**3GPP TSG RAN WG1 #110 R1-2207704**

**Toulouse, France, August 22nd – 26th, 2022**

**Agenda item:** 8.16.4

**Source:** Moderator (NTT DOCOMO, INC.)

**Title:** Summary on UE features for NR MBS

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes contributions submitted to AI 8.16.4 regarding UE features for NR MBS and captures company views based on the announcement in the following email thread.

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| [110-R17-UE\_features\_1] To be used for sharing updates on online/offline schedule, details on what is to be discussed in online/offline sessions, tdoc number of the moderator summary for online session, etc – Hiroki (DOCOMO)   * eIIoT & URLLC, RedCap, UE power saving, coverage enhancement, NB-IoT & eMTC, sidelink, MBS, 5G terrestrial broadcast, UL TX switching, SDT |

Based on the latest RAN1 UE features list in [1] and contributions in AI 8.16.4, the issues to be discussed are tagged and colour coded with High priority or Low priority based on potential RAN2 spec impact (including description update in TS38.306).

# **Discussion**

## **2.1 33-1: Broadcast**

In [1], FG 33-1 is captured as below.

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| 33. NR\_MBS | 33-1 | Broadcast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by MCCH-RNTI.  2. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI.  3. Support of CFR configuration for broadcast.  4. Support of CORESET and common search space for broadcast.  5. Support of DCI format 1\_0 with CRC scrambled with G-RNTI/MCCH-RNTI for broadcast.  6. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  7. Support MCCH change notification indication via DCI.  8. support of higher layer configured slot-level repetition up to 8 for MTCH |  | Up to RAN2 |  |  | Up to RAN2 | Up to RAN2 | Up to RAN2 |  | It is up to RAN2 whether/how to introduce the capability for support of N > 1 G-RNTIs for broadcast for a UE | Up to RAN2 |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | Since DCI format 4\_0 is defined in TS 38.212 for scheduling broadcast, DCI format 1\_0 in the 3rd component needs to be updated to DCI format 4\_0.  MBS broadcast includes MCCH and MTCH, both of which will be scheduled by G-RNTI. The 6th component needs to clarify that group-common PDSCH including MCCH and MTCH will be TDM-ed or either one will be TDM-ed with unicast in different slots.  It was proposed to have two additional components to be included in FG33-1 regarding rate matching   * Support of semi-static rate-matching resource set configuration. * Support of rate-matching around LTE CRS.   It was concerned to directly include such two bullets but instead was suggested to add “A UE supporting FG 33-1 must indicate support of FGs 5-26 and 5-28 for broadcast” in the column of note to clarify the rate matching capabilities are the ones mandatory support in Rel-15. This suggestion can be taken for approval in this meeting.  Overall, the FG33-1 and FG33-1-2 for broadcast can be updated as in the following proposal.  ***Proposal 1: Updating FG33-1 and FG33-1-2 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-1 | Broadcast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by MCCH-RNTI.  2. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI.  3. Support of CFR configuration for broadcast.  4. Support of CORESET and common search space for broadcast.  5. Support of DCI format 4\_0 with CRC scrambled with G-RNTI/MCCH-RNTI for broadcast.  6. Support of inter-slot TDM between unicast PDSCH and MCCH group-common PDSCH or MTCH group-common PDSCH, or between MCCH group-common PDSCH and MTCH group-common PDSCH, or among unicast PDSCH and MCCH group-common PDSCH and MTCH group-common PDSCH in different slots.  7. Support MCCH change notification indication via DCI.  8. support of higher layer configured slot-level repetition up to 8 for MTCH. |  | Up to RAN2 |  |  | Up to RAN2 | Up to RAN2 | Up to RAN2 |  | It is up to RAN2 whether/how to introduce the capability for support of N > 1 G-RNTIs for broadcast for a UE.  Note: A UE supporting FG 33-1 must indicate support of FGs 5-26 and 5-28 for broadcast. | Up to RAN2 | |
| [4] | Spreadtrum Communications | In latest 38.212 spec [2], DCI format for broadcast has been captured as DCI format 4\_0, and DCI format for multicast has been captured as DCI format 4\_1 and DCI format 4\_2. In order to align with the current spec, we have the following proposal:  ***Proposal 1***: Revise DCI format to align with 38.212,   * In component 5 of FG 33-1, DCI format 1\_0 is adjusted as DCI format 4\_0; * In component 4 of FG 33-2, DCI format 1\_0 is adjusted as DCI format 4\_1; * In component 1 of FG 33-6-1, DCI format 1\_1 is adjusted as DCI format 4\_2; |
| [6] | Xiaomi | In RAN1#108 e-meeting, the following agreement on how to process MBS broadcast DCI was agreed:   |  | | --- | | **Agreement**  Regarding the number of DCIs that a UE can process in a slot or span, MBS broadcast DCI monitored by the UE is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b for RRC\_CONNECTED UEs. |   The above agreement addresses MBS UE capability related to DCI processing. It should be captured in FG 33-1. We propose to add the following component for FG 33-1 in order to address the newly achieved agreement in main session.   * Broadcast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b.   ***Proposal 1: Add the following component for FG 33-1:***   * ***Broadcast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b.***   We also note that the DCI format 1\_0 and DCI format 1\_1 are used in the feature group related to multicast. Actually the new DCI format used for multicast is already captured in TS38.212, i.e. DCI format 4\_1 and DCI format 4\_2. The DCI format should be aligned between UE feature list and other physical specifications.  ***Proposal 6: Correct the DCI format in the following feature group:***   * ***Replace DCI format 1\_0 with DCI format 4\_0 in FG 33-1*** * ***Replace DCI format 1\_0 with DCI format 4\_1 in FG 33-2*** * ***Replace DCI format 1\_1 with DCI format 4\_2 in FG 33-6-1*** |
| [7] | vivo | For 33-1, higher layer configured slot-level repetition has been agreed for MTCH, and up to 8 repetitions is supported. Considering it is not necessary to support such a flexible number of repetitions from 1 to 8 for MTCH, it is better to support several fixed values, i.e., {2, 4, 8} times repetitions as defined for unicast or multicast.  ***Proposal 1*** For higher layer configured slot-level repetition in FG 33-1, UE supports {2, 4, 8} times repetitions.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** | | 33. NR\_MBS | 33-1 | Broadcast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by MCCH-RNTI.  2. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI.  3. Support of CFR configuration for broadcast.  4. Support of CORESET and common search space for broadcast.  5. Support of DCI format 4\_0 with CRC scrambled with G-RNTI/MCCH-RNTI for broadcast.  6. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  7. Support MCCH change notification indication via DCI.  8. Support {2, 4, 8} times semi-static slot-level repetition for MTCH |  | Up to RAN2 | Up to RAN2 | Up to RAN2 | Up to RAN2 |  | It is up to RAN2 whether/how to introduce the capability for support of N > 1 G-RNTIs for broadcast for a UE | Up to RAN2 | |
| [8] | MediaTek | In the latest approved TS 38.212 spec, the three DCI formats were defined for MBS broadcast and multicast that DCI format 4\_0, DCI format 4\_1, and DCI format 4\_2 correspond to broadcast DCI format, multicast first DCI format and multicast second DCI format, respectively. In order to align the MBS DCI format naming, we suggest the following proposal:  ***Proposal 1: The MBS multicast broadcast DCI format naming in UE feature discussion should be aligned with that of latest approved TS 38.212 spec, i.e., MBS broadcast and multicast DCI format 4\_0, DCI format 4\_1, and DCI format 4\_2 correspond to broadcast DCI format, multicast first DCI format and multicast second DCI format, respectively.***   * ***For broadcast FG 33-1, the description of DCI format 1\_0 shall be replaced by DCI format 4\_0.*** * ***For multicast FG 33-2, the description of DCI format 1\_0 shall be replaced by DCI format 4\_1.***   Considering the concept of group-common PDCCH/PDSCH is used for broadcast and multicast and it only state “group-common PDCCH/PDSCH” in some FG, it may cause some confusing, e.g., which means for broadcast or multicast? Therefore, we want to clarify the concept more clearly with some constrains, e.g., group-common PDCCH/PDSCH for multicast or broadcast, respectively.  ***Proposal 2: For FG component description, clarify the wording of group-common PDCCH/PDSCH more clearly for broadcast and multicast respectively, e.g., group-common PDCCH/PDSCH for multicast or broadcast.***  Regarding the CFR number for broadcast reception, it is no clear motivation to support multiple CFR. We had agreed that the number of CFRs for multicast is no more than one, and the corresponding agreement is copied as following. We suggest the similar mechanism can be reused for broadcast reception since we also have agreed that the CFR frequency for MCCH and MTCH can be configured by SIBx.   |  | | --- | | Agreement:  The number of CFRs for multicast is no more than one per dedicated unicast BWP in Rel-17.  Agreement  For broadcast reception with RRC\_IDLE/RRC\_INACTIVE UEs:   * The CFR frequency resources used for MCCH and MTCH are configured by SIBx; |   ***Proposal 3: For FG 33-1, adding a note that “For component 3, only one CFR frequency resource is supported for broadcast and the CFR frequency resource is configured by SIBx”.***   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-1 | Broadcast | 1. Support of group-common PDCCH/PDSCH for broadcast with CRC scrambled by MCCH-RNTI.  2. Support of group-common PDCCH/PDSCH for broadcast with CRC scrambled by G-RNTI.  3. Support of CFR configuration for broadcast.  4. Support of CORESET and common search space for broadcast.  5. Support of DCI format ~~1\_0~~ 4\_0 with CRC scrambled with G-RNTI/MCCH-RNTI for broadcast.  6. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  7. Support MCCH change notification indication via DCI.  8. support of higher layer configured slot-level repetition up to 8 for MTCH |  | Up to RAN2 |  |  | Up to RAN2 | Up to RAN2 | Up to RAN2 |  | It is up to RAN2 whether/how to introduce the capability for support of N > 1 G-RNTIs for broadcast for a UE  For component 3, only one CFR frequency resource is supported for broadcast and the CFR frequency resource is configured by SIBx | |
| [9] | Qualcomm | We suggest minor changes on FG 33-1 as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-1 | Broadcast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by MCCH-RNTI.  2. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI(s) for MTCH.  3. Support of CFR configuration for broadcast.  4. Support of CORESET and common search space for broadcast.  5. Support of DCI format 4\_0 with CRC scrambled with G-RNTI/MCCH-RNTI for broadcast.  6. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  7. Support MCCH change notification indication via DCI.  8. support of higher layer configured slot-level repetition up to 8 for MTCH  9. support of FDMed MCCH and PBCH |  | Up to RAN2 |  |  | Up to RAN2 | Up to RAN2 | Up to RAN2 |  | It is up to RAN2 whether/how to introduce the capability for support of N > 1 G-RNTIs for broadcast for a UE | Up to RAN2 | | 33. NR\_MBS | 33-1-3 | Dynamic scheduling for broacast for SCell | Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for SCell. | 33-1 | Yes |  |  | Per FSPC | N/A | N/A |  | Note: A UE is not required to receive broadcast on PCell and SCell simultaneously | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-1-1:**

* **Components of FG 33-1 are revised as**
  + **Component 1: Support of group-common PDCCH/PDSCH for broadcast with CRC scrambled by MCCH-RNTI. [8]**
  + **Component 2: Support of group-common PDCCH/PDSCH for broadcast with CRC scrambled by G-RNTI(s) for MTCH. [8, 9]**
  + **Component 6: Support of inter-slot TDM between unicast PDSCH and MCCH group-common PDSCH or MTCH group-common PDSCH, or between MCCH group-common PDSCH and MTCH group-common PDSCH, or among unicast PDSCH and MCCH group-common PDSCH and MTCH group-common PDSCH in different slots [2]**
  + **Component 8: Support {2, 4, 8} times semi-static slot-level repetition for MTCH [7]**
  + **Add a component “Support of FDMed MCCH and PBCH” [9]**

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### **High priority proposal 2-1-2:**

* **Introduce an FG for support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for SCell. [9]**

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### **High priority proposal 2-1-3:**

* **Replace “DCI format 1\_0” by “DCI format 4\_0” in FG 33-1. [2, 4, 6, 7, 8, 9]**

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| Moderator (NTT DOCOMO) | This is like fixing typo and should be reflected in next update. No need discussion. |

### **Low priority proposal 2-1-4:**

* **Add a note that “A UE supporting FG 33-1 must indicate support of FGs 5-26 and 5-28 for broadcast.” [2]**
* **Add a note that “Broadcast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b” [6]**
* **Add a note that “For component 3, only one CFR frequency resource is supported for broadcast and the CFR frequency resource is configured by SIBx” [8]**

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## **2.2 33-1-2: FDM-ed unicast PDSCH and group-common PDSCH for broadcast**

In [1], FG 33-1-2 is captured as below.

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| 33. NR\_MBS | 33-1-2 | FDM-ed unicast PDSCH and group-common PDSCH for broadcast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for broadcast in RRC CONNECTED mode in a slot. | 33-1 | Yes |  |  | FFS | FFS | FFS |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | One new FG33-1-2 was agreed to be separated from FG33-3-2 for FDM-ed unicast PDSCH and group-common PDSCH for broadcast in RRC\_CONNECTED mode in a slot specifically. The reporting granularity for both FG33-1-2 and FG33-3-2 are still open. The support of FDM-ed unicast and multicast/broadcast in the same slot is affected or will affect the capability for the support of CA for unicast, which is also the reason why the support of multicast for SCell is reported per FSPC. Therefore, the report is expected to be per FSPC.  Overall, the FG33-1 and FG33-1-2 for broadcast can be updated as in the following proposal.  ***Proposal 1: Updating FG33-1 and FG33-1-2 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-1-2 | FDM-ed unicast PDSCH and group-common PDSCH for broadcast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for broadcast in RRC CONNECTED mode in a slot. | 33-1 | Yes |  |  | FSPC | NA | NA |  |  | Optional with capability signalling | |
| [5] | OPPO | In RAN1#109-e meeting, the support of FDM between unicast and multicast/broadcast was defined. For the Type of FG 33-1-2, it should be per UE since the FDMed multiplexing including unicast which depends or has impact on UE’s unicast services reception, while some UE may not support to receive unicast and broadcast simultaneously. Regarding the Need of FDD/TDD and FR1/FR2 differentiation, they are both No for this FG.  ***For FG 33-1-2 on the FDM-ed unicast PDSCH and group-common PDSCH for broadcast, the report Type should be Per UE.*** |
| [8] | MediaTek | In the current spec, the multicast and broadcast can be scheduled in different components, e.g., the multicast service is scheduled in PCell with CC#1, and broadcast service is scheduled in the SCell with CC#2. If FDMed case is also scheduled in the two CCs, it will make the UE to process 2 FDMed PDSCH combination in the same slot as illustrated in Figure 1, which will make the UE behaviour more complexity and need more buffer to process the PDSCH combinations. Maybe some companies argue that the UE can report not support one of them, e.g., UE reporting not support FG33-3-2 or FG 33-1-2. However, if UE report only supporting one of them, it may restrict the gNB scheduling, e.g., if UE report does not support multicast FDM FG 33-3-2 and only support the FG 33-1-2, but, in some slot, even if the multicast PDSCH is not scheduled and UE has the capability to process the FDMed PDSCH, the gNB also cannot schedule the FDMed broadcast due to the reporting restriction.    **Figure 1 Two FDMed combination for the MBS in the same slot**  Considering the scheduling flexibility and UE processing capability, we prefer to define a new FG:   |  |  |  |  | | --- | --- | --- | --- | | 33-3-x | **FDM-ed** unicast PDSCH and  group-common PDSCH | 1. Support FDM between **one unicast PDSCH** and **one group-common PDSCH** of a serving cell in RRC CONNECTED mode in a slot. 2. The maximum number of supported FDM between **one unicast PDSCH** and **one group-common PDSCH** across all serving cells in a slot. | Component 2 candidate values: {1,2} |   Alternatively, UE can report the FDMed combination if the reporting type for the DMed case is per FSPC, e.g., UE can report the two combinations {CC#1 support multicast FDMed && CC#2 not support broadcast FDMed} and {CC#1 not support FDMed multicast && CC#2 support FDMed broadcast}, it also can achieve the gNB scheduling flexibility and UE processing capability.  ***Proposal 8: For FDMed unicast PDSCH and group-common PDSCH,***   * **Define a new UE capability as following:**  |  |  |  |  | | --- | --- | --- | --- | | 33-3-x | **FDM-ed** unicast PDSCH and  group-common PDSCH | 1. Support FDM between **one unicast PDSCH** and **one group-common PDSCH** of a serving cell in RRC CONNECTED mode in a slot. 2. The maximum number of supported FDM between **one unicast PDSCH** and **one group-common PDSCH** across all serving cells in a slot. | Component 2 candidate values: {1,2} |   **or the reporting type for the FG 33-1-2 and FG 33-3-2 is per FSPC.** |
| [9] | Qualcomm | We suggest minor changes on FG 33-1 as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-1-2 | FDM-ed unicast PDSCH and group-common PDSCH for broadcast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for broadcast in RRC CONNECTED mode in a slot. | 33-1 | Yes |  |  | per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [10] | Apple | For the reporting granularity of FG33-1-2 FDM-ed unicast PDSCH and group-common PDSCH for broadcast and FG33-3-2 FDM-ed unicast PDSCH and group-common PDSCH for multicast, both sub-features are defined for RRC connected UE. It was agreed if UE supporting MBS reception on Scell, the capability is reported per FSPC. Similarly, FDM reception is not limited to Pcell if CA is supported by UE. Thus, the FDM reception capability can be reported per FSPC as well. otherwise, FDM reception on PCell and Scell need to be defined separately.  **Proposal 1: The report type of FG33-1-2 and FG33-3-2 is per FSPC.** |
| [11] | NTT DOCOMO | The reporting type of FG for support of FDM of unicast PDSCH and multicast PDSCH should be the same as FG for TDM (i.e., per FS).  ***Proposal 7: The reporting type of FG 33-1-2 is per FS.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-1-2 | FDM-ed unicast PDSCH and group-common PDSCH for broadcast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for broadcast in RRC CONNECTED mode in a slot. | 33-1 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-1-2:**   + Since RAN2 has decided on 33-1 as optional without capability signaling, it is not clear how the gNB could take into account the information about 33-1-2. Hence, we propose leaving the FG type up to RAN2 for consistency. |
| [13] | Ericsson | For FG 33-1-2, the support of FDM between unicast and broadcast in RRC connected can be signalled in the same was as for the base multicast component which is per FS.  For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-2-1:**

* **Apply one of the following alternatives for the reporting type of FG 33-1-2** 
  + **Alt.1: Per UE [5]**
  + **Alt.2: Per FS [11, 13]**
  + **Alt.3: Per FSPC [2, 8, 9, 10]**
  + **Alt.4: Up to RAN2 [12]**

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## **2.3 33-2: Dynamic scheduling for multicast for Pcell**

In [1], FG 33-2 is captured as below.

