**3GPP TSG-RAN WG1 #110bis-e R1-2210372**

**e-Meeting, October 10 – 19, 2022**

**Agenda Item: 8.12**

**Source: Moderator (Huawei)**

**Title: FLS#1 on** **the HARQ-ACK related issues for Rel-17 NR MBS**

**Document for: Discussion and Decision**

# Introduction

The FLS in R1-2210371 documents the discussion in the preparation phase to determine maintenance issues to be handled in RAN1#110bis-e, where the conclusion of the discussion are summarized in section 3.

This FLS will discuss the HARQ-ACK related issues for Rel-17 NR MBS based on the following assignment:

[110bis-e-R17-MBS-02] Email discussion for maintenance on mechanisms to improve reliability for RRC\_CONNECTED UEs for the following issues in R1-2210371 – Jinhuan (Huawei)

* Issues 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, 1-7 (including whether case 2 and case 3 with NACK-only mode2 is supported in Rel-17), 1-8, 1-9, 1-10, 1-11, 1-12, 1-21
* Editorial/alignment issues for providing to spec editors: 1-14, 1-15
* Discuss for clarification of the issue (potentially discuss CR at RAN1#111, or conclude at RAN1#110bis-e that the issue is not essential): 1-16, 1-17, 1-18, 1-19, 1-20
* Discuss a potential conclusion (without CR) for issue 1-22
* Check points: October 14, October 19.

# Issues to be discussed

For convenience, the issues to be discussed in this meeting are summarized in Table 1 in this section for reference.

