposal 17: For RRC\_IDLE/INACTIVE UEs, the configuration of TRS at least supports:***
    - ***a list of periodic NZP CSI-RS resource sets for TRS can be configured for the same cell group serving one or more G-RNTIs in a CFR-Config-Broadcast.***
    - ***The number of NZP CSI-RS resource sets in the list of NZP CSI-RS resource sets for TRS can be configurable for each cell group, similarly as specified in NZP-CSI-RS-ResourceSetList.***
* [R1-2200310, Qualcomm]
  + **Proposal 1: A list of periodic NZP CSI-RS resource sets for TRS can be configured in a *CFR-Config-Broadcast* for RRC\_IDLE/INACTIVE UEs.**
    - **UE may assume that the GC-PDCCH/PDSCH is QCL’d with periodic TRS if configured for broadcast.**
    - **The TRS can be QCL-ed with SSB at least in terms of timing, doppler via SSB/MCCH.**
* [R1-2200580, LGE]
  + **Proposal 1: If TRS is agreed to be supported, RAN1 is requested to agree the following proposals:**
    - ***Proposal 1A: a list of NZP CSI-RS resource sets for TRS can be configured for the same cell group serving one or more G-RNTIs.***
    - ***Proposal 1B: QCL-Info is associated with a NZP CSI-RS resource set for TRS and configured to be Type C QCLed with SSB (i.e. Doppler shift, average delay) via SIBx or MCCH.***
    - ***Proposal 1C: The number of NZP CSI-RS resource sets in the list of NZP CSI-RS resource sets for TRS can be configurable for each cell group, similarly as specified in NZP-CSI-RS-ResourceSetList*.**
  + **Proposal 2: For broadcast GC-PDCCH, UE assumes that a PDCCH Monitoring Occasion (MO) is associated with one NZP-CSI-RS-ResourceSet for TRS which is QCLed with the SSB-index mapped to the MO.** 
    - **UE uses the TRS associated with the MO where GC-DCI scheduling GC-PDSCH is received for determining GC-PDSCH antenna port quasi co-location.**
  + **Proposal 3: If a same SSB index can be associated with more than one NZP CSI-RS resource sets for TRS e.g. in NZP-CSI-RS-ResourceSetPerSSB,** 
    - **for the [x×N+K]th PDCCH monitoring occasion(s) for MTCH in the scheduling window, the number of PDCCH monitoring occasions in MTCH transmission window is greater than N i.e. the number of actual transmitted SSBs; and**
    - **the same SSB index can be mapped to multiple MOs of which each is associated with one NZP CSI-RS resource set for TRS e.g. in NZP-CSI-RS-ResourceSetPerSSB.**

### **1st round FL proposals**

Huawei, QC, [LGE] consider that the periodic TRS for RRC\_IDLE/INACTIVE UEs can be supported in Rel-17 MBS with the following potential proposal:

#### Proposal 2.4-1

**If TRS is configured in a CFR-Config-MCCH-MTCH for RRC\_IDLE/INACTIVE UEs via SSB/MCCH.**

* **A list of periodic NZP CSI-RS resource sets for TRS can be configured for the same cell group serving one or more G-RNTIs.**
* **UE may assume that the DMRS for GC-PDCCH/PDSCH with G-RNTI(s) for MTCH is QCL’d with periodic TRS if configured for broadcast.**
  + - **The TRS can be QCL-ed with SSB at least in terms of timing, doppler.**

|  |  |
| --- | --- |
| **Company** | **comments** |
| Lenovo, Motorola Mobility | OK |
| Huawei, HiSilicon | Support |
| OPPO | OK |
| CMCC | Ok |

## CFR for MTCH

### **Tdoc analysis**

CFR for MTCH

* [R1-2200452, Xiaomi]
  + **Proposal 2: Only one CFR can be configured for group-common PDCCH/PDSCH carrying MTCH for broadcast reception with UEs in RRC\_IDLE/INACTIVE state.**
* [R1-2200473, Lenovo]
  + ***Proposal 2: For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, only one CFR can be configured.***
  + ***Proposal 3: For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, only same CFR for MCCH and MTCH is supported.***
* [R1-2200551, MTK]
  + ***Proposal 1: The unified CFR is defined/configured for GC-PDCCH/PDSCH carrying MCCH and GC-PDCCH/PDSCH carrying MTCH.***
  + ***Proposal 2: Not support more than one CFR for UE supporting MBS in RRC\_IDLE/RRC\_INACTIVE states.***
  + ***Proposal 3: For broadcast reception, network implementation guarantee unified CFR for UEs in both RRC\_CONNECTED mode and IDLE/INACTIVE mode.***

CORESET for MCCH vs. CORESET for MTCH

* [R1-2200029, Huawei]
  + **Proposal 18: When the CFR for MCCH/MTCH is configured with the same size as SIB1 configured initial BWP, in addition to CORESET#0, the other CORESET larger than CORESET#0 can be configured.**
* [R1-2200159, Nokia]
  + **Proposal-6: Support different/separate CORESET utilized for GC-PDCCH of MCCH and MTCH, i.e. CORESET of MCCH GC-PDCCH associated with the CORESET#0, and CORESET of MTCH GC-PDCCH associated with the CFR\_CORESET in the configured/defined CFR/BWP.**
* [R1-2200352, OPPO]
  + **Proposal 1: The same CORESET is used for GC-PDCCH of scheduling GC-PDSCH of MCCH and MTCH.**
* [R1-2200452, Xiaomi]
  + **Proposal 3: For RRC\_IDLE/RRC\_INACTIVE UEs, the same CORESET is used for MCCH and MTCH in the same CFR.**
* [R1-2200473, Lenovo]
  + **Proposal 6: New type-x CSS is configured for RRC IDLE/RRC INACTIVE UEs.**
  + **Proposal 7: For RRC\_IDLE/RRC\_INACTIVE UEs, same CORESET is used for receiving MCCH and MTCH.**
* [R1-2200096, vivo]
  + **Proposal 2: Support CSS for broadcast DCI formats have a different monitoring priority to legacy CSS.**

### **1st round FL proposals**

Based on the following RAN1 agreements,

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:

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.)