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| 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast for PCell | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for PCell.  2. Support of CFR configuration for multicast.  3. Support of CORESET and common search space configuration for multicast.  4. Support of DCI format 1\_0 with CRC scrambled with G-RNTI for multicast.  5. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  6. Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast | FFS | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | To align with TS 38.212, the DCI format 1\_0 in the 4th component of FG33-2 should be updated to 4\_1 (based on DCI format 1\_0).  It was discussed in the last meeting that whether FG33-1 is the basic feature group for Rel-17 NR MBS and if it is then FG33-1 for broadcast will be the prerequisite FG for any other FGs defined. We clarified that broadcast and multicast are separate FGs demanded in different cases and there are still some differences for developing such two features from UE implementation aspect although the basic feature sets for them are strived to be common. Therefore, for early commercialization, it is preferred to keep FG33-1 and FG33-2 as separate independent FGs.  When considering UE capability for supporting both multicast and broadcast, it would be preferred to describe it in FG for multicast instead of defining additional FG for supporting both. For example, for the 5th component of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots where the group-common PDSCH is intended for multicast, it could be updated to consider broadcast group-common PDSCH as well if UE supports FG33-1.  ***Proposal 2: Updating FG33-2/2d/2e/2h/2i as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast for PCell | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for PCell.  2. Support of CFR configuration for multicast.  3. Support of CORESET and common search space configuration for multicast.  4. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast.  5. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH for multicast, or between group-common PDSCH for multicast and group-common PDSCH for broadcast (if UE supports FG33-1), or among unicast PDSCH and group-common PDSCH for multicast and group-common PDSCH for broadcast (if UE supports FG33-1) in different slots.  6. Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast | ~~FFS~~ | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [3] | ZTE | FG 33-2 is the basic UE feature for multicast and FG 33-1 is the basic UE feature for broadcast. From our perspective, FG 33-1 is more basic feature. It is straightforward that if a UE supports FG 33-2, it also supports FG 33-1.  ***Proposal 1****: The prerequisite of FG33-2 is FG33-1.* |
| [4] | Spreadtrum Communications | In latest 38.212 spec [2], DCI format for broadcast has been captured as DCI format 4\_0, and DCI format for multicast has been captured as DCI format 4\_1 and DCI format 4\_2. In order to align with the current spec, we have the following proposal:  ***Proposal 1***: Revise DCI format to align with 38.212,   * In component 5 of FG 33-1, DCI format 1\_0 is adjusted as DCI format 4\_0; * In component 4 of FG 33-2, DCI format 1\_0 is adjusted as DCI format 4\_1; * In component 1 of FG 33-6-1, DCI format 1\_1 is adjusted as DCI format 4\_2; |
| [6] | Xiaomi | In RAN1#107bis e-meeting, the following agreement on how to processing multicast DCI was agreed:   |  | | --- | | **Agreement**  Regarding the number of DCIs that a UE can process in a slot or span, multicast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b. |   The above agreement addresses MBS UE capability related to DCI processing. It should be captured in FG 33-2. We propose to add the following component for FG 33-2 in order to address the newly achieved agreement in main session.   * Multicast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b.   ***Proposal 2: Add the following component for FG 33-2:***   * ***Multicast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b.***   We also note that the DCI format 1\_0 and DCI format 1\_1 are used in the feature group related to multicast. Actually the new DCI format used for multicast is already captured in TS38.212, i.e. DCI format 4\_1 and DCI format 4\_2. The DCI format should be aligned between UE feature list and other physical specifications.  ***Proposal 6: Correct the DCI format in the following feature group:***   * ***Replace DCI format 1\_0 with DCI format 4\_0 in FG 33-1*** * ***Replace DCI format 1\_0 with DCI format 4\_1 in FG 33-2*** * ***Replace DCI format 1\_1 with DCI format 4\_2 in FG 33-6-1*** |
| [7] | vivo | Considering different UE capabilities are required for supporting broadcast and multicast, UE may support multicast only while not supporting broadcast. Therefore, FG 33-2 should not take 33-1 as a prerequisite FG  ***Proposal 2*** FG 33-2 should not take 33-1 as a prerequisite FG.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast for PCell | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for PCell.  2. Support of CFR configuration for multicast.  3. Support of CORESET and common search space configuration for multicast.  4. Support of DCI format 1\_0 with CRC scrambled with G-RNTI for multicast.  5. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  6. Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast |  | Yes | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [8] | MediaTek | In the latest approved TS 38.212 spec, the three DCI formats were defined for MBS broadcast and multicast that DCI format 4\_0, DCI format 4\_1, and DCI format 4\_2 correspond to broadcast DCI format, multicast first DCI format and multicast second DCI format, respectively. In order to align the MBS DCI format naming, we suggest the following proposal:  ***Proposal 1: The MBS multicast broadcast DCI format naming in UE feature discussion should be aligned with that of latest approved TS 38.212 spec, i.e., MBS broadcast and multicast DCI format 4\_0, DCI format 4\_1, and DCI format 4\_2 correspond to broadcast DCI format, multicast first DCI format and multicast second DCI format, respectively.***   * ***For broadcast FG 33-1, the description of DCI format 1\_0 shall be replaced by DCI format 4\_0.*** * ***For multicast FG 33-2, the description of DCI format 1\_0 shall be replaced by DCI format 4\_1.***   Considering the concept of group-common PDCCH/PDSCH is used for broadcast and multicast and it only state “group-common PDCCH/PDSCH” in some FG, it may cause some confusing, e.g., which means for broadcast or multicast? Therefore, we want to clarify the concept more clearly with some constrains, e.g., group-common PDCCH/PDSCH for multicast or broadcast, respectively.  ***Proposal 2: For FG component description, clarify the wording of group-common PDCCH/PDSCH more clearly for broadcast and multicast respectively, e.g., group-common PDCCH/PDSCH for multicast or broadcast.***  Regarding the CFR number for multicast reception, the following agreement was achieved in previous RAN1 meeting:   |  | | --- | | Agreement:  The number of CFRs for multicast is no more than one per dedicated unicast BWP in Rel-17. |   Thus, we prefer to update the 2nd component based on the latest agreement.  ***Proposal 4: For FG 33-2, adding a note that “for component 2, up to one CFR is supported for multicast reception”.***  Regarding the multicast service reception on SCell, the following agreement was achieved in previous meeting:   |  | | --- | | **Agreement**: If UE supports carrier aggregation for unicast, multicast reception on an activated SCell with self-scheduling is supported subject to UE capability in Rel-17.   * UE is not expected to be configured simultaneously with more than one component carrier for multicast reception. * Cross-carrier scheduling for multicast reception is not supported in Rel-17. * The capability of supporting MBS multicast on SCell is a separate capability from the CA capability for unicast.   + The granularity of UE reporting the capability of supporting MBS multicast reception is per FSPC |   The part of the agreements has been reflected in the updated UE features after RAN1#108-e, however, some descriptions are not clear in [1]. For example, there is not any sentence to reflect this restriction that “UE is not expected to be configured simultaneously with more than one component carrier for multicast reception.” Thus, we suggest adding a note to reflect the agreement for both FG 33-2 and FG 33-2h.  ***Proposal 5: For FG 33-2, adding a note that*** ***“UE is not expected to be configured simultaneously with more than one component carrier for multicast reception”.***   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-2 | Dynamic scheduling for multicast for PCell | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI for PCell. 2. Support of CFR configuration for multicast. 3. Support of CORESET and common search space configuration for multicast. 4. Support of DCI format ~~1\_0~~ 4\_1 with CRC scrambled with G-RNTI for multicast. 5. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH for multicast in different slots. 6. Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast | ~~FFS~~ | Yes |  |  | Per FS | N/A | N/A |  | *Note 1: UE is not expected to be configured simultaneously with more than one component carrier for multicast reception*  *Note2: for component 2, up to one CFR is supported for multicast reception* | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs on FG 33-2 and FG33-2x as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast for PCell | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for PCell.  2. Support of CFR configuration for multicast.  3. Support of CORESET and common search space configuration for multicast.  4. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast.  5. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  6. Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast |  | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | First, DCI format name should be corrected. Second, broadcast reception and multicast reception are different features. For example, for broadcast reception, SIB20 and MCCH must also be received, but they are not necessary for multicast. There is no need to make 33-1 as prerequisite FG for 33-2.  ***Proposal 1: Update FG 33-2 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast for PCell | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for PCell.  2. Support of CFR configuration for multicast.  3. Support of CORESET and common search space configuration for multicast.  4. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast.  5. Support of inter-slot TDM between unicast PDSCH and group-common PDSCH in different slots.  6. Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast |  | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-2:**   + Add 33-1 as pre-requisite, it is unclear why a UE would support multicast but not broadcast. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-3-1:**

* **Apply one of the following alternatives for the prerequisite FG of FG 33-2**
  + **Alt.1: Remove FFS (i.e., FG 33-1 is not a prerequisite FG for FG 33-2) [2, 7, 8, 9, 11]**
  + **Alt.2: Add FG 33-1 as prerequisite [3, 12]**

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### **High priority proposal 2-3-2:**

* **Components of FG 33-2 are revised as**
  + **Component 1: Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI for PCell. [8]**
  + **Component 5: Support of inter-slot TDM between unicast PDSCH and group-common PDSCH for multicast, or between group-common PDSCH for multicast and group-common PDSCH for broadcast (if UE supports FG33-1), or among unicast PDSCH and group-common PDSCH for multicast and group-common PDSCH for broadcast (if UE supports FG33-1) in different slots. [2]**

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### **High priority proposal 2-3-3:**

* **Replace “DCI format 1\_0” by “DCI format 4\_1” in FG 33-2 [2, 4, 6, 8, 9, 11]**

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| Company | Comment |
| Moderator (NTT DOCOMO) | This is like fixing typo and should be reflected in next update. No need discussion. |

### **Low priority proposal 2-3-4:**

* **Add a note that “Multicast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b.” [6]**
* **Add a note that “for component 2, up to one CFR is supported for multicast reception” [8]**
* **Add a note that “UE is not expected to be configured simultaneously with more than one component carrier for multicast reception” [8]**

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## **2.4 33-2b: DCI-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast**

In [1], FG 33-2b is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS |  | 33-2b | DCI-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast | Support of DCI-based enabling/disabling ACK/NACK based HARQ-ACK feedback configured per G-RNTI by RRC signaling | 33-2a | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs on FG 33-2 and FG33-2x as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2b | DCI-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast | Support of DCI-based enabling/disabling ACK/NACK based HARQ-ACK feedback configured per G-RNTI by RRC signaling via DCI format 4\_2 | 33-2a, 33-2f | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-4-1:**

* **Add FG 33-2f as prerequisite FG of FG 33-2b. [9]**

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| Company | Comment |
| Huawei/HiSilicon | ok |
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### **High priority proposal 2-4-2:**

* **Components of FG 33-2b are revised as “Support of DCI-based enabling/disabling ACK/NACK based HARQ-ACK feedback configured per G-RNTI by RRC signaling via DCI format 4\_2”. [9]**

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| Company | Comment |
| Huawei/HiSilicon | ok |
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## **2.5 33-2d: PTP retransmission for multicast**

In [1], FG 33-2d is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast [on the cell same as multicast initial transmission] | 33-2a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | FG33-2d is better to be clarified that it is for dynamic scheduling. Moreover, as component, the retransmission is expected on the same cell as multicast initial transmission.  ***Proposal 2: Updating FG33-2/2d/2e/2h/2i as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast dynamic scheduling | Support of PTP retransmission for multicast ~~[~~on the cell same as multicast initial transmission~~]~~ | 33-2a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [3] | ZTE | Regarding PTP retransmission, it has to be happed in the same cell as the PTM retransmission. Thus, the component of FG 33-2d and FG 33-5-1d can be updated as following.   |  |  |  | | --- | --- | --- | | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast ~~[~~on the cell same as multicast initial transmission~~]~~ |   ***Proposal 2****: For FG 33-2d and FG 33-5-1d, PTP retransmission for SPS multicast is on the cell same as multicast initial transmission.* |
| [5] | OPPO | For FG 33-2d, keeping the initial transmission and its retransmission being scheduling in the same cell can help to maintain the transmissions consistency. When the initial transmission of multicast is scheduled in a cell, its corresponding PTP retransmission should be on the same cell.   1. ***For FG 33-2d, support of PTP retransmission for multicast on the cell same as multicast initial transmission.*** |
| [11] | NTT DOCOMO | Since HARQ retransmissions of PDSCH are performed only in the same cell as the initial transmission, the statement enclosed in brackets is self-explanatory and does not need to be described.  ***Proposal 2: Update FG 33-2d as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast | 33-2a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-5-1:**

* **Apply one of the following alternatives for Component of FG 33-2dRemove the bracket in Components for FG 33-2d, i.e., “on the cell same as multicast initial transmission” is kept.**
  + **Alt.1: Remove the bracket in Components for FG 33-2d, i.e., “on the cell same as multicast initial transmission” is kept [2, 3, 5]**
  + **Alt.2: Remove “on the cell same as multicast initial transmission” [11]**

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### **High priority proposal 2-5-2:**

* **Feature group of FG 33-2d is revised as “PTP retransmission for multicast dynamic scheduling” [2]**

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## **2.6 33-2e: Multiple G-RNTIs for group-common PDSCHs**

In [1], FG 33-2e is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-2e | Multiple G-RNTIs for group-common PDSCHs | Capability on number of G-RNTI for groupcast | [33-2] | Yes |  |  | Per UE | [Yes] | Yes |  | Reporting type of FG 33-2e is per UE with [FDD/TDD,] FR1/FR2, licensed/unlicensed, and TN/NTN differentiation, detail signalling is up to RAN2 | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | FG33-2e is the capability on number of G-RNTI for multicast and FG33-2 is the prerequisite FG.  ***Proposal 2: Updating FG33-2/2d/2e/2h/2i as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2e | Multiple G-RNTIs for group-common PDSCHs | Capability on number of G-RNTI for ~~groupcast~~ multicast | ~~[~~33-2~~]~~ | Yes |  |  | Per UE | [Yes] | Yes |  | Reporting type of FG 33-2e is per UE with [FDD/TDD,] FR1/FR2, licensed/unlicensed, and TN/NTN differentiation, detail signalling is up to RAN2 | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs on FG 33-2 and FG33-2x as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2e | Multiple G-RNTIs for group-common PDSCHs | Capability on number of G-RNTI for multicast | 33-2 | Yes |  |  | Per UE | [Yes] | Yes |  | Reporting type of FG 33-2e is per UE with [FDD/TDD,] FR1/FR2, licensed/unlicensed, and TN/NTN differentiation, detail signalling is up to RAN2 | Optional with capability signalling | |
| [11] | NTT DOCOMO | There will be no problem with making 33-2 a prerequisite FG for 33-2e. Brackets can be removed.  ***Proposal 3: Update FG 33-2e as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2e | Multiple G-RNTIs for group-common PDSCHs | Capability on number of G-RNTI for groupcast | 33-2 | Yes |  |  | Per UE | Yes | Yes |  | Reporting type of FG 33-2e is per UE with FDD/TDD, FR1/FR2, licensed/unlicensed, and TN/NTN differentiation, detail signalling is up to RAN2 | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-6-1:**