Table 1: Summary of HARQ-ACK related issues

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| --- | --- | --- |
| **Issue#** | **Issue** | **References** |
| 1-1 | PRI for NACK-only mode2*FL Note: sources have different views on whether PRI is interpreted. Need to first clarify whether moreThanOneNackOnlyMode is only applicable to the case when more than one TB is scheduled.*  | vivo-CR-x08618, Nokia-TP-x08701, CMCC-Dis-x09310, ZTE-CR-x09475, Apple-Dis-x09566, Huawei-CR-x08468, Huawei-Dis-x09822 Samsung-Dis-x09708, Ericsson-Dis-x10173 |
| 1-2 | Codebook type for NACK-only*FL Note: Discuss whether type1 CB can be configured if UE is configured with NACK-only.*  | Samsung -Dis-x09708, Qualcomm-CR-x09955, Huawei-CR-x08467,Huawei-Dis-x09822, Ericsson-Dis-x10173 |
| 1-3 | HARQ-ACK feedback for 4\_1 when configured “dci-enabler”*FL Note: clarify UE behavior whether generate HARQ-ACK for DCI 4\_1 when UE is configured with “dci-enabler”.*  | vivo-CR-x08617, CATT-CR-x08928, Lenovo-CR-x10156 |
| 1-4 | Timeline for NACK-only*FL Note: Tdocs from UE vendors point to a serious implementation issue.*  | ZTE-Dis-x09470, MediaTek-CR-x09526, Samsung-Dis-x09708,Qualcomm-CR-x09959, Huawei-CR-x08466, Huawei-CR-x09832, |
| 1-5 | PUCCH resources for NACK-only multicast SPS*FL Note: FFS from previous meeting and spec change is needed.*  | Nokia-TP-x08701, ZTE-Dis-x09470, Samsung-TP-x09708, Huawei-Dis-x09822 |
| 1-6 | Type1 CB and “dci-enabler” not configured simultaneously*FL Note: This conclusion should be the common understanding but whether spec change is needed can be discussed to collect views.*  | Qualcomm-CR-x09954, Lenovo-CR-x10158 |
| 1-7 | NACK-only mode2 for case2 and case3 | Nokia-TP-x08701, NEC-Dis-x09137, CMCC-Dis-x09310, ZTE-Dis-x09470, MediaTek-Dis-x09527, Apple-Dis-x09566, Samsung-TP-x09708, DOCOMO-CR-x09884, Lenovo-Dis-x10159, Ericsson-Dis-x10173 |
| 1-8 | Whether DAI should count the PDCCH with “dci-enabler” indicating value 0— if not counted, the spec for Type2 CB needs update for the DAI description.  | Langbo-CR-x08995, Lenovo-CR-x10157 |
| 1-9 | Type2 CB for multicast SPS—*38.213 states UE separately applies the procedures in this clause per G-RNTI or per G-CS-RNTI, but the clause also includes SPS PDSCHs. How to generate Type2 CB for multicast SPS PDSCH is unclear**FL Note: FL agrees that it may cause confusion. The discussion in this meeting can focus on whether change is needed.*  | vivo-CR-x08619 |
| 1-10 | the current description only allows to configure one HARQ-ACK codebook for multicast-- *pdsch-HARQ-ACK-Codebook* is replaced by the relevant entry in *pdsch-HARQ-ACK-CodebookListMulticast-r17**FL Note: aligning with TS38331 should be easily agreeable for this meeting* | CMCC-CR-x09312 |
| 1-11 | Change “UE is provided *moreThanOneNackOnlyMode” to “UE is not provided moreThanOneNackOnlyMode”**FL Note: aligning with TS38331 should be easily agreeable for this meeting* | vivo-CR-x08618, Huawei-CR-x08468 |
| 1-12 | Multiplexing one unicast SPS and DG multicast-- *gNB wouldn’t be able to schedule multicast PDSCHs to transmit HARQ-ACK in the same slot with unicast SPS HARQ-ACK* ***if UE does not support more than one SPS configuration*** | vivo-CR-x08887 |
| ~~1-13~~**[POSTPONED]** | ~~PTP retrans for NACK-only when applicable—~~*~~when NACK-only is converted into ACK/NACK, PTP retrans can be applied. NACK-only taking PTM retrans is too restrictive.~~*  | ~~Huawei-CR-x10207~~ |
| 1-14 | Delete the redundant descriptions of “if *pdsch-HARQ-ACK-Codebook-Multicast = semiStatic* is configured” to 38212. *FL Note: avoid unnecessary checking whether other meaning is implied by the redundant description and easily agreeable for this meeting* | Lenovo-CR-x10155 |
| 1-15 | Change “*pdsch-HARQ-ACK-Codebook-Multicast” to “pdsch-HARQ-ACK-Codebook”.**FL Note: editorial but easily agreeable for this meeting* | CMCC-CR-x09312 |
| 1-16 | pdsch-HARQ-ACK-retx for multicast- *pdsch-HARQ-ACK-retx can include the HARQ-ACK feedback for multicast* | CATT-CR-x08925, |
| 1-17 | spsHARQdeferral for multicast SPS-- *whether RRC parameter IE spsHARQdeferral can be used for multicast SPS configuration* | CATT-CR-x08926, |
| 1-18 | Type3 for NACK-only mode-- *For generating a Type-3 HARQ-ACK codebook with 〖NDI〗\_HARQ=1, the UE considers the HARQ-ACK information corresponding to a PDSCH reception has been reported if a PUCCH was not transmitted due to all values of HARQ-ACK information including the one for the PDSCH reception being ‘ACK’ according to the second HARQ-ACK reporting mode.*  | Langbo-CR-x08996 |
| 1-19 | * NACK-only mode2 multiplexed with other UCI/PUSCH is supported

*FL Note: supported but the current spec suffices?* * SR and ack/nack based multiplexing with 1bit for unicast and 1 bit for multicast.