**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.

FL’s understanding is:

* For MCCH, the frequency resources, PDCCH-Config-MCCH and PDSCH-Config-MCCH can be configured in a CFR for MCCH via SIBx.
* For MTCH, the PDCCH-Config-MTCH and PDSCH-Config-MTCH can be configured in a CFR for MTCH via MCCH.
  + The CFR frequency resources for MTCH is same as that of MCCH.
  + CORESET if configured in PDCCH-Config-MTCH can be different from CORESET configured in PDCCH-Config-MCCH.
* If the CFR for MCCH or CFR for MTCH has frequency size larger than CORESET0, the CORESET configured in the CFR can be larger than CORESET0.

If companies have same understanding, the remaining issue here is to discuss:

* Whether to support more than one CFR for MTCH configured via MCCH
  + Yes: Xiaomi

#### Proposal 2.5-1

* **Only one CFR-Config-MTCH with PDCCH-config-MTCH/PDSCH-config-MTCH can be configured via MCCH.**
  + **If CFR-Config-MTCH is not configured, CFR-Config-MCCH-MTCH configured via SIBx is used for both MCCH and MTCH.**

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| --- | --- |
| **Company** | **comments** |
| Lenovo, Motorola Mobility | OK |
| Huawei, HiSilicon | “only one …. Can be configured” could be misleading…I guess the intention was to say at a given time, only one CFR is configured. The reason is clearly that we have at least CFR in case A and case C that can be configurable. |
| OPPO | One question for clarification as follows, because it is not clear to have this proposal while compared with agreements.According to the agreements and FL’s explanation, MCCH and MTCH should have the same CFR frequency resources, but can be configured with different CFR-Config. It means that one CFR for MCCH/MTCH is supported but with different CFR configurations for PDCCH/PDSCH-Config-MCCH and PDCCH/PDSCH-Config-MTCH, respectively. |
| Huawei/HiSilicon2 | One more thing I forgot to mention in the first comment was regarding the configuration of CORESET. FL’s understanding was *“If the CFR for MCCH or CFR for MTCH has frequency size larger than CORESET0, the CORESET configured in the CFR can be larger than CORESET0.”*  The following is the agreement achieved earlier:  *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.*   According to the agreement, if *commonControlResourceSet* has the same description as legacy per TS 38.331:  ***commonControlResourceSet***  *An additional common control resource set which may be configured and used for any common or UE-specific search space. If the network configures this field, it uses a ControlResourceSetId other than 0 for this ControlResourceSet. The network configures the commonControlResourceSet in SIB1 so that it is contained in the bandwidth of CORESET#0.*  commonControlResourceSet is an CORESET smaller than CORESET#0. It is the reason we suggest to support another option that CORSET can be larger than COREST0 but the maximum number of CORESETs mandatorily (in the minimum capability) supported for Rel-15/Rel-16 UEs is still 2. |
| CMCC | Don’t support. As the previous agreement and FL’s explanation, the CFR frequency resources for MTCH is same as that of MCCH, and the current RRC parameter CFR-Config-MCCH-MTCH is used to configure the one CFR both for MCCH and MTCH.  Regarding the proposal, there may be the case that CFR-Config-MTCH is configured as Case C (larger than CORESET 0) in configured in MCCH but CFR-Config-MCCH is not configured in SIBx. According to previous agreement, if CFR is not configured, the size of CORESET 0 is used, that is the CORESET 0 size is actually used for MCCH which causes two different CFRs for MCCH and MTCH. |

## Scrambling ID configuration

### **Tdoc analysis**

* In [R1-220029, Huawei]
  + ***Proposal 1: pdcch-DMRS-ScramblingID-Broadcast, dataScramblingIdentityPDSCH-Broadcast, and scramblingID0-Broadcast are configured per G-RNTI.***
  + ***Proposal 2: G-RNTI for scheduling broadcast is configured per cell.***
  + ***Proposal 3: Confirm the row of repetitionNumber-MTCH in the RRC parameter list for NR MBS from rapporteur.***

### **1st round FL proposals**

FL suggests discussing whether the broadcast scrambling configuration for MCCH with MCCH-RNTI and MTCH with different G-RNTIs can be separately configured or not.

#### Proposal 2.6-1

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

|  |  |
| --- | --- |
| **Company** | **comments** |
| Huawei, HiSilicon | Support |

## Rate matching for MCCH/MTCH

### **Tdoc analysis**

* [R1-2200029, Huawei]
  + ***Proposal 10: Support semi-static rate-matching resource set configuration and rate-matching around LTE CRS for MBS broadcast as component of FG 33-1.***
  + ***Proposal 11: 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.***
  + ***Proposal 12: The RateMatchPattern configured for MBS broadcast is counted into the ones that are configured per serving-cell.***
  + ***Proposal 13: Adopt the following text proposal to TS 38.214:***

**-----------------------------------------Text proposal for TS 38.214 starts------------------------------------------**