* **Prerequisite FG for FG 33-2e is FG 33-2. [2, 9, 11]**

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### **High priority proposal 2-6-2:**

* **Components of FG 33-2e are revised as “Capability on number of G-RNTI for multicast”. [2, 9]**

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## **2.7 33-2h: Dynamic scheduling for multicast for SCell**

In [1], FG 33-2h is captured as below.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-2h | Dynamic scheduling for multicast for SCell | Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for SCell. | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | For FG33-2h, as discussed in [2] that it is expected that FG33-5-1 is supposed to be SPS group-common PDSCH for multicast for PCell that is reported per FS as agreed. With FG33-2 as the prerequisite FG, FG33-2h currently defined as MBS dynamic scheduling for SCell can be modified to include the cases of both dynamic and SPS scheduling for MBS, since, from UE perspective, if a CC is reported to support MBS for SCell then it is supposed to support both dynamic and SPS scheduling. A note can be added to clarify the cases supported with a given prerequisite FG.  ***Proposal 2: Updating FG33-2/2d/2e/2h/2i as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2h | Dynamic or SPS scheduling for multicast for SCell | Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI or G-CS-RNTI for SCell. | 33-2 or 33-5-1 | Yes |  |  | Per FSPC | N/A | N/A |  | Note: with 33-2 or 33-5-1 as prerequisite FG, this FG33-2h includes the cases of supporting multicast dynamic scheduling for SCell, and/or supporting multicast SPS scheduling for SCell. | Optional with capability signalling | |
| [8] | MediaTek | ***Proposal 6: For FG 33-2h, adding a note that “UE is not expected to be configured simultaneously with more than one component carrier for multicast reception”.***  ***Proposal 7: For FG 33-2h, delating the prerequisite feature group description.***   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-2h | Dynamic scheduling for multicast for SCell | Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for SCell. | ~~33-2~~ | Yes |  |  | Per FSPC | N/A | N/A |  | *Note 1:* *UE is not expected to be configured simultaneously with more than one component carrier for multicast reception* | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs on FG 33-2 and FG33-2x as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2h | Dynamic scheduling for multicast for SCell | Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI for SCell. | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  | Note: A UE is not expected to be configured simultaneously with more than one component carrier for multicast reception | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-7-1:**

* **Add support of semi-persistent scheduling for multicast on SCell to FG 33-2h. [2]**
  + **Add FG 33-5-1 as a prerequisite FG for FG 33-2h.**

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### **High priority proposal 2-7-2:**

* **Apply one of the following alternatives for prerequisite FG for FG 33-2h.**
  + **Alt.1: keep FG 33-2 [2, 9]**
  + **Alt.2: delete FG 33-2 [8]**

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### **Low priority proposal 2-7-3:**

* **Add a note that “UE is not expected to be configured simultaneously with more than one component carrier for multicast reception” [8]**

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## **2.8 33-2i: Supported maximal modulation order for multicast PDSCH**

In [1], FG 33-2i is captured as below.

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| 33. NR\_MBS | 33-2i | Supported maximal modulation order for multicast PDSCH | 1. For FR1, up to 1024QAM is supported, candidate values {256QAM, 1024QAM}  2. For FR2, up to 256QAM is supported, candidate values {64QAM, 256QAM}  FFS additional components | FFS | Yes |  | The UE supports the same modulation order as unicast | FFS | FFS | FFS |  | Note: A UE shall support the corresponding mandatory maximum modulation for unicast. | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | Regarding the UE capabilities for the modulation order, the relevant rows from TS 38.306 [4] are as follows:   | ***pdsch-256QAM-FR1***  *Indicates whether the UE supports 256QAM modulation scheme for PDSCH for FR1 as defined in 7.3.1.2 of TS 38.211 [6].*  ***It is mandatory with capability signalling for non-RedCap UEs and optional for RedCap UEs.*** | UE | CY | No | FR1 only | | --- | --- | --- | --- | --- | | ***pdsch-1024QAM-FR1-r17***  Indicates whether the UE supports 1024QAM modulation scheme for PDSCH for FR1 as defined in TS 38.211 [6], MCS and CQI feedback tables based on 1024QAM modulation order as defined in TS 38.214 [12].  UE indicating support of this feature shall also indicate support of *pdsch-256QAM-FR1*. | Band | No | N/A | FR1 only | | ***pdsch-256QAM-FR2***  Indicates whether the UE supports 256QAM modulation scheme for PDSCH for FR2 as defined in 7.3.1.2 of TS 38.211 [6]. | Band | No | N/A | FR2 only | | ***supportedModulationOrderDL***  Indicates the maximum supported modulation order to be applied for downlink in the carrier **in the max data rate calculation** as defined in 4.1.2. **If included, the network may use a modulation order on this serving cell which is higher than the value indicated in this field as long as UE supports the modulation of higher value for downlink**. If not included:  - for FR1, the network uses the modulation order signalled per band i.e. [pdsch-1024QAM-FR1] when [pdsch-1024QAM-FR1] is signalled for the band, otherwise the network uses the modulation order signalled in *pdsch-256QAM-FR1*.  - for FR2, the network uses the modulation order signalled per band i.e. *pdsch-256QAM-FR2* if signalled. If not signalled in a given band, the network shall use the modulation order 64QAM.  In all the cases, it shall be ensured that the data rate does not exceed the max data rate (*DataRate*) and max data rate per CC (*DataRateCC*) according to TS 38.214 [12]. | FSPC | No | N/A | N/A |   It is noted that the ***supportedModulationOrderDL*** report is just applied for the max data rate calculation as defined in 4.1.2 in [4], which can take any one from {bpsk-halfpi, bpsk, qpsk, qam16, qam64, qam256, qam1024}. If the intention is to separate the max data rate calculation from that for unicast, it should be reported per FSPC as legacy for unicast.  ***Proposal 2: Updating FG33-2/2d/2e/2h/2i as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2i | Supported maximal modulation order for multicast PDSCH | 1. For FR1, up to 1024QAM is supported, candidate values {256QAM, 1024QAM}  2. For FR2, up to 256QAM is supported, candidate values {64QAM, 256QAM}  FFS additional components | 33-2 | Yes |  | The UE supports the same modulation order as unicast | Per FSPC | N/A | N/A |  | Note: A UE shall support the corresponding mandatory maximum modulation for unicast. | Optional with capability signalling | |
| [5] | OPPO | For FG 33-2i, the support of modulation order in NR MBS should follow the principle and capability in unicast. The prerequisite feature groups should be FG 36-1. For its Type, by following the similar definition in unicast, it should be Per Band. The Need of FDD/TDD differentiation is N/A. The Need of FR1/FR2 differentiation is Yes here to differentiate the different modulation orders between FR1 and FR2.   1. ***For FG 33-2i,***  * ***The prerequisite feature group is FG 36-1.*** * ***The report Type is Per Band.*** * ***The Need of FDD/TDD differentiation is N/A.*** * ***The Need of FR1/FR2 differentiation is Yes.*** |
| [6] | Xiaomi | The prerequisite of FG 33-2i is still open. Considering FG 33-2i reflect the maximum modulation order of a MBS PDSCH, it is reasonable that to say this FG is only needed once MBS is supported. Hence, the prerequisite should be FG 33-1 and FG 33-2.  ***Proposal 3: The prerequisite feature groups of FG 33-2i should be FG 33-1 and FG 33-2.*** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs on FG 33-2 and FG33-2x as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2i | Supported maximal modulation order for multicast PDSCH | 1. For FR1, up to 1024QAM is supported, candidate values {256QAM, 1024QAM}  2. For FR2, up to 256QAM is supported, candidate values {64QAM, 256QAM}  FFS additional components | 33-2 | Yes |  | The UE supports the same modulation order as unicast | Per FSPC | N/A | N/A |  | Note: A UE shall support the corresponding mandatory maximum modulation for unicast. | Optional with capability signalling | |
| [10] | Apple | In Rel-15, the maximum modulation capability, i.e., *supportedModulationOrderDL*, is reported per FSPC. Similarly, same reporting type can be applied to MBS maximum modulation order if the UE is supporting MBS reception in Scell.  **Proposal 2: The report type of FG33-2i is per FSPC.** |
| [11] | NTT DOCOMO | FG 33-2 should be added as a prerequisite FG for FG 33-2i. Since the reporting type of FGs for support of 1024QAM for unicast PDSCH and 256QAM for unicast PDSCH in FR2 is per band, the reporting type of FG 33-2i should also be per band. We don’t see the need to add any other components.  ***Proposal 4: Update FG 33-2i as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2i | Supported maximal modulation order for multicast PDSCH | 1. For FR1, up to 1024QAM is supported, candidate values {256QAM, 1024QAM}  2. For FR2, up to 256QAM is supported, candidate values {64QAM, 256QAM} | 33-2 | Yes |  | The UE supports the same modulation order as unicast | Per band | N/A | N/A |  | Note: A UE shall support the corresponding mandatory maximum modulation for unicast. | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-2i:**   + Per band indication, as agreed already for 36-1 and 36-1a (unicast 1024QAM). |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-8-1:**

* **Apply one of the following alternatives for prerequisite FG for FG 33-2i**
  + **Alt.1: 33-2 [2, 9, 11]**
  + **Alt.2: 33-1 and 33-2 [6]**
  + **Alt.3: 36-1 [5]**

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### **High priority proposal 2-8-2:**

* **Apply one of the following alternatives for the reporting type of FG 33-2i**
  + **Alt.1: Per UE [13]**
  + **Alt.2: Per Band [5, 11, 12]**
  + **Alt.3: Per FSPC [2, 9, 10]**

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### **High priority proposal 2-8-3:**

* **No additional component is added for FG 33-2i [11]**

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## **2.9 33-3-1: Dynamic Slot-level repetition for group-common PDSCH**

In [1], FG 33-3-1 is captured as below.

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| 33. NR\_MBS | 33-3-1 | Dynamic Slot-level repetition for group-common PDSCH | 1. Support up to X times dynamic slot-level repetition for group-common PDSCH for multicast. | 33-2 | Yes |  |  | [Per UE] | [No] | [No] |  | Candidate values for X is: {8, 16} | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | Huawei, HiSilicon | ***Proposal 3: Updating FG33-3-1/2/3 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-1 | Dynamic Slot-level repetition for group-common PDSCH | 1. Support up to X times dynamic slot-level repetition for group-common PDSCH for multicast. | 33-2 | Yes |  |  | Per UE | No | No |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-3-x and add FG33-3-2a for additional scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and multicast PDSCH, where details of the additional scaling factor are discussed in [2].   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-1 | Dynamic Slot-level repetition for group-common PDSCH | 1. Support up to X times dynamic slot-level repetition for group-common PDSCH for multicast. | 33-2 | Yes |  |  | Per BC | N/A | N/A |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [11] | NTT DOCOMO | Since the reporting type of FG for dynamic slot-level repetition for unicast PDSCH is per band, the type of FG 33-3-1 should also be per band.  ***Proposal 5: The reporting type of FG 33-3-1 is per band.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-1 | Dynamic Slot-level repetition for group-common PDSCH | 1. Support up to X times dynamic slot-level repetition for group-common PDSCH for multicast. | 33-2 | Yes |  |  | Per band | N/A | N/A |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-3-1:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-9-1:**

* **Apply one of the following alternatives for the reporting type of FG 33-3-1**
  + **Alt.1: Per UE [2, 12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [9]**

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## **2.10 33-3-2: FDM-ed unicast PDSCH and group-common PDSCH for multicast**

In [1], FG 33-3-2 is captured as below.

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| 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH for multicast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for multicast in RRC CONNECTED mode in a slot. | 33-2 | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | FG33-3-2 should be reported per FSPC as explained in section 2.1 for FG33-1-2 for FDMed unicast and broadcast in the same slot.  ***Proposal 3: Updating FG33-3-1/2/3 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and one group-common PDSCH for multicast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for multicast in RRC CONNECTED mode in a slot. | 33-2 | Yes |  |  | Per FSPC | NA | NA |  |  | Optional with capability signalling | |
| [8] | MediaTek | In the current spec, the multicast and broadcast can be scheduled in different components, e.g., the multicast service is scheduled in PCell with CC#1, and broadcast service is scheduled in the SCell with CC#2. If FDMed case is also scheduled in the two CCs, it will make the UE to process 2 FDMed PDSCH combination in the same slot as illustrated in Figure 1, which will make the UE behaviour more complexity and need more buffer to process the PDSCH combinations. Maybe some companies argue that the UE can report not support one of them, e.g., UE reporting not support FG33-3-2 or FG 33-1-2. However, if UE report only supporting one of them, it may restrict the gNB scheduling, e.g., if UE report does not support multicast FDM FG 33-3-2 and only support the FG 33-1-2, but, in some slot, even if the multicast PDSCH is not scheduled and UE has the capability to process the FDMed PDSCH, the gNB also cannot schedule the FDMed broadcast due to the reporting restriction.    **Figure 1 Two FDMed combination for the MBS in the same slot**  Considering the scheduling flexibility and UE processing capability, we prefer to define a new FG:   |  |  |  |  | | --- | --- | --- | --- | | 33-3-x | **FDM-ed** unicast PDSCH and  group-common PDSCH | 1. Support FDM between **one unicast PDSCH** and **one group-common PDSCH** of a serving cell in RRC CONNECTED mode in a slot. 2. The maximum number of supported FDM between **one unicast PDSCH** and **one group-common PDSCH** across all serving cells in a slot. | Component 2 candidate values: {1,2} |   Alternatively, UE can report the FDMed combination if the reporting type for the DMed case is per FSPC, e.g., UE can report the two combinations {CC#1 support multicast FDMed && CC#2 not support broadcast FDMed} and {CC#1 not support FDMed multicast && CC#2 support FDMed broadcast}, it also can achieve the gNB scheduling flexibility and UE processing capability.  ***Proposal 8: For FDMed unicast PDSCH and group-common PDSCH,***   * **Define a new UE capability as following:**  |  |  |  |  | | --- | --- | --- | --- | | 33-3-x | **FDM-ed** unicast PDSCH and  group-common PDSCH | 1. Support FDM between **one unicast PDSCH** and **one group-common PDSCH** of a serving cell in RRC CONNECTED mode in a slot. 2. The maximum number of supported FDM between **one unicast PDSCH** and **one group-common PDSCH** across all serving cells in a slot. | Component 2 candidate values: {1,2} |   **or the reporting type for the FG 33-1-2 and FG 33-3-2 is per FSPC.** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-3-x and add FG33-3-2a for additional scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and multicast PDSCH, where details of the additional scaling factor are discussed in [2].   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH for multicast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for multicast in RRC CONNECTED mode in a slot. | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-3-2a | Scalng factor for maximum data rate and TBS LBRM of FDMed unicast PDSCH and group-common PDSCH | Scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and group-common PDSCH in a slot per CC. | 33-3-2 | Yes |  | If not reported, same as the scaling factor for max data rate of unciast PDSCH | Per FSPC | N/A | N/A |  | FFS: value of scaling factor: {1.75, 1.5, 1, and 0.75} | Optional with capability signalling | |
| [10] | Apple | For the reporting granularity of FG33-1-2 FDM-ed unicast PDSCH and group-common PDSCH for broadcast and FG33-3-2 FDM-ed unicast PDSCH and group-common PDSCH for multicast, both sub-features are defined for RRC connected UE. It was agreed if UE supporting MBS reception on Scell, the capability is reported per FSPC. Similarly, FDM reception is not limited to Pcell if CA is supported by UE. Thus, the FDM reception capability can be reported per FSPC as well. otherwise, FDM reception on PCell and Scell need to be defined separately.  **Proposal 1: The report type of FG33-1-2 and FG33-3-2 is per FSPC.** |
| [11] | NTT DOCOMO | The reporting type of FG for support of FDM of unicast PDSCH and multicast PDSCH should be the same as FG for TDM (i.e., per FS).  ***Proposal 8: The reporting type of FG 33-3-2 is per FS.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH for multicast | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for multicast in RRC CONNECTED mode in a slot. | 33-2 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-3-2:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-10-1:**

* **Introduce an FG for scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and group-common PDSCH in a slot per CC. [9]**

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| 33. NR\_MBS | 33-3-2a | Scalng factor for maximum data rate and TBS LBRM of FDMed unicast PDSCH and group-common PDSCH | Scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and group-common PDSCH in a slot per CC. | 33-3-2 | Yes |  | If not reported, same as the scaling factor for max data rate of unciast PDSCH | Per FSPC | N/A | N/A |  | FFS: value of scaling factor: {1.75, 1.5, 1, and 0.75} | Optional with capability signalling |

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| Company | Comment |
| Huawei/HiSilicon | Technical discussion will be needed. |
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### **High priority proposal 2-10-2:**

* **Apply one of the following alternatives for the reporting type of FG 33-3-2**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per FS [11]**
  + **Alt.3: Per FSPC [2, 8, 9, 10]**

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## **2.11 33-3-3: Intra-slot TDM-ed unicast PDSCH and group-common PDSCH**

In [1], FG 33-3-3 is captured as below.