*FL Note: how to change spec?* * HARQ-ACK multiplexing for u-cast and m-cast is per priority and then applying the intra-UE multiplexing

*FL Note: how to change spec?* | LGE-Dis-x09449 |
| 1-20 | UE behavior for disabled HARQ for NTN multicast needs to clarified.*FL Note: for UE supporting both NTN and multicast.*  | Qualcomm-CR-x09960 |
| 1-21 | UE will not transmit NACK-only PUCCH when the HARQ-ACK information is ‘ACK’. This is missing for NACK-only mode1?? | ZTE-CR-x09476 |
| 1-22 | Multiplexing NACK-only and SR*FL Note: open issue has been discussed for several times. As clarified, if no consensus for the solution, it means not support the multiplexing and it is up to UE so UE behavior is not needed.*  | Nokia-TP-x08701, NEC-Dis-x09137, ZTE-Dis-x09470, MediaTek-Dis-x09527, DOCOMO-CR-x09885 |

# Discussions for the issues

## (1-1)PRI for NACK-only mode2

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| --- | --- |
| vivo-CR-x08618, | Proposal: When UE is configured with the second HARQ-ACK reporting mode, for the case with 1 TB with NACK-only, regardless that UE is configured with NACK-only mode 1 or mode 2, the UE provides the HARQ-ACK information according to the second HARQ-ACK reporting mode.* Regardless that UE is configured with NACK-only mode 1 or mode 2, PRI indicates the PUCCH for the HARQ-ACK feedback including the case of one TB in scheduled.
 |
| Nokia-TP-x08701, | When NACK-only based feedback is configured with mode 2 and HARQ-ACK feedback is to be provided for only one TB, UE uses the PRI and CCE-based legacy PUCCH resource selection mechanism. |
| CMCC-Dis-x09310, | Proposal 2. For PRI included in DCI format 4\_1/4\_2:* if the G-RNTI is configured with NACK-only mode1, PRI indicates the PUCCH for the HARQ-ACK feedback;
* if the G-RNTI is configured with NACK-only mode2, PRI is ignored.
 |
| ZTE-CR-x09475, | The PUCCH resource is indicated by PUCCH resource indicator field in DCI format 4-1/4-2 from the configured PUCCH set 0 with up to 32 PUCCH resources for the second HARQ-ACK reporting mode. |
| Apple-Dis-x09566, | Proposal: If the G-RNTI is configured with NACK-only mode2, PRI is ignored. |
| Huawei-CR-x08468,Huawei-Dis-x09822 | *Proposal 1: For PRI included in DCI format 4\_1/4\_2, if the G-RNTI is configured with NACK-only mode2, PRI will be ignored by UEs.*  |
| Samsung-Dis-x09708, | *There is no practical benefit from using the PRI in DCI format 4\_1/4\_2 for NACK-only mode 2 and current specifications suffice.* |
| Ericsson-Dis-x10173 | For NACK-only mode2, the PRI in the DCI is interpreted by UEs in NACK-only mode to select one of the PUCCH resource pools configurations for NACK-only. |

### Round-1

***FL’s analysis:***

The following was agreed:

***Agreement***

*For PRI included in DCI format 4\_1/4\_2,*

* *if the G-RNTI is configured with NACK-only mode1, PRI indicates the PUCCH for the HARQ-ACK feedback including the case of one TB in scheduled.*
* *If the G-RNTI is configured with NACK-only mode2,*
	+ *FFS on whether/how to interpret the PRI.*

Some companies (vivo, Nokia) view that unified solution for one TB is preferred for both NACK-only mode1 and mode2, for both of which one TB can be possibly scheduled. Vivo also mentioned that the configuration of *moreThanOneNackOnlyMode* is not applicable to one TB. The RRC parameter name *moreThanOneNackOnlyMode* may be confusing, but it is FL’s understanding that whether one TB or more than one TB scheduled is dynamically changing per scheduling, which could happen despite *moreThanOneNackOnlyMode* configured or not. Moreover, **when one UE receives only one TB, it does not mean only one TB is transmitted by gNB.**

DCI missing could happen commonly to NACK-only mode1 and mode2. However, it should be noted that DCI missing is UE specific issue so the group-common DCI/PDSCH missing could happen to one but may not happen to the other UEs. From network perspective, if more than one TB is scheduled to feedback HARQ-ACK in the same PUCCH in NACK-only mode1, network can set a proper PRI in the group-common DCI which will be individually mapped to UE specific PRI and the associated PUCCH resource.