5.1.4.1 PDSCH resource mapping with RB symbol level granularity

< Unchanged parts are omitted >

A configured group *rateMatchPatternGroup1* or *rateMatchPatternGroup2* contains alist of indices of *RateMatchPattern(s)* forming a union of resource-sets not available for a PDSCH dynamically if a corresponding bit of the '*Rate matching indicator*' field of the DCI format 1\_1 scheduling the PDSCH is equal to 1. The REs corresponding to the union of resource-sets configured by *RateMatchPattern(s)* that are not included in either of the two groups are not available for a PDSCH scheduled by a DCI format 1\_0 or 4\_0 or 4\_1, a PDSCH scheduled by a DCI format 1\_1 or 4\_2, and PDSCHs with SPS. When receiving a PDSCH scheduled by a DCI format 1\_0 or PDSCHs with SPS activated by a DCI format 1\_0 or 4\_1, the REs corresponding to configured resources in *rateMatchPatternGroup1* or *rateMatchPatternGroup2* are not available for the scheduled PDSCH or the activated PDSCHs with SPS. When receiving PDSCHs with SPS activated by a DCI format 1\_1 or 4\_2, the REs corresponding to configured resources in *rateMatchPatternGroup1* or *rateMatchPatternGroup2* are not available for the PDSCHs with SPS if a corresponding bit of the Rate matching indicator field of the DCI format 1\_1 or 4\_2 activating the PDSCHs with SPS is equal to 1.

< Unchanged parts are omitted >

**-----------------------------------------Text proposal for TS 38.214 ends------------------------------------------**

* [R1-2200667, Ericsson]
  + ***Proposal 4: For UEs in all RRC states receiving broadcast, the UE may be configured with ZP-CSI-RS.***
    - ***Configuration is up to RAN2***
    - ***Update broadcast configuration parameters with ZP-CSI-RS and send LS to RAN2***
    - ***FFS: inclusion of ZP-CSI-RS triggers in broadcast DCI***

### **1st round FL proposals**

FL would like to collect the views on the following questions before going into details for broadcast PDSCH rate matching:

#### Question 2.7-1

* **Whether to support RateMatchingPattern configuration for broadcast PDSCH rate matching.**

#### Question 2.7-2

* **Whether to support ZP CSI-RS configuration for broadcast PDSCH rate matching.**

|  |  |
| --- | --- |
| **Company** | **comments** |
| Huawei, HiSilicon | As discussed previously, HW proposed to agree RateMatchingPattern is supported to be configured for broadcast as that for multicast/unicast in PDSCH-config. The only comment seemed no need to have an explicit agreement because no need to discuss the parameters one-by-one that are included in PDSCH-config and they should be configurable in general to broadcast as well.  **Therefore, we disagree the discussion starts again from checking whether to support, but instead to discuss a list of parameters that are needed for broadcast.**  As discussed in HW paper R1-2200646, we see the following parameters are needed for broadcast:   * + - ***dataScramblingIdentityPDSCH***     - ***PDSCH-TimeDomainResourceAllocationList***     - ***pdsch-AggregationFactor (per G-RNTI)***     - ***rateMatchPatternToAddModList***     - ***mcs-Table***     - ***xOverhead***   The RRC parameters need to update to list all these parameters clearly to RAN2 because RAN2 tend to create a new parameter signaling structure for broadcast PDSCH, instead of directly referring to the PDSCH-config configured for unicast. |
|  |  |

## Proposed TPs for TS38.214

### **Tdoc analysis**

#### pdsch-Config-MTCH

* [R1-2200096, vivo]
  + The IE *pdsch-Config-Broadcast* used in 38.214 shall be updated to *pdsch-Config-MTCH* according to the separation of *pdsch-Config-MCCH* and *pdsch-Config-MTCH.*

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| --- |
| TP for TS38.214 in [R1-2200096, vivo]  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. |

#### Resource allocation type

* [R1-2200245, DOCOMO]
  + ***Proposal 1: Adopt the following text proposal in TS 38.214 Section 5.1.2.2 to clarify the resource allocation type for broadcast.***

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| --- |
| TP for TS38.214 in [R1-2200245, DOCOMO]  ----------------------------------- **Start of Text proposal to 5.1.2.2 of 38.214** ------------------------------------------------  5.1.2.2 Resource allocation in frequency domain  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 or DCI format 4\_0, then downlink resource allocation type 1 is used.  <Unchanged text omitted>  ----------------------------------- **End of Text proposal to 5.1.2.2 of 38.214** ------------------------------------------------ |

#### PRB bunding

* [R1-2200245, DOCOMO]
  + ***Proposal 2: Adopt the following text proposal in TS 38.214 Section 5.1.2.3 to clarify the PRB bundling procedure for broadcast.***

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| --- |
| TP for TS38.214 in [R1-2200245, DOCOMO]  ----------------------------------- **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** ------------------------------------------------ |

#### MCS

* [R1-2200096, vivo]
  + The description on MCS for broadcast should be provided in 38.214***.***

|  |
| --- |
| TP for TS38.214 in [R1-2200096, vivo]  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 (*R*) 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 (*R*) 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  - 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. |

#### DMRS

* [R1-2200245, DOCOMO]
  + ***Proposal 3: Adopt the following text proposal in TS 38.214 Section 5.1.6.2 to clarify the DM-RS reception procedure for broadcast.***

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| --- |
| TP for TS38.214 in [R1-2200245, DOCOMO]  ----------------------------------- **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** ------------------------------------------------ |

* [R1-2200308, Qualcomm] discussed the DMRS for broadcast and multicast in case of RRC\_CONNECTED UEs.
  + **Proposal 3: For DMRS of GC-PDSCH,**
    - **PDSCH processing capability 2 is not applied to PDSCH scheduled by PDCCH with DCI format 4\_0/4\_1/4\_2.**
    - **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.**
      * **Agree on TP#4 for TS38.214.**
* [R1-2200029, Huawei]
  + ***Proposal 14: Receiving PDSCH scheduled by DCI format 4\_0 for MBS broadcast (and 4\_1 for multicast), the UE shall assume that the PDSCH is not present in any symbol carrying DM-RS with additional exception and restriction as specified in DM-RS reception procedure in TS 38.214 for*** ***receiving PDSCH scheduled by DCI format 1\_0.***
  + ***Proposal 15: Adopt the following text proposal to TS 38.214:***