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| 33. NR\_MBS | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between one unicast PDSCH and one group-common PDSCH in a slot.  2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC  3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC  4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC  5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.   * + Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). | [33-1, 33-2] | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | For FG33-3-3, it should be noted that two cases (i.e., TDM-ed unicast and multicast and TDM-ed unicast and broadcast) are included depending on whether FG33-1 or FG33-2 is prerequisite FG for FG33-3-3. In addition, it should be reported per FSPC. Since FG33-3-3 is reported separately from FG33-1, MBS broadcast transmission should be based on the assumption that there are UEs supporting FG33-1 but not support FG33-3-3. Therefore, the component 3 or component 4 with N/L TDMed group-common PDSCHs in a slot per CC should be only applied to multicast with FG33-1 as prerequisite FG.  ***Proposal 3: Updating FG33-3-1/2/3 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between one unicast PDSCH and one group-common PDSCH in a slot.  2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC  3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC  4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC  5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.   1. Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). | ~~[~~33-1 or 33-2~~]~~ | Yes |  |  | Per FSPC | NA | NA |  | Note:  component 3 or component 4 with N/L TDMed group-common PDSCHs in a slot per CC is only applied to multicast with FG33-1 as prerequisite FG. | Optional with capability signalling | |
| [3] | ZTE | Now, the components description of FG 33-3-3 is a little bit redundant. It can be updated as following to simplify the description.  ***Proposal 3****: Update the components description as following.*   |  |  |  | | --- | --- | --- | | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between X unicast PDSCH(s) and Y group-common PDSCH(s) in a slot, where X+Y <= Z. Z is the maximum number of TDMed PDSCH receptions capability in a slot per CC according to Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.    Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). | |
| [7] | vivo | In Rel-15, there is a UE capability defined for separation of two unicast PDSCHs with a gap, i.e., FG 5-32. Considering FG 33-3-3 of intra-slot TDM-ed unicast PDSCH and group-common PDSCH, there will be more than 1 PDSCHs in either slot of two consecutive slots, and thus, a new UE capability similar to FG5-32 shall be defined for multicast.  ***Proposal 3*** Add an FG to include the UE capability for separation of two multicast/unicast PDSCHs with a gap.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-3c | Separation of two multicast/unicast PDSCHs with a gap | For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is  4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | 33-3-3 | Yes | FFS | FFS | FFS |  |  | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-3-x and add FG33-3-2a for additional scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and multicast PDSCH, where details of the additional scaling factor are discussed in [2].   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between one unicast PDSCH and one group-common PDSCH in a slot.  2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC  3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC  4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC  5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.   * + Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). | [33-1, 33-2] | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [10] | Apple | If the maximum modulation order is per FSPC, then FG33-3-3 can be per FSPC as well. As the baseband capability of maximum modulation order is to determine the TDM capability, i.e., supported maximum data rate.  **Proposal 3: The report type of FG33-3-3 is per FSPC.** |
| [11] | NTT DOCOMO | The prerequisite FG for FG 33-3-3 would be no problem with FG 33-1 or FG 33-2. Brackets can be removed. Since the reporting type of FG for support of intra-slot TDM between unicast PDSCHs is per FS, the type of FG 33-3-3 should also be per FS.  ***Proposal 6: Update FG 33-3-3 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between one unicast PDSCH and one group-common PDSCH in a slot.  2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC  3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC  4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC  5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.   * Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). | 33-1, 33-2 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-3-3:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-11-1:**

* **Introduce an FG for separation of two multicast/unicast PDSCHs with a gap. [7]**

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| 33. NR\_MBS | 33-3-3c | Separation of two multicast/unicast PDSCHs with a gap | For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is  4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | 33-3-3 | Yes | FFS | FFS | FFS |  |  | Optional with capability signalling |

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### **High priority proposal 2-11-2:**

* **Prerequisite FG for FG 33-3-3 is FG 33-1 or 33-2. [2, 11]**

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### **High priority proposal 2-11-3:**

* **Apply one of the following alternatives for the reporting type of FG 33-3-3**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per FS [11]**
  + **Alt.3: Per FSPC [2, 9, 10]**

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### **Low priority proposal 2-11-4:**

* **Components of FG 33-2e are revised as “Support TDM between X unicast PDSCH(s) and Y group-common PDSCH(s) in a slot, where X+Y <= Z. Z is the maximum number of TDMed PDSCH receptions capability in a slot per CC according to Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b.”**

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## **2.12 33-3-3a/33-3-3b: FDM-ed/TDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**

In [1], FG 33-3-3a and FG 33-3-3b are captured as below.

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| 33. NR\_MBS | 33-3-3a | FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | Support of FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast  FFS value of X G-RNTIs | [TBD] | Yes |  |  | [Per UE] | [No] | [No] |  | Note1: FDM-ed Type-1 HARQ-ACK codebook is generated by concatenating the Type-1 sub-codebook for unicast and the Type-1 sub-codebook for multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast. | Optional with capability signalling |
| 33. NR\_MBS | 33-3-3b | Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | Support of Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast  FFS value of X G-RNTIs | [TBD] | Yes |  |  | [Per UE] | [No] | [No] |  | Note1: Mode 2 TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union of k1 sets from unicast and multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast. | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | As discussed in section 2.5, FG33-4 with FG33-2a as prerequisite FG for ACK/NACK based feedback is designed as the basic FG for support of NACK-only feedback for multicast, which includes both the cases for one TB or for more than one TB. For the case of more than one TB, the feedback is converted into ACK/NACK bits, for which either a Type-1 CB or Type-2 CB is generated but for multicast feedback only as already supported in FG33-2a for ACK/NACK based feedback.  When NACK-only collides with other UCI or PUSCH transmission, as agreed, the NACK-only is also converted into ACK/NACK bits. However, such UE behaviour is not expected to be a component of the basic FG33-4 for NACK-only based feedback. The reason is that, for ACK/NACK based feedback for multicast, support of multiplexing with HARQ-ACK for unicast is additional UE capability reporting on top of the basic FG33-2a for ACK/NACK based feedback for multicast.  Furthermore, the currently defined FG33-3-3a/3b/4/5 for multiplexing HARQ-ACK for unicast initially intended for ACK/NACK based feedback for multicast can be expanded to include the case of NACK-only mode1 converted into ACK/NACK bits and also to include the case of multiplexing on PUSCH. The changes can be made to include 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG and adding a note that this FG33-3-3a/3b/5 includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast.  The reporting granularity can be per UE or per BC (as the report for the support of multicast on PCell).  In addition, FFS value of X G-RNTIs for FG33-3-3a and FG33-3-3b can be deleted because the number of G-RNTI for multicast in FG33-2e is not expected to be large based on the discussion in the last RAN1 meeting though the decision was left to RAN2.  ***Proposal 4: Updating FG33-3-3a/3b/4/5 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-3a | FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast on PUCCH or PUSCH | Support of FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast on PUCCH or PUSCH.  ~~FFS value of X G-RNTIs~~ | 33-2a or 33-4 or 33-5-1a or 33-5-1f | Yes |  |  | Per BC | N/A | N/A |  | Note1: FDM-ed Type-1 HARQ-ACK codebook is generated by concatenating the Type-1 sub-codebook for unicast and the Type-1 sub-codebook for multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast.  Note2: with 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG, this FG33-3-3a includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast. | Optional with capability signalling | | 33. NR\_MBS | 33-3-3b | Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast on PUCCH or PUSCH | Support of Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast on PUCCH or PUSCH  ~~FFS value of X G-RNTIs~~ | 33-2a or 33-4 or 33-5-1a or 33-5-1f | Yes |  |  | Per BC | N/A | N/A |  | Note1: Mode 2 TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union of k1 sets from unicast and multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast.  Note3: with 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG, this FG33-3-3b includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast. | Optional with capability signalling | |
| [5] | OPPO | For FG 33-3-3a and 33-3-3b, there is a common legacy issue about the value of X G-RNTIs. One baseline is that here the value of X should not exceed the G-RNTI number defined in FG 33-2e which is the total number of G-RNTIs supported by a UE. Following this baseline, the value of X should be any integer number, e.g. 2, 3, 4 and etc.  ***For FG 33-3-3a and 33-3-3b, the value of X G-RNTIs is {2, 3, 4} which is no larger than the number of G-RNTI defined in FG 33-2e.*** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-3-x and add FG33-3-2a for additional scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and multicast PDSCH, where details of the additional scaling factor are discussed in [2].   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-3a | FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | 1. Support of FDM-ed Type-1 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast  2. Support of Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast with max number X of G-RNTIs | [TBD] | Yes |  |  | Per FSPC | N/A | N/A |  | Note1: FDM-ed Type-1 HARQ-ACK codebook is generated by concatenating the Type-1 sub-codebook for unicast and the Type-1 sub-codebook for multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast.  Candidate values of X is {2, 3, 4} with X no lareger than max number of G-RNTIs of FG33-2e | Optional with capability signalling | | 33. NR\_MBS | 33-3-3b | Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | 1. Support of Mode 2 TDM-ed Type-1 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast  2. Support of Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast with max number X of G-RNTIs | [TBD] | Yes |  |  | Per FSPC | N/A | N/A |  | Note1: Mode 2 TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union of k1 sets from unicast and multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast.  Candidate values of X is {2, 3, 4} with X no lareger than max number of G-RNTIs of FG33-2e | Optional with capability signalling | |
| [11] | NTT DOCOMO | FG 33-3-2 should be added as a prerequisite FG for FG 33-3-3a. FG 33-3-3 should be added as a prerequisite FG for FG 33-3-3b. Type-1 codebook generation mode 1 is a more advanced method than mode 2. Only FG 33-3-3b is sufficient for prerequisite FG for FG 33-3-4. Prerequisite FG for FG 33-3-5 should be FG 33-3-3a, 33-3-3b or 33-3-4.  The capability of the number of G-RNTIs is already defined as FG 33-2e. We don’t feel the need to be able to report a different value than FG 33-2e.  Time allowed for codebook generation depends on the SCS and can vary from band to band. The reporting type of FGs related to codebook generation should be per band.  ***Proposal 9: Update FG 33-3-3a, 33-3-3b, 33-3-4 and 33-3-5 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-3a | FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | Support of FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | 33-3-2 | Yes |  |  | Per band | N/A | N/A |  | Note1: FDM-ed Type-1 HARQ-ACK codebook is generated by concatenating the Type-1 sub-codebook for unicast and the Type-1 sub-codebook for multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast. | Optional with capability signalling | | 33. NR\_MBS | 33-3-3b | Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | Support of Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast | 33-3-3 | Yes |  |  | Per band | N/A | N/A |  | Note1: Mode 2 TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union of k1 sets from unicast and multicast.  Note2: The Type-2 HARQ-ACK codebook is generated by concatenating the Type-2 sub-codebook for unicast and the Type-2 sub-codebook for multicast. | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-3-3a:**   + Per UE * **33-3-3b:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-12-1:**

* **Add a component “Support of Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast with max number X of G-RNTIs” to FG 33-3-3a and 33-3-3b respectively. [5, 9]**
  + **Candidate values of X is {2, 3, 4} with X no lareger than max number of G-RNTIs of FG33-2e**

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### **High priority proposal 2-12-2:**

* **Apply one of the following alternatives for prerequisite FG for FG 33-3-3a**
  + **Alt.1: FG 33-2a or 33-4 or 33-5-1a or 33-5-1f [2]**
  + **Alt.2: FG 33-3-2 [11]**

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### **High priority proposal 2-12-3:**

* **Apply one of the following alternatives for prerequisite FG for FG 33-3-3b**
  + **Alt.1: FG 33-2a or 33-4 or 33-5-1a or 33-5-1f [2]**
  + **Alt.2: FG 33-3-3 [11]**

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### **High priority proposal 2-12-4:**

* **Apply one of the following alternatives for the reporting type of FG 33-3-3a**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [2]**
  + **Alt.4: Per FSPC [9]**

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### **High priority proposal 2-12-5:**

* **Apply one of the following alternatives for the reporting type of FG 33-3-3b**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [2]**
  + **Alt.4: Per FSPC [9]**

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### **Low priority proposal 2-12-6:**

* **Add a note to FG 33-3-3a that “with 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG, this FG33-3-3a includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast.” [2]**
* **Add a note to FG 33-3-3b that “with 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG, this FG33-3-3b includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast.” [2]**

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## **2.13 33-3-4: Mode 1 for type1 codebook generation**

In [1], FG 33-3-4 is captured as below.

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| 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation | Supports type1-Codebook-Generation-Mode configured as mode 1 | [TBD], 33-3-3b | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | Huawei, HiSilicon | As discussed in section 2.5, FG33-4 with FG33-2a as prerequisite FG for ACK/NACK based feedback is designed as the basic FG for support of NACK-only feedback for multicast, which includes both the cases for one TB or for more than one TB. For the case of more than one TB, the feedback is converted into ACK/NACK bits, for which either a Type-1 CB or Type-2 CB is generated but for multicast feedback only as already supported in FG33-2a for ACK/NACK based feedback.  When NACK-only collides with other UCI or PUSCH transmission, as agreed, the NACK-only is also converted into ACK/NACK bits. However, such UE behaviour is not expected to be a component of the basic FG33-4 for NACK-only based feedback. The reason is that, for ACK/NACK based feedback for multicast, support of multiplexing with HARQ-ACK for unicast is additional UE capability reporting on top of the basic FG33-2a for ACK/NACK based feedback for multicast.  Furthermore, the currently defined FG33-3-3a/3b/4/5 for multiplexing HARQ-ACK for unicast initially intended for ACK/NACK based feedback for multicast can be expanded to include the case of NACK-only mode1 converted into ACK/NACK bits and also to include the case of multiplexing on PUSCH. The changes can be made to include 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG and adding a note that this FG33-3-3a/3b/5 includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast.  The reporting granularity can be per UE or per BC (as the report for the support of multicast on PCell).  In addition, FFS value of X G-RNTIs for FG33-3-3a and FG33-3-3b can be deleted because the number of G-RNTI for multicast in FG33-2e is not expected to be large based on the discussion in the last RAN1 meeting though the decision was left to RAN2.  ***Proposal 4: Updating FG33-3-3a/3b/4/5 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast on PUCCH or PUSCH | Supports type1-Codebook-Generation-Mode configured as mode 1 for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast on PUCCH or PUSCH | ~~[TBD],~~ 33-3-3b | Yes |  |  | Per BC | N/A | N/A |  | Note1: Mode 1 TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the **intersection** of k1 sets from unicast and multicast. | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-3-x and add FG33-3-2a for additional scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and multicast PDSCH, where details of the additional scaling factor are discussed in [2].   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation | Supports type1-Codebook-Generation-Mode configured as mode 1 | 33-3-3b | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | FG 33-3-2 should be added as a prerequisite FG for FG 33-3-3a. FG 33-3-3 should be added as a prerequisite FG for FG 33-3-3b. Type-1 codebook generation mode 1 is a more advanced method than mode 2. Only FG 33-3-3b is sufficient for prerequisite FG for FG 33-3-4. Prerequisite FG for FG 33-3-5 should be FG 33-3-3a, 33-3-3b or 33-3-4.  The capability of the number of G-RNTIs is already defined as FG 33-2e. We don’t feel the need to be able to report a different value than FG 33-2e.  Time allowed for codebook generation depends on the SCS and can vary from band to band. The reporting type of FGs related to codebook generation should be per band.  ***Proposal 9: Update FG 33-3-3a, 33-3-3b, 33-3-4 and 33-3-5 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation | Supports type1-Codebook-Generation-Mode configured as mode 1 | 33-3-3b | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-3-4:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-13-1:**

* **Components of FG 33-3-4 are revised as “Supports type1-Codebook-Generation-Mode configured as mode 1 for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast on PUCCH or PUSCH”. [2]**

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### **High priority proposal 2-13-2:**

* **Prerequisite FG for FG 33-3-4 is FG 33-3-3b. [2, 9, 11]**

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### **High priority proposal 2-13-3:**

* **Apply one of the following alternatives for the reporting type of FG 33-3-4** 
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [2]**
  + **Alt.4: Per FSPC [9]**

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### **Low priority proposal 2-13-4:**

* **Add a note that “Mode 1 TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the intersection of k1 sets from unicast and multicast.” [2]**

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## **2.14 33-3-5: Feedback multiplexing for unicast PDSCH and group-common PDSCH for multicast with same priority and different codebook type**

