**3GPP TSG RAN WG1 #108-e R1-22xxxxx**

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

**Agenda item:** 8.16.12

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

**Title:** [draft]Summary on UE features for NR MBS

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes contributions submitted to AI 8.16.12 regarding UE features for NR MBS and captures the following email discussion.

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| [108-e-R17-UE-features-MBS-01] Email discussion on UE features for NR MBS – Shinya (DOCOMO)   * 1st check point: February 25 * Final check point: March 3 |

In the Updated RAN1 UE features list for Rel-17 NR after RAN1 #107bis-e [1], there are following feature groups for NR MBS.

* 33-1 Broadcast
* 33-2 Dynamic scheduling for multicast
* 33-2a Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast
* 33-2b DCI-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast
* 33-2c PTM retransmission for multicast
* 33-2d PTP retransmission for multicast
* 33-2-x Multiple G-RNTIs for group-common PDSCHs
* 33-3-1 Dynamic Slot-level repetition for group-common PDSCH
* 33-3-2 FDM-ed unicast PDSCH and group-common PDSCH
* 33-3-3 Intra-slot TDM-ed unicast PDSCH and group-common PDSCH
* 33-3-4 Mode 1 for type1 codebook generation
* 33-3-5 Feedback multiplexing for unicast PDSCH and group-common PDSCH for multicast with same priority and different codebook type
* 33-4 NACK-only based HARQ-ACK feedback for multicast
* 33-4-1 DCI-based enabling/disabling NACK-only based feedback for dynamic scheduling for multicast
* 33-5-1 SPS group-common PDSCH for multicast
* 33-5-2 Multiple SPS group-common PDSCH configuration
* 33-6-1 DL priority indication for multicast in DCI
* 33-6-2 Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for multicast or for unicast and multicast at a UE
* 33-6-3 More than one PUCCH for HARQ-ACK transmission for multicast or for unicast and multicast within a slot
* 33-7 Supporting group-common DCI indicating the enabling/disabling [ACK/NACK based] HARQ-ACK feedback
* 33-9 Supporting unicast PDCCH to release SPS group-common PDSCH

The issues to be discussed are tagged and colour coded with High priority, Medium priority, or Low priority, considering RAN2 impact especially for capability signaling design.

In this round of the discussion, companies are requested to provide comments on the proposals and questions tagged FL4.

# **33-1: Broadcast**

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

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 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       9. FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG |  | Yes |  |  | Per UE | No | No |  |  | Optional without capability signalling |

Following feedbacks are provided in contributions for the RAN1#108-e 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. Broadcast reception targets UEs for all RRC states. As commented by some companies, FG33-1 can be reported so that network can at least manipulate the transmissions of MBS broadcast and unicast properly for UE in RRC\_CONNECTED state. From this sense, we can accept this capability reported to network. This report can be per band if per band is preferred from UE perspective.  For UE receiving broadcast, RAN1#107bis-e meeting agreed that the rate matching pattern can be configured in *PDSCH-Config-MCCH* or *PDSCH-Config-MTCH* for GC-PDSCH rate matching subject to UE capability as follows:   |  | | --- | | ***Agreement***  *For broadcast RRC\_IDLE/INACTIVE UEs, rateMatchPatternToAddModList can be configured in PDSCH-Config-MCCH or PDSCH-Config-MTCH for GC-PDSCH rate matching.*   * + *Whether UE can receive the GC-PDSCH with rate matching based on the rateMatchPatternToAddModList is subject to UE capability.*   + *Rel-15/16 UE capability of the supported maximum number of RE mapping patterns per symbol and per slot are kept unchanged to support rate matching for unicast/multicast/broadcast. The RateMatchPattern configured for MBS broadcast is counted into the ones that are configured per serving-cell.* |   As mandatory for legacy UE supporting unicast, supporting semi-static rate-matching resource set configuration and supporting rate-matching around LTE CRS should be the components of FG33-1.  Dynamic slot-level repetition was agreed to be a separate FG for multicast and it should be a separate FG for broadcast so as to keep the commonality of FG33-1 for broadcast and FG33-2 for multicast including the commonality of the maximum number of repetitions supported for multicast and broadcast. It can be merged to FG33-3-1 with FG33-1 as the prerequisite FG as discussed in section 2.4.  Overall, the FG33-1 for broadcast can be updated as in the following proposal.  ***Proposal 1: Updating FG33-1 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. 9. Support of semi-static rate-matching resource set configuration. 10. Support of rate-matching around LTE CRS.   ~~FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG~~ |  | Yes |  |  | ~~Per UE~~  Per band | No | No |  |  | Optional ~~without~~ with capability signalling | |
| [3] | 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 a flexible number of repetitions from 1 to 8 for broadcast, it is better to support fixed values, i.e., {2, 4, 8} times repetitions.  Regarding DCI indicated slot-level repetition for MTCH, it should be a separated FG as agreed for multicast for better commonality.  Furthermore, multiple G-RNTIs facilitate different services, and thus, support of  G-RNTIs should be included in 33-1.  ***Proposal 1*** For higher layer configured slot-level repetition in FG 33-1, UE is mandated to support {2, 4, 8} times repetitions.  ***Proposal 2*** DCI indicated slot-level repletion is not included in FG33-1.  ***Proposal 3*** ‘Support of  G-RNTIs’ is included in FG 33-1.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 of higher layer configured slot-level repetition for MTCH：{2,4,8} 9. Support of G-RNTIs for broadcast.   FFS details of N |  | Yes | Optional without capability signalling | |
| [4] | ZTE | Rel-17 is the first release that supports broadcast and multicast for NR. To facilitate the MBS commercial process, it is beneficial to define some basic feature groups for MBS. For now, FG33-1 and FG33-2 can be set as the basic UE feature group for MBS. We can further merge or add more basic functionalities into FG33-1 and FG33-2 if needed.  ***Proposal 1****: FG 33-1 and FG 33-2 are the basic FG for broadcast and multicast, respectively.*  In RAN1#107-e meeting, it has been agreed to have a separate FG for dynamic repetition for multicast, and the maximum value of repetition is 8 or 16. Similar mechanism can be reused for broadcast.   |  | | --- | | **Agreement**   * Only the capability for semi-static repetition is included in FG 33-2   + For semi-static repetition, UE is mandated to support {2, 4, 8} times repetitions   + For dynamic repetition, a separate FG is introduced; UE reports one of the maximum values from {8, 16} |   ***Proposal 2****: For broadcast, a separate FG is introduced for dynamic repetition; UE reports one of the maximum values from {8, 16}.*  In Rel-15, semi-static RB-level rate-matching is a mandatory FG with capability signalling. It makes sense to include this into FG 33-1 for broadcast.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | 5-26 | Semi-static rate-matching resource set configuration for DL | 1. Bitmap 1/2/3 2. controlResourceSet |  | Yes |  | Type 4 | No need | No need |  |  |  |  | Mandatory with capability signaling |   ***Proposal 3****: Introduce “Semi-static rate-matching resource set configuration for broadcast” as a component of FG 33-1.* |
| [5] | OPPO | In RAN1#107bis-e meeting, it was agreed that a new component for support of higher layer configured slot-level repetition up to 8 for MTCH is added into FG 33-1. Another issue is left for further discussion on DCI indication of the repetition. Regarding the mechanism of slot-level, it has been merged into FG 33-1 which is considered as optional but basic function for Rel-17 NR MBS, even slot-level repetition is considered only optional in Rel-15/16. Using DCI to indicate the repetition dynamically is considered as flexible than higher layer configured. Furthermore, if DCI indication is split into a separate FG while higher signaling indication is kept into the FG33-1, the DCI indication FG might never be used as an optional and not basic feature. Regarding the repetition number 8 or 16, it is not necessary to restrict the repetition number to 8, while 16 can provide more flexibility by using DCI indication. By considering the DCI format, limiting it to 8 may also result in complicated TDRA table configuration.   1. ***“DCI indicated slot-level repetition for MTCH” is kept as one of the components of FG 33-1.*** 2. ***The repetition number of DCI indication for MTCH is up to 16.***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 9. DCI indicated slot-level repetition up to 16 for MTCH. |  | Yes |  |  | Per UE | No | No |  |  | Optional without capability signalling |   According to the discussion in last meeting, one question is that whether 33-1 FG Broadcast is a basic FG for NR MBS. According to previous UE feature discussion, basic FG means broadcast itself is supported as an optional function group, UE has to indicate that this FG is supported when the UE supports NR MBS. From our understanding, UEs are required to receive system information in a cell through broadcast, but receiving NR MBS services through broadcast is not mandatory. On the other hand, some UE may not be able to connect to cellular network, and receiving NR MBS services through broadcast is the only method if it is interested for MBS reception. Furthermore, MBS services through broadcast transmission can also be received by RRC\_CONNETED UEs, so the design and component should consider all the UEs in different RRC states. Compared with other FGs in NR MBS, broadcast reception for UEs is more general and basic. Therefore, FG 33-1 is supported as a basic FG for Rel-17 NR MBS.   1. ***FG 33-1 is supported as a basic FG for Rel-17 NR MBS broadcast.***   For capability signaling, it is not necessary for a UE to send capability signaling to inform network. First, the use case and motivation for reporting this capability by UE is not clear. Furthermore, for the transmission type of broadcast, there is no target UEs, in other word, any UE can be the target. There is no need for network to know which UE has this kind of capability, which seems useless for network.   1. ***The capability signaling is not necessary for UEs supporting MBS broadcast in FG 33-1.*** |
| [6] | Nokia, NSB | * **33-1:**   + Confirm it is per UE. Further discussion needed on whether there is a need for FR1/FR2 differentiation   + Optional with capability signalling. The network needs to know if any UE supports the feature. Alternatively, it can be left for RAN2 to decide on this aspect, as currently done for some UE power saving features (e.g. FG 29-1).   + Since this is a broadcast feature, it is preferred to have the DCI indicated slot-level repetition up to [8 or 16] for MTCH as a component to this FG, rather than a separate one.   + Per UE |
| [7] | NTT DOCOMO | At the last meeting, it was discussed whether to separate support of dynamic slot-level repetition for broadcast MTCH from FG 33-1. Broadcasts can be received by UEs in all RRC states. Since gNB cannot know the capabilities of RRC\_IDLE UEs, gNB will not be able to use dynamic slot-level repetition unless it is included in the basic FG. Therefore, we prefer to keep support of dynamic slot-level repetition in FG 33-1. FG 33-1 is basic operations for broadcast reception. So we support to make FG33-1 as a basic FG. We don’t really see the need for capability signalling. Because it is one thing to say that a UE has the capability to receive broadcast and another to say that the UE actually receives broadcast. We doubt that capability signalling is useful for PDSCH scheduling.  ***Proposal 1: Support of dynamic slot-level repetition for broadcast MTCH is kept in FG 33-1.***  ***Proposal 2: FG 33-1 is supported as a basic FG for MBS.***  ***Proposal 3: The capability signalling is not necessary for FG 33-1.*** |
| [8] | Intel | * FG 33-1   + Support of DCI indicated slot level repetition can be separated into a dependent FG 33-1a  |  |  |  |  |  | | --- | --- | --- | --- | --- | | 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   ~~FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG~~ |  | | 33. NR\_MBS | 33-1a | Dynamic repetition indication for broadcast | 1. Support DCI indicated slot-level repetition up to [8 or 16] for MTCH | 33-1 | |
| [9] | Apple | Regarding the MTCH repetition indicated by dynamic signalling, the repetition number can be following legacy release design, i.e., maximum 16 repetition indicated by *repetitionNumber* in TDRA table. This number is aligned with RRC parameter clarification made in main session. But considering the agreements for multicast PDSCH repetition, the 8 repetitions is acceptable for MTCH PDSCH repetition.  Regarding whether DCI indicated repetition is a separated FG or not, the repetition design principle is the same for multicast and broadcast. From implementation perspective, the difference between multicast PDSCH repetition and MTCH PDSCH repetition is minor. It’s preferred to have the same handling for DCI indicated slot-level repetition for broadcast and multicast. The multicast repetition agreements were showing below table.   |  | | --- | | **Agreement**[2]   * Only the capability for semi-static repetition is included in FG 33-2   + For semi-static repetition, UE is mandated to support {2, 4, 8} times repetitions   + For dynamic repetition, a separate FG is introduced; UE reports one of the maximum values from {8, 16} |   **Proposal 1: It’s preferred to have the same handling for DCI indicated slot-level repetition for broadcast and multicast.** |
| [10] | 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;  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 of higher layer configured slot-level repetition up to 8 for MTCH   FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG |  | Yes |  |  | Per UE | No | No |  |  | Optional without capability signalling | |
| [11] | CMCC | The most fundamental question is whether the FG 33-1 is a basic FG for MBS. Considering to proceed the commercial deployment of MR MBS and reduce the market fragmentation, especially considering there are much different capabilities in Rel-17 NR MBS, e.g., DCI based HARQ-ACK enable/disable, insertion type-1 codebook for multicast, we think it is necessary to define the basic FG both for broadcast and multicast.  **Proposal 1. FG 33-1 is supported as a basic FG for MBS.**  Another remaining issue is capability signaling of FG 33-1. Considering this feature is applied for three RRC states and RRC\_IDLE/IANCTIVE UEs can not report UE capability, we think the FG 33-1 should be optional without capability signaling.  **Proposal 2. The signaling of FG 33-1 should be optional without capability signaling.**  In last RAN1 meeting, RRC based slot-level repetition for MTCH has been merged into FG 33-1, one FFS is whether DCI indicated slot-level repetition is a separate FG or not.  **Agreement**   * A new component for support of higher layer configured slot-level repetition up to 8 for MTCH is added into FG 33-1   + FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG   We support both RRC based and DCI based slot-level repetition to be merged into FG 33-1, considering there is no significant technical difference between RRC based and DCI based slot-level repetition. In addition, If DCI based slot-level PDSCH repetition is a separate FG, gNB will never use it since gNB doesn’t know the UE capability which is harmful to broadcast MTCH transmission.  **Proposal 3. DCI indicated slot-level repetition for MTCH is defined as a component in FG 33-1.** |
| [12] | Xiaomi | Considering it has been agreed that dynamic PDSCH repetition is a separate feature group from FG 33-2, the same mechanism can also be applied to FG 33-1. That is DCI indicated slot level repetition can be a separate UE group for broadcast PDSCH. Furthermore, we think the maximum number of 8 is sufficient for dynamic broadcast PDSCH repetition.  **Proposal 1: DCI indicated slot-level repetition up to 8 for MTCH is defined as a separate FG.** |
| [13] | Samsung | For FG 33-1, this feature should be optional. Instead, it is proposed to note that this is a basic FG for MBS. If this is Optional without capability signaling, then “need for the gNB to know” should be no. Also, for the component 5, the DCI format should be 4\_0.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Features | Index | Feature group | Components | 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 of higher layer configured slot-level repetition up to 8 for MTCH 9. FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG | Optional ~~without capability signalling~~  This is a basic FG for MBS. | |
| [14] | 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.*  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 reader confused, 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: 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 discussion of which granularity type definition should be defined for MBS UE feature, from our view, the different carriers within the same band will have different characteristics or usage purpose, especially for considering the band n28 is a shared band by operators. What’s more, considering the IODT testing cost, we prefer the type definition for MBS UE features should be based on the granularity per FSPC.  *Proposal 3: The type definition for MBS UE features should be based on the granularity per FSPC.*  Regarding the number of MCCH-RNTI and G-RNTI for broadcast, there has not been discussed for now and need to make it clearer. For the MCCH-RNTI, we think only one MCCH-RNTI is sufficient for UE obtaining the MBS control information as similar with the legacy LTE SC-PTM mechanism. For the G-RNTI issue, RAN2 has achieved an agreement that “**one-to-many mapping between G-RNTI and MBS sessions is supported**” in previous meeting, which means the multiple services if existed can use only for G-RNTI for services reception. In addition, MBS UE has introduced the multiple RNTIs for MBS feature (e.g., multiple multicast G-RNTIs/G-CS-RNTIs, broadcast MCCH-RNTI) however, a total number RNTI supported by UE is limited. Considering the above reason and broadcast is a best-effort reception, we suggest only one G-RNTI is supported for broadcast reception.  ***Proposal 4: For FG 33-1, adding a note that “For component 1,*** ***only one MCCH-RNTI is supported for broadcast”.***  ***Proposal 5: For FG 33-1, adding a note that “For component 2, only one G-RNTI is supported for 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 6: 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”.***  Regarding slot-level repetition for MTCH, the following agreement was achieved in last meeting:   |  | | --- | | **Agreement**: A new component for support of higher layer configured slot-level repetition up to 8 for MTCH is added into FG 33-1   * + FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG |   Since the semi-static slot-level repetition added into FG33-1 has been agreed, the reliability concern for MTCH has been resolved. Besides, considering the dynamic slot-level indication was introduced in Rel-16 as a separate FG and it also has been agreed for multicast as a separate FG, we suggest the following mechanism can be reused for broadcast.  ***Proposal 7: Adding a new separate FG 33-1-1 to capture the dynamic slot-level repetition for broadcast MTCH.***   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 for broadcast 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   ~~FFS DCI indicated slot-level repetition up to [8 or 16] for MTCH is defined as another FG~~ |  | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  | For component 1, only one MCCH-RNTI is supported for broadcast  For component 2, only one G-RNTI is supported for broadcast  For component 3, only one CFR frequency resource is supported for broadcast and the CFR frequency resource is configured by SIBx | Optional without capability signalling | | 33-1-1 | Dynamic slot-level repetition for broadcast MTCH | 1. Support up to X times dynamic slot-level repetition for broadcast MTCH. | 33-1 |  |  |  | Per FSPC |  |  |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [15] | Qualcomm | Based on the agreement, we suggest the 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 in a CFR 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 other PDSCH and group-common PDSCH for broadcast in different slots. 7. Support MCCH change notification indication via DCI. 8. Support of higher-layer configured slot-level repetition for group-common PDSCH for MTCH 9. FFS: Support of TRS for GC-PDCCH/PDSCH configured in a CFR for broadcast |  | Yes |  |  | Per Band | N/A | N/A |  | Max value for higher layer configured slot-level repetition = 8 | Optional without capability signalling | | 33. NR\_MBS | 33-1a | Dynamic slot-level repetition for Broadcast | Support of DCI-indincated slot-level repetition for group-common PDSCH for MTCH | 33-1 | Yes |  |  | Per Band | N/A | N/A |  | Max value for DCI-indicated slot-level repetition = {8, 16} | Optional without capability signalling | |
| [16] | Ericsson | In our view, the use of DCI-based repetition could be a separate feature group. However, we note that any capabilities beyond 33-1 are subject to signalling from UEs in broadcast. This means that for such capability to be exploited by the gNB, all UEs in broadcast must first have been at least once in RRC\_CONNECTED state and connected to the network to report capability. |

## **Discussion**

**[FL1] High priority question 2-1:**

* **Companies are encouraged to provide views on whether to separate the capability for support of dynamic slot-level repetition for MTCH from FG 33-1.**
  + Keep in FG 33-1: OPPO, Nokia, NSB, NTT DOCOMO, CMCC
  + Separate FG: vivo, ZTE, Intel, Apple, Xiaomi, MediaTek, Qualcomm, Ericsson, Huawei, HiSilicon

|  |  |
| --- | --- |
| Company | Comment |
| Spreadtrum | Support separated FG, and it keep alignment with multicast. |
| Huawei, HiSilicon | It should be separate given what we have agreed for multicast. |
| OPPO | Dynamic slot-level repetition indication for MTCH is considered to improve the flexibility of repetition scheme. If it is separated from FG 33-1, it may never be supported/used. It should be merged in FG 33-1. |
| NTT DOCOMO | We share the same view with OPPO. If the FG for dynamic slot-level repetition is separated, how will the UE that does not support dynamic slot-level repetition behave? Will the UE not be able to receive any GC-PDSCH with repetitionNumber configured, or will it be able to receive only the first GC-PDSCH of repetition? |
| Apple | Prefer to have the same handling as multicast to make the implementation easier. |
| MediaTek | Support to separate the FG |
| ZTE | We are ok with either way. |
| CATT | We support separate FG. |
| CMCC | Share the same view as OPPO and NTT DOCOMO |
| LG Electronics | Support separate FG. |
| Xiaomi | Considering we already make a separate capability of dynamic repetition, we slightly prefer a separate FG in order to keep the commonality. |
| vivo | Support to separate the capability. |
| Nokia, NSB | Prefer to keep it in 33-1 as it is hard to see how it could be effectively used otherwise. |
| Moderator | Summary of companies view   * Keep in FG 33-1: OPPO, Nokia, NSB, NTT DOCOMO, CMCC * Separate FG: vivo, ZTE, Intel, Apple, Xiaomi, MediaTek, Qualcomm, Ericsson, Huawei, HiSilicon, SPRD, LGE   Given more companies prefer to separate the FG, following proposal is made  **[GTW1] High priority proposal 2-1:**   * **The capability for support of dynamic slot-level repetition for MTCH is separated from FG 33-1.**   + **FFS maximum number of dynamic slot-level repetitions**   + **FFS whether to merge with 33-3-1 and/or potential FG for dynamic Slot-level repetition for SPS group-common PDSCH for multicast** |
| FL2 | Following was agreed in the GTW session on Feb 23.  **Agreement**   * The capability for support of dynamic slot-level repetition for MTCH is separated from FG 33-1.   + maximum number of dynamic slot-level repetitions is 16   As discussed in the GTW session, let’s further discuss whether to merge the capability for support of dynamic slot-level repetition for MTCH with FG 33-3-1 and/or FG 33-5-1e  **[FL2] High priority question 2-1:**   * **Companies are encouraged to provide views on whether to merge the capability for support of dynamic slot-level repetition for MTCH with FG 33-3-1 and/or FG 33-5-1e.** |
| vivo | We support to merge the capability with FG 33-3-1, but not with FG 33-5-1e as broadcast doesn’t support SPS. |
| ZTE | We also support to merge the capability with FG 33-3-1. Because the capability for broadcast is likely to be applied only for RRC\_CONNECTED UEs. It makes sense to combine them together. |
| Huawei, HiSilicon | It could be merged with FG33-3-1, but no need to be merged into FG33-5-1e |
| CMCC | Support to merge with FG 33-3-1 |
| MediaTek | Considering broadcast and multicast are separate FGs, we slight prefer defining a separate FG as following:   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-1-1 | Dynamic slot-level repetition for broadcast MTCH | 1. Support up to X times dynamic slot-level repetition for broadcast MTCH. | 33-1 |  |  |  | Per FSPC |  |  |  | Candidate values for X is: {8, 16} | Optional with capability signalling |   If majority views are OK to merger the capability into FG33-3-1, we can live with the version as Huawei suggested in 33-3-1:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 or for broadcast MTCH. | 33-1 or 33-2 | Yes |  |  | Per UE | No | No |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| NTT DOCOMO | We support to merge with FG 33-3-1. |
| OPPO | Support to merge with FG 33-3-1.  No need to merge with FG 33-5-1e. |
| Moderator | * Not merge * Merge with 33-3-1: vivo, ZTE, HW/HiSi, CMCC, [MTK], DCM, OPPO * Merge with 33-5-1e:   All companies are fine to merge with 33-3-1. Following proposal is made  **[GTW2] High priority proposal 2-1:**   * **Capability for support of dynamic slot-level repetition for MTCH is merged with FG 33-3-1** |
| FL3 | This proposal was discussed in the GTW session on Feb 25 but no consensus was achieved. Main concern was potential different reporting type for broadcast and multicast. Therefore, before discussion proposal 2-1, reporting type is discussed here and **proposal 4-1**  **[FL3] Medium priority question 2-1a:**   * **Companies are encouraged to provide views on whether the type of the capability for support of dynamic slot-level repetition for MTCH, if supported as an FG, should be per UE or per band or per BC or per FS or per FSPC.** |
| Huawei, HiSilicon | As agreed in AI8.12.1, “The granularity of UE reporting the capability of supporting MBS multicast reception is per FSPC”, so FG33-2 is reported per FSPC.  Reporting FG33-1 per band can be acceptable to us.  Although one is per band and the other is per FSPC, merging dynamic slot-repetition with FG33-1 or with FG33-2 as prerequisite is still possible and the merged FG does not have to be FSPC or per band, it can also even per UE from RAN2 signaling perspective to our understanding. Technically, per FSPC is the most flexible reporting for this case. |
| ZTE | 1) We have a different understanding on the agreements in AI8.12.1 as mentioned by Huawei. The FSPC is about supporting multicast on SCell instead of FG33-2.  **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   2) Even if broadcast reception and multicast reception can have different types, it doesn’t mean we have to introduce two different FGs for the same functionality. We propose to have one FG for dynamic slot-level repetition and FFS the type after we have addressed the types for FG33-1 and FG33-2 later. |
| Spreadtrum | We are fine with per band or per FSPC |
| Qualcomm | If the reporting is per FSPC, we can accept to merge into one FG.  Otherwise, we prefer separate FGs for broadcast and multicast, respectively. |
| CMCC | Per band |
| vivo | We are open to the issue.  Considering it is **per UE** for unicast in both DL semi-static slot-level repetition and UL semi-static / dynamic(type A) slot-level repetition, we would like to understand the reason if a finer granularity of UE reporting is defined here. |
| MediaTek | Per FSPC.  From our understanding, reporting the FG 33-2 is per FSPC based on AI 8.12.1 agreement. For FG 33-1, we think it also be reported per FSPC, the reason is that not all the band combination/band can be used for broadcast reception, and only some carrier can be used for broadcast reception. Besides, per FSPC reporting can decrease the IODT testing effort. If we cannot achieve the consensus in RAN1 meeting, it is best to consider the slot-level repetition as a separate FG and the reporting type can be further discussed.   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-1-1 | Dynamic slot-level repetition for broadcast MTCH | 1. Support up to X times dynamic slot-level repetition for broadcast MTCH. | 33-1 |  |  |  | [Per FSPC] |  |  |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| Nokia, NSB | We wonder how companies supporting FSPC envision that a network could possibly deploy such a broadcast feature. There is non-zero chance that UEs will indicate disjoint sets of carriers where they can support the feature, in which case the network would need to repeat the same broadcast transmission in all possible sets of carriers. Of course, there is a also a non-zero chance that such groups would have partial overlaps, in which case some UEs would see duplicated transmissions, which in itself can cause some interesting behaviors. Hence, we have hard time seeing how anything else than “**per UE**” can be applied to a broadcast feature. |
| Apple | The report granularity is Per FSPC, if the signalling overhead is the concern, per FS is fine. |
| Moderator | [GTW3] While an FG does not have to follow the type of prerequisite FG, we can discuss the type of FG 33-1 and 33-2 at first, if it helps the progress. |

**[FL1] Medium priority proposal 2-2:**

* **Companies are encouraged to provide views on maximum number of dynamic slot-level repetitions.**
  + Up to 16: ZTE, OPPO, Intel, Apple, MediaTek, Qualcomm, Huawei, HiSilicon
  + Up to 8: Xiaomi

|  |  |
| --- | --- |
| Company | Comment |
| Huawei, HiSilicon | Dynamic repetition defined in R16 can be up to 16. |
| OPPO | Max. number of repetition can be up to 16. |
| NTT DOCOMO | We support a maximum of 16 repetitions. |
| MediaTek | The two options are ok for us if the FG for supporting of dynamic slot-level repetition for MTCH was agreed. If up to 16 is introduced, we suggest the following agreements achieved for multicast can be used for the broadcast:  UE reports one of the maximum values from {8, 16} |
| ZTE | If it is a separate FG, then up to 16 should be supported.  If it is a component of the FG33-1, we are ok to limit it to 8. |
| CATT | The maximum number of dynamic slot-level repetitions can be up to 16. |
| CMCC | Up to 16 |
| Xiaomi | We can live with the majority view. |
| Vivo | Support a separate FG with repetition up to 16. |
| Nokia, NSB | Maximum should be 16. |
| FL2 | This issue can be closed based on the above agreement |