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| --- |
| TP for TS38.214 in [R1-2200029, Huawei]  **-----------------------------------------Text proposal for TS 38.214 starts------------------------------------------**  5.1.6.2 DM-RS reception procedure  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*.  When receiving PDSCH scheduled by DCI format 1\_0 or 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  - 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 or 4\_2 by PDCCH with CRC scrambled by C-RNTI, MCS-C-RNTI, or 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].  For the UE-specific reference signals generation as defined in Clause 7.4.1.1 of [4, TS 38.211], a UE can be configured by higher layers with one or two scrambling identity(s), *i* = 0,1 which are the same for both PDSCH mapping Type A and Type B.  A UE may be scheduled with a number of DM-RS ports by the antenna port index in DCI format 1\_1 as described in Clause 7.3.1.2 of [5, TS 38.212].  < Unchanged parts are omitted >  When receiving PDSCH scheduled by DCI format 1\_0 or 4\_0 or 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 parts are omitted >  **-----------------------------------------Text proposal for TS 38.214 ends------------------------------------------** |

### **1st round FL proposals**

For DMRS, we focus on the part related with DCI format 4\_0. The proposal related with DCI format 4\_1/4\_2 will be treated in 8.12.1.

#### Proposal 2.8-1

* **Adopt TP-2.8.1 for Sect. 5.1.2.1 of TS 38.214.**

|  |
| --- |
| TP-2.8-1 for TS38.214  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. |

#### Proposal 2.8-2

* **Adopt TP-2.8.2 for Sect. 5.1.2.2 of TS 38.214.**

|  |
| --- |
| TP-2.8-2 for TS38.214  ----------------------------------- **Start of Text proposal to 5.1.2.2 of 38.214** ------------------------------------------------  5.1.2.2 Resource allocation in frequency domain  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 or DCI format 4\_0, then downlink resource allocation type 1 is used.  <Unchanged text omitted>  ----------------------------------- **End of Text proposal to 5.1.2.2 of 38.214** ------------------------------------------------ |

#### Proposal 2.8-3

* **Adopt TP-2.8-3 for Sect. 5.1.2.3 of TS 38.214.**

|  |
| --- |
| TP-2.8-3 for TS38.214  ----------------------------------- **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** ------------------------------------------------ |

#### Proposal 2.8-4

* **Adopt TP-2.8-4 for Sect. 5.1.3.1 of TS 38.214.**

|  |
| --- |
| TP-2.8-4 for TS38.214  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 (*R*) 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 (*R*) 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 (*R*) used in the physical downlink shared channel. |

#### Proposal 2.8-5

* **Adopt TP-2.8-5 for Sect. 5.1.6.2 of TS 38.214.**

|  |
| --- |
| TP-2.8-5 for TS38.214  ----------------------------------- **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** ------------------------------------------------ |

## Proposed TPs for TS38.213

### **Tdoc Analysis**

#### CFR-Config-MCCH-MTCH

[R1-2200096, vivo], [R1-220119, ZTE], [R1-2200598, CMCC], [R1-2200388, Intel] suggest deleting the duplicated part about cfr-Config-Broadcast. In addition, [R1-2200388, Intel] suggests capturing “PDDCH-Config and PDSCH-Config for MTCH can be provided by MCCH and if not provided is the same as that provided in *cfr-Config-MCCH-MTCH.*” FL proposed to merge the TPs for the CFR-Config-MCCH-MTCH in Sect. 18 of TS38.213.

|  |
| --- |
| TP for TS 38.213 in [R1-2200096, vivo] 18 Multicast Broadcast Services \*\*\* Unchanged text is omitted \*\*\*  A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH.  In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331]. |

|  |
| --- |
| TP for TS 38.213 in[R1-2200388, Intel] 18 Multicast Broadcast Services \*\*\* Unchanged text is omitted \*\*\*  A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; If *cfr-Config-MCCH-MTCH* does not contain *locationAndBandwidth-Broadcast,* the MBS frequency resource is the initial DL BWP configured by SIB-1. If initial DL BWP is not configured by SIB-1, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. MCCH can provide the PDCCH-Config-MTCH and PDSCH-Config-MTCH for MTCH reception; if not provided by MCCH, the MTCH reception uses the PDCCH-Config-MCCH and PDSCH-Config-MCCH provided by *cfr-Config-MCCH-MTCH in SIBx.*  In clauses referring to a higher layer parameter value provided by *PDCCH-ConfigCommon* or *PDSCH-ConfigCommon*, when applicable a corresponding higher layer parameter value for MCCH/MTCH PDCCH receptions or PDSCH receptions, respectively, is provided as described in [12, TS 38.331].  ~~A UE can be configured by~~ *~~cfr-Config-Broadcast~~*~~, an MBS frequency resource within the initial DL BWP for PDCCH and PDSCH receptions [4, TS 38.211]. If~~ *~~cfr-Config- Broadcast~~* ~~does not include~~ *~~locationAndBandwidth-Broadcast~~*~~, the MBS frequency resource is the initial DL BWP. A UE monitors PDCCH for scheduling PDSCH receptions for MCCH or MTCH as described in clause 10.1.~~ |