In [1], FG 33-3-5 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 33. NR\_MBS | 33-3-5 | Feedback multiplexing for unicast PDSCH and group-common PDSCH for multicast with same priority and different codebook type | Support of multiplexing HARQ-ACK for unicast and multicast with the same priority and different HARQ-ACK codebook types in the same PUCCH slot | [33-2b] | Yes |  |  | [Per FSPC] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | Huawei, HiSilicon | As discussed in section 2.5, FG33-4 with FG33-2a as prerequisite FG for ACK/NACK based feedback is designed as the basic FG for support of NACK-only feedback for multicast, which includes both the cases for one TB or for more than one TB. For the case of more than one TB, the feedback is converted into ACK/NACK bits, for which either a Type-1 CB or Type-2 CB is generated but for multicast feedback only as already supported in FG33-2a for ACK/NACK based feedback.  When NACK-only collides with other UCI or PUSCH transmission, as agreed, the NACK-only is also converted into ACK/NACK bits. However, such UE behaviour is not expected to be a component of the basic FG33-4 for NACK-only based feedback. The reason is that, for ACK/NACK based feedback for multicast, support of multiplexing with HARQ-ACK for unicast is additional UE capability reporting on top of the basic FG33-2a for ACK/NACK based feedback for multicast.  Furthermore, the currently defined FG33-3-3a/3b/4/5 for multiplexing HARQ-ACK for unicast initially intended for ACK/NACK based feedback for multicast can be expanded to include the case of NACK-only mode1 converted into ACK/NACK bits and also to include the case of multiplexing on PUSCH. The changes can be made to include 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG and adding a note that this FG33-3-3a/3b/5 includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast.  The reporting granularity can be per UE or per BC (as the report for the support of multicast on PCell).  In addition, FFS value of X G-RNTIs for FG33-3-3a and FG33-3-3b can be deleted because the number of G-RNTI for multicast in FG33-2e is not expected to be large based on the discussion in the last RAN1 meeting though the decision was left to RAN2.  ***Proposal 4: Updating FG33-3-3a/3b/4/5 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-5 | Feedback multiplexing for unicast PDSCH and group-common PDSCH for multicast with same priority and different codebook type on PUCCH or PUSCH | Support of multiplexing HARQ-ACK for unicast and for multicast with the same priority and different HARQ-ACK codebook types in the same PUCCH slot or PUSCH | ~~[33-2b]~~  33-2a or 33-4 or 33-5-1a or 33-5-1f | Yes |  |  | Per BC | N/A | N/A |  | Note: with 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG, this FG33-3-3b includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast. | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-3-x and add FG33-3-2a for additional scaling factor for max data rate and TBS LBRM to support FDMed unicast PDSCH and multicast PDSCH, where details of the additional scaling factor are discussed in [2].   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-5 | Feedback multiplexing for unicast PDSCH and group-common PDSCH for multicast with same priority and different codebook type | Support of multiplexing HARQ-ACK for unicast and multicast with the same priority and different HARQ-ACK codebook types in the same PUCCH slot | 33-2a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | FG 33-3-2 should be added as a prerequisite FG for FG 33-3-3a. FG 33-3-3 should be added as a prerequisite FG for FG 33-3-3b. Type-1 codebook generation mode 1 is a more advanced method than mode 2. Only FG 33-3-3b is sufficient for prerequisite FG for FG 33-3-4. Prerequisite FG for FG 33-3-5 should be FG 33-3-3a, 33-3-3b or 33-3-4.  The capability of the number of G-RNTIs is already defined as FG 33-2e. We don’t feel the need to be able to report a different value than FG 33-2e.  Time allowed for codebook generation depends on the SCS and can vary from band to band. The reporting type of FGs related to codebook generation should be per band.  ***Proposal 9: Update FG 33-3-3a, 33-3-3b, 33-3-4 and 33-3-5 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-5 | Feedback multiplexing for unicast PDSCH and group-common PDSCH for multicast with same priority and different codebook type | Support of multiplexing HARQ-ACK for unicast and multicast with the same priority and different HARQ-ACK codebook types in the same PUCCH slot | 33-3-3a,  33-3-3b,  33-3-4 | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-3-5:**   + Per UE, motivation for finer granularity is not clear. If limitations on level of support is needed, then it is preferrable to add those restrictions explicitly in the component description. |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-14-1:**

* **Components of FG 33-3-5 are revised as “Support of multiplexing HARQ-ACK for unicast and for multicast with the same priority and different HARQ-ACK codebook types in the same PUCCH slot or PUSCH” [2]**

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### **High priority proposal 2-14-2:**

* **Apply one of the following alternatives for prerequisite FG for FG 33-3-5** 
  + **Alt.1: FG 33-2a [9]**
  + **Alt.2: FG 33-3-3a or 33-3-3b or 33-3-4 [11]**
  + **Alt.3: FG 33-2a or 33-4 or 33-5-1a or 33-5-1f [2]**

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### **High priority proposal 2-14-3:**

* **Apply one of the following alternatives for the reporting type of FG 33-3-5**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [2]**
  + **Alt.4: Per FSPC [9]**

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### **Low priority proposal 2-14-4:**

* **Add a note that “with 33-2a or 33-4 or 33-5-1a or 33-5-1f as prerequisite FG, this FG33-3-3b includes the case of multiplexing with ACK/NACK for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast dynamic scheduling with HARQ-ACK for unicast, or multiplexing with ACK/NACK for multicast SPS scheduling with HARQ-ACK for unicast, or multiplexing with NACK-only for multicast SPS scheduling with HARQ-ACK for unicast.” [2]**

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## **2.15 33-4: NACK-only based HARQ-ACK feedback for multicast with ACK/NACK transforming**

In [1], FG 33-4 is captured as below.

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| 33. NR\_MBS | 33-4 | NACK-only based HARQ-ACK feedback for multicast with ACK/NACK transforming | 1. Support NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast, including:  a) A single TB with NACK-only feedback transmitted in PUCCH  b) One or multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits  [2. Support of shared PUCCH resource configurations with unicast] | 33-2a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | Huawei, HiSilicon | For NACK-only based feedback, the following two alternatives were agreed with Alt1 and Alt4 corresponding NACK-only mode1 and mode2, respectively:   * *Alt1: Support UE multiplexing the HARQ-ACK bits by transforming NACK-only into ACK/NACK HARQ bits.* * *Alt4: Define combination of NACK-only which corresponds to a specific sequence or a PUCCH transmission.*   Two features groups, i.e., FG33-4 and FG33-4a were agreed in the last meeting for NACK-only based feedback. FG33-4a is for support of NACK-only up to 4 TBs by selecting one of predefined PUCCH resources based on the decoding results of the scheduled TB(s), for which the predefined PUCCH resources are expected to be separately configured for multicast and it should include the case of single TB with NACK-only and include the extended Tproc1 and the corresponding referenced PUCCH as discussed in [3]. FG33-4 is expected to be the basic feature group for the support of NACK-only based feedback including NACK-only for a single TB case and for the case of more than one TB by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only, for which PUCCH resources are also expected to be shared with the PUCCH resources configured for unicast given support of separate PUCCH resource configurations from unicast taking extra UE buffer is expected to be a separate FG as defined in FG33-8-1 for ACK/NACK based feedback.  Furthermore, support of separately configured PUCCH resources for NACK-only mode1 (i.e., transforming into ACK/NACK based) can be merged into FG33-8-1 with either FG33-2a or FG33-4 as prerequisite FGs for ACK/NACK based and for NACK-only mode1 feedback, respectively, and the revision is proposed in section 2.8. In addition, considering the NACK-only feedback for multicast SPS scheduling discussed in section 2.6, FG33-4a can be expanded to include the cases of dynamic or SPS scheduling by setting FG33-4 or FG33-5-1f as prerequisites FG, respectively, and a corresponding note can be added for clarification.  For FG33-4, similar to the support of ACK/NACK-only based feedback for multicast as in FG33-2a, the support of NACK-only based feedback and RRC based enabling/disabling NACK-only based feedback as well as PTM retransmission can be merged into the FG33-4. Since UE does not feedback ACK when the TB is decoded correctly and the PUCCH resources might be shared among UEs for reporting NACK if the TB is failed in decoding, network cannot differentiate which UE is failed in decoding so UE does not need to support PTP retransmission for NACK-only based feedback.  In addition, DCI-based enabling/disabling NACK-only feedback also needs to configured firstly by RRC signalling. Similar to FG33-2b with FG33-2a as prerequisite FG for ACK/NACK based feedback for dynamic scheduling, FG33-5-1b with FG33-5-1a as prerequisite FG for ACK/NACK based feedback for SPS scheduling, and FG33-5-1g with FG33-5-1f as prerequisite FG for NACK-only based feedback for SPS scheduling, FG33-4 is prerequisite FG for FG33-4-1.  With the above analysed, the FG33-4 and FG33-4-1 can be updated as follows:  ***Proposal 5: Updating FG33-4 and FG33-4-1 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | Support of NACK-only based HARQ-ACK feedback for multicast with ACK/NACK transforming with shared PUCCH resources configuration with unicast and RRC-based enabling/disabling NACK-only based feedback for dynamic scheduling | 1. Support NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast, including:  a) A single TB with NACK-only feedback transmitted in PUCCH  b) ~~One or~~ multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only  2. Support of **shared** PUCCH resource configuration with unicast  3. Support of enabling/disabling NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast per the configuration of RRC signalling.  4. Support of PTM retransmission for dynamic scheduling for multicast. | 33-2a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [5] | OPPO | For FG 33-4, it is to support transforming from NACK-only to ACK/NACK based HARQ-ACK feedback. Similar with ACK/NACK feedback in FG 33-2a which supports shared PUCCH resource configurations with unicast. In FG 33-4, when NACK-only is transformed to ACK/NACK feedback, shared PUCCH resource configurations with unicast can also be supported.   1. ***For FG 33-4, support of shared PUCCH resource configurations with unicast.*** |
| [6] | Xiaomi | Currently, the component of FG 33-4 is defined as below:   |  | | --- | | 1. Support NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast, including:  a) A single TB with NACK-only feedback transmitted in PUCC  b) One or multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits  [2. Support of shared PUCCH resource configurations with unicast] |   The prerequisite feature group of FG 33-4 is FG 33-2a. However, the shared PUCCH resource configurations with unicast is already a component of FG 33-2a. From this point of view, component 2) of FG 33-4 is redundant.  ***Proposal 4: Component 2) of FG 33-4 should be deleted.*** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-4 and 33-4-x:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | NACK-only based HARQ-ACK feedback for multicast with ACK/NACK transforming | 1. Support NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast, including:  a) A single TB with NACK-only feedback transmitted in PUCCH  b) One or multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits  2. Support of shared PUCCH resource configurations with unicast | 33-2a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | When PUCCH-Config for multicast is not configured, PUCCH resources configured by PUCCH-Config for unicast are used as default. Support for shared PUCCH resource configuration with unicast is required as a basic feature for NACK-only based feedback.  ***Proposal 10: Update FG 33-4 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | NACK-only based HARQ-ACK feedback for multicast with ACK/NACK transforming | 1. Support NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast, including:  a) A single TB with NACK-only feedback transmitted in PUCCH  b) One or multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits  2. Support of shared PUCCH resource configurations with unicast | 33-2a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-15-1:**

* **Apply one of the following alternatives for Component of FG 33-4Remove the bracket in Components for FG 33-4, i.e., “Support of shared PUCCH resource configurations with unicast” is kept.**
  + **Alt.1: Remove the bracket in Components for FG 33-4, i.e., “Support of shared PUCCH resource configurations with unicast” is kept [2, 5, 9, 11]**
  + **Alt.2: Remove the Component 2 [6]**

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### **High priority proposal 2-15-2:**

* **Components of FG 33-4 are revised as**
  + **Component 1(b): ~~One or~~ multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only [2]**
  + **Add a component “Support of enabling/disabling NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast per the configuration of RRC signalling.” [2]**
  + **Add a component “Support of PTM retransmission for dynamic scheduling for multicast”**

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## **2.16 33-4a: NACK-only based HARQ-ACK feedback for multicast corresponding to a specific sequence or a PUCCH transmission**

In [1], FG 33-4a is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-4a | NACK-only based HARQ-ACK feedback for multicast corresponding to a specific sequence or a PUCCH transmission | 1. Support NACK-only based HARQ-ACK feedback for dynamic scheduling for multicast, including:  a) Multiple TB with NACK-only feedback transmitted in PUCCH by select one PUCCH resource.  2. Support of separate PUCCH resource configurations from unicast | 33-4 | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | For NACK-only based feedback, the following two alternatives were agreed with Alt1 and Alt4 corresponding NACK-only mode1 and mode2, respectively:   * *Alt1: Support UE multiplexing the HARQ-ACK bits by transforming NACK-only into ACK/NACK HARQ bits.* * *Alt4: Define combination of NACK-only which corresponds to a specific sequence or a PUCCH transmission.*   Two features groups, i.e., FG33-4 and FG33-4a were agreed in the last meeting for NACK-only based feedback. FG33-4a is for support of NACK-only up to 4 TBs by selecting one of predefined PUCCH resources based on the decoding results of the scheduled TB(s), for which the predefined PUCCH resources are expected to be separately configured for multicast and it should include the case of single TB with NACK-only and include the extended Tproc1 and the corresponding referenced PUCCH as discussed in [3]. FG33-4 is expected to be the basic feature group for the support of NACK-only based feedback including NACK-only for a single TB case and for the case of more than one TB by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only, for which PUCCH resources are also expected to be shared with the PUCCH resources configured for unicast given support of separate PUCCH resource configurations from unicast taking extra UE buffer is expected to be a separate FG as defined in FG33-8-1 for ACK/NACK based feedback.  Furthermore, support of separately configured PUCCH resources for NACK-only mode1 (i.e., transforming into ACK/NACK based) can be merged into FG33-8-1 with either FG33-2a or FG33-4 as prerequisite FGs for ACK/NACK based and for NACK-only mode1 feedback, respectively, and the revision is proposed in section 2.8. In addition, considering the NACK-only feedback for multicast SPS scheduling discussed in section 2.6, FG33-4a can be expanded to include the cases of dynamic or SPS scheduling by setting FG33-4 or FG33-5-1f as prerequisites FG, respectively, and a corresponding note can be added for clarification.  For FG33-4, similar to the support of ACK/NACK-only based feedback for multicast as in FG33-2a, the support of NACK-only based feedback and RRC based enabling/disabling NACK-only based feedback as well as PTM retransmission can be merged into the FG33-4. Since UE does not feedback ACK when the TB is decoded correctly and the PUCCH resources might be shared among UEs for reporting NACK if the TB is failed in decoding, network cannot differentiate which UE is failed in decoding so UE does not need to support PTP retransmission for NACK-only based feedback.  In addition, DCI-based enabling/disabling NACK-only feedback also needs to configured firstly by RRC signalling. Similar to FG33-2b with FG33-2a as prerequisite FG for ACK/NACK based feedback for dynamic scheduling, FG33-5-1b with FG33-5-1a as prerequisite FG for ACK/NACK based feedback for SPS scheduling, and FG33-5-1g with FG33-5-1f as prerequisite FG for NACK-only based feedback for SPS scheduling, FG33-4 is prerequisite FG for FG33-4-1.  With the above analysed, the FG33-4 and FG33-4-1 can be updated as follows:  ***Proposal 5: Updating FG33-4 and FG33-4-1 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4a | Support of NACK-only based HARQ-ACK feedback for multicast corresponding to a specific sequence or a PUCCH transmission for dynamic or SPS scheduling | 1. Support NACK-only based HARQ-ACK feedback for dynamic or SPS scheduling for multicast, including:  a) Multiple TB with NACK-only feedback transmitted in PUCCH by select one PUCCH resource.  b) Single TB with NACK-only feedback transmitted in PUCCH  c) Extended Tproc1 and the corresponding referenced PUCCH  2. Support of separate PUCCH resource configurations from unicast or SPS-PUCCH-AN-List configuration from unicast SPS | 33-4 or 33-5-1f | Yes |  |  | Per BC | N/A | N/A |  | Note: with 33-4 or 33-5-1f as prerequisite FG, this FG33-4a includes the cases of support of NACK-only for multicast dynamic scheduling, and/or for multicast SPS scheduling | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-16-1:**

* **Components of FG 33-4a are revised as** 
  + **Component 1: Support NACK-only based HARQ-ACK feedback for dynamic or SPS scheduling for multicast, including: [2]**
    - **Add a component “b) Single TB with NACK-only feedback transmitted in PUCCH”**
    - **Add a component “c) Extended Tproc1 and the corresponding referenced PUCCH”**
  + **Component 2: Support of separate PUCCH resource configurations from unicast or SPS-PUCCH-AN-List configuration from unicast SPS**

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### **High priority proposal 2-16-2:**

* **Add FG 33-5-1f as a prerequisite FG for FG 33-4a [2]**

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### **Low priority proposal 2-16-3:**

* **Add a note that “with 33-4 or 33-5-1f as prerequisite FG, this FG33-4a includes the cases of support of NACK-only for multicast dynamic scheduling, and/or for multicast SPS scheduling”**