**[FL1] Medium priority proposal 2-3:**

* **Companies are encouraged to provide views on whether to add following components in FG 33-1.**
  + **Support of semi-static rate-matching resource set configuration.**
    - Support: Huawei, ZTE
  + **Support of rate-matching around LTE CRS.**
    - Support: Huawei
  + **Support of**  **G-RNTIs.**
    - Support: vivo

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | Based on RAN1 agreement,  ***Agreement***  *For broadcast RRC\_IDLE/INACTIVE UEs, rateMatchPatternToAddModList can be configured in PDSCH-Config-MCCH or PDSCH-Config-MTCH for GC-PDSCH rate matching.*   * + *Whether UE can receive the GC-PDSCH with rate matching based on the rateMatchPatternToAddModList is subject to UE capability.*   + *Rel-15/16 UE capability of the supported maximum number of RE mapping patterns per symbol and per slot are kept unchanged to support rate matching for unicast/multicast/broadcast. The RateMatchPattern configured for MBS broadcast is counted into the ones that are configured per serving-cell.*   We agree to define a UE capability but not sure whether it could be a separate FG or not. Considering the limited number of RM patterns for unicast/multicast/broadcast, a UE may not be able to support RM patterns for broadcast. |
| Huawei, HiSilicon | Since semi-static rate-matching and rate-matching around LTE CRS are the mandatory UE features since from R15 and it is important for NR coexistent with other RATs or features, it should be the basic component for FG33-1 for broadcast |
| NTT DOCOMO | We support to add components for support of rate-matching. |
| MediaTek | For the first 2 sub-bullets, we share the similar view with QC.  For the final sub-bullet, we do not support. As discussed in our contribution, we think the motivation to support multiple G-RNTI for broadcast is not needed and the reason is list as following:   * The UE within RRC IDLE/INACTIVE state cannot report the capability signaling for broadcast reception * For broadcast reception, it needs to keep the similar broadcast reception behavior for both RRC IDLE/INACTIVE and RRC CONNECTED Ues, e.g., the association relationship between G-RNTI and broadcast session * RAN2 has agreed that “**one-to-many mapping between G-RNTI and MBS sessions is supported**” and “**Network may not ensure that all MBS sessions associated one G-RNTI are interested by UE**”, it align the spirit of only one G-RNTI for multicast services.   For MBS feature, we have introduced multiple RNTI numbers, e.g., (multiple G-RNTI/G-CS-RNTI for multicast, MCCH-RNTI for broadcast). However, the total number of G-RNTI supported for UE is limited, and it will have larger hardware impact if many RNTIs are introduced. |
| ZTE | Support of semi-static rate-matching resource set configuration: RAN1 has reached agreements to support RB-level rate-matching for broadcast. This should be included in the FG33-1.  Support of rate-matching around LTE CRS: This requires agreements and can be discussed in AI8.12.3 first.  Support of G-RNTIs: This can be left to RAN2. |
| CMCC | Support to add rate matching and more than one G-RNTIs |
| Xiaomi | We support to add components for support of rate-matching. |
| Vivo | As RAN 1 agreed whether UE can receive the GC-PDSCH with rate matching based on the rateMatchPatternToAddModList is subject to UE capability, a separate FG for rate matching seems more consistent with the achieved agreement.  Multiple G-RNTIs: support, since it provides flexibility for Ues having interest in different services. Please also notes that besides “**one-to-many mapping between G-RNTI and MBS sessions is supported**”, RAN2 has also agreed that “**One-to-one mapping between G-RNTI and MBS session is supported**”. Furthermore, MBS-SessionInfoList IE is contstructed reflecting this as shown below: |
| Nokia, NSB | We tend to agree with Huawei that this should be a component of 33-1. |
| FL2 | Please provide your view if not provided yet |
| Spreadtrum | For semi-static rate-matching resource set configuration, we are fine. But we are not sure where new component is needed. Since this capability is mandatory since Rel-15.    For multiple G-RNTIs, we don’t’ think it is the basic feature for broadcast.  In last GTW, for MBS SPS, we have agreed FG33-5-1h, i.e, supporting multiple G-CS-RNTI is optional UE capability. Likewise, the same principle should be applied for broadcast, and even for multicast. There is no reasonable reason to mandatory UE to support multiple G-RNTI for broadcast. For example, if UE only is interested one MBS broadcast session, why UE MUST support multiple G-RNTI for broadcast. We also share the same view with MTK, supporting multiple G-RNTIs would bring additional UE capability, and even change UE’s hardware implementation, it would be harmful for NR MBS quick commercialization.  For rate matching around LTE-CRS, more clarification is needed. For LTE-CRS rate matching pattern, FG5-28 is introduced in Rel-15 as mandatory with capability signaling, and FG 14-1 and FG14-1a are introduced in Rel-16 as UE optional capability, pasting these UE FGs for your reference. So we are not sure the component is referring FG5-28, or FG 14-1 and 14-1a, or both. In our mind, we are fine with FG5-28 also as the mandatory for MBS, but Not supporting R16 UE feature 14-1/14-1a as basic feature for MBS. |
| FL3 | * + **Support of semi-static rate-matching resource set configuration.**     - Support: Huawei, ZTE, QC, HW/HiSi, DCM, MTK, ZTE, CMCC, Xiaomi, Nokia/NSB     - Separate FG: vivo     - Not support: SPRD   + **Support of rate-matching around LTE CRS.**     - Support: Huawei, QC, DCM, MTK, CMCC, Xiaomi, Nokia/NSB     - Can be discussed in Ai 8.12.3: ZTE     - Need clarification     - Separate FG: vivo   + **Support of**  **G-RNTIs.**     - Support: vivo, CMCC     - Not support: MTK     - New FG: SPRD     - Leave to RAN2: ZTE   Given first and second bullet has much support, following proposal is made  **[FL3] Medium priority proposal 2-3:**   * **Following capabilities are added as components in FG 33-1.**   + **Support of semi-static rate-matching resource set configuration.**   + **Support of rate-matching around LTE CRS.** |
| Huawei, HiSilicon | **Agree with proposal 2-3.** |
| ZTE | Considering that we have reached agreements for the LTE CRS rate-matching in AI8.12.3, we are fine with [FL3] Medium priority proposal 2-3 above.  **Agreement**  *RateMatchPatternLTE-CRS* can be configured in PDSCH-Config-MCCH or PDSCH-Config-MTCH for RRC\_IDLE/RRC\_INACTIVE UEs*.* |
| Spreadtrum | For the first bullet, we are fine.  For the second bullet,   1. We have different view with ZTE. The agreement just states that it can be. It doesn’t mean that UE must be mandatory to support it. 2. As we comment in last round, if the second bullet refers to R15 lte-crs rate matching pattern, we also fine. But if it refers to R16 lte-crs rate matching patterns, we could not support it, since actually they are UE optional capability even if for unicast. |
| CMCC | Support |
| vivo | Ok in principle. |
| MediaTek | Not support the proposal  Considering the two components are mandatory UE features in Rel-15, e.g., FG 5-26 and 5-28, we do think the two components should be captured into the FG 33-1.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 5-26 | | Semi-static rate-matching resource set configuration for DL | | 1) Bitmap 1/2/3  2) controlResourceSet | |  | | *rateMatchingResrcSetSemi-Static* | | *Phy-ParametersCommon* | | No | | No | |  | | Mandatory with capability signalling | | | 5-28 | Rate-matching around LTE CRS | | Rate-matching around LTE CRS | |  | | *rateMatchingLTE-CRS* | | *BandNR* | | n/a | | n/a | |  | | Mandatory with capability signalling | | |
| Nokia, NSB | Support |
| Apple | The proposal is ok in general. The second bullet needs to clarify the rate pattern is rel-15 rate matching pattern. |
| Moderator | Assuming FGs 5-26 and 5-28 is for unicast, the same proposal is set for further discussion.  **[GTW3] Medium priority proposal 2-3:**   * **Following capabilities are added as components in FG 33-1.**   + **Support of semi-static rate-matching resource set configuration.**   + **Support of rate-matching around LTE CRS.** |
| FL4 | Companies are encouraged to check the above comments and provide further comment, if any. |
| MediaTek | As commented in previous round, we still think it is not needed to capture the two components within the FG 33-1 since they are the mandatory FG in Rel-15, it also can be used for the Rel-17 feature if the corresponding parameter is configured. If majority views are ok with the proposal, we can compromise to live with proposal with some modification, e.g., as Apple suggested, The second bullet needs to clarify the rate pattern is rel-15 rate matching pattern. |
| ZTE | Support the latest FL proposal 2-3. |

**[FL1] Medium priority proposal 2-4:**

* **FG 33-1 is supported as a basic FG for MBS**
  + Support: ZTE, OPPO, NTT DOCOMO, CMCC, Samsung, Huawei, HiSilicon

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| Company | Comment |
| Huawei, HiSilicon | We support it. |
| OPPO | Support it. |
| MediaTek | Can FL explain the difference between the proposal 2-4 and proposal 2-5? |
| ZTE | We support this proposal.  @MediaTek, from our understanding, basic UE FG means if UE supports broadcast, it has to support FG33-1. While proposal 2-5 is discussing whether to have signaling report for FG33-1. |
| CATT | Support. |
| CMCC | Support |
| Xiaomi | Support. |
| Vivo | Support |
| Nokia, NSB | Support |
| Samsung | Support |
| FL2 | Moderator has the same understanding with ZTE  Please provide your view if not provided yet |
| MediaTek | Thanks for ZTE’s clarification. We tend to agree the proposal if the understanding is 100% correct. However, from our understanding, the concept of FG was introduced only for Rel-16 NR V2X and NR-U feature and it is not used for other FGs, and the common things of the two FGs are for unlicensed band (or ITS band), if FG 33-1 is defined as a basic FG, does it mean the NR MBS also can be used in unlicensed band? If Yes, we cannot support the proposal as supporting MBS on unlicensed band is out of Rel-17 MBS scope. If No, we can live with the proposal with some explicit explanation for the wording of “basic FG”. |
| LG Electronics | Support |
| Nokia, NSB | @Mediatek, we do not see any connection whatsoever between a ‘basic’ FG for a certain WI and any assumption on licensed/unlicensed access. The examples you cited are just coincidental due to the complicated nature of the FG definitions for those WIs. |
| FL3 | Given most companies support the proposal, the same proposal is set. Further input is not necessary unless you have concern on this propsoal  **[FL3] Medium priority proposal 2-4:**   * **FG 33-1 is supported as a basic FG for MBS** |
| Huawei, HiSilicon | Ok with proposal 2-4. |
| Spreadtrum | OK |
| MediaTek | Although we think there is no need to define the feature as basic FG for licensed from 3GPP perspective because whether the FG should be as a basic FG will be decided by region standard, we can live with the proposal if it makes the wording more clear.   * **FG 33-1 is supported as a basic FG for MBS**   + **Note: Basic UE FG means if UE supports Rel-17 MBS feature, it has to support FG33-1.** |
| Nokia, NSB | OK |
| Apple | Just clarify, FG33-1 is the basic FG for MBS or broadcast? |
| Moderator | The proposal is updated based on the comment from MTK  **[GTW3] Medium priority proposal 2-4:**   * **FG 33-1 is supported as a basic FG for MBS**   + **Add a note in column of “Mandatory/Optional” in FG 33-1: For UE supports NR MBS, UE must indicate this FG is supported.** |
| FL4 | Reply to Apple: This proposal means FG 33-1 is basic FG for MBS, not only of broadcast. Therefore, UE supporting e,g. FG 33-2 must support FG 33-1.  If FG 33-1 is basic FG only for broadcast, this proposal is not necessary. FG 33-1 can be added as a prerequisite FG for any FGs for broadcast.  No further input is necessary unless you have concern on this proposal  **[FL4] Medium priority proposal 2-4:**   * **FG 33-1 is supported as a basic FG for MBS**   + **Add a note in column of “Mandatory/Optional” in FG 33-1: For UE supports NR MBS, UE must indicate this FG is supported.** |
| MediaTek | From my understanding, it we agree that “**FG 33-1 is supported as a basic FG for MBS**”, it needs to add the content in the Note column, so, our original purpose is to add another note in the Note column to further clarify the meaning of “basic FG”. |
| ZTE | Support the latest FL proposal 2-4. |

**[FL1] Medium priority question 2-5:**

* **Companies are encouraged to provide views on** **whether capability signalling is necessary for FG 33-1, i.e., whether to support as optional with capability signalling or optional without capability ignalling**
  + Optional with capability signalling: Huawei, HiSilicon, Nokia, NSB
  + Optional without capability signalling: OPPO, NTT DOCOMO, CMCC
  + Optional: Samsung

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | We prefer optional without capability signaling |
| Huawei, HiSilicon | Since MII is not mandatory reporting, it is beneficial for network to tell whether there is UE in the cell receiving broadcast. |
| OPPO | We also prefer it as optional without capability signaling. |
| MediaTek | Can FL explain the difference between the proposal 2-4 and proposal 2-5? |
| ZTE | We support optional **with** capability signaling. This can gives information to the network, e.g., how many Ues in this cell supporting broadcast reception. |
| CATT | We support optional without capability signaling. |
| CMCC | Support optional without capability signalling |
| LG Electronics | Prefer optional without capability signalling |
| Xiaomi | We prefer optional without capability signaling |
| vivo | We prefer optional without capability signaling |
| Nokia, NSB | We have a slight preference for optional with capability signaling, but it is also OK to leave this for RAN2 to decide, to be consistent with similar discussions for other features. |
| Samsung | If Gnb needs to know whether this feature is supported or not, then how can this be realized without capability signaling? On the other hand, if capability signaling is required, how can RRC idle UE indicate its capability? |
| FL2 | Please provide your view if not provided yet |
| Spreadtrum | Ok for optional with UE capability signaling, also fine to leave it to RAN2 |
| MediaTek | One clarification question is that if we agree FG 33-1 is optional with capability signalling, does it mean that the UE only need to report to capability in RRC connected state?  [Moderator] Yes, UE can report the capability in RRC connected mode. |
| FL3 | * + Optional with capability signalling: Huawei, HiSilicon, Nokia, NSB, ZTE   + Optional without capability signalling: OPPO, NTT DOCOMO, CMCC, QC, CATT, LGE, Xiaomi, vivo, SPRD   + Optional: Samsung   + Leave to RAN2: Nokia/NSB, SPRD   Given more companies prefer without capability signalling, following proposal is made  **[FL3] Medium priority proposal 2-5:**   * **FG 33-1 is supported as optional without capability signalling** |
| Huawei, HiSilicon | UE reporting this capability happens when UE is in RRC connected state. In addition, we should understand that with this capability reporting, it is beneficial to both UE can network. To network, it help network identify whether there is UE receiving broadcast and to UE network can have more information for scheduling unicast and broadcast.  Technically we don’t see the reason why “without capability signaling ” is preferred by some companies. |
| ZTE | We don’t understand the concern from the proponents here. Reporting this FG is just one bit of signaling. It won’t complicate any UE design but can provide network important information, e.g., how many UEs are capable of MBS reception, which can be used as reference for whether to open broadcast service here. |
| Spreadtrum | We are fine to have the UE capability as we comment in last round. |
| Qualcomm | We think ‘without capability signaling’ means it is not required for UE to report in IDLE/INACTIVE/CONNECTED mode. The broadcast has different requirement than multicast. The reporting is not required as multicast. |
| vivo | One question for clarification.  If capability signalling is necessary for FG 33-1, does it mean that UEs in RRC IDLE/INACTIVE have to enter CONNECTED mode at least once before receiving broadcast? |
| MediaTek | If majority views support the proposal, we can live with the proposal. |
| Nokia, NSB | We prefer to leave this to RAN2 but we can live the proposal too. However such decision needs to be applied consistently. It is completely pointless to have a feature as optional without capability signalling and at the same time indicate its type is anything else than per UE. This applies to all FGs that have this one as pre-requisite as well. |
| Apple | OK with the proposal. |
| Moderator | Further discuss in the GTW. If companies view cannot be converged, we can leave it to RAN2  **[GTW3] Medium priority proposal 2-5:**   * **FG 33-1 is supported as optional without capability signalling** |
| FL4 | This proposal could not be discussed in the GTW. Since companies still have different view, can we leave it to RAN2?  **[FL4] Medium priority proposal 2-5:**   * **FG 33-1 is supported as optional**   + **It is up to RAN2 whether to support as optional without capability signalling or optional with capability signalling** |
| ZTE | OK with the latest proposal 2-5. |
|  |  |

**[FL1] Medium priority question 2-6:**

* **Companies are encouraged to provide views on whether the type of FG 33-1 should be per UE, per band or per FSPC**
  + Per UE: Nokia, NSB, OPPO, Spreadtrum Communications
  + Per band: Huawei, HiSilicon, Qualcomm
  + Per FSPC: MediaTek

|  |  |
| --- | --- |
| Company | Comment |
| MediaTek | Per FSPC |
| ZTE | We prefer to make it per UE. |
| CATT | Per UE |
| CMCC | Per UE |
| Nokia, NSB (typos corrected) | It is hard to understand how gNB would be able to take into account any capability indication with strong restrictions here, such as FSPC. Even if there is capability signaling (not decided yet), each particular gNB will not know exactly which restrictions to satisfy as those might vary for each UE. Even a per band indication would be difficult to manage, as in practice the gNB would need to transmit in all bands supported by UEs that have indicated support to the feature, as it cannot know under which gNB each UE happens to be. This is not an efficient way to operate the system. |
| FL2 | Please provide your view if not provided yet |
| NTT DOCOMO | Per UE |
| FL3 | * + Per UE: Nokia, NSB, OPPO, Spreadtrum Communications, ZTE, CATT, CMCC, per UE   + Per band: Huawei, HiSilicon, Qualcomm   + Per FSPC: MediaTek   This issue can be discussed after some progress is made in **proposal 2-5** |

**Low priority proposal 2-7:**

* **Components of FG 33-1 is revised as**
  + **Component 1: Support of group-common PDCCH/PDSCH for broadcast with CRC scrambled by MCCH-RNTI.**
  + **Component 2: Support of group-common PDCCH/PDSCH for broadcast with CRC scrambled by G-RNTI(s) for MTCH.**
  + **Component 4: Support of CORESET and common search space in a CFR for broadcast.**
  + **Component 5: Support of DCI format 4\_0 with CRC scrambled with G-RNTI/MCCH-RNTI for broadcast.**
  + **Component 6: 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.**
  + **Add a note that “For component 1, only one MCCH-RNTI is supported for broadcast”.**
  + **Add a note that “For component 2, only one G-RNTI is supported for broadcast”.**
  + **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”.**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei, HiSilicon | **We support all these changes.** |
|  |  |
|  |  |

**Low priority question 2-8:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FG 33-1 which do not have capability signalling impacts**