#### PDCCH-Config-MTCH

* [R1-2200598, CMCC], [R1-2200308, Qualcomm] suggested to correct the typo of “*pdcch-Config-MTCH*”.
* [R1-2200119, ZTE] suggests to delete *“* ~~or~~ *~~pdcch-Config-MCCH~~”.*
* It seems *pdcch-Config-MTCH* is needed here for a DCI format with CRC scrambled by a G-RNTI for MTCH

|  |
| --- |
| TP for TS 38.213 in [R1-2200598, CMCC], [R1-2200308, Qualcomm]  **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 *pdcch-Config-MCCH or pdcch-Config-MTCH* is not provided, for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI, on the primary cell of the MCG  ---------------------------- Other parts are omitted. ---------------------------- |

|  |
| --- |
| TP for TS 38.213 in [R1-2200119, ZTE]  **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 *pdcch-Config-MCCH* is not provided, for a DCI format with CRC scrambled by a MCCH-RNTI or a G-RNTI, on the primary cell of the MCG  ---------------------------- Other parts are omitted. ---------------------------- |

#### Broadcast CFR monitoring in active BWP for RRC\_CONNECTED UEs

* [R1-2200665, Ericsson]
  + **Proposal 1: For UEs in RRC CONNECTED, the CFRs for multicast and broadcast may be independently configured, i.e. could use arbitrary different frequency resources, within the active BWP.**
  + **Proposal 3: UEs in RRC CONNECTED are expected to receive unicast within the active BWP, in parallel with multicast and broadcast, on independent CFRs within the active BWP, based on UE capabilities.**
  + **Proposal 4: For broadcast services, where the UE has sent an MII, broadcast is counted as multicast in the number of supported multicast PDSCHs, without increasing the total number of supported PDSCHs.**
  + **Observation 1: For broadcast services to UEs in RRC CONNECTED, where the UE has not sent an MII, broadcast reception is best effort.**
* [R1-2200029, Huawei]
  + ***Proposal 7: If the active DL BWP and the CFR have same SCS and same CP length and the active DL BWP includes all RBs of the CFR configured for broadcast, UE monitors PDCCH candidates for Type0/0B-PDCCH CSS set on UE’s active DL BWP.***
  + ***Proposal 8: Adopt the following proposal to TS 38.213:***

|  |
| --- |
| TP for TS 38.213 in [R1-2200029, Huawei]  ***----------------------------------------------------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 >  If a UE is not provided *pagingSearchSpace* for Type2-PDCCH CSS set, the UE does not monitor PDCCH for Type2-PDCCH CSS set on the DL BWP. The CCE aggregation levels and the number of PDCCH candidates per CCE aggregation level for Type2-PDCCH CSS set are given in Table 10.1-1.  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 not provided *searchSpace* for Type0B-PDCCH CSS set, the UE does not monitor PDCCH for Type0B-PDCCH CSS set on the DL BWP. The CCE aggregation levels and the number of PDCCH candidates per CCE aggregation level for Type0B-PDCCH CSS set are given in Table 10.1-1.  < Unchanged parts are omitted >  ***----------------------------------------------------Text proposal ends-----------------------------------------------*** |

### **1st round FL proposals**

#### Proposal 2.9-1

* **Adopt TP-2.9-1 for Sect. 18 of TS 38.213.**

|  |
| --- |
| **TP-2.9-1 for TS 38.213** 18 Multicast Broadcast Services \*\*\* Unchanged text is omitted \*\*\*  A UE can be configured by *cfr-Config-MCCH-MTCH* an MBS frequency resource for PDCCH and PDSCH receptions providing MCCH and MTCH [12, TS 38.331]; otherwise, the MBS frequency resource is same as for the CORESET with index 0 that is associated with the Type0-PDCCH CSS set for PDCCH and PDSCH receptions providing MCCH and MTCH. MCCH can provide the *PDCCH-Config-MTCH* and *PDSCH-Config-MTCH* for MTCH reception; if not provided by MCCH, the MTCH reception uses the *PDCCH-Config-MCCH* and *PDSCH-Config-MCCH* provided by *cfr-Config-MCCH-MTCH in SIBx.*  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]. |

#### Proposal 2.9-2

* **Adopt TP-2.9-2 for Sect. 10 of TS 38.213.**

|  |
| --- |
| **TP-2.9-2 for TS 38.213**  **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 *pdcch-Config-MCCH or 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. ---------------------------- |

#### Proposal 2.9-3

* ***If the active DL BWP and the CFR have same SCS and same CP length and the active DL BWP includes all RBs of the CFR configured for broadcast, UE monitors PDCCH candidates for Type0/0B-PDCCH CSS set on UE’s active DL BWP.***
  + **Adopt TP-2.9-3 for TS 38.213.**

|  |
| --- |
| **TP-2.9-3 for TS 38.213**  ***----------------------------------------------------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 >  If a UE is not provided *pagingSearchSpace* for Type2-PDCCH CSS set, the UE does not monitor PDCCH for Type2-PDCCH CSS set on the DL BWP. The CCE aggregation levels and the number of PDCCH candidates per CCE aggregation level for Type2-PDCCH CSS set are given in Table 10.1-1.  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 not provided *searchSpace* for Type0B-PDCCH CSS set, the UE does not monitor PDCCH for Type0B-PDCCH CSS set on the DL BWP. The CCE aggregation levels and the number of PDCCH candidates per CCE aggregation level for Type0B-PDCCH CSS set are given in Table 10.1-1.  < Unchanged parts are omitted >  ***----------------------------------------------------Text proposal ends-----------------------------------------------*** |

|  |  |
| --- | --- |
| **Company** | **comments** |
| Huawei, HiSilicon | All these TPs seem straightforward, we support all in principle. |
| CMCC | Support in principle. |

## Proposed TPs for TS38.212

### **Tdoc analysis**

#### LBRM table

* [R1-220119, ZTE]
  + ***Proposal 5****: Adopt the following TP for Section 5.4.2.1 of TS38.212.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TP for TS38.212 in [R1-220119, ZTE]  **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. ---------------------------- |