However, if it is NACK-only mode2, for other UEs not missing DCI, PUCCH resource selection will depend on UE decoding result. **It is not predictable for network to set a proper PRI in the group-common DCI which may be missed by some UE because the indicated PUCCH is expected to be shared by all the UEs.** In addition, the mapping table between HARQ-ACK values and the PUCCH resources is tolerable to DCI missing and the missed TB/PDSCH can be retrieved as long as not all UEs missed the same TB/PDSCH. Therefore, for NACK-only mode2, it is not practically easy to use PRI indicating the PUCCH resource for the case of one TB scheduled due to the DCI missing issue.

#### Proposal 3.1.1

**For PRI included in DCI format 4\_1/4\_2, if the G-RNTI is configured with NACK-only mode2, PRI will be ignored by UEs.**

***Company views:***

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| Company | Comments |
| Samsung | Support |
| Qualcomm | Assuming case 2/3 are not supported, PRI can be ignored by UE. |
| vivo | We want to clarify whether the parameter moreThanOneNackOnlyMode is applicable for the one TB case first. Note that during pervious discussion, there is no issue for NACK-only with one TB in the beginning, i.e., UE transmits the PUCCH when it is NACK and does not transmit the PUCCH when it is ACK. Then some issues raised for the case with more than one NACK only, then we made discussion and the following agreements was made. In addition, the description of the latest TS 38.331 for moreThanOneNackOnlyMode and the description in TS 38.213-h10, it is clearly that moreThanOneNackOnlyMode is only for the case with more than one TB. My question is when we did we make the agreement to apply this parameter for the one TB case? If moreThanOneNackOnlyMode is applied for all TB cases,if UE is configured with NACK-only mode 1, for the case of one TB, does UE still need to transform NACK-only to ACK/NACK? I think there is no need for the UE do have such transform.**Agreement (RAN1#108-e)**For supporting more than one NACK-only feedback in the same PUCCH transmission, define RRC configuration to configure between Alt1 and Alt4 (from previous agreements):* Alt1: Support UE multiplexing the HARQ-ACK bits by transforming NACK-only into ACK/NACK HARQ bits.
	+ FFS: how to determine PUCCH resource
* Alt4: Define combination of NACK-only which corresponds to a specific sequence or a PUCCH transmission.
	+ define up to 15 orthogonal PUCCH resources to select from according to combinations of up to 4 TBs with NACK-only feedback,
		- FFS: The PUCCH slot for the transmission is based on the K1 in the “last DCI” scheduling multicast.
		- FFS: The PUCCH resource for the transmission is from PUCCH-config configured for NACK-only based feedback according to the mapping between number of TBs with PUCCH resource ID.
			* FFS mapping details.
			* How to determine the number of TBs is discussed separately, e.g., Type-1-like and/or Type-2-like codebook.
		- FFS: whether this applies to a single G-RNTI or multiple G-RNTIs
	+ Alt4 is not supported for more than 4 TBs
* FFS: whether RRC configuration between Alt1 and Alt4 is per G-RNTI or per CFR
* FFS: UE capability