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## **2.17 33-4-1: DCI-based enabling/disabling NACK-only based feedback for dynamic scheduling for multicast**

In [1], FG 33-4-1 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-4-1 | DCI-based enabling/disabling NACK-only based feedback for dynamic scheduling for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-RNTI by RRC signalling | [33-4] | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | For NACK-only based feedback, the following two alternatives were agreed with Alt1 and Alt4 corresponding NACK-only mode1 and mode2, respectively:   * *Alt1: Support UE multiplexing the HARQ-ACK bits by transforming NACK-only into ACK/NACK HARQ bits.* * *Alt4: Define combination of NACK-only which corresponds to a specific sequence or a PUCCH transmission.*   Two features groups, i.e., FG33-4 and FG33-4a were agreed in the last meeting for NACK-only based feedback. FG33-4a is for support of NACK-only up to 4 TBs by selecting one of predefined PUCCH resources based on the decoding results of the scheduled TB(s), for which the predefined PUCCH resources are expected to be separately configured for multicast and it should include the case of single TB with NACK-only and include the extended Tproc1 and the corresponding referenced PUCCH as discussed in [3]. FG33-4 is expected to be the basic feature group for the support of NACK-only based feedback including NACK-only for a single TB case and for the case of more than one TB by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only, for which PUCCH resources are also expected to be shared with the PUCCH resources configured for unicast given support of separate PUCCH resource configurations from unicast taking extra UE buffer is expected to be a separate FG as defined in FG33-8-1 for ACK/NACK based feedback.  Furthermore, support of separately configured PUCCH resources for NACK-only mode1 (i.e., transforming into ACK/NACK based) can be merged into FG33-8-1 with either FG33-2a or FG33-4 as prerequisite FGs for ACK/NACK based and for NACK-only mode1 feedback, respectively, and the revision is proposed in section 2.8. In addition, considering the NACK-only feedback for multicast SPS scheduling discussed in section 2.6, FG33-4a can be expanded to include the cases of dynamic or SPS scheduling by setting FG33-4 or FG33-5-1f as prerequisites FG, respectively, and a corresponding note can be added for clarification.  For FG33-4, similar to the support of ACK/NACK-only based feedback for multicast as in FG33-2a, the support of NACK-only based feedback and RRC based enabling/disabling NACK-only based feedback as well as PTM retransmission can be merged into the FG33-4. Since UE does not feedback ACK when the TB is decoded correctly and the PUCCH resources might be shared among UEs for reporting NACK if the TB is failed in decoding, network cannot differentiate which UE is failed in decoding so UE does not need to support PTP retransmission for NACK-only based feedback.  In addition, DCI-based enabling/disabling NACK-only feedback also needs to configured firstly by RRC signalling. Similar to FG33-2b with FG33-2a as prerequisite FG for ACK/NACK based feedback for dynamic scheduling, FG33-5-1b with FG33-5-1a as prerequisite FG for ACK/NACK based feedback for SPS scheduling, and FG33-5-1g with FG33-5-1f as prerequisite FG for NACK-only based feedback for SPS scheduling, FG33-4 is prerequisite FG for FG33-4-1.  With the above analysed, the FG33-4 and FG33-4-1 can be updated as follows:  ***Proposal 5: Updating FG33-4 and FG33-4-1 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4-1 | DCI-based enabling/disabling NACK-only based feedback for dynamic scheduling for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-RNTI by RRC signaling | 33-4 | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [5] | OPPO | For FG 33-4-1, the prerequisite can be confirmed as FG 33-4, which is also similar with ACK/NACK DCI-based enabling/disabling.   1. ***For FG 33-4-1, the prerequisite is FG 33-4.*** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG 33-4 and 33-4-x:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4-1 | DCI-based enabling/disabling NACK-only based feedback for dynamic scheduling for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-RNTI by RRC signaling via DCI format 4\_2 | 33-4, 33-2f | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | There would be no problem with making FG 33-4 the prerequisite FG for FG 33-4-1. Brackets can be removed.  ***Proposal 11: Update FG 33-4-1 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4-1 | DCI-based enabling/disabling NACK-only based feedback for dynamic scheduling for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-RNTI by RRC signalling | 33-4 | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-17-1:**

* **Apply one of following alternatives for prerequisite FG of FG 33-4-1**
  + **Alt.1: FG 33-4 [2, 5, 11]**
  + **Alt.2: FG 33-4 and 33-2f [9]**

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| Company | Comment |
| Huawei/HiSilicon | Ok with Alt.2 |
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### **High priority proposal 2-17-2:**

* **Components of FG 33-4-1 are revised as “Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-RNTI by RRC signaling via DCI format 4\_2”. [9]**

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| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Ok |
|  |  |
|  |  |

## **2.18 33-5-1: SPS group-common PDSCH for multicast**

In [1], FG 33-5-1 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast  2. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH | 33-2 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | As discussed in [2] that it is expected that FG33-5-1 is supposed to be SPS group-common PDSCH for multicast for PCell that is reported per FS as agreed. With FG33-2 as the prerequisite FG, FG33-2h currently defined as MBS dynamic scheduling for SCell can be modified to include the cases of both dynamic and SPS scheduling for MBS, since, from UE perspective, if a CC is reported to support MBS for SCell then it is supposed to support both dynamic and SPS scheduling.  FG33-5-1a is ACK/NACK based feedback for multicast SPS, which should include the components that support of PTM retransmission, support of Type-1 and Type-2 HARQ-ACK CB for multicast feedback only, and support of shared or separate SPS-PUCCH-AN-List configuration from unicast SPS.  ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast for PCell | 1. Support one SPS group-common PDSCH configuration for multicast  2. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH | 33-2 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [7] | vivo | As RAN2 has agreed that MBS SPS for multicast can be configured on one SCell or PCell, two UE FGs can be added to reflect one SPS group-common PDSCH configuration and multiple SPS group-common PDSCH configurations for SCell, respectively.  ***Proposal 4*** Add FG 33-5-3 and FG 33-5-4, which include supporting of one and multiple SPS group-common PDSCH configurations for multicast for Scell.  Furthermore, in Rel-16, it is defined that up to 8 configured SPS configurations in a BWP of a serving cell and up to 32 configured SPS configurations in a cell group are supported in FG 12-2. When multicast is considered, the UE capabilities on multiple SPS configurations are expected to keep the same as existed UE capabilities for unicast only, and thus, the total number of SPS configurations for both multicast and unicast is no larger than 8 per cell, the total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32.  ***Proposal 5*** The total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast for Pcell | 1. Support one SPS group-common PDSCH configuration for multicast  2. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH | 33-2 | Yes | Per FS | N/A | N/A |  |  | Optional with capability signalling |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-3 | SPS group-common PDSCH for multicast for Scell | 1. Support one SPS group-common PDSCH configuration for multicast for Scell.  2. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH for Scell. | 33-5-1 | Yes | Per FS | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-4 | SPS group-common PDSCH for multicast for SCell | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast for Scell.  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast for Scell.  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 [per cell], and activated SPS group-common PDSCH configurations is no larger than M.  4. The total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32. | 33-5-2 | Yes | [Per FSPC] | [No] | [No] |  | Candidate value set for M is {1, 2, …, 8} | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast  2. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH  3. Support of group-common PDCCH/PDSCH with CRC scrambled by G-CS-RNTI(s) for multicast  4. Support of DCI format 4\_1 with CRC scrambled with G-CS-RNTI for multicast  5. ACK/NABK-based HARQ-ACK feedback for SPS group-common PDCCH activation and SPS release associated with G-CS-RNTI | 33-2 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-5-1**:   + Per UE |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-18-1:**

* **Feature group of FG 33-5-1 is revised as “SPS group-common PDSCH for multicast for PCell” [2, 7]**

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### **High priority proposal 2-18-2:**

* **Introduce FGs for support of semi-persistent scheduling for multicast on SCell. [7]**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-3 | SPS group-common PDSCH for multicast for Scell | 1. Support one SPS group-common PDSCH configuration for multicast for Scell.  2. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH for Scell. | 33-5-1 | Yes | Per FS | N/A | N/A |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-5-4 | SPS group-common PDSCH for multicast for SCell | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast for Scell.  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast for Scell.  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 [per cell], and activated SPS group-common PDSCH configurations is no larger than M.  4. The total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32. | 33-5-2 | Yes | [Per FSPC] | [No] | [No] |  | Candidate value set for M is {1, 2, …, 8} | Optional with capability signalling |

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| Company | Comment |
| Huawei/HiSilicon | May not be needed. Can be addressed by adding a note? |
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### **High priority proposal 2-18-3:**

* **Components of FG 33-5-1 are revised as** 
  + **Add a component “Support of group-common PDCCH/PDSCH with CRC scrambled by G-CS-RNTI(s) for multicast” [9]**
  + **Add a component “Support of DCI format 4\_1 with CRC scrambled with G-CS-RNTI for multicast” [9]**
  + **Add a component “ACK/NACK-based HARQ-ACK feedback for SPS group-common PDCCH activation and SPS release associated with G-CS-RNTI” [9]**

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| Company | Comment |
| Huawei/HiSilicon | Ok with these componenets |
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## **2.19 33-5-1a: Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast**

In [1], FG 33-5-1a is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast | Support of ACK/NACK based HARQ-ACK feedback, and support of enabling/disabling ACK/NACK based HARQ-ACK feedback configured by RRC signalling for SPS group-common PDSCH without PDCCH scheduling, SPS group-common PDSCH activation, and SPS release PDCCH | 33-5-1 | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | FG33-5-1a is ACK/NACK based feedback for multicast SPS, which should include the components that support of PTM retransmission, support of Type-1 and Type-2 HARQ-ACK CB for multicast feedback only, and support of shared or separate SPS-PUCCH-AN-List configuration from unicast SPS.  ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast | 1) Support of ACK/NACK based HARQ-ACK feedback, and support of enabling/disabling ACK/NACK based HARQ-ACK feedback configured by RRC signalling for SPS group-common PDSCH without PDCCH scheduling, SPS group-common PDSCH activation, and SPS release PDCCH  2) Support of PTM retransmission for multicast  3) support of Type-1 and Type-2 HARQ-ACK CB for multicast feedback only  4) Support of shared or separate SPS-PUCCH-AN-List configuration from unicast SPS. | 33-5-1 | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [9] | Qualcomm Incorporated | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast | 1. Support of ACK/NACK based HARQ-ACK feedback, and support of enabling/disabling ACK/NACK based HARQ-ACK feedback configured by RRC signalling for SPS group-common PDSCH without PDCCH scheduling, SPS group-common PDSCH activation, and SPS release PDCCH  2. Support of PTM retransmission for SPS multicast associated with G-CS-RNTI  3. Support of Type-1 and Type-2 HARQ-ACK CB for SPS multicast feedback only  4. Support of shared SPS-PUCCH-AN-List with unicast | 33-5-1 | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-19-1:**

* **Components of FG 33-5-1a are revised as** 
  + **Add a component “Support of PTM retransmission for SPS multicast associated with G-CS-RNTI” [2, 9]**
  + **Add a component “Support of Type-1 and Type-2 HARQ-ACK CB for SPS multicast feedback only” [2, 9]**
  + **Add a component “Support of shared or separate SPS-PUCCH-AN-List configuration from unicast SPS” [2, 9]**

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| Company | Comment |
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## **2.20 33-5-1b: DCI-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast**

In [1], FG 33-5-1b is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1b | DCI-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast | Support of DCI-based enabling/disabling ACK/NACK based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling | 33-5-1a | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [9] | Qualcomm Incorporated | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1b | DCI-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast | Support of DCI-based enabling/disabling ACK/NACK based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling via DCI format 4\_2 | 33-5-1a, 33-5-1i | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-20-1:**

* **Add FG 33-5-1i as a prerequisite FG for FG 33-5-1b [9]**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | ok |
|  |  |
|  |  |

### **High priority proposal 2-20-2:**

* **Components of FG 33-5-1b are revised as “Support of DCI-based enabling/disabling ACK/NACK based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling via DCI format 4\_2”. [9]**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | ok |
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## **2.21 33-5-1d: PTP retransmission for SPS group-common PDSCH for multicast**

In [1], FG 33-5-1d is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for SPS multicast [on the cell same as multicast initial transmission] | 33-5-1a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | FG33-5-1d support of PTP retransmission for multicast SPS should include base on retransmission on the cell same as multicast initial transmission, so the [] can be deleted.  ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for SPS multicast ~~[~~on the cell same as multicast initial transmission~~]~~ | 33-5-1a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [3] | ZTE | Regarding PTP retransmission, it has to be happed in the same cell as the PTM retransmission. Thus, the component of FG 33-2d and FG 33-5-1d can be updated as following.   |  |  |  | | --- | --- | --- | | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for SPS multicast ~~[~~on the cell same as multicast initial transmission~~]~~ |   ***Proposal 2****: For FG 33-2d and FG 33-5-1d, PTP retransmission for SPS multicast is on the cell same as multicast initial transmission.* |
| [5] | OPPO | For FG 33-5-1d, it is similar with FG 33-2d for PTP retransmission, in which the initial multicast transmission and PTP retransmission should be scheduled on the same cell.   1. ***For FG 33-5-1d, PTP retransmission for SPS multicast on the cell same as multicast initial transmission.*** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission associated with CS-RNTI for SPS multicast on the cell same as multicast initial transmission | 33-5-1a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | As discussed for FG 33-2d, the statement enclosed in brackets does not need to be described.  ***Proposal 12: Update FG 33-5-1d as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for SPS multicast | 33-5-1a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-21-1:**

* **Apply one of the following alternatives for Component of FG 32-5-1d.**
  + **Alt.1: Remove the bracket in Components for FG 33-5-1d, i.e., “on the cell same as multicast initial transmission” is kept [2, 3, 5, 9]**
  + **Alt.2: Remove “on the cell same as multicast initial transmission” [11]**

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| Company | Comment |
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### **High priority proposal 2-21-2:**

* **Components of FG 33-5-1d are revised as “Support of PTP retransmission associated with CS-RNTI for SPS multicast on the cell same as multicast initial transmission”. [9]**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | ok |
|  |  |
|  |  |

## **2.22 33-5-1e: Dynamic Slot-level repetition for SPS group-common PDSCH for multicast**

In [1], FG 33-5-1e is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1e | Dynamic Slot-level repetition for SPS group-common PDSCH for multicast | Support up to X times dynamic slot-level repetition for SPS group-common PDSCH for multicast. | 33-5-1 | Yes |  |  | [Per UE] | [No] | [No] |  | Candidate values for X is: {8, 16} | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | As discussed in [2] that it is expected that FG33-5-1 is supposed to be SPS group-common PDSCH for multicast for PCell that is reported per FS as agreed. With FG33-2 as the prerequisite FG, FG33-2h currently defined as MBS dynamic scheduling for SCell can be modified to include the cases of both dynamic and SPS scheduling for MBS, since, from UE perspective, if a CC is reported to support MBS for SCell then it is supposed to support both dynamic and SPS scheduling.  FG33-5-1a is ACK/NACK based feedback for multicast SPS, which should include the components that support of PTM retransmission, support of Type-1 and Type-2 HARQ-ACK CB for multicast feedback only, and support of shared or separate SPS-PUCCH-AN-List configuration from unicast SPS.  ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1e | Dynamic Slot-level repetition for SPS group-common PDSCH for multicast | Support up to X times dynamic slot-level repetition for SPS group-common PDSCH for multicast. | 33-5-1 | Yes |  |  | Per BC | N/A | N/A |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1e | Dynamic Slot-level repetition for SPS group-common PDSCH for multicast | Support up to X times dynamic slot-level repetition for SPS group-common PDSCH for multicast. | 33-5-1 | Yes |  |  | Per BC | N/A | N/A |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [11] | NTT DOCOMO | Since the reporting type of FG for dynamic slot-level repetition for unicast is per band, the type of FG 33-3-1 should also be per band.  ***Proposal 13: The reporting type of FG 33-5-1e is per band.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1e | Dynamic Slot-level repetition for SPS group-common PDSCH for multicast | Support up to X times dynamic slot-level repetition for SPS group-common PDSCH for multicast. | 33-5-1 | Yes |  |  | Per band | N/A | N/A |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-5-1e/f/g/i**:   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-22-1:**

* **Apply one of the following alternatives for the reporting type of FG 33-5-1e** 
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [2, 9]**

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| Company | Comment |
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## **2.23 33-5-1f: NACK-only based HARQ-ACK feedback for multicast RRC-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast**