#### FDRA and RB numbering for DCI format 4\_0

* [R1-2200473, Lenovo] proposed to add **“** is size of common frequency resource for broadcast” for the FDRA field in DCI format 4\_0. However, it seems unnecessary change and may cause more confusion (per FL’s understanding)
* [R1-2200452, Xiaomi]
  + **Proposal 8: For MCCH and MTCH scheduled with the first DCI format, RB numbering starts from the lowest RB of the CFR.**

Agreement:

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

As pointed out by Xiaomi, there is no description on for DCI format 4\_0 in clause 7.3.1.0. The the determination of needs to be specified in 7.3.1.5.1.

|  |  |
| --- | --- |
| TP for TS38.212 in [R1-2200452, Xiaomi]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 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> |  |

### **1st round FL proposals**

#### Proposal 2.10-1

* **Adopt TP-2.10-1 for Sect. 5.4.2.1 of TS 38.212.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TP-2.10-1 for TS38.212**  **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. ---------------------------- |

#### Proposal 2.10-2

* **Adopt TP-2.10-2 for Sect. 5.4.2.1 of TS 38.212.**

|  |  |
| --- | --- |
| TP-2.10-2 for TS38.2127.3.1.5.1 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> |  |

#### Proposal 2.10-3

* **For MCCH and MTCH scheduled with DCI format 4\_0, RB numbering starts from the lowest RB of the CFR**

|  |  |
| --- | --- |
| **Company** | **comments** |
| Lenovo, Motorola Mobility | 2.10-1: Support  2.10-2: Support  2.10-3: Support |
| Huawei, HiSilicon | We just wonder how the proposal 2.10-3 will affect 38.212 because there is no TP to show where needs to be updated in 38.212. |

## Proposed TPs for TS38.211

### **Tdoc analysis**

#### NZP CSI-RS not applied for broadcast

* [R1-220119, ZTE]
  + ***Proposal 4****: Adopt the following TP for Section 7.3.1.51 of TS38.211.*

|  |
| --- |
| **TP-2.13-1 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. ---------------------------- |

### **1st round FL proposals**

#### Proposal 2.11-1

* **Adopt TP-2.11-1 for Sect. 7.3.1.5 of TS 38.211.**

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

|  |  |
| --- | --- |
| **Company** | **comments** |
| Huawei, HiSilicon | Ok with this change, because the rate matching will be reflected in the following bullet:   * not declared as 'not available for PDSCH according to clause 5.1.4 of [6, TS 38.214]. |

## Other issues for broadcast

FL suggests deprioritizing the discussion in 2.12 due to no consensus or being subject to RAN2 discussion.

### **HARQ feedback for broadcast**

* [R1-2200352, OPPO]

1. ***It is proposed for RRC idle and inactive state UEs to provide HARQ feedback in order to meet reliability requirement of MBS application/service.***

* ***Only NACK feedback is needed since the number of RRC idle and inactive state UEs may not be accurately known by the network.***

1. ***To support “only NACK” HARQ feedback for idle and inactive UEs, it should be further consider using PUCCH or PRACH.***

* [R1-2200452, Xiaomi]
  + **Proposal 4: For broadcast reception with UEs in RRC\_IDLE/INACTIVE states, do not support HARQ feedback for GC- PDSCH carrying MCCH/MTCH.**
* [R1-2200473, Lenovo]
  + ***Proposal 8: For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, HARQ-ACK feedback is not supported.***

Based on the companies’ views, there is no consensus on supporting HARQ-ACK feedback for RRC\_IDLE/INACTIVE UEs.

* Whether to support HARQ-ACK feedback for RRC\_IDLE/INACTIVE UEs
  + Yes: OPPO
  + No: Xiaomi, Lenovo

### **Broadcast CFR configuration (related with Case E)**

* [R1-220119, ZTE]
  + ***Proposal 1****: Regarding the CFR Case E issue, RAN1 waits for RAN2’s discussion outcome and provides information for RAN2 if needed.*
* [R1-220159, Nokia]
  + **Observation-1: Based on the outcome of RAN#94, Case E (CFR for UEs in RRC\_IDLE/INACTIVE state can be larger than the SIB1 configured initial BWP) is supported, under the assumption that this is done by RAN2 with zero RAN1 impact.**
  + **Proposal-1: The configured/defined CFR for broadcast reception should be considered as a new BWP (in addition to the CORESET#0 initial BWP) for UEs in RRC\_IDLE/INACTIVE state.**
  + **Proposal-2: From network point of view, the broadcast MTCH CFR can be configured per G-RNTI or G-CS-RNTI, where there can be multiple broadcast MTCH CFRs configured by gNB, i.e. a broadcast MTCH traffic with low data rate associated with the narrow CORESET#0 initial BWP, and other MTCH(s) traffic with high data rate associated with the configured/defined larger CFR/BWP.**
  + **Proposal-3: CFR/BWP for MCCH and MTCH can be configured differently for broadcast reception, i.e. MCCH associated with the CORESET#0 initial BWP and MTCH associated with the configured/defined CFR/BWP.**
  + **Proposal-4: The above Proposal-2 and Proposal-3 have been intensely discussed in RAN1-107-e meeting with no agreement being reached in the end. In the meanwhile, there were no key RAN1 impacts have been identified. It is therefore proposed with LS to RAN2 for further discussions in RAN2.**
* [R1-2200667, Ericsson]

1. Whether a broadcast BWP is defined for Case E does not have any technical implications, which means that it does not need to be defined from a technical perspective. Whether it is anyway part of the technical specification can be left to the editor, considering specification consistency.
2. Whether a configured BWP should be defined to support a Case E CFR does not require further RAN1 agreements but can be left to the editor.
3. Include support for Case E in the RAN1 list of agreements for Rel-17 MBS
4. RAN1 to inform RAN2 about the agreement of Case E and associated required configurations.