***moreThanOneNackOnlyMode***Indicates the mode of supporting more than one NACK-only feedback in the same PUCCH transmission. Mode 1 means UE multiplexing the HARQ-ACK bits by transforming NACK-only into ACK/NACK HARQ bits. Mode 2 means UE transmitting a specific sequence or a PUCCH transmission corresponding to the combination of more than one NACK-only HARQ feedback. If multicast CFR is not configured, this field is not included. Otherwise, if the field is absent, UE uses mode 1 for multicast CFR.TS 38.213-h10For the second HARQ-ACK reporting mode, when a number of HARQ-ACK information bits is 2, 3, or 4, the UE can be indicated by *moreThanOneNackOnly-Mode* to provide the HARQ-ACK information bits in a PUCCH either according to the first HARQ-ACK reporting mode or by selecting a resource from a set of resources for the PUCCH transmission based on the values of the HARQ-ACK information bits as described in Table 18-1. |
| NTT DOCOMO | Support |
| ZTE | For Case 1, the network does not need to indicate the PUCCH resource since the PUCCH resource is determined by the PDSCH decoding. We prefer to limit this proposal to Case 1. For Case 2 and Case 3, the PRI can be discussed separately. |
| MTK | The initial purpose of introducing the NACK only mode 2 is trying to resolve the more than one NACK only bits in one PUCCH slot, so, from this perspective, we have the similar view with vivo. Another question needs to be clarified that whether the normal one TB scheduling for NACK only and more than one TB scheduling for NACK only will be scheduling in TDMed manner as illustrated in the following figure?If the answer is yes, which PUCCH determination mechanism will be used for more than one NACK only case if UE only the one TB and miss other three TBs when two different PUCCH determination mechanism are defined?If the answer is no, we think the current spec can work even if some IE naming cause a little confusing. |
| CATT | Support. |
| ZTE2 | For clarification, our CR-x09475 is actually to capture the previous agreement in the spec for NACK-only mode 1 when only one PDSCH is scheduled.For NACK-only mode 1, it was agreed that the NACK-only PUCCH resource is indicated by the PRI in case one PDSCH is scheduled. This should be captured in the specification so that the NACK-only PUCCH resource determination is clear in this case.

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| **Agreement(RAN1#107bis-e)**For the separate PUCCH-Config/ PUCCH-ConfigurationList configured to UE for NACK-only based feedback,* 1 PUCCH resource set in each PUCCH-Config.
* up to 32 PUCCH resources in PUCCH resource set
* Note: the separate PUCCH-Config/PUCCH-ConfigurationList applies to all configured G-RNTIs configured with NACK-only based feedback.

**Agreement(RAN1#110)**For PRI included in DCI format 4\_1/4\_2, * if the G-RNTI is configured with NACK-only mode1, PRI indicates the PUCCH for the HARQ-ACK feedback including the case of one TB in scheduled.
* If the G-RNTI is configured with NACK-only mode2,
	+ FFS on whether/how to interpret the PRI.
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The following CR is proposed.

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| For the second HARQ-ACK reporting mode, if *moreThanOneNackOnlyMode* is not provided, when a number of HARQ-ACK information bits is one, a UE transmits a PUCCH only when the HARQ-ACK information bit has NACK value. For a PUCCH resource associated with PUCCH format 0, the UE transmits the PUCCH as described in [4, TS 38.211] by obtaining as described for HARQ-ACK information in clause 9.2.3 and by setting . For a PUCCH resource associated with PUCCH format 1, the UE transmits the PUCCH as described in [4, TS 38.211] by setting . The PUCCH resource is indicated by PUCCH resource indicator field in DCI format 4-1/4-2 from the configured PUCCH set 0 with up to 32 PUCCH resources for the second HARQ-ACK reporting mode. |

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| Nokia, NSB | We are ok to compromise at this late stage. Although, in our view, there is no technical issue of missing the DCI more than any other use cases of PRI, as anyway DAI is used for this purpose in the DCI. Therefore, the usage of PRI in NACK-only mode 2 for one TB would bring more flexibility on PUCCH resource selection.To clarify vivo, for NACK-only mode 1, if the UE receives only one TB, it shall use the PRI and not convert NACK-only to ACK/NACK feedback. The conversion only applies if the feedback is scheduled in the same PUCCH for more than 1 TBs. Otherwise, this would be ACK/NACK feedback, rather than NACK-only. |

## (1-2)CB type for NACK-only

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| Samsung-Dis-x09708, | Proposal 1: Consider simultaneous configuration of Type-1 HARQ-ACK codebook and NACK-only mode 2 as a misconfiguration; if not agreeable, conclude on Alt1 from Proposal 2.3.2 of [1] and Alt2 from RAN1#108e agreement. |
| Qualcomm-CR-x09955, | the UE is not expected to be configured with Type-1 HARQ-ACK codebook for multicast HARQ-ACK information if a G-RNTI/G-CS-RNTI is indicated by using second HARQ-ACK reporting mode |
| Huawei-CR-x08467,Huawei-Dis-x09822 | *Proposal 3: When UE is configured with NACK-only mode2, UE is not expected to be configured with Type-1 codebook for multicast and then configuration of fdmed-ReceptionMulticast, or type1-Codebook-GenerationMode is not applicable accordingly.*  |
| Ericsson-Dis-x10173 | When pdsch-HARQ-ACK-CodebooklistMulticast indicates Type-1 CB, fdmed-ReceptionMulticast or type1-Codebook-GenerationMode is configured, for NACK-only in mode2, Alt1: the configured parameters are used for multiplexing NACK-only mode2 with other UCI or PUSCH according to the corresponding agreements |