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

# **33-2 to 33-2-x: Dynamic scheduling for multicast**

In [1], FGs 33-2 to 33-2-x are captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the Gnb to know if the feature is supported | Applicable to the capability signalling exchange between Ues (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI. 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 / 1\_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   FFS whether to separate the capability for support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast |  | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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  At least 33-2c or 33-2d is merged, FFS which one or both | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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 UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-2c | PTM retransmission for multicast | Support of PTM retransmission for multicast  FFS whether to merge with 33-2a | 33-2a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast  FFS whether to merge with 33-2a | 33-2a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-2-x | Multiple G-RNTIs for group-common PDSCHs | Capability on number of G-RNTI for groupcast  FFS details. | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#108-e meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | Since components for FG33-1 for broadcast and components for FG33-2 for multicast are converging to be common, DCI format 4\_2 for scheduling multicast can be a separate FG (as FG33-2-1) from FG33-2 for facilitating UE implementation and early commercialization.  The UE capability for multicast and broadcast is preferred to be separate although the basic feature sets for them are strived to be common. 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. In addition, RAN2 has agreed that separate UE capabilities for MBS multicast and broadcast are used [2], so supporting FG33-2 for multicast does not need the support of FG33-1 for broadcast as the prerequisite FG.  If merging one retransmission scheme into FG33-2a about support of ACK/NACK based feedback, from UE point of view, PTM retransmission is preferred because of the commonality to the PTM intimal transmission and PTP retransmission is preferred to be a separate FG. With PTM retransmission merged into FG33-2a, FG33-2c can be deleted.  In addition, the report can be per FSBC.  ***Proposal 2: Updating FG33-2, FG33-2a, FG33-2d, deleting FG33-2c, and adding FG33-2-1 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI. 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 whether to separate the capability for support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast~~ |  | Yes |  |  | ~~Per UE~~  Per FSBC | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-2-1 | Dynamic scheduling for multicast by DCI format 4\_2 | 1. Support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast. | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signaling | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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. 2. Support of PTM retransmission for multicast.   ~~At least 33-2c or 33-2d is merged, FFS which one or both~~ | 33-2 or 33-2-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 UE | No | No |  |  | Optional with capability signalling | | ~~33. NR\_MBS~~ | ~~33-2c~~ | ~~PTM retransmission for multicast~~ | ~~Support of PTM retransmission for multicast~~  ~~FFS whether to merge with 33-2a~~ | ~~33-2a~~ | ~~Yes~~ |  |  | ~~Per UE~~ | ~~No~~ | ~~No~~ |  |  | ~~Optional with capability signalling~~ | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast  ~~FFS whether to merge with 33-2a~~ | 33-2a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |   RAN2 has agreed to define UE capability for the number of simultaneous G-RNTIs / G-CS-RNTIs reception for multicast [2] and companies were invited to provide the views on the actual maximum number of G-RNTIs/G-CS-RNTIs (or their combination) for UE to simultenously monitor, for which RAN2 discussions seem to leave it to RAN1 [3].  Besides the capability of the maximum number of G-RNTIs supported for dynamic multicast scheduling, if UE supports multicast SPS, UE also needs to report the maximum number of G-CS-RNTIs supported. Since usually dynamic scheduling and SPS scheduling are separated UE capabilities. The maximum number of G-RNTIs and G-CS-RNTIs can be reported separately as well. FG33-2-x1 is added for the report of G-CS-RNTIs.  FG33-2-x is currently worded for the number of supported G-RNTIs for multicast. In light of *avoiding device hardware impact* to facilitate implementation and deployment of the feature, receiving multicast and broadcast may take the resources built for unicast from UE implementation perspective without changing the existing hardware, e.g., the maximum number of RNTIs UE supports that was dimensioned for unicast will be shared with multicast as well when to support MBS multicast. Therefore, in addition to the value of the maximum number of G-RNTIs/G-CS-RNTIs supported for multicast in FG33-2-x/FG33-2-x1, UE reporting the total number of all RNTIs (e.g., as introduced in FG33-2-x2) that UE can support can also help network schedule unicast properly.  There are two alternative that can be considered as following proposal:  ***Proposal 3: Consider the following two alternatives to modify the FG33-2-x:***   * ***Alt1: Updating FG33-2-x and adding FG33-2-x1 and FG33-2-x2 as follows in red:***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2-x | Multiple G-RNTIs for dynamic group-common PDSCHs | The maximum number of G-RNTIs supported for multicast dynamic scheduling.  ~~FFS details.~~ | 33-2 | Yes |  |  | Per UE | No | No |  | Candidate values for X is: {1, 2, 3, 4} | Optional with capability signalling | | 33. NR\_MBS | 33-2-x1 | Multiple G-CS-RNTIs for SPS group-common PDSCHs | The maximum number of G-CS-RNTIs supported for multicast SPS scheduling. | 33-2 | Yes |  |  | Per UE | No | No |  | Candidate values for X is: {1, 2, 3, 4} | Optional with capability signalling | | 33. NR\_MBS | 33-2-x2 | Total number of RNTIs | The maximum number of all RNTIs UE can support. |  | Yes |  |  | Per UE | No | No |  | Candidate values for X is: {16, 32} | Optional with capability signalling |  * ***Alt2: Updating FG33-2-x and adding FG33-2-x1 as follows in red:***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2-x | Multiple G-RNTIs for group-common PDSCHs | 1. The maximum number of G-RNTIs supported for multicast. 2. Indication of whether the maximum number of G-RNTIs supported for multicast is to be added to the maximum number of supported RNTIs without multicast operation, or to be subtracted from the maximum number of supported RNTIs without multicast operation. | 33-2 | Yes |  |  | Per UE | No | No |  | For component 1：Candidate values for X is: {1, 2, 3, 4}  For component 2: candidate value is {added, subtracted} | Optional with capability signalling | | 33. NR\_MBS | 33-2-x1 | Multiple G-CS-RNTIs for SPS group-common PDSCHs | 1. The maximum number of G-CS-RNTIs supported for multicast SPS scheduling. 2. Indication of whether the maximum number of G-CS-RNTIs supported for multicast is to be added to the maximum number of supported RNTIs without multicast operation, or to be subtracted from the maximum number of supported RNTIs without multicast operation. | 33-2 | Yes |  |  | Per UE | No | No |  | For component 1：Candidate values for X is: {1, 2, 3, 4}  For component 2: candidate value is {added, subtracted} | Optional with capability signalling | |
| [3] | vivo | It has been agreed that components 6/7/8 are separated from 33-2 and added as new FGs by leaving how to merge PTM and/or PTP retransmission to HAR-ACK feedback as FFS. Considering there exists ambiguity between unicast re-transmission and PTP retransmission for multicast when the same HPID is used, it is better to merge PTM retransmission only to HARQ-ACK feedback, but leave PTP retransmission as a separate UE capability.  ***Proposal 4*** Support to merge 33-2c to 33-a.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback andRRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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. 2. Support of PTM retransmission for multicast | 33-2 | Yes |  |  | Per UE | No | No | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast  ~~FFS whether to merge with 33-2a~~ | 33-2a | Yes |  |  | Per UE | No | No |   In RAN 1 #107bis meeting, it has been agreed that support of MCS/NDI/RV for TB2 is subject to UE capability, and thus, an FG can be added to reflect this.  ***Proposal 6*** Add an FG for support of MCS/NDI/RV for TB2.   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2e | Support two TBs for multicast | 1. Support of MCS/NDI/RV for TB2 | 33-2 | Yes | Optional with capability signalling | |
| [4] | ZTE | Rel-17 is the first release that supports broadcast and multicast for NR. To facilitate the MBS commercial process, it is beneficial to define some basic feature groups for MBS. For now, FG33-1 and FG33-2 can be set as the basic UE feature group for MBS. We can further merge or add more basic functionalities into FG33-1 and FG33-2 if needed.  ***Proposal 1****: FG 33-1 and FG 33-2 are the basic FG for broadcast and multicast, respectively.*  FG 33-2a is expected to be the basic FG for multicast feedback. From our perspective, we have the following proposal for FG 33-2a. It is beneficial to merge at least the PTM retransmission with FG 33-2a to avoid the situation when UE only supports UL feedback but doesn’t support retransmission. Furthermore, separate PUCCH-Config configuration for multicast should also be included in FG 33-2a as it is an essential component for UL feedback. There are two types of codebook for ACK/NACK based HARQ-ACK feedback for multicast, i.e., type-1 and type-2 HARQ-ACK codebook. At least one of them should be merged in FG 33-2a. Otherwise, if different UEs supporting different type of codebooks, it would be difficult for network to group them together. From our perspective, type-2 codebook can be merged with FG 33-2a.  ***Proposal 4****: Add the following components for FG 33-2a.*   |  |  |  | | --- | --- | --- | | 33-2a | Support of ACK/NACK based HARQ-ACK feedback ~~and RRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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  At least 33-2c or 33-2d is merged, FFS which one or both  2. Support of PTM retransmission for multicast  3. Support of a PUCCH-Config for multicast ACK/NACK-based HARQ-ACK feedback, separate from that of unicast configurations  4. Support of Type-2 HARQ-ACK codebook for multicast | |
| [5] | OPPO | In FG 33-2, one legacy issue for further discussion is whether to separate the capability for support of DCI format 4\_2 for multicast. With the agreement by now, DCI format 4\_1 in component 4 in FG 33-2, which is considered as sufficient for dynamic scheduling for multicast as the basic feature. DCI format 4\_2 can be separated from FG 33-2.   1. ***For FG 33-2, support to separate the capability of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast.***   In FG 33-2a, one legacy issue is which one of 33-2c and 33-2d is merged into 33-2a. For 33-2a, it is to support ACK/NACK based feedback and RRC signaling based enabling/disabling ACK/NACK feedback, therefore one type of retransmission scheme, either PTM or PTP, should be supported when HARQ-ACK feedback is supported. PTP retransmission for multicast for ACK/NACK based feedback is needed because the ACK/NACK feedbacks can be differentiated per UE through UL resources. PTM retransmission scheme for ACK/NACK based feedback can be then separated as in 33-2c.   1. ***“Support 33-2d PTP retransmission for multicast” can be merged into FG 33-2a together with ACK/NACK based feedback for dynamic scheduling for multicast.*** 2. ***“Support PTM retransmission for multicast” can be separated from FG 33-2a and kept in 33-2c.***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI. 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 ~~1\_0 / 1\_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   ~~FFS whether to separate the capability for support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast~~ |  | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback andRRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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 2. Support of PTP retransmission for multicast | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-2c | PTM retransmission for multicast | Support of PTM retransmission for multicast  FFS whether to merge with 33-2a | 33-2a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | ~~33. NR\_MBS~~ | ~~33-2d~~ | ~~PTP retransmission for multicast~~ | ~~Support of PTP retransmission for multicast~~  ~~FFS whether to merge with 33-2a~~ | ~~33-2a~~ | ~~Yes~~ |  |  | ~~Per UE~~ | ~~No~~ | ~~No~~ |  |  | ~~Optional with capability signalling~~ | | 33. NR\_MBS | 33-2-x | Multiple G-RNTIs for group-common PDSCHs | Capability on number of G-RNTI for groupcast  FFS details. | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-2-Y | DCI format for dynamic scheduling for multicast | Support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast. | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [6] | Nokia, NSB | * **33-2:**   + Add 33-1 as pre-requisite, it is unclear why a UE would support multicast but not broadcast.   + No need to separate the capability for support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast   + Merge 33-4 into this one   + Per UE * **33-2-x:**   + Confirm FG and provide a proper FG numbering   + Per UE |
| [7] | NTT DOCOMO | At the last meeting, it was agreed to merge at least one of support of PTM retransmission for multicast (i.e., FG 33-2c) or support of PTP retransmission for multicast (i.e., FG 33-2d) into FG 33-2a. It is basic to use group-common PDSCH for multicast transmission [3]. So at least support of PTM retransmission for multicast (i.e., FG 33-2c) should be merged into FG 33-2a. UE supports retransmission using C-RNTI for unicast communication. The only difference between unicast retransmission and PTP retransmission for multicast is the RNTI type of the initial transmission. We don’t see the need to make support of PTP retransmission for multicast a separate capability. FG 33-2d can also be merged into FG 33-2a  ***Proposal 4: Merge both FG 33-2c and FG 33-2d into FG 33-2a.*** |
| [8] | Intel | * FG 33-2   + Separate support of DCI 4\_2 into a dependent FG   + The PTP and PTM retransmission for MBS should be separated from 33-2 and added to dependent FG on ACK/NACK based HARQ feedback * FG 33-2a   + Merge 33-2c into FG 33-2a  |  |  |  |  |  | | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI. 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 / 1\_1~~ 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.   Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast  ~~FFS whether to separate the capability for support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast~~ |  | | 33. NR\_MBS | 33-2x | Support of DCI format 4\_2 for dynamic scheduling | 1. Support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast | 33-2 | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback andRRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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 2. Support of PTM retransmission for multicast   ~~At least 33-2c or 33-2d is merged, FFS which one or both~~ | 33-2 | | 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 | | ~~33. NR\_MBS~~ | ~~33-2c~~ | ~~PTM retransmission for multicast~~ | ~~Support of PTM retransmission for multicast~~  ~~FFS whether to merge with 33-2a~~ | 33-2a | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast  FFS whether to merge with 33-2a | 33-2a | | 33. NR\_MBS | 33-2-x | Multiple G-RNTIs for group-common PDSCHs | Capability on number of G-RNTI for groupcast  FFS details. | 33-2 | |
| [9] | Apple | For DCI format 4\_2, it could be better to treat as an independent FG. As this format supports some enhanced sub-features, such as two TBs, dynamic enabling/disabling HARQ feedback. These features differentiae DCI format 4\_2 from DCI format 4\_1. DCI format 4\_1 is the basic format to support multicast.  **Proposal 2: Supporting DCI format 4\_2 with CRC scrambled with G-RNTI for multicast as independent FG from FG33-2.** |
| [10] | 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 4 of FG 33-2, DCI format 1\_0/1\_1 is adjusted as DCI format 4\_1/4\_2;  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI. 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 / 4\_2 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 whether to separate the capability for support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast |  | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [11] | CMCC | As the discussion above, it is necessary to define basic FG both for broadcast and multicast.  **Proposal 4. FG 33-2 is supported as a basic FG for MBS.**  One remaining issue is whether DCI format 4\_2 is kept in FG 33-2, we think it should be kept. The most important consideration is the scheduling restriction of only using DCI format 4\_1, e.g., the frequency scheduling graduality, priority indication and so on. To maintain the DCI format 4\_2 as the basic feature for multicast is better for MBS commercial deployment.  **Proposal 5. Don’t support to separate the capability for support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast in FG 33-2.**  Although ACK/NACK based HARQ-ACK feedback is separated from FG 33-2, one FSS is which retransmission scheme or both transmission schemes are merged with FG 33-2a. From our point of view, both PTM retransmission and PTP retransmission should be merged with it, since the PTM retransmission and PTP retransmission are applied in different scenarios, e.g., PTM retransmission is used when large number of UE don’t decode the GC-PDSCH correctly and PTP retransmission is used when only small number of UE fail decoding. If only PTM retransmission is kept in FG 33-2a, the ACK/NACK based HARQ feedback has no technique advantage than NACK-only based HARQ feedback, and is also not the intention to design ACK/NACK based HARQ feedback for NR multicast. If only PTP retransmission is kept in FG 33-2a, Gnb will always use UE-specific PDCCH for retransmission scheduling, which may cause much resource overhead when larger number of UEs don’t decode the GC-PDSCH correctly. Thus, keeping both PTM retransmission and PTP retransmission in FG 33-2a is a best solution for Gnb to handle all retransmission cases and can also achieve the best network performance.  **Proposal 6. Merge both FG 33-2c and FG 33-2d into FG 33-2a.** |
| [12] | Xiaomi | For support of DCI format 4\_2 in addition to DCI format 4\_1, we don’t see additional complexity. There is no necessity to split the support of DCI format 4\_2 with CRC scrambled with G-RNTI from FG 33-2.  **Proposal 2: Support of DCI format 4\_2 with CRC scrambled with G-RNTI scheduling multicast is a component of FG 33-2.**  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 address 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 3: 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.***   The difference between PTP retransmission and PTM retransmission is summarized as below:   * PTP retransmission is scheduled by a DCI format with CRC scrambled with C-RNTI. The retransmitted TB is carried by a unicast PDSCH and can be received by a dedicated UE. * PTM retransmission is scheduled by a DCI format with CRC scrambled with G-RNTI. The retransmitted TB is carried by a multicast PDSCH and can be received by a group of UE.   From feedback perspective, it is does not matter how the PDSCH is scheduled if UE supports ACK/NACK based HARQ feedback. From PDSCH reception and soft combination perspective, we believe there is no difference for UE implementation.  **Proposal 4: Both FG 33-2c and FG 33-2d can be merged into FG 33-2a.** |
| [13] | Samsung | Also, DCI format 0\_1 and 1\_1 in FG 33-2 and 33-6-1 should be replaced with DCI format 4\_1 and 4\_2, respectively.  Regarding which 33-2c (PTM reTx) or 33-2d (PTP reTx) to be merged 33-2a, we prefer to have 33-2d as a separate FG and use it as a pre-requisite of the capability to indicate whether a UE can support combining a PTM initial transmission and a PTP retransmission in case of different circular buffer. |
| [14] | MediaTek | There is a remaining issue that “At least 33-2c or 33-2d is merged, FFS which one or both”. From our perspective, considering PTM transmission is a basic feature for MBS services and can enhance the spectrum resource utilization, we prefer the FG 33-2c can be merged into FG 33-2a, and PTP retransmission can be split as a separate FG.  *Proposal 8: The FG 33-2c (i.e., PTM retransmission for multicast) can be merged into FG 33-2a.*  *Proposal 9: The FG 33-2d (i.e., PTP retransmission for multicast) is split as a separate FG.*  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 10: For FG 33-2, adding a note that “for component 2, only one CFR is supported for multicast reception”.*  Regarding whether to separate the capability for support of DCI format 4\_2 for multicast, we think the DCI format 4\_1 for multicast is sufficient and the DCI format 4\_2 can be defined as the similar with DCI format 1\_2 that as a separate UE capability.  *Proposal 11: For FG 33-2, monitoring DCI format 4\_2 can be as a separate FG.*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI. 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 / 1\_1~~ 4\_1/4\_2 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 whether to separate the capability for support of DCI format 1\_1 with CRC scrambled with G-RNTI for multicast~~ |  | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  | For component 2, only one CFR is supported for multicast reception | Optional with capability signalling | | 33-2a | Support of ACK/NACK based HARQ-ACK feedback andRRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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   ~~At least 33-2c or 33-2d is merged, FFS which one or both~~   1. Support of PTM retransmission for multicast | 33-2 | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  |  | Optional with capability signalling | | ~~33-2c~~ | ~~PTM retransmission for multicast~~ | ~~Support of PTM retransmission for multicast~~  ~~FFS whether to merge with 33-2a~~ | ~~33-2a~~ | ~~Yes~~ |  |  | ~~Per UE~~  ~~Per FSPC~~ | ~~No~~ | ~~No~~ |  |  | ~~Optional with capability signalling~~ | | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast  ~~FFS whether to merge with 33-2a~~ | 33-2a | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  |  | Optional with capability signalling | | 33-2-1 | Monitoring DCI format 4\_2 | Support monitoring DCI format 4\_2 for multicast DL scheduling | 33-2 |  |  |  | Per FSPC |  |  |  |  | Optional with capability signalling |   In the RAN2#116-e meeting, one-to-many mapping between G-RNTI and MBS sessions/services was agreed as following.   |  | | --- | | * one-to-many mapping between G-RNTI and MBS sessions is supported and it is assumed that this does not introduce additional specification work. |   Since the multiple MBS sessions associated with one G-RNTI is supported, the motivation for supporting multiple G-RNTIs for group-common PDSCH is not clear, and supporting multiple G-RNTIs will increase the probability of false alarm for PDCCH detection, which will degrade the system performance. In addition, MBS UE has introduced the multiple RNTIs for MBS feature (e.g., multicast G-RNTI/G-CS-RNTI, broadcast MCCH-RNTI/G-RNTI), however, a total number RNTI supported by UE is limited. Considering the reason above, We think one G-NRTI is sufficient for Rel-17 UE supporting multicast services.  *Proposal 12: Only one multicast G-RNTI is sufficient for Rel-17 UE supporting multicast services.*  *Proposal 13: For FG 33-2-X, RAN1 needs to re-consider the motivation for UE supporting multiple G-RNTIs.*  *Proposal 14: For FG 33-2-X, adding a note that “For component 1, the candidate value for M is: {0, 1}”.*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-2-x | Multiple G-RNTIs for group-common PDSCHs | 1. ~~Capability on number of~~ Support up to M G-RNTI for multicast ~~groupcast~~   FFS details. | 33-2 | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  | For component 1, the candidate value for M is: {0, 1} | Optional with capability signalling | |
| [15] | Qualcomm | Based on the above agreements, we suggest the following changes on FG 33-2 as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI(s) for multicast. 2. Support of CFR configuration for multicast. 3. Support of CORESET and common search space configuration in a CFR for multicast. 4. Support of DCI format 4\_1with 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 of higher-layer configured slot-level repetition for group-common PDSCH scheduled associated with G-RNTI |  | Yes |  |  | Per FSPC | N/A | N/A |  | Max value for higher layer configured slot-level repetition = {2, 4, 8} | Optional with capability signalling | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback andRRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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.  Support of PTM retransmission for dynamically scheduled multicast associated with G-RNTI | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-2b | Dynamic multicast with DCI format 4\_2 | Support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-2c | 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 per G-RNTI for multicast by RRC signaling via DCI format 4\_2 | 33-2a, 33-2b | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission associated with C-RNTI for multicast | 33-2a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-2e | Dynamic Slot-level repetition for group-common PDSCH | Support DCI-indicated slot-level repetition for group-common PDSCH for multicast associated with G-RNTI. | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  | Max value of DCI-indicated slot-level repeition = {8, 16} | Optional with capability signalling | | 33. NR\_MBS | 33-2f | TCI-state configuration for multicast group-common PDSCH | Support of M’ TCI-state configurations within the PDSCH-Config-Multicast | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  | FFS: values of M’ | Optional with capability signalling |   For FG33-2-x, we think it is for UE to report the capability of monitoring group-common PDCCHs with multiple G-RNTIs in a slot in the serving cell. So, we suggest the following modification as:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2-x | Multiple G-RNTIs for dynamic group-common PDSCHs | Max number of G-RNTIs for multicast per slot per CC | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  | FFS: max number = {2, …} | Optional with capability signalling | |
| [16] | Ericsson | In the feature description, the DCI formats should be corrected to DCI 4\_1 and 4\_2 to reflect the changes in 38.212.  Regarding the support of DCI 4\_2 (referred as multicast 1\_1 in the UE feature document), we believe that UE should support both non-fallback and fallback DCI for multicast as part of the core functionality. Fragmenting the feature further will result in making the non-fallback DCI useless for group scheduling in practice.  The changes in the feature are reflected changed marks below:   |  |  |  |  | | --- | --- | --- | --- | | 33. NR\_MBS | 33-2 | Dynamic scheduling for multicast | 1. Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI. 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 / 1\_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.   Support {2, 4, 8} times semi-static slot-level repetition for group-common PDSCH for multicast |   During RAN1#107b-e the merging of 33-2c and or 33-2d into 33-2a was discussed with the possibility of merging at last one of them, or both:  In our view, we do not see a case where a UE will not support at last one of PTM or PTP retransmission. Since clearly retransmission should be supported if HARQ feedback of any type is supported, we propose to remove components 33-2c and 33-2d, and introduce a component for “type of retransmission for multicast” which could take values “PTP” or “PTM”.  The changes are shown below:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback andRRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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 2. Type of retransmission for multicast | 33-2 | Yes |  |  | Per UE | No | No |  | Candidate values for (2) are {PTP,PTM} | Optional with capability signalling | |

## **Discussion**

**[FL1] High priority question 3-1:**

* **Companies are encouraged to provide views on whether to merge either FG 33-2c or FG 33-2d into FG 33-2a.**
  + FG 33-2c (PTM retx): Huawei, HiSilicon, vivo, ZTE, Intel, MediaTek, Qualcomm, Spreadtrum, Apple
  + FG 33-2d (PTP retx): OPPO
  + Both: NTT DOCOMO, CMCC, Xiaomi, Ericsson

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | As proposed in our tdoc, we prefer to merge FG 33-2c into FG 33-2a and leave FG 33-2d as a separate FG. |
| Spreadtrum | Prefer 33-2c merge into 33-2a, and 33-2d as separated FG. Also add our position. |
| Huawei, HiSilicon | PTP retransmission should be separate because we are confident we solved all issues at this stage which makes PTP retransmission complete and practically work well. |
| OPPO | We can compromise if we are the only one company to support only PTP reTx merged into FG 33-2a, we can accept that at least PTM reTx can be merged into FG 33-2a. |
| Apple | Prefer to merge 33-2c. |
| MediaTek | Prefer PTM ReTx to be merged into FG 33-2a and PTP ReTx as a separate FG. |
| ZTE | We are ok with either the first option (merge PTM retx) or the third option (merge both PTP and PTM retx). |
| CATT | We prefer to merge both of FG33-2 and FG33-2d into FG33-2a. |
| CMCC | Prefer both, since the PTM retransmission and PTP retransmission are applied in different scenarios, e.g., PTM retransmission is used when large number of UE feedback NACK and PTP retransmission is used when only small number of UE feedback NACK. If only PTM retransmission is kept in FG 33-2a, the ACK/NACK based HARQ feedback has no technique advantage than NACK-only based HARQ feedback, and is also not the intention to design ACK/NACK based HARQ feedback for NR multicast. |
| Xiaomi | Prefer both. We share similar views with CMCC. Besides, it is does not matter how the PDSCH is scheduled if UE supports ACK/NACK based HARQ feedback from feedback perspective. From PDSCH reception and soft combination perspective, we believe there is no difference for UE implementation. |
| Vivo | Prefer to merge FG 33-2c into FG 33-2a and leave FG 33-2d as a separate FG, as it is multicast, UE can report the capability of 33-2d when it supports. |
| Nokia, NSB | We share views of vivo here, i.e. prefer to merge only FG 33-2c into 33-2a. |
| Samsung | We prefer to merge 33-2c into FG 33-2a and have 33-2d as a separate FG and use it as a pre-requisite of the capability to indicate whether a UE can support combining a PTM initial transmission and a PTP retransmission in case of different circular buffer depending on the discussion in the main agenda item. |
| Moderator | Summary of companies view   * + FG 33-2c (PTM retx): Huawei, HiSilicon, vivo, ZTE, Intel, MediaTek, Qualcomm, Spreadtrum, Apple, [OPPO], Nokia/NSB, SS   + FG 33-2d (PTP retx): [OPPO]   + Both: NTT DOCOMO, CMCC, Xiaomi, Ericsson, ZTE, CATT   Given more companies prefer to merge FG 33-2c only, following proposal is made  **[GTW1] High priority proposal 3-1:**   * **FG 33-2c is merged into FG 33-2a and FG 33-2d is kept as follows**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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  2) Support of PTM retransmission for multicast  ~~At least 33-2c or 33-2d is merged, FFS which one or both~~ | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | ~~33. NR\_MBS~~ | ~~33-2c~~ | ~~PTM retransmission for multicast~~ | ~~Support of PTM retransmission for multicast~~  ~~FFS whether to merge with 33-2a~~ | ~~33-2a~~ | ~~Yes~~ |  |  | ~~Per UE~~ | ~~No~~ | ~~No~~ |  |  | ~~Optional with capability signalling~~ | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast  ~~FFS whether to merge with 33-2a~~ | 33-2a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| FL2 | Following was agreed in the GTW session on Feb 23.  **Agreement**   * FG 33-2c is merged into FG 33-2a and FG 33-2d is kept as follows  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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  2) Support of PTM retransmission for multicast  FFS shared/separate PUCCH resource configurations with/from unicast  ~~At least 33-2c or 33-2d is merged, FFS which one or both~~ | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | ~~33. NR\_MBS~~ | ~~33-2c~~ | ~~PTM retransmission for multicast~~ | ~~Support of PTM retransmission for multicast~~  ~~FFS whether to merge with 33-2a~~ | ~~33-2a~~ | ~~Yes~~ |  |  | ~~Per UE~~ | ~~No~~ | ~~No~~ |  |  | ~~Optional with capability signalling~~ | | 33. NR\_MBS | 33-2d | PTP retransmission for multicast | Support of PTP retransmission for multicast  ~~FFS whether to merge with 33-2a~~ | 33-2a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |   Regarding the FFS shared/separate PUCCH resource configurations with/from unicast, this issue is discussed together with **question 11-1**  Another issue was raised in the GTW session whether there are any default HARQ-ACK CB for multicast.  **[FL2] Medium priority question 3-1a:**   * **Companies are encouraged to provide views on whether there are any default HARQ-ACK CB for multicast or both type 1 and type 2 HARQ-ACK CB must be supported by UE supporting HARQ-ACK feedback for multicast.** |
| Qualcomm | We think FG 33-2a can include supporting Type-1 and Type-2 CB for multicast feedback only by default |
| vivo | We support both type 1 and type 2 HARQ-ACK CB. |
| ZTE | We propose to update the FG 33-21a as following.  Note that, this FG 33-2a is about codebook construction. The codebook concatenation/PUCCH multiplexing between unicast and multicast is discussed under [FL1] High priority question 5-1. If UE indicate support of FG33-2a but doesn’t indicate support of codebook concatenation/PUCCH multiplexing between unicast and multicast, then UE is only able to transmit PUCCH carrying feedback for unicast and PUCCH carrying feedback for multicast in different slots to avoid multiplexing issue.   |  |  |  |  | | --- | --- | --- | --- | | 33. NR\_MBS | 33-2a | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling 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  2) Support of PTM retransmission for multicast  3) Support of Type-1 and Type-2 codebook  4) Support of shared/separate PUCCH resource configurations with/from unicast | |
| Huawei, HiSilicon | With the update of adding new FG for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast with FDM-ed/TDM-ed Type-1 CB, Type-2CB. Now it seems clear that FG33-2a is for multicast only. From this sense, agree with Qualcomm that Type-1 and Type-2 CB for multicast feedback only can be the components. Regarding support of shared/separate PUCCH resource configurations with/from unicast, I would tend to believe it should tie to separate PUCCH resource configuration. |
| CMCC | We support both type 1 and type 2 codebook. |
| MediaTek | Regarding the CB type feedback for multicast, QC’s suggestion is fine for us, the basic multicast CB feedback only can be as a default.  Regarding the PUCCH resource as mentioned by ZTE, we think it is no need to be captured in the main component. We prefer adding a note in “Note column” that “if dedicated PUCCH resource for multicast is not configured, the PUCCH resource configured for unicast can be shared for multicast”. |
| NTT DOCOMO | We support to include both type1 and type2 HARQ-ACK CB. |
| LG Electronics | We support to include both type1 and type2 HARQ-ACK CB. |
| OPPO | It is OK to merge Support of Type-1 and Type-2 codebook into FG 33-2a.  Regarding “support of shared/separate PUCCH resource configurations with/from unicast”, we have the following agreement that if the optional separate PUCCH-Config for multicast is not configured, the PUCCH-Config for unicast can be applied/shared by multicast and unicast. Does it mean this component can be a separate FG from 33-2a?  *Agreement:*  *For ACK/NACK based feedback if supported for RRC\_CONNECTED UEs receiving multicast, UE can be optionally configured a separate PUCCH-Config for multicast. Otherwise, PUCCH-Config for unicast applies.* |
| Moderator | * both type 1 and type 2 HARQ-ACK CB by default: QC, vivo, ZTE, HW/HiSi, CMCC, MTK, DCM, LGE, OPPO   All companies have the same understanding that FG 33-2a can include supporting Type-1 and Type-2 CB for multicast feedback only by default. Following proposal is made  **[GTW2] Medium priority proposal 3-1a:**   * **Add a component for supporting Type-1 and Type-2 HARQ-ACK CB for multicast feedback only in FG 33-2a** |
| FL3 | This proposal could not be discussed in the GTW session on Feb 25. No further input is necessary unless you have concern on this proposal  **[FL3] Medium priority proposal 3-1a:**   * **Add a component for supporting Type-1 and Type-2 HARQ-ACK CB for multicast feedback only in FG 33-2a** |
| Huawei, HiSilicon | Ok with 3-1a. |
| ZTE | Ok with 3-1a. |
| CMCC | OK |
| Moderator | This proposal is stable for more than 24 hours and can be agreed via email endorsement  **[email1] Medium priority proposal 3-1a:**   * **Add a component for supporting Type-1 and Type-2 HARQ-ACK CB for multicast feedback only in FG 33-2a** |

**[FL1] High priority question 3-2:**

* **Companies are encouraged to provide views on whether to separate the capability for support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast from FG 33-2.**
  + Keep in FG 33-2: Nokia, NSB, CMCC, Xiaomi, Ericsson
  + Separate FG: Huawei, HiSilicon, OPPO, Intel, Apple, MediaTek, Qualcomm, Spreadtrum

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| --- | --- |
| Company | Comment |
| Spreadtrum | Add our positioin |
| Huawei, HiSilicon | As commented, targeting a common UE features design for broadcast and multicast since we have been doing in this direction is beneficial for both UE and NW for early commercialization. |
| OPPO | Support to separate it. UE does not have to support both DCI format 4\_1 and 4\_2, while 4\_1 has already merged into FG 33-2, which make it sufficient. |
| NTT DOCOMO | We prefer to keep in FG 33-2. |
| MediaTek | Prefer separate FG as discussed in our contribution. |
| ZTE | We prefer to keep in FG 33-2. |
| CATT | We prefer to keep in FG 33-2. |
| CMCC | We prefer to keep in FG 33-2. |
| LG Electronics | We prefer separate FG. |
| Xiaomi | We prefer to keep in FG 33-2. |
| Nokia, NSB | Similar to others here, we prefer to keep it in FG 33-2. |
| Moderator | Summary of companies view   * + Keep in FG 33-2: Nokia, NSB, CMCC, Xiaomi, Ericsson, DCM, ZTE, CATT   + Separate FG: Huawei, HiSilicon, OPPO, Intel, Apple, MediaTek, Qualcomm, Spreadtrum, LGE   There is no majority view there to keep in FG 32-2 or separate from FG 32-2.  [GTW1] Further discuss in the GTW session |
| FL2 | This issue could not be discussed in the GTW session on Feb 23.  **TO companies who prefer to keep in FG 33-2**: Please provide your view why it should be kept in FG 33-2 and why it is not allowed to have separate FG  **TO companies who prefer to have separate FG**: Please provide your view why it should be defined as separate FG and why it is not allowed to be kept in FG 33-2 |
| Qualcomm | We prefer to have DCI format 4\_1 as basic one for multicast. The DCI format 4\_2 with configurable fields and configurable size can be optional, subject to UE capability. |
| ZTE | We support to keep it in FG33-2 with the following reasons  1) For legacy unicast scheduling, both DCI 1\_0 and 1\_1 are supported by default. We can follow the same rule for DCI format 4\_1 and 4\_2.  2) Most of the fields in DCI format 4\_2 have corresponding FGs, e.g., DCI based HARQ-ACK enabling/disabling, MIMO layer, etc. UE already have FGs to indicate support of these correspond features, we don’t need have a further separate FG for 4\_2. |
| Huawei, HiSilicon | We are not sure that all the configurable features with DCI format 4\_2 scheduling can be fairly implemented by UE in short time, it is not helpful for early deployment. Keeping it separate is preferable. |
| CMCC | We prefer to keep it in FG 33-2.  Only support DCI format 4\_1 may cause much scheduling restriction, e.g., the rough granularity of frequency resource allocation, DL priority, etc.. |
| MediaTek | Prefer to have separate FG.  Considering the legacy of DCI format 1\_2 is optional FG and the MCS/NDI/RV for DCI 4\_2 TB2 is subject to UE capability, we prefer the DCI 4\_2 can be as a separate FG. |
| OPPO | For multicast scheduling, one DCI (i.e. format 4\_1) is enough to support the basic scheduling and indication function of MBS. DCI format 4\_2 can support more functions/flexible scheduling and indications in addition to 4\_1. But whether both DCI format 4\_1 and 4\_2 should be merged into one FG, by considering about different UEs’ capabilities, only keep 4\_1 is preferred. |
| Moderator | * + Keep in FG 33-2: Nokia, NSB, CMCC, Xiaomi, Ericsson, DCM, ZTE, CATT     - For legacy unicast scheduling, both DCI 1\_0 and 1\_1 are supported by default     - Most of the fields in DCI format 4\_2 have corresponding FGs     - Only support DCI format 4\_1 may cause much scheduling restriction   + Separate FG: Huawei, HiSilicon, OPPO, Intel, Apple, MediaTek, Qualcomm, Spreadtrum, LGE     - DCI format 4\_2 with configurable fields and configurable size can be optional     - legacy of DCI format 1\_2 is optional FG and the MCS/NDI/RV for DCI 4\_2 TB2 is subject to UE capability   **[GTW2] Further discuss in the GTW session** |
| FL3 | Following was agreed in the GTW session on Feb 25.  **Agreement**   * The capability for support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast is separated from FG 33-2.   **[FL3] Medium priority question 3-5:**   * **Companies are encouraged to provide views on whether the type of FG** **for support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast should be per UE or any other reporting type.** |
| Huawei, HiSilicon | Since FG33-2 is per FSPC, to question 3-5, reporting per FSPC would be more flexible. |
| ZTE | Per UE is preferred from our perspective. |
| Spreadtrum | Prefer per FSPC. |
| Qualcomm | Per FSPC |
| MediaTek | Per FSPC and share the similar view with Huawei. |
| Nokia, NSB | Per UE. As per RAN2 guidance a stronger reason is needed than “more flexible” to defined an FG as FSPC. |
| Apple | Per FSPC or FS. |
| Moderator | * Per UE: ZTE, Nokia/NSB * Per FSPC: HW/HiSi, SPRD, QC, MTK, Apple   This question can be discussed together with **question 3-5** |