* [R1-2200215, Samsung]
  + **Proposal 1: The MBS-BWP uses the same SCS and CP length as the initial BWP, and also includes all the PRBs belonging to the initial BWP.**
* [R1-2200452, Xiaomi]
  + **Proposal 1: The SIB-1 configured initial BWP for legacy Rel-15/Rel-16 UEs in RRC\_CONNECTED state is applied as initial BWP for Rel-17 MBS capable UEs.**

Based on the companies’ views, no specific RAN1 impact has been identified. The discussion on broadcast CFR will be left to RAN2 discussion.

### **Beam sweeping for MTCH**

* [R1-2200452, Xiaomi]
  + **Proposal 7: The association between the PDCCH monitoring occasions and SSB within the MCCH scheduling window is same as that of MTCH scheduling window.**

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.

* [R1-2200159, Nokia]
  + **Proposal-9: Additional association rules between SSB indexes and UE monitoring occasions other than the rule defined for OSI in TS 38.331, i.e. evenly distribute the number of SSB beams among each window duration, and/or enabling the network to control the number of repetition transmission for each SSB beam within the on-duration window.**

Based on the following conclusion, the discussion of MTCH scheduling window will be left to RAN2.

**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

### **SPS for MTCH**

* [R1-2200159, Nokia]
  + **Proposal-5: The mechanism of SPS without DCI activation/deactivation can be considered for broadcast reception, and further specified by RAN2, if there is no key RAN1 impact being identified.**
* [R1-220352, OPPO]
  + **Proposal 1: SPS for MTCH in broadcast can be considered in the future release of NR MBS.**
* [R1-2200452, Xiaomi]
  + **Proposal 6: For broadcast reception with UEs in RRC\_IDLE/INACTIVE states, support SPS GC-PDSCH carrying MTCH.**
* [R1-2200580, LGE]
  + **Proposal 4: For reliable group common SPS activation/deactivation for broadcast, (de)activation DCI can be repeated in association with same/different SSB indexes in a window, as previously agreed for mapping between MO and SSB.**
  + **Proposal 5: For activation DCI with G-CS-RNTI for a group common SPS configuration, G-CS-RNTI indicates a broadcast service associated with the SPS configuration, as agreed for multicast.**

Based on companies’ views, there is no consensus on supporting SPS broadcast MTCH in Rel-17 MBS.

* Whether to support SPS for MTCH in Rel-17 MBS.
  + Yes: Nokia, LGE, Xiaomi
    - Alt1: SPS without DCI (de)activation: Nokia
    - Alt2: SPS with repeated DCI (de)activation): LGE
  + No: OPPO, QC

# Proposals for Discussion at GTW sessions

Proposals for potential discussion at the different GTW scheduled for NR MBS at RAN1#107b-e:

## GTW on Jan. 20

# References

**Relevant tdocs from AI 8.12.3**

|  |  |  |
| --- | --- | --- |
| [**R1-2200029**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200029.zip) | Discussion on UE receiving broadcast in RRC IDLE/INACTIVE state | Huawei, HiSilicon, CBN |
| [**R1-2200096**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200096.zip) | Remaining issues on basic functions for broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE UEs | vivo |
| [**R1-2200119**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200119.zip) | Discussion on basic Functions for Broadcast or Multicast for RRC\_IDLE or RRC\_INACTIVE UEs | ZTE |
| [**R1-2200159**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200159.zip) | Remaining Issues on Broadcast / Multicast for RRC\_IDLE / RRC\_INACTIVE Ues | Nokia, Nokia Shanghai Bell |
| [**R1-2200215**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200215.zip) | Remaining issues on broadcast/multicast for RRC\_IDLE/RRC\_INACTIVE Ues | Samsung |
| [**R1-2200245**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200245.zip) | Remaining issues on basic functions for broadcast | NTT DOCOMO, INC. |
| [**R1-2200310**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200310.zip) | Maintenance on group scheduling for Broadcast RRC\_IDLE-INACTIVE UEs | Qualcomm Incorporated |
| [**R1-2200352**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200352.zip) | Discussion on remaining issues of basic functions for RRC\_IDLE/RRC\_INACTIVE UEs | OPPO |
| [**R1-2200388**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200388.zip) | Broadcast for RRC\_IDLE/INACTIVE UEs | Intel Corporation |
| [**R1-2200429**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200429.zip) | Discussion on MBS for RRC\_IDLE and RRC\_INACTIVE UEs | Apple |
| [**R1-2200452**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200452.zip) | Discussion on basic functions for broadcastmulticast for RRC\_IDLERRC\_INACTIVE UEs | xiaomi |
| [**R1-2200473**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200473.zip) | Basic functions for broadcast/multicast in idle/inactive states | Lenovo, Motorola Mobility |
| [**R1-2200527**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200527.zip) | Discussion on basic functions for broadcast mode | TD Tech, Chengdu TD Tech |
| [**R1-2200551**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200551.zip) | Remaing issues on MBS broadcast reception for RRC\_IDLE and INACTIVE UEs | MediaTek Inc. |
| [**R1-2200580**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200580.zip) | Basic function for broadcast/multicast | LG Electronics |
| [**R1-2200598**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200598.zip) | Remaining issues on NR MBS in RRC\_IDLE RRC\_INACTIVE states | CMCC |
| [**R1-2200667**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_107b-e/Docs/R1-2200667.zip) | Support for NR broadcast reception in RRC Inactive/Idle | Ericsson |

# Annex A: Agreements in previous RAN1 meetings

## RAN1#103-e agreements

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

* FFS details

Agreements:

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

Agreements: For RRC\_IDLE/RRC\_INACTIVE UEs, define/configure common frequency resource(s) for group-common PDCCH/PDSCH.