### Round-1

***FL’s analysis:***

ACK/NACK based or NACK-only based HARQ-ACK feedback is configured per G-RNTI. For NACK-only based feedback, mode1 (converting into ACK/NACK) or mode2 (PUCCH channel selection) is configured per CFR. The *pdsch-HARQ-ACK-CodebooklistMulticast*, *fdmed-ReceptionMulticast*, or *type1-Codebook-GenerationMode* is configured per UE for multicast*.*

When UE is configured with a G-RNTI with NACK-only mode2, the question is whether *pdsch-HARQ-ACK-CodebooklistMulticast*, *fdmed-ReceptionMulticast*, or *type1-Codebook-GenerationMode* is configured or when configured how to interpret the configurations.

For NACK-only mode2, one of 15 PUCCH resources will be chosen based on the decoding result for the HARQ-ACK transmission and counting/ordering the HARQ-ACK bits is based on C-DAI. In addition, when NACK-only feedback collides with other UCI or PUSCH, the NACK-only is converted into ACK/NACK feedback for multiplexing. If NACK-only mode2 only supports Type-2 codebook, when UE multiplexes with other UCI or PUSCH, the codebook for NACK-only mode2 should still be based on Type-2. Otherwise, from UE implementation perspective, dropping Type-2 codebook and regenerating codebook based on Type-1 to multiplex HARQ-ACK for unicast or PUSCH is more complex and may require additional time.

Since multiplexing different codebook types for unicast and multicast is supported, despite Type-1 or Type-2 codebook for unicast, it is supported to multiplex HARQ-ACK feedback for unicast and NACK-only mode that is always based on Type-2 codebook. If UE is configured with multiple G-RNTIs, given the *pdsch-HARQ-ACK-CodebooklistMulticast* configuration is applied to all configured G-RNTIs, UE is expected to be configured with Type-2 codebook as long as one G-RNTI is configured with NACK-only mode2. Otherwise, it may happen that NACK-only mode2 alone based on Type-2 will be dropped and a Type-1 codebook will be regenerated instead for multiplexing Type-1 codebook for the other G-RNTI(s).

It seems agreeable to take simultaneous configuration of Type-1 HARQ-ACK codebook and NACK-only mode 2 as a misconfiguration and Qualcomm also views that Type-1 HARQ-ACK codebook should not be configured together with NACK-only mode1 either.

#### Proposal 3.2.1

**Which one is agreeable from the following:**

* **Alt1: UE is not expected to be configured with Type1 CB for NACK-only.**
* **Alt2: UE is not expected to be configured with Type1 CB for NACK-only mode2.**

***Company views:***

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| Company | Comments |
| Samsung | Alt1 – it is simpler which is preferable at this stage and for that issue. |
| Qualcomm | Alt1 |
| vivo | Alt 1 |
| NTT DOCOMO | We prefer Alt1. |
| ZTE | We don’t support this proposal. In our understanding, the configured HARQ-ACK codebook type is only applied to the G-RNTI configured with ACK/NACK even though these parameters are configured per CFR or per UE because more than one G-RNTIs can be configured with ACK/NACK feedback. When NACK-only is transferred to ACK/NACK, type-2 codebook is generated. According to the current spec, the type-2 codebook transferred from NACK-only is concatenated with Type-1 codebook. We don’t see any issue for this case. If type-1 CB and NACK-only can be enabled, this can bring more flexibility for the network. It should not be excluded.  |
| MTK | Alt 1 |
| CATT | Alt 2Actually, we don’t see any issue that configured Type-1 CB for NACK-only mode1. Thus, we support Alt.2. |
| Nokia, NSB | We do not support and agree with ZTE’s understanding. The issue has already been clarified with previous discussions.No dropping occurs, rather NACK-only Type-2 codebook is concatenated with Type-1 codebook. Also, the wording of the proposal is not good. The UE does not get configure Type-1 codebook for NACK-only at all. |