**[FL1] High priority question 3-3:**

**Companies are encouraged to provide views on whether to introduce new FGs for the following capabilities.**

* Support of MCS/NDI/RV for TB2: vivo
* Support of M’ TCI-state configurations within the PDSCH-Config-Multicast: Qualcomm
* Supported maximum number of all RNTIs: HW/HiSi

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | For max number of all RNTIs, is it per CC or across all CCs? Since all RNTIs may not be only for MBS, we are not sure it should be under discussion of MBS feature. |
| Spreadtrum | 1st bullet: ok  2nd bullet: It is being discussed in AI8.12.1. We can wait the progress of 8.12.1.  3rd bullet: share the same view with Qualcomm. |
| Huawei, HiSilicon | Since we are proposing 4\_2 as separate UE feature, not sure we need to have MCS/NDI/RV for TB2 as an additional new FG.  Support of M’ TCI-state configurations within the PDSCH-Config-Multicast is being discussed in the main agenda where the conclusion/agreement should be reached at first for discussing this feature group.  For the maximum number of all RNTIs, the motivation was not changing UE hardware to support multicast/broadcast. Since the RNTIs UE supports as capability should be pre-dimensioned before UE implementation and when building multicast/broadcast on top of the current UE without changing the hardware, in addition to reporting the number of G-RNTIs or G-CS-RNTIs, reporting the total number of RNTIs (including all cases, e.g., PS-RNTI, IMT-RNTI, ….) can **help NW decides which feature can be configured to the UE**. Without this reporting, UE may have to not report the capability of supporting some UE feature (but actually UE does have such capability) so as to control the features corresponding to the RNTIs not exceeding UE capability.  It is per cell. The deficit of RNTs is originated from supporting multiple G-RNTI/G-CS-RNTI. If UE does not support MBS, this number may not be needed to be reported as legacy. From this sense, we can discuss it under MBS and even can have MBS FG33-1/FG33-2 as the prerequisite FG. |
| OPPO | We do not have strong views on the first and second bullets.  For the third bullet: similar view with Qualcomm that the RNTIs should be only focused on MBS related RNTIs, such as G-RNTI, G-CS-RNTI, MCCH-RNTI. One question for clarification is that whether the maximum number should be determined by RAN1 in UE feature or by RAN2? |
| NTT DOCOMO | We support to introduce a FG for support of TB2.  Regarding TCI-state, it is being discussed in AI8.12.1 whether to support TCI-state configuration in PDSCH-Config-Multicast, so we should wait for its conclusion. |
| Apple | 1st bullet: share the similar as HW, it seems not necessary if we are agreeing the DCI format 4\_2 as independent feature.  2nd bullet: it’s up to discussion in AI8.12.1.  3rd bullet: if UE reports the supported RNTI number, it’s better to report the MBS related RNTI, we don’t want to impact other features. |
| MediaTek | 1st bullet: ok  2nd bullet: up to the conclusion in AI 8.12.1  3rd bullet: From our understanding, whether some UE features are supported for the UE, it will be predefined before commercial deployment, which means the UE needs to support all the UE feature declared by the UE, and the corresponding total RNTI number have been defined as well. We are not sure whether it is needed to report the value. |
| ZTE | •Support of MCS/NDI/RV for TB2: RAN1 has defined UE capability for unicast, i.e., FG2-3. From our perspective, it is ok to reuse the same FG to report whether it can support two codewords. But we can also live with a separate FG for this.  •Support of M’ TCI-state configurations within the PDSCH-Config-Multicast: This is under discussion in the main session.  •Supported maximum number of all RNTIs: We think this can be left to RAN2. |
| CATT | We are ok with the first bullet. The second bullet and the third bullet need more discussion. |
| CMCC | Support of separate of TB2  The second and third bullets needs more discussion. |
| Xiaomi | 1st bullet: ok  2nd bullet: agree with companies that we should wait for conclusion in AI 8.12.1 |
| vivo | 1st bullet: support  2nd bullet: wait for progress in AI 8.12.1  3nd bullet: We prefer to consider MBS related RNTIs |
| Nokia, NSB | For the second bullet we need to wait for progress in AI 8.12.1. |
| Moderator | Summary of companies view   * 1) Support of MCS/NDI/RV for TB2   + Support: vivo, SPRD, DCM, MTK, [ZTE], CATT, CMCC, Xiaomi, Qualcomm   + Not support: HW/HiSi (depend on question 3-2), Apple (depend on question 3-2), * 2) Support of M’ TCI-state configurations within the PDSCH-Config-Multicast:   + Support: Qualcomm   + Not support:   + Wait for AI8.12.1: SPRD, HW/HiSi, DCM, Apple, MTK, ZTE, Xiaomi, vivo * 3) Supported maximum number of all RNTIs   + Support: HW/HiSi, [Apple (report the MBS related RNTI)], [vivo (report the MBS related RNTI)]   + Not support: SPRD, OPPO, MTK   + Leave to RAN2: ZTE   [GTW1]  For 1), most companies are fine to support, but some companies think it depends on question 3-2 (capability for support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast). Let’s further discuss after some conclusion is made for question 3-2  For 2), as suggested by many companies, let’s wait for the progress in AI 8.12.1  For 3), there is no majority view. More discussion is necessary. |
| FL2 | For 3), no further input is required but proponent can provide further comments based on the comments provided by others so far. |
| Qualcomm | For 1), the UE support DCI format 4\_2 does not mean the UE should support TB2, which requires additional complexity. So, we prefer to have a separate FG (aligned with the following RAN1 agreement).  **Agreement**  DCI format 4\_2 includes the following field (configurable):   * + MCS/NDI/RV for TB2     - Support of this field is subject to UE capability   For 3), we are not objecting to this proposed FG, just not sure whether it should be discussed with other features or not. |
| Huawei, HiSilicon | Regarding 3) Supported maximum number of all RNTIs,  I have explained the motivation clearly, I would have to repeat it here because I doubt companies “not support” it get the point:  For the maximum number of all RNTIs, the motivation was not changing UE hardware to support multicast/broadcast. Since the RNTIs UE supports as capability should be pre-dimensioned before UE implementation and when building multicast/broadcast on top of the current UE without changing the hardware, in addition to reporting the number of G-RNTIs or G-CS-RNTIs, reporting the total number of RNTIs (including all cases, e.g., PS-RNTI, IMT-RNTI, ….) can **help NW decides which feature can be configured to the UE**. Without this reporting, UE may have to not report the capability of supporting some UE feature (but actually UE does have such capability) so as to control the features corresponding to the RNTIs not exceeding UE capability.  It is per cell. The deficit of RNTs is originated from supporting multiple G-RNTI/G-CS-RNTI. If UE does not support MBS, this number may not be needed to be reported as legacy. From this sense, we can discuss it under MBS and even can have MBS FG33-1/FG33-2 as the prerequisite FG. |
| Spreadtrum | For 3), we agree with the intention. |
| MediaTek | For 3), The intention of this proposal is ok for us. However, we just confused that whether it has the necessity to report the capability. From our understanding, only MBS feature needs to support the multiple RNTI number for the same RNTI type (e.g., G-RNTI), for the other FGs, UE only needs to report whether the FG is supported, and the corresponds RNTI number can be calculated by NW. If my understanding is incorrect, please correct me freely. |
| FL3 | It was agreed to add an FG for support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast. Companies are invited to check whether an FG for Support of MCS/NDI/RV for TB2 is necessary in addition to the FG FG for support of DCI format 4\_2 with CRC scrambled with G-RNTI for multicast.  **[FL3] High priority question 3-3:**  **Companies are encouraged to provide views on whether to introduce new FGs for the following capabilities.**   * **Support of MCS/NDI/RV for TB2** |
| Huawei, HiSilicon | To question 3-3, we can accept this as separate FG.  To MediaTek, I have explained the intention of reporting this max number of RNTIs, if you agree with intention, I suppose you agree with reporting. We are not talking about whether or how many number of RNTIs corresponding to the same RNTI type. We are saying the total number of RNTIs including multiple G-RNTIs for the same G-RNTI types. The situation is we are targeting to not affect UE hardware but MBS will take RNTI budgets from the total number of RNTI capabilities especially it could be large. With this total number of RNTI reporting, network not only has the information how many G-RNTI UE supports but also knows how many RNTIs including G-RNTIs, so that network can have a proper configuration/scheduling between unicast and multicast. |
| ZTE | We can live with a separate FG for support of MCS/NDI/RV for TB2. But it seems the current proposal is from a different perspective than that for unicast, i.e., FG2-3. FG2-3 is from the number of layers that UE can support for unicast PDSCH.  The network needs to know the maximum number of PDSCH layers for multicast PDSCH. If it is larger than 4, then network can configure MCS/NDI/RV for TB2. Per FG2-3 below, only one value is large than 4, 8. Thus, if a separate FG is used to indicate support of MCS/NDI/RV for TB2 for multicast, we should also add a component to clarify that 8 layers is supported.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 2-3 | PDSCH MIMO layers | 1. Supported maximal number of MIMO layers | 2-1 | Yes | Only one layer is supported | Type 3 | N.A. | N.A. |  |  | RAN1 | Mandatory with capability signaling  Candidate values: {1,2,4,8} | For single CC standalone NR, it is mandatory with capability signaling to support at least 4 MIMO layers in the bands where 4Rx is specified as mandatory for the given UE and at least 2 MIMO layers in FR2.  Some relaxations to this requirement may be applicable in the future (including in Rel-15).  Mandatory in all cases means mandatory with capability signaling.  It is not expected that there is a signaling change (i.e. signaling remains to be defined as {1, 2, 4, 8} in every band and every band combination, including FR1 and FR2 in all cases. | |
| Qualcomm | Echo ZTE’s comment, the network needs to know maximum number of PDSCH layers for multicast PDSCH for whether to be able to configure TB2 for the UE, which is independent from unicast.  We think separate FG should be added for UE to report *maxNumberMIMO-LayersPDSCH* of multicast PDSCH, *supportedModulationOrderDL* for multicast PDSCH in IE *FeatureSetDownlinkPerCC*, which can be no larger than that of unicast ones. Alternatively, separate IE *FeatureSetDownlinkPerCC* for multicast and unicast, respectively.  FeatureSetDownlinkPerCC ::=         SEQUENCE {      supportedSubcarrierSpacingDL        SubcarrierSpacing,      supportedBandwidthDL                SupportedBandwidth,      channelBW-90mhz                     ENUMERATED {supported}                                                  OPTIONAL,      maxNumberMIMO-LayersPDSCH           MIMO-LayersDL                                                           OPTIONAL,      supportedModulationOrderDL          ModulationOrder                                                         OPTIONAL  } |
| CMCC | Support |
| vivo | We support to add a separate FG in question 3-3 |
| MediaTek | Support |
| Apple | Support |
| Moderator | Based on the comments from ZTE and QC, I would like to ask companies whether we need another FG to report *maxNumberMIMO-LayersPDSCH* of multicast PDSCH and if supported, whether we need the FG for MCS/NDI/RV for TB2  [GTW3] discuss in the GTW |
| FL4 | Following was agreed in the GTW on Mar 1.  **Agreement**   * Separate FG of *maxNumberMIMO-LayersPDSCH* for multicast PDSCH is introduced   + Note: If UE supports up to 8 layers, the UE supports TB2   + FFS any condition for mandatory supported layers   Let’s further discuss based on FG 2-3 as starting point.  **[FL4] Medium priority question 3-3a:**   * **Companies are encouraged to provide views on whether/how to update the FG for maxNumberMIMO-LayersPDSCH for multicast PDSCH.**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-2g | MIMO layers for multicast PDSCH | Supported maximal number of MIMO layers for multicast PDCH | 33-2 | Yes |  |  | [Per FSPC] | [N/A] | [N/A] |  | Candidate values: {1,2,4,8}  Note: If UE supports up to 8 layers, the UE supports TB2  [For single CC standalone NR, it is mandatory with capability signalling to support at least 4 MIMO layers in the bands where 4Rx is specified as mandatory for the given UE and at least 2 MIMO layers in FR2.  Mandatory in all cases means mandatory with capability signalling.  It is not expected that there is a signalling change (i.e. signalling remains to be defined as {1, 2, 4, 8} in every band and every band combination, including FR1 and FR2 in all cases.)] | [Optional with capability signalling] | |
| Qualcomm | For reporting type: we support per FSPC. It is similar as the multicast PDSCH for unicast reported per FSPC, included in IE *FeatureSetDownlinkPerCC.*  For the notes, we think no need to make it mandatory for UE to support at least 4MIMO layers in case of single CC standalone NR. The MIMO layer for multicast can be treated in a similar way as that of CA case.  For capability signaling, we support ‘Optional with capability signaling’. |
| MediaTek | Considering the *FeatureSetDownlinkPerCC* is defined for the legacy FG 3-2, we support the reporting type for FG 33-2g is per FSPC.  Regarding the note marked with yellow, considering the Rel-17 MBS is defined as a basic function for fast commercial deployment as stated in the objective of Rel-17 MBS WID, we think there is no need to make such constrain, and the current candidate values are sufficient.  We support this FG is optional with capability signalling. |
| ZTE | Since the legacy FG for unicast is FSPC, we are ok to reuse the type for this new FG.   |  |  | | --- | --- | | ***maxNumberMIMO-LayersPDSCH***  Defines the maximum number of spatial multiplexing layer(s) supported by the UE for DL reception. For single CC standalone NR, it is mandatory with capability signaling to support at least 4 MIMO layers in the bands where 4Rx is specified as mandatory for the given UE and at least 2 MIMO layers in FR2. If absent, the UE does not support MIMO on this carrier. | FSPC | |

**[FL1] Medium priority question 3-4:**

* **Companies are encouraged to provide views on whether FG 33-2 is supported as a basic FG for MBS**
  + Support: ZTE, CMCC

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| --- | --- |
| Company | Comment |
| NTT DOCOMO | We support to make FG 33-2 a basic FG for MBS. |
| Nokia, NSB | It is basic for multicast within MBS. But for broadcast it is not needed. |
| FL2 | Please provide your view if not provided yet |
| Huawei, HiSilicon | ok |
| CMCC | Support |
| Spreadtrum | Not support. In our understanding, only broadcast is the basic FG for MBS. |
| Mediatek | Not support. |
| FL3 | Please provide your view if not provided yet |
| Apple | Just want to clarify FG33-2 is the basic FG for MBS or multicast. If it’s for MBS, then both FG 33-1 and 33-2 are the basic FG, is this the intention? |
| Moderator | [GTW3] Further discuss in the GTW |
| FL4 | Reply to Apple: This question means FG 33-2 is basic FG for MBS, not only of multicast. Therefore, UE supporting e,g. FG 33-1 must support FG 33-2.  If FG 33-2 is basic FG only for multicast, this proposal is not necessary. FG 33-2 can be added as a prerequisite FG for any FGs for multicast.  Following proposal is made  **[FL4] Medium priority proposal 3-4:**   * **FG 33-2 is supported as a basic FG for MBS**   + **Add a note in column of “Mandatory/Optional” in FG 33-2: For UE supports NR MBS, UE must indicate this FG is supported.** |
| Qualcomm | We don’t think a UE who supports FG 33-1is required to support FG 33-2. Considering there may be different UE types, a UE may be able to receive broadcast services but not multicast services. We prefer that FG 33-2 is only for multicast. |
| MediaTek | Not support the proposal.  As discussed in **proposal 2-4,** although we don’t prefer broadcast is defined as basic FG, we have compromised to accept it. However, for multicast, we don’t support the proposal. The reason is that the use case and devices type for Rel-17 MBS is not clear, and there may be different UE types for receiving different services as QC mentioned. Also, it does not benefit to fast commercial deployment for Rel-17 MBS. |
| vivo | Not support. We support FG 33-1 only as a basic FG for MBS |

**[FL1] Medium priority question 3-5:**

* **Companies are encouraged to provide views on whether the type of FGs 33-2 to 33-2-x should be per UE or per FSPC.**
  + FG 33-2
    - Per UE: Nokia, NSB, OPPO,
    - Per FSPC: MediaTek, Huawei, HiSilicon, Qualcomm, Spreadtrum
  + FG 33-2a
    - Per UE: vivo, OPPO, Ericsson
    - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum
  + FG 33-2b
    - Per UE: OPPO
    - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum
  + FG 33-2-x
    - Per UE: Nokia, NSB, OPPO
    - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum

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| Company | Comment |
| Huawei, HiSilicon | All they can be per FSBC. |
| OPPO | For FG 33-2 to 33-2x, if it is per FSPC, it may require UE to support these functions with related capabilities, especially for dynamic scheduling and HARQ-ACK feedback and retransmission. |
| MediaTek | Per FSPC |
| ZTE | We support per UE for them. |
| Xiaomi | Same view as HW and MTK. |
| Nokia, NSB | Per UE, it is very hard to imagine how the system can operate efficiently if UEs indicate support to only a few bands, and even worse if more restricted ignalling is adopted such as FSPC. This might make the deployment of the feature impracticable in real life. |
| FL2 | Please provide your view if not provided yet |
| CMCC | Support per UE |
| Spreadtrum | Add our position |
| NTT DOCOMO | Per UE |
| FL3 | * + FG 33-2     - Per UE: Nokia, NSB, OPPO, , ZTE, CMCC, DCM     - Per FSPC: MediaTek, Huawei, HiSilicon, Qualcomm, Spreadtrum, Xiaomi, Apple   + FG 33-2a     - Per UE: vivo, OPPO, Ericsson, ZTE, CMCC, DCM     - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum, Xiaomi, Apple   + FG 33-2b     - Per UE: OPPO, ZTE, CMCC, DCM     - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum, Xiaomi, Apple   + FG 33-2-x     - Per UE: Nokia, NSB, OPPO, ZTE, CMCC, DCM     - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum, Xiaomi, Apple   Given no majority view, companies are encouraged to provide view why you think your supporting option is necessary/enough |
| Huawei, HiSilicon | Since FG33-2 is per FSPC, such FGs with FG33-2 is more flexible though may not be necessary technically. |
| Nokia, NSB | We see no justification to have FG33-2 as FSPC, as it is a multicast functionality, not unicast. Consequently the same reasoning applies to derived functionalities. Type should be “per UE” for those. |
| Apple | Prefer per FSPC or FS |
| Moderator | This question can be discussed together with **question 3-2a**   * + FG 33-2: Dynamic scheduling for multicast     - Per UE: Nokia, NSB, OPPO, , ZTE, CMCC, DCM     - Per FSPC: MediaTek, Huawei, HiSilicon, Qualcomm, Spreadtrum, Xiaomi, Apple   + FG 33-2a: Support of ACK/NACK based HARQ-ACK feedback andRRC-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast     - Per UE: vivo, OPPO, Ericsson, ZTE, CMCC, DCM     - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum, Xiaomi, Apple   + FG 33-2b: DCI-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast     - Per UE: OPPO, ZTE, CMCC, DCM     - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum, Xiaomi, Apple   + FG 33-2d: PTP retransmission for multicast   + FG 33-2e: Multiple G-RNTIs for group-common PDSCHs     - Per UE: Nokia, NSB, OPPO, ZTE, CMCC, DCM     - Per FSPC: MediaTek, Qualcomm, Huawei, HiSilicon,, Spreadtrum, Xiaomi, Apple   + FG 33-2f: Dynamic multicast with DCI format 4\_2     - Per UE: ZTE, Nokia/NSB     - Per FSPC: HW/HiSi, SPRD, QC, MTK   [GTW3] further discuss in the GTW |
| FL4 | [FL4] further discuss in next GTW as least for FG 33-2. |
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**Low priority proposal 3-6:**

* **Components of FG 33-2 are revised as**
  + **Component 1: Support of group-common PDCCH/PDSCH with CRC scrambled by G-RNTI(s) for multicast**
  + **Component 3: Support of CORESET and common search space configuration in a CFR for multicast.**
  + **Component 4: Support of DCI format 4\_1 / 4\_2 with CRC scrambled with G-RNTI for multicast.**
  + **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.**
  + **Component 6: Support of NACK-only based HARQ-ACK feedback for dynamic multicast scheduling, and support of enabling/disabling NACK-only based HARQ-ACK feedback per configuration of RRC signaling.**
  + **Add a note that “Multicast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b”.**
  + **Add a note that “for component 2, only one CFR is supported for multicast reception”.**
* **Components of FG 33-2c is revised as “Support of DCI-based enabling/disabling ACK/NACK-based HARQ-ACK feedback per G-RNTI for multicast by RRC signaling via DCI format 4\_2”**
* **Components of FG 33-2-x is revised as “Max number of G-RNTIs for multicast per slot per CC”.**

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| --- | --- |
| Company | Comment |
| Huawei, HiSilicon | All components revision seem ok except the last one. I suppose the max number of G-RNTI should not be limited to per slot. |
| Xiaomi | In FG 3-1/3-5a/3-5b, DCI processing is captured as a component as it is important for both UE and gNB when process DCI reception/transmission. Hence we prefer to take ‘**Multicast DCI is treated as unicast DCI scheduling DL following the current feature group 3-1/3-5a/3-5b**’ as a component instead of a note.  For the last bullet, agree with HW. For the others, we are OK. |
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**Low priority question 3-7:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FGs 33-2 to 33-2-x**

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| Company | Comment |
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**Low priority question 3-8:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FGs 33-2 to 33-2-x which do not have capability signalling impacts**

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| Company | Comment |
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# **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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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the Gnb to know if the feature is supported | Applicable to the capability signalling exchange between Ues (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-3-1 | 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 feedbacks are provided in contributions for the RAN1#108-e meeting.

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| [2] | Huawei, HiSilicon | As discussed in section 2.1, dynamic slot-level repetition is proposed to be a separate FG from FG33-1 for broadcast and it can be merged into FG33-3-1 with FG33-1 as prerequisite FG for broadcast. The FG33-3-1 can be updated as the following proposal.  ***Proposal 4: Updating FG33-3-1 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 or for broadcast MTCH. | 33-1 or 33-2 | Yes |  |  | Per UE | No | No |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |

## **Discussion**

**[FL1] Medium priority question 4-1:**

* **Companies are encouraged to provide views on whether the type of FG 33-3-1 should be per UE or per FSPC.**
  + Per UE: Huawei, HiSilicon
  + Per FSPC: MediaTek,

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| --- | --- |
| Company | Comment |
| ZTE | We propose to make it as a per UE FG. |
| Xiaomi | Considering the prerequisite of FG 33-3-1 is FG 33-1 or 33-2, it may be better to determine the reporting granularity after we have consensus on FG 33-1 and FG 33-2. |
| Nokia, NSB | Per UE, see earlier comments on 33-2. Pre-requisites are not an issue to define granularity in any case. |
| FL2 | Please provide your view if not provided yet |
| CMCC | Per UE |
| MediaTek | Per FSPC |
| NTT DOCOMO | Per UE |
| FL3 | * + Per UE: Huawei, HiSilicon, ZTE, Nokia/NSB, DCM   + Per FSPC: MediaTek,   Given more companies prefer per UE, following proposal is made  **[FL3] Medium priority proposal 4-1:**   * **The type of FG 33-3-1 is per UE** |
| Huawei, HiSilcon | Note that as the first FL3 proposal, we are talking about whether merging dynamic repetition with FG33-1 or with FG33-2 as prerequisite, this proposal can be discussed together. |
| MediaTek | Not support.  Considering reporting the FG 33-2 is per FSPC based on RAN1’s agreements that “The granularity of UE reporting the capability of supporting MBS multicast reception is per FSPC” and the prerequisite FG for 33-3-1 is FG 33-2, we support the reporting type of FG 33-3-1 is per FSPC |
| Nokia, NSB | Per UE, we do not agree with Mediatek that FG33-2 is FSPC either. This has never been agreed in UE feature session, so we would appreciate if Mediatek copies the exact agreement in its original context here for appreciation. |
| Moderator | [GTW3] This issue can be discussed after some progress is made in **question 3-5** |

**Low priority proposal 4-2:**

* **Components of FG 33-3-1 are revised as “Support up to X times dynamic slot-level repetition for group-common PDSCH for multicast or for broadcast MTCH”.**

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| Company | Comment |
| Huawei, HiSilicon | Support. Without this clarification, the FG could be ambiguous though FG33-1 or FG33-1 as prerequisite can explain. |
| Qualcomm2 | Considering different prerequisite, we slightly prefer to have separate FGs of up to X times dynamic slot-level repetition for dynamic grant multicast, SPS multicast and broadcast MTCH, respectively. |
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**Low priority question 4-3:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FG 33-3-1**

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| Company | Comment |
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**Low priority question 4-4:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FG 33-3-1 which do not have capability signalling impacts.**

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| Company | Comment |
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# **33-3-2 to 33-3-5: Multiplexing of unicast PDSCH and group-common PDSCH**

In [1], FGs 33-3-2 to 33-3-5 are captured as below.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between Ues (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. Support FDM-ed Type-1 HARQ-ACK codebook for multicast. 3. Support FDM-ed Type-2 HARQ-ACK codebook for multicast.   FFS whether/how to separate the capability for HARQ-ACK codebook | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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). 6. Support TDM-ed Type-1 HARQ-ACK codebook for multicast. 7. Support TDM-ed Type-2 HARQ-ACK codebook for multicast.   FFS whether/how to separate the capability for HARQ-ACK codebook | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation | Supports type1-Codebook-Generation-Mode configured as mode 1 | TBD | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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 feedbacks are provided in contributions for the RAN1#108-e meeting.