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

Agreements: From physical layer perspective, for broadcast reception, the same group-common PDCCH and the corresponding scheduled group-common PDSCH can be received by both RRC\_IDLE/RRC\_INACTIVE UEs and RRC\_CONNECTED UEs.

* FFS details.

Agreements: For RRC\_IDLE/RRC\_INACTIVE UEs, CSS is supported for group-common PDCCH.

* FFS: reuse current CSS type, define a new CSS type, etc.
* FFS other details.

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

* FFS: configuration details of the CORESET for group-common PDCCH/PDSCH

## RAN1#104-e agreements

Agreement:

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

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

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, the UE may assume that group-common PDCCH/PDSCH is QCL’d with SSB.

* It is up to UE implementation whether UE monitors monitoring occasions corresponding to all SSB indexes or monitoring occasions corresponding to a subset of all SSB indexes.
* FFS: association rules between SSB indexes and UE monitoring occasions.
* FFS: group-common PDCCH/PDSCH is QCl’d with TRS if configured

Agreement:

For broadcast reception, the same group-common PDCCH and the corresponding scheduled group-common PDSCH can be received by both RRC\_IDLE/RRC\_INACTIVE UEs and RRC\_CONNECTED UEs when UE-specific active BWP of RRC\_CONNECTED UE contains the common frequency resource of RRC\_IDLE/INACTIVE UEs and the SCS and CP are the same.

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

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, further study the following cases of a configured/defined specific common frequency resource (CFR) for group-common PDCCH/PDSCH, and identify which case(s) will be supported:

* [Case E] the case where a CFR is defined based on a configured BWP.
  + In particular, study the following:
    - whether a configured BWP for MBS is needed or not.
    - whether BWP switching is needed or not.
  + In this study, the configured BWP has the following properties:
    - The configured BWP is different than the initial BWP where the frequency resources of this initial BWP are configured smaller than the full carrier bandwidth.
    - The CFR has the frequency resources identical to the configured BWP.
    - The configured BWP needs to fully contain the initial BWP in frequency domain and has the same SCS and CP as the initial BWP.
  + Note: The configured BWP is not larger than the carrier bandwidth
* the case where the initial BWP fully contains the CFR in the frequency domain.
  + In this study the following sub-cases are considered:
    - [Case B] A CFR with smaller size than the initial BWP, where the initial BWP has the same frequency resources as CORESET0. In this case the CFR has the frequency resources confined within the initial BWP and have the same SCS and CP as the initial BWP.
    - [Case D] A CFR with smaller size than the initial BWP, where the initial BWP has the frequency resources configured by SIB1. In this case the CFR has the frequency resources confined within the initial BWP and have the same SCS and CP as the initial BWP.
  + In particular, study the following:
    - Whether the considered two options with a CFR with smaller size than the initial BWP are needed or not for MBS.
* the case where the initial BWP has same size as the CFR in the frequency domain.
  + In this study the following two sub-cases are considered:
    - [Case A] A CFR with the same size as the initial BWP, where the initial BWP has the same frequency resources as CORESET0. In this case the CFR has the same frequency resources and same SCS and CP as the initial BWP.
    - [Case C] A CFR with same size as the initial BWP, where the initial BWP has the frequency resources configured by SIB1. In this case the CFR has the same frequency resources and same SCS and CP as the initial BWP.
  + In particular, study the following:
    - Whether the considered two options with a CFR with the same size as the initial BWP are needed or not for MBS.

## RAN1#105-e agreements

Agreement:

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

Agreement:

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

* FFS details of FDRA.

Agreement:

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

* RAN2 assumes, in case searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the mapping between PDCCH occasions and SSBs is the same as for SIB1.
* RAN2 assumes that if common search space other than searchSpace#0 is configured for MCCH (if allowed, pending RAN1 decision), the PDCCH monitoring occasions for MCCH message which are not overlapping with UL symbols are sequentially numbered from one in the MCCH transmission window and mapped to SSBs using the similar rule as defined for OSI in TS 38.331.

Agreement:

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

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

Agreement:

For RRC\_IDLE/RRC\_INACTIVE UEs, for broadcast reception, study the following alternatives for MCCH change notification indication due to session start:

* Alt 1: Define a dedicated RNTI to scramble the CRC of a DCI indicating a MCCH change notification;
* Alt 2: Use of a field in a DCI format scheduling a MCCH without a dedicated RNTI for MCCH change notification;

Other solutions are not precluded and it is also not precluded whether to support both Alt1 and Alt2.

Conclusion:

It is up to RAN2 to decide the specific contents of the MCCH change notification, e.g, whether notification only informs about session start, whether or not notification also informs about session modification/stop or whether or not the notification informs about any other information.

Agreement:

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

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

Agreement:

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

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

Agreement:

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

Agreement:

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

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

Agreement:

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

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

## RAN1#106-e agreements

Agreement:

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

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

Conclusion:

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

Agreement:

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

Agreement:

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

Agreement:

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

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

Agreement:

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

Agreement:

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

Agreement:

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

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

Conclusion:

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

Agreement:

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

Agreement:

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

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

## RAN#93-e agreements

Agreement:

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

Agreement (Updated proposal from RAN1#106e):

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

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

## RAN1#106bis-e agreements

Agreement:

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

Agreement:

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

Agreement:

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

* 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.

## RAN1#107-e agreements

Agreement:

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

Working assumption:

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

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

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

Final LS is endorsed in R1-2112646

Agreement:

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

**Conclusion**

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

**Agreement**

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

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

**Working assumption**

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

* is the size of CORESET 0if CORESET 0 is configured for the cell; and the size of initial DL bandwidth part if CORESET 0 is not configured for the cell.
* If the size of CFR (i.e.)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