## (1-3)HARQ-ACK feedback for DCI 4\_1 when configured “dci-enabler”

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| vivo-CR-x08617, | If a UE is provided *harq-FeedbackEnablerMulticast* with value set to 'dci-enabler' for a G-RNTI or a G-CS-RNTI, the UE provides HARQ-ACK information for PDSCH receptions scheduled by multicast DCI format 4\_1 associated with the G-RNTI or the G-CS-RNTI and determines whether or not to provide the HARQ-ACK information for PDSCH receptions scheduled by multicast DCI format 4\_2 based on an indication by the multicast DCI format 4\_2 associated with the G-RNTI or the G-CS-RNTI. |
| CATT-CR-x08928, | If a UE is provided *harq-FeedbackEnablerMulticast* with value set to 'dci-enabler' for a G-RNTI or a G-CS-RNTI, the UE determines whether or not to provide the HARQ-ACK information for PDSCH receptions based on an indication by the DCI format 4\_2 associated with the G-RNTI or the G-CS-RNTI [4, TS 38.212], and provides the HARQ-ACK information for PDSCH receptions scheduled by the DCI format 4\_1 associated with G-RNTI or the G-CS-RNTI. |
| Lenovo-CR-x10156 | If a UE is provided *harq-FeedbackEnablerMulticast* with value set to 'dci-enabler' for a G-RNTI or a G-CS-RNTI, the UE provides the HARQ-ACK information for PDSCH receptions scheduled by the multicast DCI format 4-1 associated with the G-RNTI or the G-CS-RNTI, and determines whether or not to provide the HARQ-ACK information for PDSCH receptions based on an indication by the multicast DCI format 4\_2 associated with the G-RNTI or the G-CS-RNTI [4, TS 38.212]. |

### Round-1

***FL’s analysis:***

The submitted CRs basically are proposing the similar changes. The harmonized CR is provided by moderator draft CR on this issue.

#### Draft CR 3.3.1

**The draft CR in** [***Moderator Draft CR on issue 1-3***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-3_v000_Mod.docx) **(to be replaced by the link to the draft CR in the inbox) is endorsed.**

***Company views:***

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| Company | Comments |
| Samsung | Support.We suggest that all agreed CRs are combined into a single CR as was the case in some other WIs in RAN1#110 for easier tracking. |
| Qualcomm | We have concern on the proposed CRs.For multicast feedback enabling/disabling, the default UE behavior is not to transmit the HARQ-ACK feedback.If a G-RNTI/G-CS-RNTI is configured with dci-enabler, we think the following two alternatives can be considered and we slightly prefer Alt1 for sake of simplicity.Alt1: the UE is not expected to be scheduled by DCI format 4\_1 for this G-RNTI/G-CS-RNTIAlt2: the UE is not transmitting the multicast feedback (i.e., fall back to default UE behavior) when scheduled by DCI format 4\_1 for this G-RNTI/G-CS-RNTI. |
| vivo | Support. We think alt1 proposed by Qualcomm is too restricted for gNB’s scheduling. Alt 2 can be considered. But considering UE already supports dynamic indication of enabling/disabling HARQ-ACK, UE supports HARQ-ACK feedback for multicast, defining transmitting the multicast HARQ-ACK can be beneficial for the performance, the behavior defined in the draft CR is preferred. |
| NTT DOCOMO | Support |
| ZTE | We are fine with this proposal that HARQ-ACK is always enabled for the PDSCH scheduled by DCI format 4\_1.  |
| MTK | Support the draft CR since it clarifies the issue clearer.Regarding QC’s comments, we are also fine with the Alt 1if the gNB can ensure it. |
| CATT | Support. |
| Nokia, NSB | Support the draft. We can also be ok with Alt.2 of Qualcomm, but Alt.1 would bring unnecessary limitations. |