In [1], FG 33-5-1f is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1f | NACK-only based HARQ-ACK feedback for multicast RRC-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | 1) Support NACK-only based HARQ-ACK feedback, and support of enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signalling for SPS group-common PDSCH without PDCCH scheduling  2) Support of PTM retransmission associated with G-CS-RNTI for SPS multicast | 33-5-1 | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | FG33-5-1f is expected to be the basic FG for NACK-only feedback for multicast SPS, as FG33-4 defined as the basic FG for NACK-only feedback for multicast dynamic scheduling and FG33-4a defined as additional UE capability for NACK-only mode2. Furthermore, FG33-4a can be expanded to include the cases of dynamic or SPS scheduling by setting FG33-4 or FG33-5-1f as prerequisites FG, respectively, as proposed in section 2.5. In addition, the components needed to be added include a single TB with NACK-only feedback transmitted in PUCCH, multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only, support of **shared or separate** SPS-PUCCH-AN-List configuration from unicast SPS, and support of PTM retransmission associated with G-CS-RNTI for SPS multicast.  ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1f | NACK-only based HARQ-ACK feedback for multicast with ACK/NACK transforming and RRC-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | 1) Support NACK-only based HARQ-ACK feedback, including:  a) A single TB with NACK-only feedback transmitted in PUCCH  b) multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only  2) Support of **shared or separate** SPS-PUCCH-AN-List configuration from unicast SPS.  3) support of enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signalling for SPS group-common PDSCH without PDCCH scheduling  4) Support of PTM retransmission associated with G-CS-RNTI for SPS multicast | 33-5-1a | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1f | NACK-only based HARQ-ACK feedback for multicast RRC-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | 1) Support NACK-only based HARQ-ACK feedback, and support of enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signalling for SPS group-common PDSCH without PDCCH scheduling  2) Support of PTM retransmission associated with G-CS-RNTI for SPS multicast  3) Support of Type-1 and Type-2 HARQ-ACK CB for SPS multicast feedback only  4) Support of shared SPS-PUCCH-AN-List with unicast | 33-5-1 | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | The reporting type of these FGs should be aligned with the corresponding FGs for ACK/NACK-based feedback for SPS group-common PDSCH. In other words, the reporting type of FG 33-5-1f should be per BC as in FG 33-5-1a. Also, the reporting type of FG 33-5-1g should be per band as in FG 33-5-1b.  ***Proposal 14: The reporting type of FG 33-5-1f is per BC.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1f | NACK-only based HARQ-ACK feedback for multicast RRC-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | 1) Support NACK-only based HARQ-ACK feedback, and support of enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signalling for SPS group-common PDSCH without PDCCH scheduling  2) Support of PTM retransmission associated with G-CS-RNTI for SPS multicast | 33-5-1 | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-5-1e/f/g/i**:   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-23-1:**

* **Components of FG 33-5-1f are revised as** 
  + **Add a component “a) A single TB with NACK-only feedback transmitted in PUCCH” [2]**
  + **Add a component “b) multiple TB with NACK-only feedback transmitted in PUCCH by transforming into ACK/NACK bits to generate Type-1 or Type-2 HARQ-ACK CB for multicast feedback only” [2]**
  + **Add a component “Support of shared or separate SPS-PUCCH-AN-List configuration from unicast SPS” [2]**
  + **Add a component “Support of PTM retransmission associated with G-CS-RNTI for SPS multicas” [2]**
  + **Add a component “Support of Type-1 and Type-2 HARQ-ACK CB for SPS multicast feedback only” [9]**
  + **Add a component “Support of shared SPS-PUCCH-AN-List with unicast” [9]**

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| Company | Comment |
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### **High priority proposal 2-23-2:**

* **Apply one of the following alternatives for the reporting type of FG 33-5-1f**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per BC [2, 9, 11]**

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| Company | Comment |
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## **2.24 33-5-1g: DCI-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast**

In [1], FG 33-5-1g is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1g | DCI-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling | 33-5-1f | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1g | DCI-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling | 33-5-1f | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1g | DCI-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling via DCI format 4\_2 | 33-5-1f, 33-5-1i | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [10] | Apple | The report type of FG33-5-1b ‘DCI-based enabling/disabling ACK/NACK-based feedback for SPS group-common PDSCH for multicast’ was agreed per band. FG 33-5-1g is DCI-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast, which has the similar function as FG33-5-1b. It’s natural to have the same reporting type, i.e., per band.  **Proposal 5: The report type of FG33-5-1g is per band.** |
| [11] | NTT DOCOMO | ***Proposal 15: The reporting type of FG 33-5-1g is per band.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1g | DCI-based enabling/disabling NACK-only based feedback for SPS group-common PDSCH for multicast | Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling | 33-5-1f | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-5-1e/f/g/i**:   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-24-1:**

* **Add FG 33-5-1i as a prerequisite FG for FG 33-5-1g [9]**

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| Company | Comment |
| Huawei/HiSilicon | ok |
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### **High priority proposal 2-24-2:**

* **Select one of the following alternatives for the reporting type of FG 33-5-1g**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [9, 10, 11]**
  + **Alt.3: Per BC [2]**

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| Company | Comment |
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### **High priority proposal 2-24-3:**

* **Components of FG 33-5-1g are revised as “Support of DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-CS-RNTI for multicast by RRC signaling via DCI format 4\_2”. [9]**

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| Company | Comment |
| Huawei/HiSilicon | ok |
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## **2.25 33-5-1i: Multicast SPS scheduling with DCI format 4\_2**

In [1], FG 33-5-1i is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1i | Multicast SPS scheduling with DCI format 4\_2 | Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling  FFS whether to include retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI | [33-5-1] | Yes |  |  | FFS | FFS | FFS |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | FG33-5-1i FFS whether to include retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI, it is understood that retransmission by DCI format 4\_2 scheduling can be supported or the initial transmission by DCI format 4\_2 scheduling is supported.  ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1i | Multicast SPS scheduling with DCI format 4\_2 | 1. Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling  2. retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI  ~~FFS whether to include~~ | ~~[~~33-5-1~~]~~ | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [3] | ZTE | FG 33-5-1i is about multicast SPS scheduling with DCI format 4\_2. It is obvious that it includes retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI.   |  |  |  | | --- | --- | --- | | 33-5-1i | Multicast SPS scheduling with DCI format 4\_2 | Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling  FFS whether to include retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI |   ***Proposal 4****: FG 33-5-1i includes retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI.* |
| [5] | OPPO | For FG 33-5-1i, applying DCI format 4\_2 for multicast SPS scheduling as well as retransmissions are similar functions for a group of UEs. DCI format 4\_2 to schedule retransmission of SPS can be a separate FG or merged in FG 33-5-1i.   1. ***“Retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI” can be merged into FG 33-5-1i as a component, or separated as FG 33-5-1j.*** |
| [6] | Xiaomi | In RAN1#104 meeting, we agreed that a SPS retransmission can be scheduled by a DCI format scrambled with G-CS-RNTI for PTM scheme1.   |  | | --- | | Agreement:  Define G-CS-RNTI at least for SPS group-common PDSCH and activation/deactivation of SPS group-common PDSCH, different from CS-RNTI for unicast SPS PDSCH.   * G-CS-RNTI is used for PTM scheme 1 based dynamic retransmission of SPS group-common PDSCH * FFS: Whether CS-RNTI can be used for PTP retransmission of SPS group-common PDSCH. * FFS: Number of G-CS-RNTI. |   In TS 38.213, the retransmission of multicast SPS is captured as below:   |  | | --- | | For the first HARQ-ACK reporting mode and for a transport block that a UE received in a SPS PDSCH, a PDSCH reception providing a retransmission of the transport block can be scheduled either by a unicast DCI format using a CS-RNTI or by a multicast DCI format using a same G-CS-RNTI as the G-CS-RNTI of the initial transmission of the transport block [6, TS 38.214]. |   It can be seen that reschedule a SPS PDSCH with multicast DCI is a basic functionality. Considering the nature of FG 33-5-1i is to support DCI format 4\_2 for multicast SPS scheduling, there is no reason to preclude retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI.  ***Proposal 5: Retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI should be included in FG 33-5-1i.*** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1i | Multicast SPS scheduling with DCI format 4\_2 | Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling | 33-5-1 | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | We don’t see the need to separate support of retransmission scheduled by DCI format 4\_2. The reporting type of FG 33-5-1i should be per band like FG for support of DCI format 4\_2 for dynamic scheduling.  ***Proposal 16: Update FG 33-5-1i as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1i | Multicast SPS scheduling with DCI format 4\_2 | 1. Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling 2. Retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI | 33-5-1 | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-5-1e/f/g/i**:   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types.   The FG 33-5-1i has one remaining FFS regarding the support of retransmission of group scheduled SPS. Since the support of HARQ feedback for SPS is a separate FG (33-5-1a), it follows that UEes may support separately DCI format 4\_2 and HARQ feedback. Therefore, support for retransmission should be independent from 33-5-1i. we note that support of retransmission for dynamic scheduling is coupled to support of ACK/NACK based or nack only based feedback (feature group 33-2a / 33/4).   |  |  |  | | --- | --- | --- | | 33-5-1i | Multicast SPS scheduling with DCI format 4\_2 | Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling  FFS whether to include retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI |  1. Support a separate FG 33-5-1j for retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI, with a dependency on FG 33-5-1i and FG 33-5-1a (ACK NACK based feedback supported and/or FG 33-5-1f (NACK only feedback supported). |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-25-1:**

* **Apply one of the following alternatives for Component of FG 33-5-1i.**
  + **Alt.1: Retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI is included in FG 33-5-1i [2, 3, 5, 6, 11]**
  + **Alt.2: Retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI is NOT included in FG 33-5-1i [9, 13]**
    - **Separate FG for retransmission scheduled by DCI format 4\_2 with CRC scrambled with G-CS-RNTI is introduced with a dependency on FG 33-5-1i and FG 33-5-1a and/or FG 33-5-1f [13]**

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### **High priority proposal 2-25-2:**

* **Prerequisite FG for FG 33-5-1i is FG 33-5-1. [2, 9, 11]**

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| Company | Comment |
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### **High priority proposal 2-25-3:**

* **Apply one of the following alternatives for the reporting type of FG 33-5-1i**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [2, 9, 11]**

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| Company | Comment |
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## **2.26 33-5-2: Multiple SPS group-common PDSCH configuration**

In [1], FG 33-5-2 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 [per cell], and activated SPS group-common PDSCH configurations is no larger than M. | 33-2 | Yes |  |  | [Per UE] | [No] | [No] |  | Candidate value set for M is {1, 2, …, 8} | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 ~~[~~per cell~~]~~, and activated SPS group-common PDSCH configurations is no larger than M. | 33-2 | Yes |  |  | Per BC | N/A | N/A |  | Candidate value set for M is {1, 2, …, 8} | Optional with capability signalling | |
| [7] | vivo | As RAN2 has agreed that MBS SPS for multicast can be configured on one SCell or PCell, two UE FGs can be added to reflect one SPS group-common PDSCH configuration and multiple SPS group-common PDSCH configurations for SCell, respectively.  ***Proposal 4*** Add FG 33-5-3 and FG 33-5-4, which include supporting of one and multiple SPS group-common PDSCH configurations for multicast for Scell.  Furthermore, in Rel-16, it is defined that up to 8 configured SPS configurations in a BWP of a serving cell and up to 32 configured SPS configurations in a cell group are supported in FG 12-2. When multicast is considered, the UE capabilities on multiple SPS configurations are expected to keep the same as existed UE capabilities for unicast only, and thus, the total number of SPS configurations for both multicast and unicast is no larger than 8 per cell, the total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32.  ***Proposal 5*** The total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32.   |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration for Pcell | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 [per cell], and activated SPS group-common PDSCH configurations is no larger than M.  4. The total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32. | 33-2 | Yes | [Per UE] | [No] | [No] |  | Candidate value set for M is {1, 2, …, 8} | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-5-1, FG33-5-1x and FG33-5-2 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 [per cell], and activated SPS group-common PDSCH configurations is no larger than M. | 33-5-1 | Yes |  |  | Per FS | N/A | N/A |  | Candidate value set for M is {1, 2, …, 8} | Optional with capability signalling | |
| [10] | Apple | In last RAN1 meeting, the details of supporting multiple SPS PDSCH were agreed, one remaining is whether the total number of SPS configuration is per cell configured.  As indicated in TS 38.331, the maximum number of SPS configuration is configured per BWP. Thus, component 3 of FG33-5-2 can be updated accordingly.  Excerpt from TS33.3381  maxNrofSPS-Config-r16 INTEGER ::= 8 -- Maximum number of SPS configurations per BWP  – *SPS-ConfigIndex*  The IE *SPS-ConfigIndex* is used to indicate the index of one of multiple DL SPS configurations in one BWP.  ***SPS-ConfigIndex* information element**  SPS-ConfigIndex-r16 ::= INTEGER (0.. maxNrofSPS-Config-r16-1)  **Proposal 4: Update the component 3 of FG33-5-2 with per BWP configured.**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 per BWP, and activated SPS group-common PDSCH configurations is no larger than M. | 33-2 | Yes | |
| [11] | NTT DOCOMO | SPS-Config for unicast is a per-cell configuration, so the description “per cell” will be necessary. The reporting type of FG for support of 8 SPS configurations for unicast is per band, the reporting type of FG 33-5-2 should also be per band.  ***Proposal 17: The reporting type of FG 33-5-2 is per band.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support up to 8 SPS group-common PDSCH configuration per CFR for multicast  2. Support M>=1 activated SPS group-common PDSCH configurations per CFR for multicast  3. The total number of SPS configurations for both multicast and unicast is no larger than 8 per cell, and activated SPS group-common PDSCH configurations is no larger than M. | 33-2 | Yes |  |  | Per band | N/A | N/A |  | Candidate value set for M is {1, 2, …, 8} | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-5-2**:   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-26-1:**

* **Apply one of the following alternatives for the description in the bracket in Components for FG 33-5-2**
  + **Alt.1: Per cell [2, 11]**
  + **Alt.2: Per BWP [10]**

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| Company | Comment |
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### **High priority proposal 2-26-2:**

* **Components of FG 33-5-2 are revised as** 
  + **Add a component “The total number of SPS configurations for both multicast and unicast in a cell group is no larger than 32” [7]**

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| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | ok |
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### **High priority proposal 2-26-3:**

* **Apply one of the following alternatives for the reporting type of FG 33-5-2**
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [2]**
  + **Alt.4: Per FS [9]**

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| Company | Comment |
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## **2.27 33-6-1: DL priority indication for multicast in DCI**

In [1], FG 33-6-1 is captured as below.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-6-1 | DL priority indication for multicast in DCI | 1. Support of priority indicator field configured in DCI formats 1\_1 with CRC scrambled with G-RNTI for multicast.  2. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast and multicast at a UE | 33-2 | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | For dynamic scheduling, the priority indication can be included in DCI format 4\_2 for multicast. The priority index cannot be directly configured by RRC signalling, although it means low priority when the priority indication is not included in the DCI format. Given FG33-6-1a is for configuring priority for multicast SPS configuration, it is better to make it clear that FG33-6-1 is for indicating priority for multicast dynamic scheduling. In addition, since FG33-2f is for indicating the capability of dynamic multicast with DCI format 4\_2, the prerequisite FG should be FG33-2f instead of FG33-2.  ***Proposal 7: Updating FG33-6-1/1a/2/3 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1 | DL priority indication for multicast in DCI for multicast dynamic scheduling | 1. Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-RNTI for multicast dynamic scheduling.  2. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast and multicast at a UE | 33-2f | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [4] | Spreadtrum Communications | In latest 38.212 spec [2], DCI format for broadcast has been captured as DCI format 4\_0, and DCI format for multicast has been captured as DCI format 4\_1 and DCI format 4\_2. In order to align with the current spec, we have the following proposal:  ***Proposal 1***: Revise DCI format to align with 38.212,   * In component 5 of FG 33-1, DCI format 1\_0 is adjusted as DCI format 4\_0; * In component 4 of FG 33-2, DCI format 1\_0 is adjusted as DCI format 4\_1; * In component 1 of FG 33-6-1, DCI format 1\_1 is adjusted as DCI format 4\_2; |
| [6] | Xiaomi | We also note that the DCI format 1\_0 and DCI format 1\_1 are used in the feature group related to multicast. Actually the new DCI format used for multicast is already captured in TS38.212, i.e. DCI format 4\_1 and DCI format 4\_2. The DCI format should be aligned between UE feature list and other physical specifications.  ***Proposal 6: Correct the DCI format in the following feature group:***   * ***Replace DCI format 1\_0 with DCI format 4\_0 in FG 33-1*** * ***Replace DCI format 1\_0 with DCI format 4\_1 in FG 33-2*** * ***Replace DCI format 1\_1 with DCI format 4\_2 in FG 33-6-1*** |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-6-x as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1 | DL priority indication for multicast in DCI | 1. Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-RNTI for multicast.  2. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast and multicast at a UE | 33-2a, 33-2f | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [10] | Apple | The reporting type of FG 33-2f Dynamic multicast with DCI format 4\_2 was agreed per band. DL priority indication field is included in the DCI format 4\_2, such the reporting type of FG33-6-1 DL priority indication for multicast in DCI can be the same as FG33-2f, and DL priority related sub-features can be per band reported as well.  **Proposal 6: The report type of FG33-6-x is per band.** |
| [11] | NTT DOCOMO | DCI format name should be corrected. FG 33-6-1 includes the generation of two HARQ-ACK codebooks. Since the reporting type of FG for support of two unicast HARQ-ACK codebooks with different priorities is per FS, the reporting type of FG 33-6-1 should also be per FS.  ***Proposal 18: Update FG 33-6-1 and 33-6-2 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1 | DL priority indication for multicast in DCI | 1. Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-RNTI for multicast.  2. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast and multicast at a UE | 33-2 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-6-1/1a:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-27-1:**

* **Replace DCI format 1\_1 with DCI format 4\_2 in FG 33-6-1. [2, 4, 6, 9, 11]**

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| Company | Comment |
| Moderator (NTT DOCOMO) | This is like fixing typo and should be reflected in next update. No need discussion. |

### **High priority proposal 2-27-2:**

* **Components of FG 33-5-2 are revised as** 
  + **Component 1: Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-RNTI for multicast dynamic scheduling**

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### **High priority proposal 2-27-3:**

* **Apply one of the following alternatives for prerequisite FG for FG 33-6-1**
  + **Alt.1: FG 33-2 [11]**
  + **Alt.2: FG 33-2f [2]**
  + **Alt.3: FG 33-2a and 33-2f [9]**

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### **High priority proposal 2-27-4:**

* **Apply one of the following alternatives for the reporting type of FG 33-6-1**
  + **Alt.1: Per UE [2, 12, 13]**
  + **Alt.2: Per Band [10]**
  + **Alt.3: Per FS [11]**
  + **Alt.4: Per FSPC [9]**

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## **2.28 33-6-1a: DL priority configuration for SPS multicast**

In [1], FG 33-6-1a is captured as below.