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| [2] | Huawei, HiSilicon | The IE *FeatureSetDownlinkPerCC* indicates a set of features that the UE supports on the corresponding carrier of one band entry of a band combination including *supportedBandwidthDL*, *maxNumberMIMO-LayersPDSCH* and *supportedModulationOrderDL* that can determine an maximum TB size in a slot. For UE supporting FDM-ed unicast PDSCH and one group-common PDSCH in a slot, the maximum TBS size should be reported and is supposed to be the total maximum TB size for both unicast and group-common PDSCH. It should be noted that two cases (i.e., FDM-ed unicast and multicast and FDM-ed unicast and broadcast) are included depending on FG33-1 or FG33-2 is prerequisite FG for FG33-3-2.  Given FG33-2 has no HARQ-ACK feedback or NACK-only as the component, it makes sense to separate the support of FDM-ed Type1/Type2 HARQ-ACK codebook from FG33-3-2 and define additional UE capability.  ***Proposal 5: Updating FG33-3-2 and adding FG33-3-2a as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and one group-common PDSCH in a slot | 1. Support of FDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. The maximum TB size supported in a slot 3. ~~Support FDM-ed Type-1 HARQ-ACK codebook for multicast.~~ 4. ~~Support FDM-ed Type-2 HARQ-ACK codebook for multicast.~~   ~~FFS whether/how to separate the capability for HARQ-ACK codebook~~ | 33-1 or 33-2 | Yes |  |  | Per FSPC | NA | NA |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-3-2a | ACK/NACK feedback multiplexing for FDM-ed unicast PDSCH and one group-common PDSCH for multicast | Support of FDM-ed ACK/NACK-based HARQ-ACK codebook for unicast and group-common PDSCH in a slot. | 33-3-2 | Yes |  |  | Per FSPC | NA | NA |  | Values = {Type-1 HARQ-ACK codebook only, Type-2 HARQ-ACK codebook only, both} | Optional with capability signalling |   Similar rationale for the update for FG33-3-2, the maximum TBS size supported in a slot or a separate FG for reporting the maximum data rate per slot should be reported and reasonable to add another feature group for the ACK/NACK based feedback multiplexing for the TDM-ed scheduling. It should be noted that two cases (i.e., FDM-ed unicast and multicast and FDM-ed unicast and broadcast) are included depending on FG33-1 or FG33-2 is prerequisite FG for FG33-3-3.  In addition, as discussed in [4], a good balance between network and UE could be that UE does not need to report more than two group-common PDSCHs for MBS broadcast in the same slot. In case repetition is configured and TDM-ed two group-common PDSCHs could be scheduled in the same slot, at most two HARQ processes are needed for MBS broadcast scheduling.  ***Proposal 6: Updating FG33-3-3 and adding FG33-3-3a 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    1. N=2 for FG33-1 as prerequisite 4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC    1. L=2 for FG33-1 as prerequisite 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). 6. The maximum TB size supported in a slot 7. ~~Support TDM-ed Type-1 HARQ-ACK codebook for multicast.~~ 8. ~~Support TDM-ed Type-2 HARQ-ACK codebook for multicast.~~   ~~FFS whether/how to separate the capability for HARQ-ACK codebook~~ | 33-1 or 33-2 | Yes |  |  | Per FSPC | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-3-3a | ACK/NACK feedback multiplexing for intra-slot TDM-ed unicast PDSCH and one group-common PDSCH for multicast based on the union of *K1 sets* | Support of TDM-ed ACK/NACK based HARQ-ACK codebook for M>= 1 unicast and N>=1 multicast in a slot.  Note:  For Type-1 HARQ-ACK codebook, it is based on the union of *K1* sets for unicast and multicast. | 33-3-3 |  |  |  | Per FSPC | N/A | N/A |  | Values = {Type-1 HARQ-ACK codebook only, Type-2 HARQ-ACK codebook only, both} | Optional with capability signalling |   FG33-3-4 was agreed in RAN1#107bis-e meeting but FFS on which FG is prerequisite FG. Since mode1 Type-1 codebook generation is decided by the intersection of k1 sets configured to unicast and multicast, it is mainly used for TDM-ed unicast and multicast, so FG33-3-3a should be the prerequisite FG.  ***Proposal 7: Updating FG33-3-4 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation | Supports type1-Codebook-Generation-Mode configured as mode 1 | 33-3-3a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [3] | vivo | For FG33-3-2 and FG33-3-3, the HARQ-ACK codebook should be separated from multiplexing of unicast PDSCH and group-common PDSCH, and similar as that in NR Rel-15, support of type 1 and type 2 codebook should be separated as different UE capabilities. Furthermore, as there is no difference between FDMed and TDMed type-2 codebok, it is not necessary to differentiate them, and thus, option 1 in [1] should be supported.  ***Proposal 5*** Regarding HARQ-ACK codebook   * Add an FG for TDM-ed Type-1 HARQ-ACK codebook for multicast * Add an FG for FDM-ed Type-1 HARQ-ACK codebook for multicast * Add an FG for Type-2 HARQ-ACK codebook for multicast  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot. | 33-1 or 33-2 | Yes | Optional with capability signalling | | 33. NR\_MBS | 33-3-2a | FDM-ed Type-1 HARQ-ACK codebook for multicast | 1. Support FDM-ed Type-1 HARQ-ACK codebook for multicast. | 33-2,  33-3-2 | Yes | Optional with capability signalling |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 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 | Optional with capability signalling | | 33. NR\_MBS | 33-3-3a | TDM-ed Type-1 HARQ-ACK codebook for multicast | 1. Support TDM-ed Type-1 HARQ-ACK codebook for multicast. | 33-2,  33-3-3, | Yes | Optional with capability signalling | | 33. NR\_MBS | 33-3-4 | Type 2 HARQ-ACK codebook for multicast | 1. Support Type-2 HARQ-ACK codebook for multicast. | 33-2, 33-3-2 or 33-3-3 | Yes | Optional with capability signalling | |
| [4] | ZTE | Another issue is how to capture agreements for FG33-3-3. From our perspective, UE can share the same maximum PDSCH receptions in a slot per CC between unicast and multicast. Thus, the FG33-3-3 can be updated as following.  ***Proposal 5****: 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). | |
| [5] | OPPO | For FG 33-3-2, FDM-ed Tx/Rx and FDM-ed Type-1/2 codebook have not to be merged into one FG, while support FDM-ed Tx/Rx of unicast PDSCH and multicast PDSCH does not mean that the FDM-ed codebook should be supported. Therefore, FDM-ed Type-1/2 codebook should be separated from 33-3-2. FG 33-3-3 also has the similar reason to on TDM-ed Type-1/2 codebook to be separated from FG 33-3-3.   1. ***For FG 33-3-2, separate the capability for FDM-ed Type-1/2 HARQ-ACK codebook for multicast.*** 2. ***For FG 33-3-3, separate the capability for TDM-ed Type-1/2 HARQ-ACK codebook for multicast.***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. ~~Support FDM-ed Type-1 HARQ-ACK codebook for multicast.~~ 3. ~~Support FDM-ed Type-2 HARQ-ACK codebook for multicast.~~   ~~FFS whether/how to separate the capability for HARQ-ACK codebook~~ | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-3-2a | FDM-ed HARQ-ACK codebook for multicast | 1. Support FDM-ed Type-1 HARQ-ACK codebook for multicast. 2. Support FDM-ed Type-2 HARQ-ACK codebook for multicast. | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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). 6. ~~Support TDM-ed Type-1 HARQ-ACK codebook for multicast.~~ 7. ~~Support TDM-ed Type-2 HARQ-ACK codebook for multicast.~~   ~~FFS whether/how to separate the capability for HARQ-ACK codebook~~ | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-3-3a | TDM-ed HARQ-ACK codebook for multicast | 1. Support TDM-ed Type-1 HARQ-ACK codebook for multicast. 2. Support TDM-ed Type-2 HARQ-ACK codebook for multicast. | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation | Supports type1-Codebook-Generation-Mode configured as mode 1 | TBD | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 | |
| [6] | Nokia, NSB | * **33-3-2:**   + If CONNECTED\_MODE Ues can receive broadcast without supporting multicast, component 1 may need to be separated from 2/3. More clarification needed here.   + Per UE * **33-3-3:**   + Same comment as for 33-3-2.   + Per UE |
| [7] | NTT DOCOMO | Type-2 codebook generation process is the same for TDM-ed PDSCHs and for FDM-ed PDSCHs. So we don’t see the need to separate Type-2 HARQ-ACK codebook capabilities for FDM and TDM. Therefore, we prefer Option 1.  ***Proposal 6: For the capability for HARQ-ACK codebook, support Option 1.*** |
| [9] | Apple | For the separation of capability for HARQ-ACK codebook in FG33-3-2 and Fg33-3-3, according to last meeting discussion, there are two options to split the FGs for HARQ-ACK codebook.   * + Option 1:     - add an FG for TDM-ed Type-1 HARQ-ACK codebook for multicast     - add an FG for FDM-ed Type-1 HARQ-ACK codebook for multicast     - add an FG for Type-2 HARQ-ACK codebook for multicast   + Option 2:     - add an FG for FDM-ed Type-1/2 HARQ-ACK codebooks for multicast     - add an FG for TDM-ed Type-1/2 HARQ-ACK codebook for multicast   For option1, the type-2 HARQ-ACK codebook construction is applied to both TDM-ed and FDM-ed reception, i.e., DAI is separately counted and codebooks for unicast and multicast are concatenated. Thus, supporting Type -2 HARQ-ACK codebook should be an independent feature.  For Option 2, each FG requires to support both Type-1 and Type-2 HARQ-ACK codebook construction. From implementation and specification perspective, Type-1 and Type-2 HARQ-ACK codebook construction are fully independent features and can’t be combined together.  **Proposal 3: For splitting UE capability for HARQ-ACK codebook, Option 1 is supported,**   * + - **add an FG for TDM-ed Type-1 HARQ-ACK codebook for multicast**     - **add an FG for FDM-ed Type-1 HARQ-ACK codebook for multicast**     - **add an FG for Type-2 HARQ-ACK codebook for multicast** |
| [10] | Spreadtrum Communications | Last meeting, we have discussed on whether the HARQ-ACK feedback for multicast is optional UE capability. After extensive discussion, finally we have agreed that HARQ-ACK feedback for multicast is optional UE capability.  For FG33-3-2, in our understanding, the intention is to state the feature of FDMed multiplexing. It is not proper to combine the multiplexing issue and HARQ-ACK feedback. For example, one UE can support FDMed multiplexing, but can not support HARQ-ACK feedback operation. Thus, we prefer to split component 2 and 3 in FG33-3-2 as separated FG.  ***Proposal 2***: Component 2 and 3 in FG33-3-2 can be split as separated FG, and as optional UE capability.  Given the above, like FG33-3-2, we also think it is not proper to combine the multiplexing issue and HARQ-ACK feedback. Thus, we prefer to split component 6 and 7 in FG33-3-3 as separated FG.  ***Proposal 3***: Component 6 and 7 in FG33-3-3 can be split as separated FG, and as optional UE capability.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot.   FFS whether/how to separate the capability for HARQ-ACK codebook | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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).   FFS whether/how to separate the capability for HARQ-ACK codebook | 33-1, 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [11] | CMCC | As the comments from companies, it is not necessary to differentiate TDM/FDM-ed Type-2 HARQ-ACK codebook, thus we support Option 1 to separate the capability for HARQ-ACK codebook from FGs 33-3-2 and 33-3-3. Besides since ACK/NACK-based HARQ-ACK feedback has been separated from FG 33-2, at least one of the HARQ-ACK codebook should also be included FG 33-2a.  **Proposal 7. Support Option 1 to** **separate the capability for HARQ-ACK codebook from FGs 33-3-2 and 33-3-3.** |
| [12] | Xiaomi | These two feature group define UE capability on whether UE supports FDMed or TDMed PDSCHs respectively, including multicast-to-unicast and multicast-to-multicast. The component related to HARQ-ACK codebooks are actually irrelevant. Furthermore, there is no FDMed/TDMed type-1 codebook or FDMed/TDMed type-2 codebook. HARQ-ACK construction should be separate from that of PDSCH transmission. Actually we already have the following separate FGs for different codebook construction:   * FG 33-3-5: *Support of multiplexing HARQ-ACK for unicast and multicast with the same priority and different HARQ-ACK codebook types in the same PUCCH slot* * FG 33-6-2: *Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast or for unicast and multicast at a UE*   The only thing missed is the support of multiplexing HARQ-ACK for unicast and multicast with the same priority and same HARQ-ACK codebook type in the same PUCCH slot, which can be a separate FG or a component of FG 33-3-2 and FG 33-3-3.  **Proposal 5: Remove the following two components for FG 33-3-2**   * + ***Support FDM-ed Type-1 HARQ-ACK codebook for multicast.***   + ***Support FDM-ed Type-2 HARQ-ACK codebook for multicast.***   **Proposal 6: Remove the following two components for FG 33-3-3**   * + ***Support TDM-ed Type-1 HARQ-ACK codebook for multicast.***   + ***Support TDM-ed Type-2 HARQ-ACK codebook for multicast.***   **Proposal 7: Adopt one of the following options to cover the case wherein multiplexing HARQ-ACK for unicast and multicast with the same priority and same HARQ-ACK codebook type in the same PUCCH slot**   * + **Option 1: Define a component for FG 33-3-2 and FG 33-3-3 respectively such as: *support of multiplexing HARQ-ACK for unicast and multicast with the same priority and same HARQ-ACK codebook type in the same PUCCH slot***   + **Option 2:Define a new FG 33-3-6: *support of multiplexing HARQ-ACK for unicast and multicast with the same priority and same HARQ-ACK codebook type in the same PUCCH slot***   Furthermore, the prerequisite feature groups for FG 33-3-2 and FG 33-3-3 should be FG 33-2 as there is no HARQ-ACK feedback for broadcast.  **Proposal 8: The prerequisite feature groups for FG 33-3-2 and FG 33-3-3 should be FG 33-2 instead of FG 33-1 and FG 33-2.** |
| [13] | Samsung | For 33-3-2/3, pre-requisite can be either 33-1 or 33-2, but should not be both.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Features | Index | Feature group | Components | Prerequisite feature groups | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. Support FDM-ed Type-1 HARQ-ACK codebook for multicast. 3. Support FDM-ed Type-2 HARQ-ACK codebook for multicast.   FFS whether/how to separate the capability for HARQ-ACK codebook | 33-1 or 33-2 | | 33. NR\_MBS | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH | 1. Support TDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH in a slot per CC 3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC 4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC 5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b. 6. Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s). 7. Support TDM-ed Type-1 HARQ-ACK codebook for multicast. 8. Support TDM-ed Type-2 HARQ-ACK codebook for multicast.   FFS whether/how to separate the capability for HARQ-ACK codebook | 33-1 or 33-2 | |
| [14] | MediaTek | codebook. Thus, we suggest to separate the FDM-ed HARQ-ACK from the FG 33-3-2.  *Proposal 15: For FG 33-3-2, the FDM-ed HARQ-ACK codebook capability should be as a separate FG.*  Regarding the prerequisite feature groups 33-1, we think the broadcast reception is “best-effort” reception and the UE in RRC IDLE/INACTIVE cannot report capability. So, we think FDMed reception for MBS is supported for multicast and not broadcast.  *Proposal 16: For FG 33-3-2, the prerequisite feature groups 33-1 should be deleted.*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot. 2. ~~Support FDM-ed Type-1 HARQ-ACK codebook for multicast.~~ 3. ~~Support FDM-ed Type-2 HARQ-ACK codebook for multicast~~.   FFS whether/how to separate the capability for HARQ-ACK codebook | ~~33-1,~~ 33-2 | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  |  | Optional with capability signalling | | 33-3-2-1 | HARQ-ACK codebook for FDM-ed unicast and multicast | 1. Support FDM-ed Type-1 HARQ-ACK codebook for multicast. 2. Support FDM-ed Type-2 HARQ-ACK codebook for multicast | 33-3-2 |  |  |  | ~~Per UE~~  Per FSPC |  |  |  |  | Optional with capability signalling |   Regarding the FG 33-3-3 we need to further discuss whether/how to separate the capability for HARQ-ACK codebook. We share the similar view as that of FG 33-3-2 and have the following proposals:  *Proposal 17: For FG 33-3-3, the TDM-ed HARQ-ACK codebook capability should be as a separate FG.*  *Proposal 18: For FG 33-3-3, the prerequisite feature groups 33-1 should be deleted.*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 for multicast in a slot. 2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH for multicast in a slot per CC 3. Support TDM among N (N>1) group-common PDSCHs for multicast in a slot per CC 4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs for multicast 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) for multicast  are counted as unicast PDSCH(s). 6. ~~Support TDM-ed Type-1 HARQ-ACK codebook for multicast.~~ 7. ~~Support TDM-ed Type-2 HARQ-ACK codebook for multicast~~.   FFS whether/how to separate the capability for HARQ-ACK codebook | ~~33-1,~~ 33-2 | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  |  | Optional with capability signalling | | 33-3-2-1 | HARQ-ACK codebook for FDM-ed unicast and multicast | 1. Support TDM-ed Type-1 HARQ-ACK codebook for multicast. 2. Support TDM-ed Type-2 HARQ-ACK codebook for multicast |  |  |  |  | ~~Per UE~~  Per FSPC |  |  |  |  | Optional with capability signalling | |
| [15] | Qualcomm | Among the options, we prefer Option 2 and propose the following changes.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support of FDM between one unicast PDSCH and one group-common PDSCH in a slot. | 33-1, 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-3-2a | FDM-ed pattern of feedback codebook for unicast PDSCH and group-common PDSCH | Support of FDM-ed ACK/NACK-based Type-1 HARQ-ACK codebook for one unicast and one multicast in a slot.  Max number of G-RNTI(s) configured to UE for the FDMed unicast and multicast Type-1 HARQ-ACK codebook | 33-2a, 33-3-2 | Yes |  |  | Per FSPC | N/A | N/A |  | FFS: value | Optional with capability signalling | | 33. NR\_MBS | 33-3-2b | Maximum data rate of FDMed unicast PDSCH and group-common PDSCH for multicast | Max data rate of FDMed unicast PDSCH and group-common PDSCH for multicast respectively in a slot per CC. | 33-3-2 | Yes |  |  | Per FSPC | N/A | N/A |  | FFS: value | Optional with capability signalling | | 33. NR\_MBS | 33-3-3 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast | 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 | | 33. NR\_MBS | 33-3-3a | Feedback multiplexing for intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast | Support of TDM-ed ACK/NACK-based HARQ-ACK codebook for M (M>= 1) unicast and N (N>=1) multicast in a slot. | 33-2b, 33-3-3 | Yes |  |  | Per FSPC | N/A | N/A |  | Values = {Type-1 HARQ-ACK codebook only, Type-2 HARQ-ACK codebook only, both} | Optional with capability signalling | | 33. NR\_MBS | 33-3-3b | Maximum data rate of TDMed unicast PDSCH and group-common PDSCH for multicast | Max data rate for TDMed unicast PDSCH(s) and group-common PDSCH(s) for multicast respectively in a slot per CC. | 33-3-3 | Yes |  |  | Per FSPC | N/A | N/A |  | FFS: value | Optional with capability signalling |   We suggest the changes for FG 33-3-4 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-4 | Mode 1 for type1 codebook generation | Supports type1-Codebook-Generation-Mode configured as mode 1 | 33-2a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling |   We suggest minor changes for FG 33-3-5 as   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 | |
| [16] | Ericsson | create a common codebook. Moreover, It is understood that both TDM and FDM are “advanced” features, and therefore we think that UE capable of FDM or intra slot TDM will also be capable of HARQ feedback.  The following change is proposed:   |  |  |  |  | | --- | --- | --- | --- | | 33. NR\_MBS | 33-3-2 | FDM-ed unicast PDSCH and group-common PDSCH | 1. Support FDM between one unicast PDSCH and one group-common PDSCH in a slot. 2. Support FDM-ed Type-1 HARQ-ACK codebook for multicast and unicast.. 3. Support FDM-ed Type-2 HARQ-ACK codebook for multicast and unicast.. | | 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). 6. Support TDM-ed Type-1 HARQ-ACK codebook for multicast and unicast.. 7. Support TDM-ed Type-2 HARQ-ACK codebook for multicast and unicast.. | |

## **Discussion**

**[FL1] High priority question 5-1:**

* **Companies are encouraged to provide views on how to separate the capability for** **HARQ-ACK codebook from FGs 33-3-2 and 33-3-3.**
  + **Option 1:**
    - **add an FG for TDM-ed Type-1 HARQ-ACK codebook for multicast**
    - **add an FG for FDM-ed Type-1 HARQ-ACK codebook for multicast**
    - **add an FG for Type-2 HARQ-ACK codebook for multicast**
  + **Option 2:**
    - **add an FG for FDM-ed Type-1/2 HARQ-ACK codebooks for multicast**
    - **add an FG for TDM-ed Type-1/2 HARQ-ACK codebook for multicast**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies view   * Option 1: Option 1: vivo, NTT DOCOMO, Apple, CMCC, * Option 2: Huawei, HiSilicon, OPPO, MediaTek, Qualcomm, Spreadtrum |
| Spreadtrum | Add our position |
| ZTE | One thing needs to be clarified first. Based on our understanding, we only discussed TDMed/FDMed type-1 HARQ-ACK codebook, but not for type-2 HARQ-ACK codebook. What’s the definition of TDMed Type-2 HARQ-ACK codebook?  Another aspect is, RAN1 needs to define one type of codebook for multicast as a common prerequisite for other types of codebooks. Otherwise, if different UEs supporting different types of codebooks, if would be impossible for network to configure a common type of codebook for all UEs in the same group. |
| CATT | We prefer to support option2. |
| LG Electronics | We prefer Option 2. |
| Xiaomi | There is no FDMed or TMDed HARQ-ACK codebook. The terminology of ‘TDMed/FDMed’ is define the multiplexing pattern between corresponding PDSCHs. We can live with majority view, i.e. option 2. If people do want to capture ‘**FDM-ed Type-1/2 HARQ-ACK codebook**’ or ‘**TDM-ed Type-1/2 HARQ-ACK codebook**’, we suggest to add the following descriptions in the note column to avoid potential confusion:  Note for ‘FG for FDM-ed Type-1/2 HARQ-ACK codebooks for multicast’: FDM-ed Type-1/2 HARQ-ACK codebook means FDM between one unicast PDSCH and one group-common PDSCH in a slot  Note for ‘FG for TDM-ed Type-1/2 HARQ-ACK codebooks for multicast’: TDM-ed Type-1/2 HARQ-ACK codebook means TDM between one unicast PDSCH and one group-common PDSCH in a slot |
| vivo | * As supporting type-1 codebook and type-2 codebook are separated FGs for legacy UEs, we prefer to follow the legacy rule for MBS UEs * From our understanding, when FDM of one unicast PDSCH and one group-common PDSCH happens, the codebook option could be FDM-ed Type-1, TDM-ed Type-1 and Type-2 if UE has such capabilities. We are not sure why to separate type-2 into FDM-ed and TDM-ed, and the difference between them is not clear to us. |
| Moderator | Summary of companies view   * Option 1: vivo, NTT DOCOMO, Apple, CMCC, * Option 2: Huawei, HiSilicon, OPPO, MediaTek, Qualcomm, Spreadtrum, CATT, LGE,   Based on the comment from Xiaomi, terminology is revised as follows:   * + **Option 1:**     - **add an FG for ~~TDM-ed~~ Type-1 HARQ-ACK codebook for TDM-ed unicast PDSCH and group-common PDSCH ~~multicast~~**     - **add an FG for ~~FDM-ed~~ Type-1 HARQ-ACK codebook for FDM-ed unicast PDSCH and group-common PDSCH ~~multicast~~**     - **add an FG for Type-2 HARQ-ACK codebook for unicast PDSCH and group-common PDSCH ~~multicast~~**   + **Option 2:**     - **add an FG for ~~FDM-ed~~ Type-1/2 HARQ-ACK codebooks for FDM-ed unicast PDSCH and group-common PDSCH ~~multicast~~**     - **add an FG for ~~TDM-ed~~ Type-1/2 HARQ-ACK codebook for TDM-ed unicast PDSCH and group-common PDSCH ~~multicast~~**   [GTW1] As commented by ZTE and vivo, companies may have different understanding for type-2 HARQ-ACK CB. Some clarification from companies supporting Option 2 is necessary  Question from ZTE:  *One thing needs to be clarified first. Based on our understanding, we only discussed TDMed/FDMed type-1 HARQ-ACK codebook, but not for type-2 HARQ-ACK codebook. What’s the definition of TDMed Type-2 HARQ-ACK codebook?*  Comment from vivo:  *From our understanding, when FDM of one unicast PDSCH and one group-common PDSCH happens, the codebook option could be FDM-ed Type-1, TDM-ed Type-1 and Type-2 if UE has such capabilities. We are not sure why to separate type-2 into FDM-ed and TDM-ed, and the difference between them is not clear to us* |
| Huawei, HiSilicon | The reason for separating the capability for such HARQ-ACK codebook (either option1 or option2) from FGs 33-3-2 and 33-3-3, to me, was because how to generate the codebook should not rely on dynamic scheduling (FDM-ed, or TDM-ed) and also this is why it is better to keep FDM-ed/TDM-ed as the description for codebook instead of for scheduling. There is RRC parameter “*fdmed-Reception-Multicast*” instructs how UE generates the codebook as agreed as follows. The condition for UE being able to be configured with this parameter is UE has such capability and this is why we talking about this capabilities now.   |  | | --- | | *Agreement:*  *For a UE configured with Type-1 HARQ-ACK codebook,*   * *If UE is not configured to receive FDM-ed unicast and multicast, Type-1 HARQ codebook is generated as the agreement for TDM-ed unicast and multicast.* * *If UE is configured to receive FDM-ed unicast and multicast, Type-1 HARQ codebook is generated as the agreement for FDM-ed unicast and multicast.* |   For convenience, I also copy-paste the agreements here   |  | | --- | | *Agreement:*  *For Type-1 HARQ-ACK codebook construction for FDM-ed unicast and multicast with the same priority from the same TRP, support*   * *Opt 4:* *HARQ-ACK bits for all the PDSCH occasions over all the slots for all serving cells for unicast, precede, HARQ-ACK bits for all the PDSCH occasions over all the slots for all serving cells for multicast. (This is similar to the joint Type-1 codebook for mTRP).\* * *FFS: If UE reports the capability of supporting the FDM-ed unicast and multicast in the same slot, UE can be indicated semi-statically to generate Type-1 HARQ-ACK codebook as FDM-ed manner (i.e., Opt 4).*   + *Otherwise, UE does not expect unicast and multicast are to be scheduled in FDM-ed.*   *Agreement:*  *For TDM-ed unicast and multicast, for Type-1 HARQ-ACK codebook construction for ACK/NACK-based unicast and multicast to be multiplexed in the same PUCCH resource, determining PDSCH reception candidate occasions is based on down-selecting one of the two alternatives as follows:*   * *Alt 1:*   + *for slot timing values in the intersection of set for unicast (termed set A) and set for multicast (termed set B), based on union of the PDSCH TDRA sets,*   + *for slot timing values in set A but not in set B, based on PDSCH TDRA set for unicast, and*   + *for slot timing values in set B but not in set A, based on PDSCH TDRA set for multicast.* * *Alt 2: for slot timing values in the union of set for unicast and set for multicast, based on the union of the PDSCH TDRA sets.* * *Companies are encouraged to continue discussion of pros and cons for each alternative for further down-selection in the next meeting.*   *Agreement:*  *For ACK/NACK based feedback if supported for multicast, for Type-2 HARQ-ACK feedback construction for PTM scheme 1,*   * *DAI for unicast and DAI for multicast are separately counted.* * *Concatenation of Type-2 HARQ-ACK codebook for unicast and multicast is supported.*    + *FFS details on*  *the codebooks.* * *FFS whether to support concatenating more than one Type-2 HARQ-ACK codebook for multicast.*   *Agreement:*  *For Type-2 HARQ-ACK codebook concatenation to be multiplexed in the same PUCCH resource,*   * *The first Type-2 HARQ-ACK sub-codebook for unicast precedes the second Type-2 HARQ-ACK sub-codebook for multicast.* * *FFS: The number of Type-2 HARQ-ACK sub-codebooks for multicast.* * *Note: The case of SPS PDSCH will be discussed separately.* |   To keep the description short, I did not directly use the wording from the agreement but recapping it as follows in tracking changes   * + **Option 1:**     - **add an FG for TDM-ed Type-1 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**       * **Note: TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union/intersection of k1 sets from unicast and multicast.**     - **add an FG for FDM-ed Type-1 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**       * **Note: FDM-ed Type-1 HAQR-ACK codebook is generated by concatenating the Type-1 sub-codebook for unicast and the Type-1 sub-codebook for multicast.**     - **add an FG for Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**       * **Note: 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.**   + **Option 2:**     - **add an FG for FDM-ed Type-1, Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**       * **Note1: FDM-ed Type-1 HAQR-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.**     - **add an FG for TDM-ed Type-1, Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**       * **Note: TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union/intersection 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.**   Note: there is a column “Note” in the table, we can also consider removing all above notes there if more appropriate.  With these notes added, the difference is really number of bits for the FG reporting (3bits for option1 and 2bits for option2), the difference seems minor.  Another thing worth mentioning is the relation of these newly added FGs (either option1 or option2) with the FG 33-3-4 “Mode 1 for type1 codebook generation” which means the “**intersection**”of k1 sets from unicast and multicast for the Type-1 codebook, which can be further discussed. |
| FL2 | Thank you Jinhuan as FL in AI8.12.2 for sharing the comprehensive information!  As discussed in the GTW session on Feb 23, let’s try to have common understanding for the above cases at first, using the description provided by Jinhuan as the starting point.  At first, companies are encouraged to check whether you have the same understanding with the above notes for the HARQ-ACK CB generation. As long as the basic principle is captured correctly, you don’t have to try to revise the wording. Here what we need to do is to have common understanding whether it is worth defining separate FGs for the above cases.  It is also appreciated if companies can confirm/update their supporting option based on the above. |
| Qualcomm | Based on Jinhuan’s clarification, we understand the options now are focusing on **CB generation of multiplexing unicast and multicast feedback with same priority and same CB type**, which is decoupled from TDMed/FDMed multiplexing of unicast and multicast PDSCHs.  So far, the following cases are related with CB type discussion.   * For multicast feedback only, we have FG 33-2a. For the CB of multicast feedback only, we think 33-2a can include supporting Type-1 and Type-2 CB by default * For multiplexing feedback of unicast and multicast with the **different priority** in the same PUCCH slot, we have FG 33-6-2 and 33-6-3. * For multiplexing feedback of unicast and multicast with the **same priority and** **different CB types** in the same PUCCH slot, we have FG 33-3-5. * For multiplexing feedback of unicast and multicast with the **same priority and** **same** **CB types** in the same PUCCH slot, we can go with the Option 1 with some modifications.   + - **add an FG for Mode 2 TDM-ed Type-1 HARQ-ACK ACK/NACK-based codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast with same priority**       * **Note: TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union/intersection of k1 sets from unicast and multicast.**       * This FG’s prerequisite is 33-2a.       * This FG is the prerequisite of FG 33-3-4.     - **add an FG for FDM-ed Type-1 HARQ-ACK ACK/NACK-based codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast associated with max X G-RNTIs** **with same priority**       * **Note: FDM-ed Type-1 HAQR-ACK codebook is generated by concatenating the Type-1 sub-codebook for unicast and the Type-1 sub-codebook for multicast.**       * This FG’s prerequisite is 33-2a and 33-3-2.       * FFS value of X G-RNTIs     - **add an FG for Type-2 HARQ-ACK ACK/NACK-based codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast associated with max X G-RNTIs** **with same priority**       * **Note: 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.**       * This FG’s prerequisite is 33-2a       * FFS value of X G-RNTIs |
| vivo | We have the same understanding on constructing CB here, and the difference between option 1 and updated option 2 by removing FDM-ed and TDM-ed from type-2 HARQ-ACK is whether type 1 and 2 are separated, we slightly prefer separation of type 1 and 2 as what we have in 38.822 for legacy UEs. |
| ZTE | Thanks for the detailed explanation from companies above. We propose to go with Option2 in Huawei’s comments above. The reason is that Option2 provides a default multiplexing scheme, i.e., multiplexing type-2 codebook for unicast and multicast.  Without the default multiplexing scheme, different UEs may support different multiplexing schemes, it is difficult to configure a common codebook type and multiplexing scheme for all UEs in the same group. This will unnecessary complicate the system design.  Regarding the maximum number of G-RNTIs, we suggest to have a separate FG for it instead of coupling it with the FG for multiplexing here. In the end, having a separate FG for the maximum number of G-RNTI can offer the same flexibility as desibled by Qualcomm above from our perspective. |
| Huawei, HiSilicon | As explained, with the clarification by adding all these changes, the differences seem minor. Regarding the point from ZTE there could be a default codebook, seems valid also. Maybe we can take option2 for further solving the prerequisite FGs and reporting granularity, etc… |
| CMCC | We can go with ZTE and Huawei’s suggestion to take option 2 |
| Spreadtrum | Slightly prefer option 2, but no strong preference. |
| MediaTek | Prefer option 2, and the note content can be merged into the “Note column” |
| OPPO | Option 2 is preferred. |
| Moderator | More companies prefer Option 2 based on the clarification above.  Following proposal is made  **[GTW2] High priority proposal 5-1:**   * **Add an FG for FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **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.** * **Add an FG for TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **Note: TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union/intersection 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.** |
| FL3 | This proposal could not be discussed in the GTW session. No further input is necessary unless you have concern on this proposal  **[FL3] High priority proposal 5-1:**   * **Add an FG for FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **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.** * **Add an FG for TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **Note: TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union/intersection 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.** |
| Huawei, HiSilicon | If companies agree to go option 2, we can further modify a bit to solve “the intersection” issue as Qualcomm suggested as follows: |
|  | **FL3] High priority proposal 5-1:**   * **Add an FG for FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **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.** * **Add an FG for Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **Note: 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.** |
| Moderator | Based on the comments from HW/HiSi, proposal is updated accordingly.  **[GTW3] High priority proposal 5-1:**   * **Add an FG for FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **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.** * **Add an FG for Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast**   + **Note: Mode 2 TDM-ed Type-1 HARQ-ACK codebook is generated based on the union TDRA tables from unicast and multicast and the union~~/ intersection~~ 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.** |
| FL4 | Following was agreed in the GTW on Mar 1.  **Agreement**   * Add an FG 33-3-3a for FDM-ed Type-1 and Type-2 HARQ-ACK codebooks for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast   + 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.     - FFS value of X G-RNTIs * Add an FG 33-3-3b for Mode 2 TDM-ed Type-1 and Type-2 HARQ-ACK codebook for multiplexing HARQ-ACK for unicast and HARQ-ACK for multicast   + Note: 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.     - FFS value of X G-RNTIs * FG 33-3-3b is added as a prerequisite FG for FG 33-3-4   **[FL4] Medium priority question 5-1a:**   * **Companies are encouraged to provide view on the FFS value of X G-RNTIs** |
| MediaTek | We prefer to discuss the proposal after we have clear conclusion on FG33-2-x |
| ZTE | We would like to hear some comments from the proponents on why the number of G-RNTIs matters in case of type-2 codebook generation.  From our perspective, the procedure is agnostic to the number of G-RNTIs. It seems we can use the following FG to indicate the number of G-RNTIs for type-2 codebook as well. We don’t need to have another separate FG.   |  |  |  | | --- | --- | --- | | 33. NR\_MBS | 33-2-x | Multiple G-RNTIs for group-common PDSCHs |   We can also support MediaTek’s proposal above, i.e., to wait for the conclusion of FG33-2-x. |
|  |  |

**[FL1] High priority question 5-2:**

* **Companies are encouraged to provide views on whether to introduce new FGs for the following capabilities.**
  + **Max data rate of FDMed unicast PDSCH and group-common PDSCH for multicast respectively in a slot per CC.**
  + **Max data rate of TDMed unicast PDSCH(s) and group-common PDSCH(s) for multicast respectively in a slot per CC.**
  + Support: Qualcomm

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| --- | --- |
| Company | Comment |
| Spreadtrum | Not understand the motivation. Clarification is needed. |
| Huawei, HiSilicon | We can accept them as separate FGs but we need to make it clear how network should understand such UE capability if such FGs are not reported by UE. |
| Apple | The motivation is not clear. The max data rate is for MBS PDSCH, unicast PDSCH or both? |
| MediaTek | More clarification is needed. |
| ZTE | More clarification is needed. |
| Qualcomm2 | In 38.306, the supported DL max data rate in a slot is summed over all the carriers in the frequency range for any signaled band combination and feature set consistent with the configured servings cells as  where parameters for the j-th CC reported in the IE *FeatureSetDownlinkPerCC* are originally for unicast only. Now a UE may have separate multicast and unicast processing capabilities, such as , *, .*  At least when a UE capable of FDMed/TDMed unicast and multicast in a slot in j-th CC, the max data rate counting for MBS PDSCH and unicast PDSCH will be different from unicast only. We think a separate FG is needed for such cases. |
| vivo | We have one question for clarification based on the elaboration from Qualcomm.  If a max data rate of FDMed or TDMed unicast PDSCH and group-common PDSCH for multicast is supported from UE, for example, data rate 1. Is it possible to assume data rate 1 is supported for unicast only case? |
| Moderator | [GTW1] More discussion is necessary to have common understanding |
| FL2 | This issue was not discussed in the GTW session on Feb 23. Companies are invited to check the clarification from QC and provide further comments, if any. |
| Qualcomm | To answer vivo’s question:  For a slot with unicast only on j-th CC, max data rate is , which is similar as legacy based on unicast parameters.  For a slot with unicast and multicast on j-th CC, max data rate is based on , which can be larger than for unicast only.  It is possible to keep the same total data rate of all CCs and borrow the margin from another CC to support the CC with multicast on top of unicast. |
| vivo2 | Thanks Qualcomm;s reply. We are fine to add them as separated FGs |
| ZTE | We are thinking that if the total number of PDSCHs that can be scheduled in each slot is kept unchanged and the max TBS is kept unchanged, it seems we don’t need to change the calculation of data rate. Is this the common understanding among companies? |
| Huawei, HiSilicon | We agree with QC’s intention, the ambiguity to network is how to understand the data rate UE can support per the existing report if not defining FG/component for data rate/max total TB size. |
| Spreadtrum | Thanks Qualcomm foe detailed explanation. We got it.  Regarding ZTE’s question, in our understanding, although total number of PDSCHs in a slot not changed, but the maximum layer, modulation order may be different for unicast and multicast, so the data rate is also different.  In our mind, maybe we should firstly discuss whether maximum layer, the maximum modulation order and others can be different for unicast and multicast for one UE, subject to UE capability. Then discuss this issue. |
| NTT DOCOMO | We share the similar view with ZTE. We are not sure these new FGs are needed. |
| Moderator | [GTW2] Still some companies don’t see the necessity of this FGs. **Further discuss in the GTW** |
| FL3 | As discussed in the GTW, this issue is further discuss in AI 8.12.1 |

**[FL1] Medium priority question 5-3:**

* **Companies are encouraged to provide views on whether the type of FGs 33-3-2 to 33-3-5 should be per UE or per FSPC.**
  + FG 33-3-2
    - Per UE: OPPO, Nokia, NSB, Spreadtrum Communications
    - Per FSPC: MediaTek, Huawei, HiSilicon, Qualcomm, Apple
  + FG 33-3-3
    - Per UE: OPPO, Nokia, NSB, Spreadtrum Communications
    - Per FSPC: MediaTek, Huawei, HiSilicon, Qualcomm, Apple
  + FG 33-3-4
    - Per UE: Huawei, HiSilicon, OPPO
    - Per FSPC: MediaTek, Qualcomm, Apple
  + FG 33-3-5
    - Per UE:
    - Per FSPC: MediaTek, OPPO, Qualcomm, Apple

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| --- | --- |
| Company | Comment |
| Nokia, NSB | Per UE, see earlier related comments. |
| FL2 | Please provide your view if not provided yet |
| ZTE | We prefer per UE for the above FGs |
| NTT DOCOMO | Per UE |
| FL3 | Please provide your view if not provided yet |
| Huawei, HiSilicon | Our views are as FL summarized. We can also accept FG33-3-4 as per FSPC |
| MediaTek | Per FSPC |
| Apple | Per FSPC |
| Moderator | [GTW3] This issue can be discussed after some progress is made in **question 3-5** |

**Low priority question 5-4:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FGs 33-3-2 to 33-3-5**

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| Company | Comment |
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**Low priority question 5-5:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FGs 33-3-2 to 33-3-5 which do not have capability signalling impacts**

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| Company | Comment |
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# **33-4 to 33-4-1: NACK-only based HARQ-ACK feedback for multicast**

In [1], FGs 33-4 to 33-4-1 are captured as below.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between Ues (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-4 | NACK-only based HARQ-ACK feedback for multicast | 1. Support NACK-only based HARQ-ACK feedback. | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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 UE |  |  |  |  | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#108-e meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | 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 a single 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.  ***Proposal 8: Updating FG33-4 as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | Support of NACK-only based HARQ-ACK feedback and RRC-based enabling/disabling NACK-only based feedback for dynamic scheduling for multicast | 1. Support NACK-only based HARQ-ACK feedback for multicast SPS group-common PDSCH without PDCCH scheduling 2. support of enabling/disabling NACK-only based HARQ-ACK feedback for multicast SPS scheduling per the configuration of RRC signalling. 3. Support PTM retransmission for multicast SPS. | 33-2 or 33-2-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [5] | OPPO | Similar with ACK/NACK based feedback in FG 33-2a, enabling/disabling of NACK-only based feedback by RRC signaling can be within the same FG. Supporting NACK-only based HARQ-ACK feedback requires enabling/disabling mechanism, while DCI-based mechanism is not the only one. Furthermore, using RRC-based signaling to enable/disable NACK-only based HARQ-ACK feedback is considered as a default method.   1. ***For FG 33-4, “and support enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signaling” should be added to the component.***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | NACK-only based HARQ-ACK feedback for multicast | 1. Support NACK-only based HARQ-ACK feedback, and support of enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signaling. | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 UE |  |  |  |  | Optional with capability signalling | |
| [6] | Nokia, NSB | * **33-4:**   + To be merged in 33-2, or at least to be mandatorily indicated for UEs supporting 33-2, as it is an essencial functionality for groupcast.   + Per UE |
| [8] | Intel | * FG 33-4   + Add component for support of enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signaling  |  |  |  |  |  | | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | NACK-only based HARQ-ACK feedback for multicast | Support NACK-only based HARQ-ACK feedback and support of enabling/disabling ACK/NACK based HARQ-ACK feedback configured by RRC signalling | 33-2 | |
| [9] | Apple | As it was agreed HARQ-ACK based feedback is an independent FG33-2a from FG33-2, FG33-4 should be an independent FG as well. In addition, the prerequisite feature group should include FG33-2c, i.e., PTM retransmission for multicast.  **Proposal 4: Keeping FG33-4 as independent feature and include FG33-2c as prerequisite feature group.** |
| [10] | Spreadtrum Communications | During previous RAN1 meetings, we have the common understanding on reusing the design for ACK/NACK based feedback for NACK-only as far as possibly. For the basic function of ACK/NACK based feedback, i.e., FG33-2a, supporting of enabling/disabling ACK/NACK based HARQ-ACK feedback configured by RRC signaling is also included. Likewise, for the basic function of NACK-only feedback, we also think the function of NACK-only enabling/disabling by RRC also should be included. Thus, we have the following proposal:  ***Proposal 4***: Component 1 of FG33-4 can be revised as ‘Support NACK-only based HARQ-ACK feedback, and support of enabling/disabling NACK-only based HARQ-ACK feedback configured by RRC signalling’.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | NACK-only based HARQ-ACK feedback 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. | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [15] | Qualcomm | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-4 | NACK-only based HARQ-ACK feedback for multicast | Support of NACK-only based HARQ-ACK feedback for dynamically scheduled multicast associated with G-RNTI  Support PTM retransmission for dynamically scheduled multicast associated with G-RNTI | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-4a | More than one NACK-only based HARQ-ACK feedback for multicast in a PUCCH resource | Support of more than one NACK-only based HARQ-ACK feedback for dynamically scheduled multicast in a PUCCH resource | 33-4 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling |   We suggest minor changes for FG 33-4-1 as   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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, 33-2b | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |
| [16] | Ericsson | We are OK with this feature in general but would like to clarify that this should exclude multicast SPS, which needs specific features to be supported. |

## **Discussion**

**[FL1] High priority question 6-1:**

* **Companies are encouraged to provide views on whether to introduce a new FG for the support of more than one NACK-only based HARQ-ACK feedback for dynamically scheduled multicast in a PUCCH resource**
  + Support: Qualcomm

|  |  |
| --- | --- |
| Company | Comment |
| Huawei, HiSilicon | No decision yet for the support of this function. UE feature discussion for this can wait. |
| Apple | We can wait for the outcome from AI 8.12.2 |
| ZTE | Same view as Huawei and Apple. |
| Moderator | [GTW1] As suggested, we need to wait for the progress in AI 8.12.2. |
| Qualcomm | Based on latest agreements in 8.12.2, a new FG should be added for more than one NACK-only based HARQ-ACK feedback for DG multicast |
|  |  |

**[FL1] Medium priority question 6-3:**

* **Companies are encouraged to provide views on whether the type of FGs 33-4 and 33-4-1 should be per UE or per FSPC**
  + FG 33-4
    - Per UE: Huawei, HiSilicon, OPPO, Nokia, NSB, Spreadtrum Communications
    - Per FSPC: MediaTek, Qualcomm, Apple
  + FG 33-4-1
    - Per UE: OPPO,
    - Per FSPC: MediaTek, Qualcomm, Apple

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Per UE, see earlier comments. |
| FL2 | Please provide your view if not provided yet |
| ZTE | We prefer per UE for the above FGs. |
| FL3 | Please provide your view if not provided yet |
| Huawei, HiSilicon | We can also accept the reporting as per FSPC |
| MediaTek | Per FSPC |
| Apple | Per FSPC |
| Moderator | [GTW3] This issue can be discussed after some progress is made in **question 3-5** |

**Low priority proposal 6-4:**

* **Add a component in FG 33-4 “Support of enabling/disabling NACK-only based HARQ-ACK feedback for multicast configured by RRC signaling”**
* **Component 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”**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei, HiSilicon | Support both. |
|  |  |
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**Low priority question 6-5:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FGs 33-4 and 33-4-1.**

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| Company | Comment |
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**Low priority question 6-6:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FGs 33-4 and 33-4-1 which do not have capability signalling impacts**

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| Company | Comment |
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# **33-5-1 to 33-5-2:** **SPS group-common PDSCH for multicast**

In [1], FGs 33-5-1 to 33-5-2 are captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between Ues (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. 3. Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. 4. FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH. 5. Support slot-level repetition for SPS group-common PDSCH   FFS whether/how to separate the above capabilities from FG 33-5-1 | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support [N>1] SPS group-common PDSCH configuration for multicast 2. Support M>=1 activated SPS group-common PDSCH configurations among the N SPS group-common PDSCH configurations per CFR for multicast | 33-2 | Yes |  |  | Per UE | No | No |  | FFS: Candidate values for M | Optional with capability signalling |

Following feedbacks are provided in contributions for t he RAN1#108-e meeting.

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| [2] | Huawei, HiSilicon | How to group the UE features for multicast SPS could refer to the UE features for multicast dynamic scheduling.  Similar to MBS broadcast FG33-1 and multicast FG33-2, support of slot-level repetition for SPS group-common PDSCH can be the component of FG33-5-1.  Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling can be a separate FG in FG33-5-1a.  Support of ACK/NACK based HARQ-ACK feedback, support of enabling/disabling ACK/NACK based HARQ-ACK feedback, and support of PTM retransmission can be grouped into FG33-5-1b.  Support of enabling/disabling HARQ-ACK feedback in the group-common DCI for multicast SPS activation per the configuration of RRC signaling for each G-CS-RNTI can be separate in FG33-5-1c.  Support of PTP retransmission can be separate in FG33-5-1d.  Support of NACK-only based HARQ-ACK feedback for multicast SPS group-common PDSCH without PDCCH scheduling, support of PTM retransmission for multicast SPS, and support of enabling/disabling NACK-only based HARQ-ACK feedback per configuration of RRC signaling can be grouped into FG33-5-1e.  ***Proposal 9: Updating FG33-5-1/2, adding FG33-5-1a/1b/1c/1d/1e as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support of one SPS group-common PDSCH configuration for multicast 2. Support of one SPS group-common PDSCH activated/deactivated by group-common PDCCH scrambled with G-CS-RNTI. 3. Support of DCI format 4\_1 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling. 4. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 5. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 6. ~~FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH.~~ 7. Support semi-static slot-level repetition for SPS group-common PDSCH   ~~FFS whether/how to separate the above capabilities from FG 33-5-1~~ | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1a | Multicast SPS scheduled by DCI format 4\_2 | 1. Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling. | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1b | ACK/NACK based HARQ-ACK feedback for multicast SPS | 1. Support of ACK/NACK based HARQ-ACK feedback for multicast SPS group-common PDSCH without PDCCH scheduling. 2. Support of enabling/disabling ACK/NACK based HARQ-ACK feedback for multicast SPS scheduling per the configuration of RRC signaling 3. Support of PTM retransmission for multicast SPS. | 33-5-1 or 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1c | Group-common DCI indicating the enabling/disabling HARQ-ACK feedback for multicast SPS | Support of enabling/disabling HARQ-ACK feedback in the group-common DCI for multicast SPS activation per the configuration of RRC signaling for each G-CS-RNTI. | 33-5-1b | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1d | PTP retransmission for multicast SPS | Support of PTP retransmission for multicast SPS. | 33-5-1b | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1e | Support of NACK-only based HARQ-ACK feedback for multicast SPS | 1. Support of ACK/NACK based HARQ-ACK feedback for multicast SPS group-common PDSCH without PDCCH scheduling. 2. Support of enabling/disabling ACK/NACK based HARQ-ACK feedback for multicast SPS scheduling per the configuration of RRC signaling 3. Support of PTM retransmission for multicast SPS. | 33-5-1 or 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support [N>1] SPS group-common PDSCH configuration for multicast 2. Support M>=1 activated SPS group-common PDSCH configurations among the N SPS group-common PDSCH configurations per CFR for multicast. | 33-5-1 | Yes |  |  | Per UE | No | No |  | FFS: Candidate values for M | Optional with capability signalling | |
| [5] | OPPO | For FG 33-5-1, at least supporting one SPS GC-PDSCH configuration for multicast is the basic function. The rest components 2~5 can be separated from FG 33-5-1. HARQ-ACK feedback is can be enabled/disabled with different feedback schemes. Furthermore, slot-level repetition can also be separated to an independent FG.   1. ***For FG 33-5-1, component 2/3/4/5 can be separated from this FG as in 33-5-4, 33-5-5, 33-5-6 and 33-5-7.***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 3. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 4. ~~FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH.~~ 5. ~~Support slot-level repetition for SPS group-common PDSCH~~   ~~FFS whether/how to separate the above capabilities from FG 33-5-1~~ | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support [N>1] SPS group-common PDSCH configuration for multicast 2. Support M>=1 activated SPS group-common PDSCH configurations among the N SPS group-common PDSCH configurations per CFR for multicast | 33-2 | Yes |  |  | Per UE | No | No |  | FFS: Candidate values for M | Optional with capability signalling | | 33. NR\_MBS | 33-5-4 | SPS group-common PDSCH for multicast | Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-5 | SPS group-common PDSCH for multicast | Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-6 | SPS group-common PDSCH for multicast | HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH. | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-7 | SPS group-common PDSCH for multicast | Support slot-level repetition for SPS group-common PDSCH | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [6] | Nokia, NSB | * **33-5-1**:   + Per UE * **33-5-2**:   + Per UE |
| [7] | NTT DOCOMO | Capabilities for SPS GC-PDSCH should be structured similarly to FGs for dynamic scheduled GC-PDSCH.  ***Proposal 7: Divide FG 33-5-1 as follows.***   |  |  |  |  | | --- | --- | --- | --- | | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 3. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 4. FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH. 5. Support slot-level repetition for SPS group-common PDSCH | 33-2 | | 33-5-1a | ACK/NACK based HARQ-ACK feedback for SPS GC-PDSCH | 1. Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. | 33-5-1 | | 33-5-1b | NACK-only based HARQ-ACK feedback for SPS GC-PDSCH | 1. Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. | 33-5-1 | |
| [8] | Intel | * FG 33-5-1   + Separate HARQ-ACK feedback and slot repetition support into separate dependent FGs  |  |  |  |  |  | | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 3. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 4. ~~FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH.~~ 5. ~~Support slot-level repetition for SPS group-common PDSCH~~   ~~FFS whether/how to separate the above capabilities from FG 33-5-1~~ | 33-2 | |  | 33-5-1a | HARQ-ACK Feedback for SPS group-common PDSCH for multicast | 1. Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. 2. Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. | 33-5-1 | |  | 33-5-1b | Slot level repetition for SPS group-common PDSCH for multicast | 1. Support slot-level repetition for SPS group-common PDSCH | 33-5-1 | |
| [10] | Spreadtrum Communications | Like FG33-2, we also think HARQ-ACK feedback is not the basic feature for group-common SPS operation. Thus, we prefer to split component 2, 3 in FG33-5-1 as separated FG.  ***Proposal 5***: Component 2, 3 in FG33-5-1 can be split as separated FG, and as optional UE capability.  Regarding repetition for SPS, we have the following agreement made in RAN1#106b-e:  Agreement:  For slot-level repetition for SPS GC-PDSCH for multicast RRC\_CONNECTED UEs.   * Config A or Config B can be configured to UE:   + (Config A) UE can be optionally configured with *pdsch-AggregationFactor* per *SPS-Config-Multicast*.   + (Config B) UE can be optionally configured with TDRA table with *repetitionNumber* as part of the TDRA table in *PDSCH-Config-Multicast*. If UE is configured with Config B, UE does not expect to be configured with Config A for the same SPS group-common PDSCH. * For Config A, if pdsch-AggregationFactor in SPS-Config-Multicast is not configured, default value is   + Alt1: equal to 1.   Dynamic repetition number indication and semi-static repetition number indication for SPS group-common PDSCH are considered. It is similar to repetition indication for dynamic group-common PDSCH. In our mind, there is no necessary to have additional FG for SPS. We are fine that FG 33-3-1 is also applied for SPS group-common PDSCH, and only semi-static repetition is included in FG33-5-1.  ***Proposal 6:*** For FG33-5-1, suggest to revise component 5 as ‘Support semi-static slot-level repetition for SPS group-common PDSCH’.  For the component 1 of FG33-5-2, if taking FG12-2 as reference, it shall be per CFR configuration, and further constraint on per cell or cell group can also be considered.  ***Proposal 7***: Component 1 in FG33-5-2 can be revised as ‘Support up to [N>1] SPS group-common PDSCH configuration per CFR for multicast, and up to K SPS group-common PDSCH configuration in a cell group’.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. 3. Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. 4. FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH. 5. Support semi-static slot-level repetition for SPS group-common PDSCH   FFS whether/how to separate the above capabilities from FG 33-5-1 | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support [N>1] SPS group-common PDSCH configuration per CFR for multicast, and up to K SPS group-common PDSCH configuration in a cell group 2. Support M>=1 activated SPS group-common PDSCH configurations among the N SPS group-common PDSCH configurations per CFR for multicast | 33-2 | Yes |  |  | Per UE | No | No |  | FFS: Candidate values for M | Optional with capability signalling | |
| [11] | CMCC | There were also some discussions about whether to separate the capabilities in FG 33-5-1 similar the discussion in FG 33-2. In general, we think the same principle of multicast dynamic scheduling and multicast SPS should be applied, e.g., RRC based slot-level repetition and DCI format 4\_2 are kept as components of FG 33-5-1, DCI based slot-level repetition and ACK/NACK based HARQ-ACK feedback are introduced as separate FGs. Thus, we suggest the following proposal.  **Proposal 8. For FG 33-5-1:**   * **Don’t support to separate the capability for support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS transmission;** * **RRC based slot-level repetition is merged with FG 33-5-1;** * **A separate FG is introduced for DCI based slot-level repetition.**   **Proposal 9. Add following FG for ACK/NACK based HARQ-ACK feedback for SPS:**   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-5-3 | Support of ACK/NACK based HARQ-ACK feedback and RRC-based enabling/disabling ACK/NACK-based feedback for SPS 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.  2.Support of PTM retransmission for multicast SPS.  3.Support of PTP retransmission for multicast SPS. | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [14] | MediaTek | Regarding the SPS group-common PDSCH for multicast, we need to further discuss whether/how to separate the capabilities from FG 33-5-1. Actually, we think the capability for SPS should be align with the dynamic scheduling and have the following proposal:  *Proposal 19: For FG 33-5-1, the similar separate capability for dynamic scheduling can be reused for SPS group-common PDSCH for multicast.*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 for multicast 3. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 4. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 5. ~~FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH.~~ 6. ~~Support slot-level repetition for SPS group-common PDSCH~~   FFS whether/how to separate the above capabilities from FG 33-5-1 | 33-2 | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  |  | Optional with capability signalling | | 33-5-1a | ACK/NACK based HARQ-ACK feedback for SPS multicast | 1. Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. | 33-5-1 |  |  |  | Per FSPC |  |  |  |  | Optional with capability signalling | | 33-5-1b | NACK only based HARQ-ACK feedback for SPS multicas | 1. Support NACK only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. | 33-5-1 |  |  |  | Per FSPC |  |  |  |  | Optional with capability signalling | | 33-5-1c | PTM retransmission for SPS multicast | 1. Support PTM retransmission of SPS group common PDSCH for multicast | 33-5-1 |  |  |  | Per FSPC |  |  |  |  | Optional with capability signalling | | 33-5-1d | PTP retransmission for SPS multicast | 1. Support PTP retransmission of SPS group common PDSCH for multicast | 33-5-1 |  |  |  | Per FSPC |  |  |  |  | Optional with capability signalling | | 33-5-1f | Dynamic Slot-level repetition for SPS multicast | 1. Support up to X times dynamic slot-level repetition for group-common PDSCH for SPS multicast. | 33-2 | Yes |  |  | ~~Per UE~~  Per FSPC | No | No |  | Candidate values for X is: {8, 16} | Optional with capability signalling | |
| [15] | Qualcomm | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support of one SPS group-common PDSCH configuration for multicast 2. Support of group-common PDCCH/PDSCH with CRC scrambled by G-CS-RNTI(s) for multicast 3. Support of DCI format 4\_1 with CRC scrambled with G-CS-RNTI for multicast. 4. Support of higher-layer configured slot-level repetition for group-common PDSCH scheduled associated with G-CS-RNTIACK/NABK-based HARQ-ACK feedback for SPS group-common PDCCH activation and SPS release associated with G-CS-RNTI. | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  | Max value of higher layer configured slot-level repetition = {2, 4, 8} | Optional with capability signalling | | 33. NR\_MBS | 33-5-1a | ACK/NACK-based HARQ ACK feedback for SPS multicast | Support of ACK/NACK based HARQ-ACK feedback, and support of enabling/disabling ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling configured by RRC signalling.  Support of PTM retransmission for SPS multicast associated with G-CS-RNTI | 33-5-1 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1b | SPS multicast using DCI format 4\_2 | Support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS transmission. | 33-5-1 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1c | DCI-based enabling/disabling ACK/NACK-based feedback for SPS multicast | Support of DCI-based enabling/disabling ACK/NACK-based HARQ-ACK feedback per G-CS-RNTI for multicast by RRC signaling by using DCI format 4\_2 | 33-5-1a, 33-5-1b | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS multicast | Support PTP retransmission associated with CS-RNTI for SPS multicast | 33-5-1b | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1e | Dynamic slot-level repetition of SPS group-common PDSCH for multicast | Support of DCI-indicated slot-level repetition for group-common PDSCH with CRC scrambled with G-CS-RNTI | 33-5-1 | Yes |  |  | Per FSPC | N/A | N/A |  | Max value of DCI-indicated slot-level repetition = {8, 16} | Optional with capability signalling | | 33. NR\_MBS | 33-5-1f | NACK-only-based HARQ ACK feedback for SPS multicast | Support of NACK-only-based HARQ-ACK feedback , and support of enabling/disabling ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling configured by RRC signalling.  Support of PTM retransmission for SPS group-common PDSCH associated with G-CS-RNTI | 33-5-1 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1g | DCI-based enabling/disabling NACK-only-based feedback for SPS multicast | Support of DCI-based enabling/disabling NACK-only-based HARQ-ACK feedback per G-CS-RNTI for multicast by RRC signaling by using DCI format 4\_2 | 33-5-1f, 33-5-1b | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-2 | Multiple SPS group-common PDSCH configuration | 1. Support [N>1] SPS group-common PDSCH configurations ~~per CFR~~ for multicast 2. Support [N>=M>=1] activated SPS group-common PDSCH configurations among the N SPS group-common PDSCH configurations per CFR for multicast | 33-2 | Yes |  |  | Per FSPC | N/A | N/A |  | FFS: value of N, M | Optional with capability signalling |   Similar as FG33-2-x, we suggest adding a new FG33-5-x for the capability of monitoring group-common PDCCHs with multiple G-CS-RNTIs for SPS multicast per slot per CC.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-x | Multiple G-CS-RNTIs for SPS group-common PDSCHs | Max number of G-CS-RNTIs for SPS multicast per slot per CC | 33-5-1 | Yes |  |  | Per FSPC | N/A | N/A |  | FFS: max number = {2, …} | Optional with capability signalling | |
| [16] | Ericsson | For SPS for multicast, we have the following comments:   * For SPS, retransmission can be done via PTM or PTP. Therefore how retransmission is supported for SPS should also be a separate feature component. * Regarding SPS with NACK only feedback we propose that feature 4 is clarified to be relevant for SPS activation and release. Additionally,in our view either NACK-only (sub-feature 3) and support for the use of HARQ ACK-NACK feedback for activation and release (sub-feature 4) are dependent on each otherand could be a separate feature group if needed. Therefore we propose to either remove the FFS or brand out NACK-only support for SPS in a separate FG.   The following change is proposed:   |  |  |  |  | | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. 3. Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling. 4. ~~FFS:~~ HARQ-ACK feedback for SPS group-common activation with PDCCH scheduling and SPS release PDCCH. 5. Support slot-level repetition for SPS group-common PDSCH 6. Support of PTM retransmission for SPS multicast 7. Support of PTP retransmission for SPS multicast | |