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| 33. NR\_MBS | 33-6-1a | DL priority configuration for SPS multicast | Support of priority configured for multicast HARQ-ACK feedback of SPS multicast | 33-6-1 | Yes |  |  | FFS | FFS | FFS |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | Given FG33-6-1a is for configuring priority for multicast SPS configuration, it is better to make it clear that FG33-6-1 is for indicating priority for multicast dynamic  ***Proposal 7: Updating FG33-6-1/1a/2/3 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1a | DL priority configuration for SPS multicast | Support of priority configured for multicast HARQ-ACK feedback of SPS multicast | 33-6-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-6-x as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1a | DL priority configuration for SPS multicast | Support of priority indicator field configured in DCI formats 4\_2 for multicast HARQ-ACK feedback of SPS multicast | 33-5-1a, 33-5-1i | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [10] | Apple | The reporting type of FG 33-2f Dynamic multicast with DCI format 4\_2 was agreed per band. DL priority indication field is included in the DCI format 4\_2, such the reporting type of FG33-6-1 DL priority indication for multicast in DCI can be the same as FG33-2f, and DL priority related sub-features can be per band reported as well.  **Proposal 6: The report type of FG33-6-x is per band.** |
| [11] | NTT DOCOMO | The processing of this feature would be band-independent. Reporting type per UE without FDD/TDD/FR1/FR2 differentiation would be sufficient.  ***Proposal 19: The reporting type of FG 33-6-1a is per UE.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1a | DL priority configuration for SPS multicast | Support of priority configured for multicast HARQ-ACK feedback of SPS multicast | 33-6-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-6-1/1a:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-28-1:**

* **Components of FG 33-6-1a are revised as “Support of priority indicator field configured in DCI formats 4\_2 for multicast HARQ-ACK feedback of SPS multicast” [9]**

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### **High priority proposal 2-28-2:**

* **Apply one of the following alternatives for prerequisite FG for FG 33-6-1a**
  + **Alt.1: FG 33-6-1 [2, 11]**
  + **Alt.2: FG 33-5-1a and 33-5-1i [9]**

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### **High priority proposal 2-28-3:**

* **Apply one of the following alternatives for the reporting type of FG 33-6-1a**
  + **Alt.1: Per UE [2, 11, 12, 13]**
  + **Alt.2: Per Band [10]**
  + **Alt.3: Per FSPC [9]**

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## **2.29 33-6-2: Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for unicast and multicast at a UE**

In [1], FG 33-6-2 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 33. NR\_MBS | 33-6-2 | Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for unicast and multicast at a UE | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for unicast and multicast at a UE. | 33-6-1 | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | Huawei, HiSilicon | ***Proposal 7: Updating FG33-6-1/1a/2/3 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-2 | Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for unicast and multicast at a UE | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for unicast and multicast at a UE. | 33-6-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-6-x as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-2 | Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for unicast and multicast at a UE | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for unicast and multicast at a UE. | 33-6-1 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [10] | Apple | The reporting type of FG 33-2f Dynamic multicast with DCI format 4\_2 was agreed per band. DL priority indication field is included in the DCI format 4\_2, such the reporting type of FG33-6-1 DL priority indication for multicast in DCI can be the same as FG33-2f, and DL priority related sub-features can be per band reported as well.  **Proposal 6: The report type of FG33-6-x is per band.** |
| [11] | NTT DOCOMO | FG 33-6-1 includes the generation of two HARQ-ACK codebooks. Since the reporting type of FG for support of two unicast HARQ-ACK codebooks with different priorities is per FS, the reporting type of FG 33-6-1 should also be per FS. The type of FG 33-6-2 should be per FS for the same reason.  ***Proposal 18: Update FG 33-6-1 and 33-6-2 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-2 | Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for unicast and multicast at a UE | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for unicast and multicast at a UE. | 33-6-1 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-6-2:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-29-1:**

* **Apply one of the following alternatives for the reporting type of FG 33-6-2**
  + **Alt.1: Per UE [2, 12, 13]**
  + **Alt.2: Per Band [10]**
  + **Alt.3: Per FS [11]**
  + **Alt.4: Per FSPC [9]**

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## **2.30 33-6-3: More than one PUCCH for HARQ-ACK transmission for multicast or for unicast and multicast within a slot**

In [1], FG 33-6-3 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 33. NR\_MBS | 33-6-3 | More than one PUCCH for HARQ-ACK transmission for multicast or for unicast and multicast within a slot | 1. Supports two non-overlapping slot-based PUCCHs for ACK/NACK based HARQ-ACK feedback for multicast or for unicast and multicast with different priorities in a slot. | 33-6-1, 33-6-2 | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | Huawei, HiSilicon | ***Proposal 7: Updating FG33-6-1/1a/2/3 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-3 | More than one PUCCH for HARQ-ACK transmission for multicast or for unicast and multicast within a slot | 1. Supports two non-overlapping slot-based PUCCHs for ACK/NACK based HARQ-ACK feedback for multicast or for unicast and multicast with different priorities in a slot. | 33-6-1, 33-6-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the following changes for the remaining FFSs of FG33-6-x as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-3 | More than one PUCCH for HARQ-ACK transmission for multicast or for unicast and multicast within a slot | 1. Supports two non-overlapping slot-based PUCCHs for ACK/NACK based HARQ-ACK feedback for multicast or for unicast and multicast with different priorities in a slot. | 33-6-1, 33-6-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [10] | Apple | The reporting type of FG 33-2f Dynamic multicast with DCI format 4\_2 was agreed per band. DL priority indication field is included in the DCI format 4\_2, such the reporting type of FG33-6-1 DL priority indication for multicast in DCI can be the same as FG33-2f, and DL priority related sub-features can be per band reported as well.  **Proposal 6: The report type of FG33-6-x is per band.** |
| [11] | NTT DOCOMO | Since the reporting type of FG for support of more than one PUCCH for unicast HARQ-ACK transmission within a slot is per FS, the reporting type of FG 33-6-3 should also be per FS.  ***Proposal 20: The reporting type of FG 33-6-3 is per FS.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-3 | More than one PUCCH for HARQ-ACK transmission for multicast or for unicast and multicast within a slot | 1. Supports two non-overlapping slot-based PUCCHs for ACK/NACK based HARQ-ACK feedback for multicast or for unicast and multicast with different priorities in a slot. | 33-6-1, 33-6-2 | Yes |  |  | Per FS | N/A | N/A |  |  | Optional with capability signalling | |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-30-1:**

* **Apply one of the following alternatives for the reporting type of FG 33-6-3**
  + **Alt.1: Per UE [2, 13]**
  + **Alt.2: Per Band [10]**
  + **Alt.3: Per FS [11]**
  + **Alt.4: Per FSPC [9]**

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## **2.31 33-8-1: PUCCH resource configuration for multicast feedback for dynamically scheduled multicast**

In [1], FG 33-8-1 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 33. NR\_MBS | 33-8-1 | PUCCH resource configuration for multicast feedback for dynamically scheduled multicast | Support of a PUCCH-Config for multicast HARQ-ACK feedback, separate from that of unicast configurations | 33-2a | Yes |  |  | [Per band or per FSPC] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [2] | Huawei, HiSilicon | As discussed in section 2.5, FG33-4 is defined for NACK-only mode1 with shared PUCCH resources configured for unicast. Support of separately configured PUCCH resources from unicast for NACK-only mode1 is expected to be separate UE FG.  Given FG33-8-1 is already defined that was initially intended for at least ACK/NACK based feedback for multicast, such FG can be expanded to include the case for NACK-only mode1. Overall, the change can be made to the prerequisite FG to include FG33-2a or FG33-4 for ACK/NACK based and for NACK-only mode1 feedback, respectively.  ***Proposal 8: Updating FG33-8-1 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-8-1 | PUCCH resource configuration for multicast feedback for dynamically scheduled multicast | Support of a PUCCH-Config for multicast HARQ-ACK feedback, separate from that of unicast configurations | 33-2a or 33-4 | Yes |  |  | Per BC | No | No |  | Note: With 33-2a or 33-4 as prerequisite FG, this FG33-8-1 includes the case of ACK/NACK for multicast or NACK-only mode1 for multicast. | Optional with capability signalling | |
| [9] | Qualcomm | We suggest the changes for the remaining FFSs of FG 33-8 as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-8-1 | PUCCH resource configuration for multicast feedback for dynamically scheduled multicast | Support of a PUCCH-Config for multicast HARQ-ACK feedback, separate from that of unicast configurations | 33-2a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-8-2 | Up to 2 PUCCH resources configuration for multicast feedback for dynamically scheduled multicast | Support of a PUCCH-ConfigurationList for multicast HARQ-ACK feedback, separate from that of unicast configurations | 33-8-1, 33-6-1 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-8-3 | PUCCH resource configuration for multicast feedback for SPS GC-PDSCH | Support of a SPS-PUCCH-AN-List for multicast HARQ-ACK feedback of all multicast SPS configuration(s), separate from that of SPS unicast configurations | 33-5-1a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | We don’t see the need to make the reporting type of FG 33-8-1 finer granularity than per band. Reporting type per band would be sufficient.  ***Proposal 21: The reporting type of FG 33-8-1 is per band.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-8-1 | PUCCH resource configuration for multicast feedback for dynamically scheduled multicast | Support of a PUCCH-Config for multicast HARQ-ACK feedback, separate from that of unicast configurations | 33-2a | Yes |  |  | Per band | N/A | N/A |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-8-1:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-31-1:**

* **Add FG 33-4 as a prerequisite FG for FG 33-8-1 [2]**

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### **High priority proposal 2-31-2:**

* **Apply one of the following alternatives for the reporting type of FG 33-8-1** 
  + **Alt.1: Per UE [12, 13]**
  + **Alt.2: Per Band [11]**
  + **Alt.3: Per BC [2]**
  + **Alt.4: Per FSPC [9]**

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### **High priority proposal 2-31-3:**

* **Introduce FG for support of the following. [9]**
  + **Support of a PUCCH-ConfigurationList for multicast HARQ-ACK feedback, separate from that of unicast configurations**
  + **Support of a SPS-PUCCH-AN-List for multicast HARQ-ACK feedback of all multicast SPS configuration(s), separate from that of SPS unicast configurations**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-8-2 | Up to 2 PUCCH resources configuration for multicast feedback for dynamically scheduled multicast | Support of a PUCCH-ConfigurationList for multicast HARQ-ACK feedback, separate from that of unicast configurations | 33-8-1, 33-6-1 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-8-3 | PUCCH resource configuration for multicast feedback for SPS GC-PDSCH | Support of a SPS-PUCCH-AN-List for multicast HARQ-ACK feedback of all multicast SPS configuration(s), separate from that of SPS unicast configurations | 33-5-1a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling |

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| Company | Comment |
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## **2.32 33-9: Support group-common PDSCH RE-level rate matching for multicast**

In [1], FG 33-9 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-9 | Supporting unicast PDCCH to release SPS group-common PDSCH | Supports unicast PDCCH scrambled with CS-RNTI to release SPS group-common PDSCH | [33-5-1] | Yes |  |  | [Per UE] | [No] | [No] |  |  | Optional with capability signalling |

Following views are provided in contributions for the RAN1#110 meeting.

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| [2] | Huawei, HiSilicon | ***Proposal 6: Updating 33-5-1/1a/1d/1e/1f/1g/1i/2/33-9 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-9 | Supporting unicast PDCCH to release SPS group-common PDSCH | Supports unicast PDCCH scrambled with CS-RNTI to release SPS group-common PDSCH | ~~[~~33-5-1~~]~~ | Yes |  |  | Per BC | N/A | N/A |  |  | Optional with capability signalling | |
| [4] | Spreadtrum Communications | The Feature group refers to use unicast PDCCH to release SPS group-common PDSCH. In details, it means that one PDCCH scrambled with CS-RNTI is used to release SPS group-common PDSCH. In our mind, only UE supports unicast SPS, CS-RNTI would be configured. Thus, we suggest to add FG 5-18 (i.e., the capability of supporting DL SPS for unicast) as the prerequisite FG of FG33-9.  ***Proposal 2: Support to add FG5-18 as the prerequisite FG of FG33-9.*** |
| [9] | Qualcomm | We suggest the changes for the remaining FFSs of FG 33-9 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-9 | Supporting unicast PDCCH to release SPS group-common PDSCH | Supports unicast PDCCH scrambled with CS-RNTI to release SPS group-common PDSCH | 33-5-1 | Yes |  |  | Per BC | N/A[No] | N/A[No] |  |  | Optional with capability signalling | |
| [11] | NTT DOCOMO | There will be no problem with making 33-5-1 a prerequisite FG for 33-2e. Brackets can be removed.  The process of checking if it is a DCI for SPS release would be band-independent. Reporting type per UE without FDD/TDD/FR1/FR2 differentiation would be sufficient.  ***Proposal 22: Update FG 33-9 as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-9 | Supporting unicast PDCCH to release SPS group-common PDSCH | Supports unicast PDCCH scrambled with CS-RNTI to release SPS group-common PDSCH | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [12] | Nokia, NSB | * **33-9:**   + Per UE |
| [13] | Ericsson | For the remaining FGs, support can be per UEs as there is already a dependent FG that is per FS (FG 33-2). For FG 33-8-1, the option was to choose between per banf or per FSPC. However, 33-8-1 depends on 33-2a, which itself is per FSPC. Thus we think having 33-8 per UE is enough.   1. Support per FS type for FG 33-1-2 and per UE for the remaining MBS FGs with undecided types. |

Based on above, following proposal should be discussed at the RAN1#110 meeting.

### **High priority proposal 2-32-1:**

* **Apply one of the following alternatives for prerequisite FG of FG 33-9.**
  + **Alt.1: FG 33-5-1: [2, 9, 11]**
  + **Alt.2: FG 33-5-1 and FG 5-18: [4]**

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### **High priority proposal 2-32-2:**

* **Apply one of the following alternatives for the reporting type of FG 33-9**
  + **Alt.1: Per UE [11, 12, 13]**
  + **Alt.2: Per BC [2, 9]**

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# **Conclusions**

TBD

# **References**

[1] R1-2205608 Updated RAN1 UE features list for Rel-17 NR after RAN1 #109-e including remaining RAN1 issues Moderators (AT&T, NTT DOCOMO, INC.)

[2] R1-2205758 Rel-17 UE features for NR MBS Huawei, HiSilicon

[3] R1-2205958 Discussion on Rel-17 UE features for NR MBS ZTE

[4] R1-2205979 UE features for R17 NR MBS Spreadtrum Communications

[5] R1-2206286 Discussion on UE features for NR MBS OPPO

[6] R1-2206613 Discussion on UE features for NR MBS Xiaomi

[7] R1-2206769 UE features for NR MBS vivo

[8] R1-2207014 Views on UE features for NR MBS MediaTek Inc.

[9] R1-2207213 UE features for Rel-17 NR MBS Qualcomm Incorporated

[10] R1-2207318 On Rel-17 NR MBS UE Features Apple

[11] R1-2207391 Discussion on Rel.17 UE features for NR MBS NTT DOCOMO, INC.

[12] R1-2207583 On UE features for NR MBS Nokia, Nokia Shanghai Bell

[13] R1-2207617 Views on NR MBS UE features Ericsson