## **Discussion**

**[FL1] High priority question 7-1:**

* **FG 33-5-1 is updated as follows**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 3. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 4. ~~FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH.~~ 5. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH   FFS whether~~/how~~ to separate ~~the above capabilities from FG 33-5-1~~ the capability for support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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 UE | No | No |  |  | Optional with capability signalling |
| 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 | 33-2a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-5-1c | PTM retransmission for SPS group-common PDSCH for multicast | Support of PTM retransmission associated with G-CS-RNTI for SPS multicast  FFS whether to merge with 33-5-1a | 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for associated with G-CS-RNTI for SPS multicast  FFS whether to merge with 33-5-1a | 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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 |
| 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 | 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, SPS group-common PDSCH activation, and SPS release PDCCH | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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 |
| 33. NR\_MBS | 33-5-1h | Multiple G-CS-RNTIs for SPS group-common PDSCHs | Max number of G-CS-RNTIs for SPS multicast per lost per CC | 33-5-1 | Yes |  |  | Per UE | No | No |  | FFS max number = {2, …} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | In FG 33-5-1a, “RRC signalling for SPS group-common PDSCH without PDCCH scheduling~~, SPS group-common PDSCH activation, and SPS release PDCCH~~”. ACK/NACK-based feedback for SPS activation/release should be included in 33-5-1.  In FG 33-5-1f, “RRC signalling for SPS group-common PDSCH without PDCCH scheduling~~, SPS group-common PDSCH activation, and SPS release PDCCH~~”. NACK-only-based feedback is not supported for SPS activation/release.  In FG 33-5-1c, it can be merged into 33-5-1a and 44-5-1f, respectively. We suggest changing FFS as "FFS whether to merge with 33-5-1a and 33-5-1f respectively” |
| Spreadtrum | The prerequisite FG of FG33-5-1b should be FG33-5-1a.  Others are fine. |
| NTT DOCOMO | We are generally fine with the proposal. At least FG 33-5-1c should be merged into FG 33-5-1a. |
| CMCC | Support in principle |
| Xiaomi | Generally fine with the above FG list. |
| Moderator | All companies are generally fine with the proposal.  The proposal is updated based on the provided comments  **[GTW1] High priority proposal 7-1:**   * **FG 33-5-1 is updated as follows**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 3. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 4. ~~FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH.~~ 5. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH   FFS whether~~/how~~ to separate ~~the above capabilities from FG 33-5-1~~ the capability for support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 UE | No | No |  |  | Optional with capability signalling | | 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 UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1c | PTM retransmission for SPS group-common PDSCH for multicast | Support of PTM retransmission associated with G-CS-RNTI for SPS multicast  FFS whether to merge with 33-5-1a and 33-5-1f, respectively | 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for associated with G-CS-RNTI for SPS multicast  FFS whether to merge with 33-5-1a | 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 | | 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 | 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, SPS group-common PDSCH activation, and SPS release PDCCH | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 | | 33. NR\_MBS | 33-5-1h | Multiple G-CS-RNTIs for SPS group-common PDSCHs | Max number of G-CS-RNTIs for SPS multicast per slot per CC | 33-5-1 | Yes |  |  | Per UE | No | No |  | FFS max number = {2, …} | Optional with capability signalling | |
| FL2 | Following was agreed in the GTW session on Feb 23.  **Agreement**   * FG 33-5-1 is updated as follows  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-5-1 | SPS group-common PDSCH for multicast | 1. Support one SPS group-common PDSCH configuration for multicast 2. ~~Support ACK/NACK based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 3. ~~Support NACK-only based HARQ-ACK feedback for SPS group-common PDSCH without PDCCH scheduling.~~ 4. ~~FFS: HARQ-ACK feedback for SPS group-common with PDCCH scheduling and SPS release PDCCH.~~ 5. Support {2, 4, 8} times semi-static slot-level repetition for SPS group-common PDSCH   FFS whether~~/how~~ to separate ~~the above capabilities from FG 33-5-1~~ the capability for support of DCI format 4\_2 with CRC scrambled with G-CS-RNTI for multicast SPS scheduling | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 UE | No | No |  |  | Optional with capability signalling | | 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 UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1c | PTM retransmission for SPS group-common PDSCH for multicast | Support of PTM retransmission associated with G-CS-RNTI for SPS multicast  FFS whether to merge with 33-5-1a and 33-5-1f, respectively | 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for SPS multicast  FFS whether to merge with 33-5-1a | 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 | | 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 | 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 | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 | | 33. NR\_MBS | 33-5-1h | Multiple G-CS-RNTIs for SPS group-common PDSCHs | Max number of G-CS-RNTIs for SPS multicast [per slot] per CC | 33-5-1 | Yes |  |  | Per UE | No | No |  | FFS max number | Optional with capability signalling |   Let’s further discuss FFS highlighted in yellow.  **[FL2] High priority question 7-1a:**   * **Companies are encouraged to provide views on whether FGs 33-5-1a/33-5-1f can be confirmed**   **[FL2] High priority question 7-1b:**   * **Companies are encouraged to provide views on whether FGs 33-5-1c and/or FGs 33-5-1d can be merged with 33-5-1a and 33-5-1f (if they are confirmed), respectively** |
| vivo | Following what we have in dynamic scheduling case, we support to merge FGs 33-5-1c with 33-5-1a and leave FGs 33-5-1d as a separate FG |
| Huawei, HiSilicon | 7-1a, confirm. 7-1b. FG33-5-1c can be merged but keep FG33-5-1d as separate as what we agreed for dynamic scheduling |
| CMCC | Merge FG 33-5-1c with FG 33-5-1a, FG 33-5-1d can be a separate FG |
| NTT DOCOMO | FG 33-5-1c should be merged with FG 33-5-1a, just like FGs for dynamic scheduling. |
| OPPO | 7-1a: FG 33-5-1a/f can be confirmed.  7-1b: FG 33-5-1c can be merged into FG 33-5-1a; FG 33-5-1d can be a separate FG. |
| Moderator | All companies are fine to confirm FGs 33-5-1a/33-5-1f and to merge FGs 33-5-1c with 33-5-1a  Following proposal is made  **[GTW2] High priority proposal 7-1ab:**   * **FGs 33-5-1a, 33-5-1c, 33-5-1d, and 33-5-1f are updated as follows**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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 associated with G-CS-RNTI for SPS multicast | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | ~~33. NR\_MBS~~ | ~~33-5-1c~~ | ~~PTM retransmission for SPS group-common PDSCH for multicast~~ | ~~Support of PTM retransmission associated with G-CS-RNTI for SPS multicast~~  ~~FFS whether to merge with 33-5-1a and 33-5-1f, respectively~~ | ~~33-5-1a~~ | ~~Yes~~ |  |  | ~~Per UE~~ | ~~No~~ | ~~No~~ |  |  | ~~Optional with capability signalling~~ | | 33. NR\_MBS | 33-5-1d | PTP retransmission for SPS group-common PDSCH for multicast | Support of PTP retransmission for SPS multicast  ~~FFS whether to merge with 33-5-1a~~ | 33-5-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 | 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 | 33-5-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| FL3 | Following was agreed in the GTW session on Feb 25  **Agreement**   * FGs 33-5-1c and 33-5-1f are updated as follows  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | ~~33. NR\_MBS~~ | ~~33-5-1c~~ | ~~PTM retransmission for SPS group-common PDSCH for multicast~~ | ~~Support of PTM retransmission associated with G-CS-RNTI for SPS multicast~~  ~~FFS whether to merge with 33-5-1a and 33-5-1f, respectively~~ | ~~33-5-1a~~ | ~~Yes~~ |  |  | ~~Per UE~~ | ~~No~~ | ~~No~~ |  |  | ~~Optional with capability signalling~~ | | 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 |   Regarding FG 33-5-1a, as discussed in the GTW, discuss the UE behaviour for type 1 CB construction in 8.12.2  Remaining FFS is the value for the max number of G-CS-RNTIs for SPS multicast [per slot] per CC  **[FL3] Medium priority question 7-1c:**   * **Companies are encouraged to provide views on the value for the max number of G-CS-RNTIs for SPS multicast in FG 33-5-1h** |
| Huawei, HiSilicon | Since it is separate FG, it should be at least 2. It is for multicast, max number of G-CS-RNTI can be with candidates values as: 2, 3. 4. |
| ZTE | We don’t have strong view on the candidate numbers. But it would be better if we can align the number of G-CS-RNTI and the number of multiple SPS configurations for multicast (FG 33-5-2). |
| MediaTek | Regarding the relationship between G-RNTI and MBS session (i.e., MBS services), RAN2 has agreed that “**one to multiple mapping between G-CS-RNTI and MBS SPS config are supported**”, based on this agreement, we think there is no need to define more G-CS-RNTI. Besides, for MBS feature, we have introduced multiple RNTI numbers, e.g., (multiple G-RNTI/G-CS-RNTI for multicast, MCCH-RNTI for broadcast, G-RNTI for broadcast). However, the total number of RNTI supported for UE is limited, and it will have larger hardware impact if many RNTIs are introduced.  Based on the above reasons, we prefer the maximum value of G-CS-RNTI for SPS multicast is 2. |
| Apple | Share the same view as MediaTek, one maximum value 2 is enough, the RNTI resources are saved as well. |
| Moderator | Based on the comments, following proposal is made. Further discuss yellow-highlighted part  **[GTW3] Medium priority proposal 7-1c:**   * **The value for the max number of G-CS-RNTIs for SPS multicast [per slot per CC] in FG 33-5-1h is 2** |
| FL4 | Companies are encouraged to provide view on the following proposal including the yellow-highlighted part.  **[FL4] Medium priority proposal 7-1c:**   * **The value for the max number of G-CS-RNTIs for SPS multicast [per slot per CC] in FG 33-5-1h is 2** |
| Qualcomm | We are fine to remove per slot but keep per CC in FG 33-5-1h.  For the value, it can be 2, 3, 4. |
| MediaTek | The intention of this proposal is to say the maximum value of G-CS-RNTI supported by UE, so, we suggest to delete per slot and per slot. If the reporting type of this FG is per FSPC, we are ok to keep the wording of per CC.  Regarding the max number of G-CS-RNTIs for SPS multicast, as commented in previous round, we still think 2 G-CS-RNTIs are sufficient. |
| ZTE | We are fine to remove “**[per slot per CC]**”.  The maximum number can be 2, 3,4 or even more. We would prefer to add a note to ask RAN2 to double check these numbers since the maximum number of G-RNTIs are also related to the number of MRB (MBS Radio Bear). |

**[FL1] Medium priority question 7-2:**

* **Companies are encouraged to provide views on whether to update component 1 in FG 33-5-2 as follows**
  + **Support [N>1] SPS group-common PDSCH configuration per CFR for multicast, and up to K SPS group-common PDSCH configuration in a cell group**
    - **FFS the value range for K**

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| --- | --- |
| Company | Comment |
| Qualcomm | Support |
| Huawei, HiSilicon | ok |
| LG Electronics | OK. |
| FL2 | Please provide your view if not provided yet |
| vivo | support |
| ZTE | Support |
| CMCC | OK |
| Spreadtrum | Support |
| NTT DOCOMO | Support |
| FL3 | All companies are fine to update component 1  **[FL3] Medium priority proposal 7-2:**   * **Component 1 in FG 33-5-2 is updated as follows**   + **Support [N>1] SPS group-common PDSCH configuration per CFR for multicast, and up to K SPS group-common PDSCH configuration in a cell group**     - **FFS the value range for K** |
| Moderator | This proposal is stable for more than 24 hours and can be agreed via email endorsement  **[email1] Medium priority proposal 7-2:**   * **Component 1 in FG 33-5-2 is updated as follows**   + **Support [N>1] SPS group-common PDSCH configuration per CFR for multicast, and up to K SPS group-common PDSCH configuration in a cell group**     - **FFS the value range for K** |
| Qualcomm | Support  For the value range for K, it can be 2, 4 or 8. |

**[FL1] Medium priority question 7-2:**

* **Companies are encouraged to provide views on whether the type of FGs 33-5-1 and 33-5-2 should be per UE or per FSPC**
  + FG 33-5-1
    - Per UE: Huawei, HiSilicon, OPPO, Nokia, NSB, Spreadtrum Communications
    - Per FSPC: MediaTek, Qualcomm
  + FG 33-5-2
    - Per UE: Huawei, HiSilicon, OPPO, Nokia, NSB, Spreadtrum Communications
    - Per FSPC: MediaTek, Qualcomm

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Per UE, see earlier comments. |
| FL2 | Please provide your view if not provided yet |
| ZTE | We prefer per UE for the above FGs |
| NTT DOCOMO | Per UE |
| FL3 | * + FG 33-5-1     - Per UE: Huawei, HiSilicon, OPPO, Nokia, NSB, Spreadtrum Communications, ZTE, DCM     - Per FSPC: MediaTek, Qualcomm   + FG 33-5-2     - Per UE: Huawei, HiSilicon, OPPO, Nokia, NSB, Spreadtrum Communications, ZTE, DCM     - Per FSPC: MediaTek, Qualcomm   As a number of new FGs 33-5-x are agreed, the question is updated as follows:  **[FL3] Medium priority question 7-2a:**   * **Companies are encouraged to provide views on whether the type of FGs 33-5-1/1b/1d/1e/1f/1g/1h, and 33-5-2 should be per UE or per FSPC or any other reporting type** |
| Huawei, HiSilicon | Per FSPC seems the most flexible and we can accept it. |
| Spreadtrum | per FSPC is fine to us. |
| MediaTek | Per FSPC |
| Nokia, NSB | We do not agree with per FSPC. These should be per UE. As said before, flexibility is not really an argument here. |
| Apple | Per FSPC |
| Moderator | [GTW3] This issue can be discussed after some progress is made in **question 3-5** |

**Low priority proposal 7-3:**

* **Component 2 of FG 33-5-2 is revised as:** **Support [N>=M>=1] activated SPS group-common PDSCH configurations among the N SPS group-common PDSCH configurations per CFR for multicast.**

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| Company | Comment |
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**Low priority question 7-4:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FG 33-5-1 and 33-5-2.**

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| Company | Comment |
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**Low priority question 7-5:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FGs 33-5-1 and 33-5-2 which do not have capability signaling impacts**

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| --- | --- |
| Company | Comment |
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# **33-6-1 to 33-6-3: HARQ-ACK with different priorities for multicast**

In [1], FGs 33-6-1 to 33-6-3 are captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-6-1 | 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.  FFS whether/how to separate the above capability from FG 33-6-1 | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 33. NR\_MBS | 33-6-2 | Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for multicast or for unicast and multicast at a UE. | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast or for unicast and multicast at a UE. | 33-6-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |
| 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 feedbacks are provided in contributions for the RAN1#108-e 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. Therefore, separating UE capabilities of supporting priority configuration from supporting priority indication included in DCI format does not seem necessary.  For multicast SPS scheduling, the priority index is configured together with the configuration for SPS. There could be an UE capability of support of priority configuration for multicast SPS but it is not needed to have a capability defined for support of priority indicator field in the DCI format just for multicast SPS scheduling.  ***Proposal 10: Updating FG33-6-1 and adding FG33-6-1a as follows in red:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1 | DL priority indication in DCI for multicast dynamic scheduling | Support of priority indicator field configured in DCI format 4\_2 with CRC scrambled with G-RNTI for multicast dynamic scheduling. | 33-2-1 | Yes |  |  | Per UE | No | No |  | Notes:  - Two priority indexes are introduced for multicast, with index 0 meaning low priority and index 1 meaning high priority.  - The priority of multicast is the same as the priority of unicast for the same priority index of HARQ-ACK at least for ACK/NACK based feedback. | Optional with capability signalling | | 33. NR\_MBS | 33-6-1a | DL priority configuration for multicast SPS scheduling | Support of priority index configuration for multicast SPS scheduling. | 33-5-1 | Yes |  |  | Per UE | No | No |  | Notes:  - Two priority indexes are introduced for multicast, with index 0 meaning low priority and index 1 meaning high priority.  - The priority of multicast is the same as the priority of unicast for the same priority index of HARQ-ACK at least for ACK/NACK based feedback. | Optional with capability signalling | |
| [5] | OPPO | For FG 33-6-1, support of priority indicator field configured in DCI format 4\_1 with CRC scrambled with G-RNTI for multicast.   1. ***For FG 33-6-1, there is no need to separate the capability.***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1 | DL priority indication for multicast in DCI | 1. Support of priority indicator field configured in DCI formats 4\_1 ~~1\_1~~ with CRC scrambled with G-RNTI for multicast.  ~~FFS whether/how to separate the above capability from FG 33-6-1~~ | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-2 | Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for multicast or for unicast and multicast at a UE. | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast or for unicast and multicast at a UE. | 33-6-1 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 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 | |
| [6] | Nokia, NSB | * **33-6-1:**   + Per UE * **33-6-2:**   + Per UE * **33-6-3:**   + Per UE |
| [10] | 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 1 of FG 33-6-1, DCI format 1\_1 is adjusted as DCI format 4\_2;  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 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.  FFS whether/how to separate the above capability from FG 33-6-1 | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [13] | Samsung | Also, DCI format 0\_1 and 1\_1 in FG 33-2 and 33-6-1 should be replaced with DCI format 4\_1 and 4\_2, respectively.  For 33-6-1, we assume that activation DCI with G-CS-RNTI would also indicate priority. Then, G-CS-RNTI needs to be added as well.   |  |  |  |  | | --- | --- | --- | --- | | Features | Index | Feature group | Components | | 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 and G-CS-RNTI for multicast.  FFS whether/how to separate the above capability from FG 33-6-1. | |
| [15] | Qualcomm | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1a | DL priority of multicast HARQ-ACK feedback for dynamically scheuled multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of dynamically scheuled multicast  Notes:   * Two priority indexes are introduced for multicast, with index 0 meaning low priority and index 1 meaning high priority. * The priority of multicast is the same as the priority of unicast for the same priority index of HARQ-ACK at least for ACK/NACK based feedback. | 33-2a or 33-4 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1b | DL priority indication for dynamically scheduled multicast in DCI | 1.    Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-RNTI for multicast. | 33-2b, 33-6-1a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1c | DL priority of multicast HARQ-ACK feedback SPS multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of SPS multicast | 33-5-1a or 33-5-1d | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1d | DL priority indication for SPS multicast with PDCCH scheduling | 1. Support of priority indicator field configured in DCI format 4\_2 with CRC scrambled with G-CS-RNTI for SPS multicast. | 33-5-1b, 33-6-1c | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-2 | Two HARQ-ACK codebooks simultaneously constructed for supporting HARQ-ACK codebooks with different priorities for multicast or for unicast and multicast at a UE. | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed different priorities for multicast or for unicast and multicast at a UE. | 33-6-1a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 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. | 33-6-2 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |

## **Discussion**

**[FL1] High priority question 8-1:**

* **Companies are encouraged to provide views on** **whether to separate the following capabilities from FG 33-6-1.**
  + **Support of priority index configuration for dynamically scheduled multicast**
  + **Support of priority index configuration for multicast SPS scheduling**
  + **Support of priority indicator field configured in DCI format 4\_2 with CRC scrambled with G-CS-RNTI for SPS multicast**

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | Support |
| Huawei, HiSilicon | We can be separate because SPS and dynamic scheduling are separate FG. |
| OPPO | SPS related FG should be separated from the FG of dynamic scheduling multicast. |
| NTT DOCOMO | We are fine to separate SPS related FGs. |
| Apple | Support |
| MediaTek | Support |
| ZTE | We don’t see the motivation to have separate FG for priority indication for DG-PDSCH and SPS. In Rel-16, FG11-4 is a FG for priority indication for both DG-PDSCH and SPS. We can follow the same rule.   |  |  |  |  | | --- | --- | --- | --- | | 11.  NR\_L1enh\_URLLC | 11-4 | Two HARQ-ACK codebooks with up to one sub-slot based HARQ-ACK codebook (i.e. slot-based + slot-based, or slot-based + sub-slot based) simultaneously constructed for supporting HARQ-ACK codebooks with different priorities at a UE | 1. Supports two HARQ-ACK codebooks with different priorities to be simultaneously constructed with the restriction up to one sub-slot based HARQ-ACK codebook. 2. Supports separate PUCCH configuration for different HARQ-ACK codebooks 3. Supports 2-level priority of HARQ-ACK for dynamically scheduled PDSCH and SPS PDSCH. 4. Supports a DCI format (from the formats 1\_1/1\_2) scheduling PDSCH with different HARQ-ACK priorities when only DCI format 0\_1/1\_1 is configured or only DCI format 0\_2/1\_2 is configured per BWP 5. Supports separate configuration of parameters PDSCH-HARQ-ACK-Codebook, UCI-OnPUSCH and ‘codeBlockGroupTransmission” for different HARQ-ACK codebooks. 6. Supported maximum number of actual PUCCH transmissions for HARQ-ACK within a slot   Candidate values for the component 6 of FG11-4 is: For NCP, {4, 5, 6, 7} for 2-symbol\*7 sub-slot configuration; For ECP, the candidate value is {4,5,6} for 2-symbol\*6 sub-slot configuration. | |
| Xiaomi | Support. |
| Samsung | Support |
| Moderator | Majority companies are fine to separate the capabilities. Following proposal is made  **[GTW1] High priority proposal 8-1:**   * **Following capabilities are separated from FG 33-6-1:**   + **Support of priority index configuration for dynamically scheduled multicast**   + **Support of priority index configuration for multicast SPS scheduling**   + **Support of priority indicator field configured in DCI format 4\_2 with CRC scrambled with G-CS-RNTI for SPS multicast**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1a | DL priority of multicast HARQ-ACK feedback for dynamically scheduled multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of dynamically scheduled multicast |  | Yes |  |  | Per UE | No | No |  | Two priority indexes are introduced for multicast, with index 0 meaning low priority and index 1 meaning high priority.  The priority of multicast is the same as the priority of unicast for the same priority index of HARQ-ACK at least for ACK/NACK based feedback | Optional with capability signalling | | 33. NR\_MBS | 33-6-1b | DL priority indication for dynamically scheduled multicast in DCI | 1. Support of priority indicator field configured in DCI formats ~~1\_1~~ 4\_2 with CRC scrambled with G-RNTI for multicast.  ~~FFS whether/how to separate the above capability from FG 33-6-1~~ | 33-2, 33-6-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1c | DL priority of multicast HARQ-ACK feedback for SPS multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of SPS multicast |  | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1d | DL priority indication for SPS multicast with PDCCH scheduling | 1. Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-CS-RNTI for SPS multicast. | 33-6-1c | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| FL2 | This proposal was discussed in the GTW session on Feb 23 but no consensus was achieved.  The main discussion point was whether to separate for DG vs SPS. Companies are invited to provide view whether to separate the FGs for DG vs SPS |
| vivo | We are ok with either way |
| ZTE | In fact, the priority index is for PUCCH or for PUCCH multiplexing to be specific. UEs can multiple the PUCCH with the same priority and may have to drop the PUCCH with lower priority in case of different priorities. Thus, the complexity for UE is not about priority indication or priority configuration, instead it is the PUCCH multiplexing. Considering that we have defined several FGs for PUCCH multiplexing (e.g., FG33-3-5 and FG33-6-2), we really don’t see the necessity to have different FGs for priority indication/configuration for DG and SPS.  Regarding whether to have a separate FG for priority indication/configuration for DCI format 4\_2, we can compromise to support this only if we concluded that DCI format 4\_2 is kept in FG33-2 as discussed in  **[FL1] High priority question 3-2.** |
| CMCC | We don’t see the motivation to separate FG for DG vs SPS, even the HARQ feedback and codebook construction for the same priority for DG PDSCH and SPS PDSCH is the same |
| Moderator | Two companies showed concern for the separation.  **[GTW2] More discussion is necessary** |
| FL3 | If have not yet provided, please provide view whether to separate the FGs for DG vs SPS  Also, proponents are encouraged to try to address the concern from companies |
| Qualcomm | Since G-RNTI and G-CS-RNTI may be used for different multicast services, we prefer separate FGs for DG and SPS priority. |
| MediaTek | Share the similar view with QC. |
| Apple | We prefer to separate FGs, we think the URLLC like MBS service is not mandatory feature. |
| Moderator | Motivation to separate FG for DG vs SPS was provided by proponent. Further discuss in the GTW  **[GTW3] High priority proposal 8-1:**   * **Following capabilities are separated from FG 33-6-1:**   + **Support of priority index configuration for dynamically scheduled multicast**   + **Support of priority index configuration for multicast SPS scheduling**   + **Support of priority indicator field configured in DCI format 4\_2 with CRC scrambled with G-CS-RNTI for SPS multicast**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1a | DL priority of multicast HARQ-ACK feedback for dynamically scheduled multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of dynamically scheduled multicast |  | Yes |  |  | Per UE | No | No |  | Two priority indexes are introduced for multicast, with index 0 meaning low priority and index 1 meaning high priority.  The priority of multicast is the same as the priority of unicast for the same priority index of HARQ-ACK at least for ACK/NACK based feedback | Optional with capability signalling | | 33. NR\_MBS | 33-6-1b | DL priority indication for dynamically scheduled multicast in DCI | 1. Support of priority indicator field configured in DCI formats ~~1\_1~~ 4\_2 with CRC scrambled with G-RNTI for multicast.  ~~FFS whether/how to separate the above capability from FG 33-6-1~~ | 33-2, 33-6-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1c | DL priority of multicast HARQ-ACK feedback for SPS multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of SPS multicast |  | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1d | DL priority indication for SPS multicast with PDCCH scheduling | 1. Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-CS-RNTI for SPS multicast. | 33-6-1c | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| FL4 | Following proposal was discussed in the GTW on Mar 1 but no consensus was achieved.  **[FL4] High priority proposal 8-1:**   * **Following capabilities are separated from FG 33-6-1:**   + **Support of priority index configuration for dynamically scheduled multicast**   + **Support of priority index configuration for multicast SPS scheduling**  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1a | DL priority of multicast HARQ-ACK feedback for dynamically scheduled multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of dynamically scheduled multicast |  | Yes |  |  | Per UE | No | No |  | Two priority indexes are introduced for multicast, with index 0 meaning low priority and index 1 meaning high priority.  The priority of multicast is the same as the priority of unicast for the same priority index of HARQ-ACK at least for ACK/NACK based feedback | Optional with capability signalling | | 33. NR\_MBS | 33-6-1b | DL priority indication for dynamically scheduled multicast in DCI | 1. Support of priority indicator field configured in DCI formats ~~1\_1~~ 4\_2 with CRC scrambled with G-RNTI for multicast.  ~~FFS whether/how to separate the above capability from FG 33-6-1~~ | 33-2, 33-6-1a | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-6-1c | DL priority of multicast HARQ-ACK feedback for SPS multicast | 1. Support of priority configured for multicast HARQ-ACK feedback of SPS multicast |  | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |   As commented on the GTW, the priority is configured via PUCCH configuration list for DG, while via SPS index for SPS  Companies are encouraged to provide view whether to separate the FG for DG vs SPS for RRC configured priority |
| Qualcomm | For SPS multicast,   * SPS multicast HARQ-ACK feedback priority is based on RRC-configured *harq-CodebookID* within SPS-Config-Multicast. FG 33-6-1c should be added.   For DG multicast,   * After checking the RAN1 agreements, it seems no dedicated RRC signaling can indicate priority index of DL multicast HARQ-ACK feedback. 33-6-1a can be removed. * DG multicast HARQ-ACK feedback priority is based on the priority index in DCI format 4\_2. FG 33-6-1b should be added but it is separate from the FG for *PUCCH-ConfigurationList\_Multicast*.   Based on the following RAN1 agreements, *PUCCH-ConfigurationList\_Multicast* is not supported or not configured, *PUCCH-ConfigurationList* for unicast will be used for multicast as default. But, FG 33-6-1b should be prerequisite of the FG for *PUCCH-ConfigurationList\_Multicast*. We consider shared *PUCCH-ConfigurationList* of unicast included in FG 33-6-1b.  Agreement:  For UE supporting both ACK/NACK based and NACK-only basedfeedback for multicast, for the same G-RNTI, support the following   * UE can be configured with either ACK/NACK based or NACK-only feedback for a single G-RNTI.   + Note: Case1-1: if configured with ACK/NACK based feedback, UE can be optionally configured a separate *PUCCH-Config/PUCCH-ConfigurationList* for multicast. Otherwise, *PUCCH-Config/PUCCH-ConfigurationList* for unicast applies (This has been agreed.)   + Case 1-2: if configured with NACK-only based feedback, when separate *PUCCH-Config/PUCCH-ConfigurationList* for NACK-onlyis not configured, *PUCCH-Config/PUCCH-ConfigurationList* for unicast applies. |
| vivo | By considering twoHARQ-ACK-Codebook-type1-r16 is prerequisite FG of DL priority indication in R16, for example, when a UE has capability of constructing two HARQ-ACK codebooks with different priorities, it can further report whether it also supports of priority indicator field configured in DCI formats, we support to add a separate FG for dynamically scheduled multicast in DCI and add 33-6-2 also as a prerequisite.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-6-1~~b~~ | DL priority indication for dynamically scheduled multicast in DCI | 1. Support of priority indicator field configured in DCI formats ~~1\_1~~ 4\_2 with CRC scrambled with G-RNTI for multicast.  ~~FFS whether/how to separate the above capability from FG 33-6-1~~ | 33-2, 33-6-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |   Furthermore, we think a separate capability on DL priority for SPS multicast **is not necessary**, when a UE has capability of twoHARQ-ACK-Codebook in 33-6-2, it supports of constructing two HARQ-ACK codebooks with different priorities simultaneously for both dynamic scheduling and SPS cases. Specifically, for SPS multicast, the priority configuration of HARQ-ACK codebook index by RRC signaling doesn’t involve additional UE capability. |
|  |  |

**[FL1] Medium priority question 8-2:**

* **Companies are encouraged to provide views on whether the type of FGs 33-6-1 to 33-6-3 should be per UE or per FSPC**
  + FGs 33-6-1
    - Per UE: Huawei, HiSilicon, OPPO, Nokia, NSB, Spreadtrum Communications
    - Per FSPC: MediaTek, Qualcomm, Apple
  + FGs 33-6-2
    - Per UE: OPPO, Nokia, NSB
    - Per FSPC: MediaTek, Qualcomm, Apple
  + FGs 33-6-3
    - Per UE: OPPO, Nokia, NSB
    - Per FSPC: MediaTek, Qualcomm, Apple

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Per UE, see earlier comments. |
| FL2 | Please provide your view if not provided yet |
| ZTE | We prefer per UE for the above FGs. |
| FL3 | Please provide your view if not provided yet |
| Huawei, HiSilicon | Ok with per FSPC as well. |
| Spreadtrum | Ok for per FSPC as well |
| MediaTek | Per FSPC |
| Apple | Per FSPC |
| Moderator | [GTW3] This issue can be discussed after some progress is made in **question 3-5** |

**Low priority proposal 8-3:**

* **Components of FG 33-6-1 are revised as “Support of priority indicator field configured in DCI formats 4\_2 with CRC scrambled with G-RNTI for multicast”.**

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| --- | --- |
| Company | Comment |
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**Low priority question 8-4:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FG 33-6-1 to 33-6-3.**

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| Company | Comment |
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**Low priority question 8-5:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FGs 33-6-1 to 33-6-3 which do not have capability signaling impacts**

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| --- | --- |
| Company | Comment |
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# **33-7: Supporting group-common DCI indicating the enabling/disabling [ACK/NACK based] HARQ-ACK feedback**

In [1], FG 33-7 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-7 | Supporting group-common DCI indicating the enabling/disabling [ACK/NACK based] HARQ-ACK feedback | 1. Supports the function of group-common DCI indicating the enabling/disabling [ACK/NACK based] HARQ-ACK feedback | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#108-e meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [5] | OPPO | As the difference between FG 33-7 and FG 33-2b has been clarified during RAN1#107bis-e meeting, FG 33-7 is a separate feature for UE to support GC-DCI enabling/disabling HARQ-ACK feedback. By considering FG 33-2 and FG 33-4, both ACK/NACK and NACK-only based HARQ-ACK feedback should be considered. However, the two types of feedback mechanism can be separated since they are two independent features based on different UE capabilities and use cases.   1. ***For FG 33-7, group-common DCI indicating the enabling/disabling ACK/NACK and NACK-only based HARQ-ACK feedback should be supported.*** 2. ***For FG 33-7, ACK/NACK based feedback and NACK-only based feedback should be separated into two sub-FGs.***  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-7-1 | Supporting group-common DCI indicating the enabling/disabling [ACK/NACK based] HARQ-ACK feedback | 1. Supports the function of group-common DCI indicating the enabling/disabling ~~[~~ACK/NACK based~~]~~ HARQ-ACK feedback | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-7-2 | Supporting group-common DCI indicating the enabling/disabling [ACK/NACK based] HARQ-ACK feedback | 1. Supports the function of group-common DCI indicating the enabling/disabling NACK-only based HARQ-ACK feedback | 33-2 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [6] | Nokia, NSB | * **33-7:**   + Per UE |
| [7] | NTT DOCOMO | The feature of FG 33-7 is redundant with FG 33-2b. FG 33-7 can be removed.  ***Proposal 8: Remove FG 33-7.*** |
| [8] | Intel | * FG 33-7:   + Add NACK-only feedback also to this FG  |  |  |  |  |  | | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-7 | Supporting group-common DCI indicating the enabling/disabling  ~~[~~ACK/NACK and NACK-only based~~]~~ HARQ-ACK feedback | 1. Supports the function of group-common DCI indicating the enabling/disabling ~~[~~ACK/NACK and NACK-only based~~]~~ HARQ-ACK feedback | 33-2 | |
| [10] | Spreadtrum Communications | Since FG33-2b has captured the function of supporting DCI-based enabling/disabling ACK/NACK based HARQ-ACK feedback configured per G-RNTI by RRC signaling, and FG33-4-1 has captured the function of supporting DCI-based enabling/disabling NACK-only based HARQ-ACK feedback configured per G-RNTI by RRC signaling, in order to avoid duplication, we suggest to delete FG33-7.  ***Proposal 8***: Suggest to delete FG33-7. |
| [11] | CMCC | As the DCI based HARQ-ACK feedback enabling/disabling, it is supported for both ACK/NACK based HARQ-ACK feedback and NACK-only HARQ-ACK feedback. In addition, considering ACK/NACK based HARQ-ACK feedback and NACK-only based HARQ-ACK feedback are two separate FGs, both FG 33-2 and FG 33-4 should be the prerequisite feature groups of FG 33-7.  **Proposal 10. Update the FG 33-7 as the following:**   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33-7 | Supporting group-common DCI indicating the enabling/disabling ~~[ACK/NACK based]~~ HARQ-ACK feedback | 1. Supports ~~the function of~~ group-common DCI indicating the enabling/disabling ~~[ACK/NACK based]~~ HARQ-ACK feedback | 33-2, 33-4 | Yes |  |  | Per UE | No | No |  |  | Optional with capability signalling | |
| [12] | Xiaomi | In the updated RAN1 UE features list, FG 33-7 is captured for supporting group-common DCI indicating the enabling/disabling [ACK/NACK based] HARQ-ACK feedback.[1] However, FG 33-2b is already specified to support DCI-based enabling/disabling ACK/NACK-based feedback for dynamic scheduling for multicast, which fully covers the current FG 33-7.  **Proposal 9: FG 33-2b is sufficient and remove FG 33-7 in the MBS UE feature list.** |
| [15] | Qualcomm | We suggest to delete FG33-7 since it can be replaced by FG33-2c for ACK/NACK-based and FG33-4-1 for NACK-only-based, respectively. |

## **Discussion**

**[FL1] High priority question 9-1:**

* **Companies are encouraged to provide views on whether to remove FG 33-7.**
  + Keep: OPPO, Intel, CMCC
  + Remove: NTT DOCOMO, Spreadtrum Communications, Xiaomi, Qualcomm

|  |  |
| --- | --- |
| Company | Comment |
| Huawei, HiSilicon | Should be removed because it has been included in some other FGs. |
| OPPO | We are not sure about whether this FG 33-7 had been discussed and kept as an independent FG here during last meeting. Because we found it in the final summary which seems like it was kept rather than removed. If other FG has already included, it may not be needed here. Even we proposed to keep it in FG 33-7, we also agree with remove it. |
| Apple | Support to remove, keeping 33-2b is enough. |
| ZTE | Ok to remove. |
| CATT | Support to remove. |
| Xiaomi | Support to remove. |
| vivo | Support to remove |
| Moderator | All companies are fine to remove FG 33-7. Following proposal is made  **[GTW1] High priority proposal 9-1:**   * **FG 33-7 is removed.** |
| FL2 | This proposal could not be discussed in the GTW session on Feb 23. No further input is necessary unless you have concern on the proposal. |
| Moderator | This proposal is stable for more than 24 hours. We can quickly agree on this proposal either in the GTW or over the reflector  **[GTW2] High priority proposal 9-1:**   * **FG 33-7 is removed.** |
| FL3 | Following was agreed in the GTW session on Feb 25  **Agreement**   * FG 33-7 is removed. |

**[FL1] High priority question 9-2:**

* **Companies are encouraged to provide views on whether NACK-only based feedback should also be included in FG 33-7.**
  + Include in FG 33-7: Intel, CMCC
  + Separate FG: OPPO

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | We prefer Separate FG |
| Huawei, HiSilicon | Could be separate. |
| OPPO | Similar with above FG 33-7, whether other FG has already included this FG, if not, a separate FG of NACK-only based FG can be kept here. |
| ZTE | Ok to have one separate UE capability for NACK-only based feedback. |
| vivo | As NACK-only is not included in 33-2, as separate FG for NACK-only is better. |
| Moderator | [GTW1] This issue can be discussed after some conclusion is made in **proposal 7-1** and **proposal 9-1** |
|  |  |
|  |  |

**[FL1] Medium priority question 9-3:**

* **Companies are encouraged to provide views on whether the type of FG 33-7 should be per UE or per FSPC**
  + Per UE: OPPO, Nokia, NSB, CMCC
  + Per FSPC: MediaTek,

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Per UE, see earlier comments. |
| FL2 | Please provide your view if not provided yet |
| Huawei, HiSilicon | It could be per UE |
| FL3 | Please provide your view if not provided yet |
| Huawei, HiSilicon | It could be per FSPC as well |
| MediaTek | Per FSPC |
| Apple | Per FSPC |
| Moderator | [GTW3] This issue can be discussed after some progress is made in **question 3-5** |

**Low priority question 9-4:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FG 33-7**

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| --- | --- |
| Company | Comment |
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**Low priority question 9-5:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FG 33-7 which do not have capability signaling impacts**

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

# **33-9: Supporting unicast PDCCH to release SPS group-common PDSCH**

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (Sidelink WI only)”. | **Consequence if the feature is not supported by the UE** | **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 | 33-9 | 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 feedbacks are provided in contributions for the RAN1#108-e meeting.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [15] | Qualcomm | We suggest the changes for 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 FSPC | N/A | N/A |  |  | Optional with capability signalling | |

## **Discussion**

**[FL1] Medium priority question 10-1:**

* **Companies are encouraged to provide views on whether the type of FG 33-9 should be per UE or per FSPC**
  + Per FSPC: MediaTek, Qualcomm

|  |  |
| --- | --- |
| Company | Comment |
| Nokia, NSB | Per UE, see earlier comments |
| FL2 | Please provide your view if not provided yet |
| Huawei, Huawei | Per UE. |
| FL3 | Please provide your view if not provided yet |
| Huawei, HiSilicon | It could be per FSPC as well. |
| MediaTek | Per FSPC |
| Apple | Per FSPC |
| Moderator | [GTW3] This issue can be discussed after some progress is made in **question 3-5** |

**Low priority question 10-2:**

* **Companies are encouraged to provide views on whether/how to revise the prerequisite feature groups for FG 33-9.**

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| --- | --- |
| Company | Comment |
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**Low priority question 10-3:**

* **Companies are encouraged to provide views on whether/how to revise any other contents in FG 33-9 which do not have capability signaling impacts**

|  |  |
| --- | --- |
| Company | Comment |
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# **Other FGs**

This section discusses other FGs which are not included in [1].

Following feedbacks are provided in contributions for the RAN1#108-e meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [15] | Qualcomm | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 33. NR\_MBS | 33-8-1 | PUCCH resource configuration for ACK/NACK-based multicast feedback for dynamically scheduled multicast | 1. Support of a PUCCH-Config for multicast ACK/NACK-based 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 ACK/NACK-based multicast feedback for dynamically scheduled multicast | 1. Support of a PUCCH-ConfigurationList for multicast ACK/NACK-based HARQ-ACK feedback, separate from that of unicast configurations | 33-2a, 33-6-1a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-8-3 | PUCCH resource configuration for NACK-only-based multicast feedback for dynamically scheduled multicast | 1. Support of a PUCCH-Config for multicast NACK-only-based HARQ-ACK feedback, separate from that of multicast ACK/NACK-based configurations if configured | 33-4 | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-8-4 | Up to 2 PUCCH resources configuration for NACK-only-based multicast feedback for dynamically scheduled multicast | 1. Support of a seperate PUCCH-ConfigurationList for multicast NACK-only-based HARQ-ACK feedback, separate from that of multicast ACK/NACK-based configurations if configured | 33-4, 33-6-1b | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | | 33. NR\_MBS | 33-8-5 | PUCCH resource configuration for ACK/NACK-based multicast feedback for SPS GC-PDSCH | 1. Support of a SPS-PUCCH-AN-List for multicast ACK/NACK-based HARQ-ACK feedback of all SPS configuration(s), separate from that of SPS unicast configurations | 33-5-1a | Yes |  |  | Per FSPC | N/A | N/A |  |  | Optional with capability signalling | |

## **Discussion**

**[FL1] High priority question 11-1:**

* **Companies are encouraged to provide views on whether to introduce new FGs for** **PUCCH resource configuration as follows:**
  + **FG for support of a PUCCH-Config for multicast ACK/NACK-based HARQ-ACK feedback, separate from that of unicast configurations.**
  + **FG for support of a PUCCH-ConfigurationList for multicast ACK/NACK-based HARQ-ACK feedback, separate from that of unicast configurations.**
  + **FG for support of a PUCCH-Config for multicast NACK-only-based HARQ-ACK feedback, separate from that of multicast ACK/NACK-based configurations if configured.**
  + **FG for support of a seperate PUCCH-ConfigurationList for multicast NACK-only-based HARQ-ACK feedback, separate from that of multicast ACK/NACK-based configurations if configured.**
  + **FG for support of a SPS-PUCCH-AN-List for multicast ACK/NACK-based HARQ-ACK feedback of all SPS configuration(s), separate from that of SPS unicast configurations.**

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | Support  Considering feedback is optional feature, the PUCCH resource configuration for multicast should be treated as separate FGs. |
| Huawei, HiSilicon | I suppose as long as UE reports the support of HARQ-ACK feedback, then UE should support the PUCCH configuration. Otherwise, no point to support HARQ-ACK without the capability of PUCCH configuration. |
| CMCC | The PUCCH configuration should be merged as components in HARQ-ACK feedback FG |
| Moderator | [GTW1] More discussion is necessary to have common understanding |
| FL2 | As discussed in the GTW session on Feb 23, this issue is discussed together with the FFS shared/separate PUCCH resource configurations with/from unicast in FG 32-2a.  **[FL2] High priority question 11-1a:**   * **Companies are invited to provide view whether the support of any of shared/separate PUCCH resource configurations with/from unicast should be defined as separate FG from FGs 33-2a/33-4**   + **Note: SPS FGs 33-5-1a/33-5-1f can be discussed after the confirmation of them** |
| Huawei, HiSilicon | We tend to agree both FG33-2a and FG33-4 should take “separate PUCCH resources” instead of “shared” |
| CMCC | We support both separate and shared PUCCH resources should be merged with FG 33-2a. |
| MediaTek | Support the separate PUCCH resource for multicast as separate FG since the HARQ-ACK can be disabled from UE size. |
| NTT DOCOMO | We would like support of separate PUCCH resources to be included in FG 33-2a/33-4. |
| Moderator | * As a component of FG33-2a/33-4   + separate PUCCH resources: HW/HiSi: DCM   + Shared PUCCH resources: MTK   + Both: CMCC, ZTE   **[GTW2] More discussion is necessary** |
| FL | If have not yet provided, please provide your view on the following question.  **[FL3] High priority question 11-1a:**   * **Companies are invited to provide view whether the support of any of shared/separate PUCCH resource configurations with/from unicast should be defined as separate FG from FGs 33-2a/33-4**   + **Note: SPS FGs 33-5-1a/33-5-1f can be discussed after the confirmation of them** |
| ZTE | From our perspective, PUCCH resource configuration itself should not be a separate FG. “Support of shared/separate PUCCH resource configurations with/from unicast” can be merged with 33-2a. |
| vivo | We would like to understand why it requires separate UE capability on shared/separate PUCCH resource configurations with/from unicast |
| Moderator | * As a component of FG33-2a/33-4   + separate PUCCH resources: HW/HiSi: DCM   + Shared PUCCH resources: MTK, QC     - Shared PUCCH resources are used by default   + Both: CMCC, ZTE, vivo(?)     - No additional complexity, capability should be separated based on different HARQ-ACK feedbacks   **[GTW3] More discussion is necessary** |
| FL4 | This proposal was quickly discussed in the GTW.  Companies are invited to check the above comments and provide further view. This issue should be resolved in this meeting. |
| Qualcomm | RAN1 has agreed that PUCCH-Config for multicast is optionally configured. The default is the share PUCCH resource of unicast.  Agreement:  For UE supporting both ACK/NACK based and NACK-only basedfeedback for multicast, for the same G-RNTI, support the following   * UE can be configured with either ACK/NACK based or NACK-only feedback for a single G-RNTI.   + Note: Case1-1: if configured with ACK/NACK based feedback, UE can be optionally configured a separate *PUCCH-Config/PUCCH-ConfigurationList* for multicast. Otherwise, *PUCCH-Config/PUCCH-ConfigurationList* for unicast applies (This has been agreed.)   + Case 1-2: if configured with NACK-only based feedback, when separate *PUCCH-Config/PUCCH-ConfigurationList* for NACK-onlyis not configured, *PUCCH-Config/PUCCH-ConfigurationList* for unicast applies. |
| MediaTek | We support the shared PUCCH of unicast as a default PUCCH resource for multicast, and the corresponding content can be captured in the Note column. |
| ZTE | We still support “both” should be included in FG33-2a.  The agreements cited by Qualcomm is just about RRC configuration, instead of UE capability from our perspective. Based on our understanding, the UE behavior is the same for shared/separate PUCCH resource, it is just the configuration of RRC parameters could be different. We still don’t see the necessity to have a FG for different kinds of RRC configurations. |
| vivo | We think both can be included as component of FG33-2a.  From our understanding, neither shared resource nor separate PUCCH resource configurations with/from unicast requires separate UE capability, as the total number of PUCCH resources from all *PUCCH-Config/PUCCH-ConfigurationList* is not changed which was agreed in RAN1*.*  Agreement:  For UEs supporting ACK/NACK-based HARQ-ACK feedback for multicast and unicast, the following values are unchanged compared to unicast in Rel-16:   * + The maximum number of PUCCH resources sets in each *PUCCH-Config*,   + The maximum number of PUCCH resources in a PUCCH resource set in each *PUCCH-Config*,   + The maximum number of UCI information bits for the first PUCCH resource set.   + The total number of PUCCH resources from all *PUCCH-Config/PUCCH-ConfigurationList*.   + Note:     - This applies to both cases of whether or not UE is configured optionally with a separate *PUCCH-Config or PUCCH-ConfigurationList* for multicast.     - The case of NACK-only based is discussed separately. |

# **Conclusions**

TBD

# **References**

[1] R1-2200780 Updated RAN1 UE features list for Rel-17 NR after RAN1 #107bis-e Moderators (AT&T, NTT DOCOMO, INC.)

[2] R1-2200951 Rel-17 UE features for NR MBS Huawei, HiSilicon

[3] R1-2201128 Discussion on UE features for MBS vivo

[4] R1-2201178 Discussion on Rel-17 UE features for NR MBS ZTE

[5] R1-2201260 Discussion on UE features for NR MBS OPPO

[6] R1-2201419 On UE features for NR MBS Nokia, Nokia Shanghai Bell

[7] R1-2201511 Discussion on Rel-17 UE features for NR MBS NTT DOCOMO, INC.

[8] R1-2201722 UE Features for NR MBS Intel Corporation

[9] R1-2201800 Views on Rel-17 MBS UE Features Apple

[10] R1-2201818 UE features for R17 NR MBS Spreadtrum Communications

[11] R1-2201888 Discussion on UE features for NR MBS CMCC

[12] R1-2201934 Discussion on UE features for NR MBS Xiaomi

[13] R1-2202047 UE features for NR MBS Samsung

[14] R1-2202082 Views on UE features for NR MBS MediaTek Inc.

[15] R1-2202176 UE features for MBS Qualcomm Incorporated

[16] R1-2202395 views on NR MBS UE features Ericsson