## (1-4)Timeline for NACK-only

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| --- | --- |
| ZTE-Dis-x09470, | the same transmission power can be obtained as long as the network configures the PUCCH resource for NACK-only with the same RB allocations.Based on the above analysis, for NACK-only PUCCH with PF0 and PF1, it still needs the decoding result of MBS PDSCH to determine the transmitted information in NACK-only PUCCH. We found no need to redefine processing time for NACK-only feedback. |
| MediaTek-CR-x09526, | adding d3 to T\_proc,1 in TS38214 with value N1 |
| Samsung-Dis-x09708, | *There is no need to consider any change to .**Transmission power determination does not require extending a timeline of PUCCH transmission for NACK-only mode 2.* |
| Qaulcomm-CR-x09959 | adding d3 to T\_proc,1 in TS38214 with value N2 |
| Huawei-CR-x08466,Huawei-CR-x09832, | adding d3 to T\_proc,1 in TS38214 with value N2 |

### Round-1

***FL’s analysis:***

Three UE vendors proposed the similar resolution. ZTE and Samsung basically view the current T\_proc,1 is not relevant and should not be extended since the timeline for decoding PDSCH as specified in TS38.214 clause 5.3 is not affected due to delay PUCCH resource determination after decoding PDSCH. Note that I also noticed that the email thread [110bis-e-NR-R15-08] is discussing the time needed for UE adjusting power for PUSCH/SRS, from which clearly vast majority see the issue of adjusting power by extremely short time.

Similarly, UE vendors point it is a serious implementation issue. The following proposal which was also discussed in the last meeting appears the good middle ground for both UE and network. Where the change is made can be further discussed if companies really concerned to change the current timeline in TS38.214 clause 5.3.

#### Proposal 3.4.1

* **For UE configured with NACK-only mode2, UE is expected to have additional to provide valid HARQ-ACK feedback on top of as follows: , where if the PUCCH resources for NACK-only mode2 is not allocated in the same PRB. Otherwise, .**
* **FFS the change is made to TS38.214 clause 5.3 or made in TS38.213 clause 18 in this meeting.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Do not support. There is no need, and it is actually detrimental, to introduce another – justification was provided in x9708.  |
| Qualcomm | Considering the RF power adjustment time, we support to add d3=N2 when UE transmits the NACK-only feedback on one of the PUCCH resources with different PRBs configured for NACK-only mode2. Just need to mention that if NACK-only mode2 feedback is to be multiplexed with other PUCCH/PUSCH, the other PUCCH/PUSCH will used (known after DCI detection) and d3=0.We support the proposal with the following changes and prefer the changes to be in 38.214.Proposal 3.4.1* **For UE configured with NACK-only mode2, UE is expected to have additional to provide valid HARQ-ACK feedback on top of as follows: , where if the UE transmits the NACK-only mode2 feedback on one of the PUCCH resources for NACK-only mode2 not allocated in the same PRB. Otherwise, .**
* **FFS the change is made to TS38.214 clause 5.3 or made in TS38.213 clause 18 in this meeting.**
 |
| ZTE | At least for single PDSCH scheduling, there is no need to prolong the timeline as discussed previously. |
| MTK | Support.Since the UE only can determine the PUCCH RB position after decoding all the related PDSCHs for the NACK only mode 2, it does not have sufficient time to process the TPC procedure, the extending for the processing time is needed for UE better support this MBS feature, which is similar with the discussion in email thread [110bis-e-NR-R15-08]. |
| Nokia, NSB | Ok to target UE vendors’ concerns for NACK-only mode 2. |

## (1-5)PUCCH resources for NACK-only multicast SPS

|  |  |
| --- | --- |
| Nokia-TP-x08701, | If a UE multiplexes in PUCCH HARQ-ACK information associated only with the second HARQ-ACK reporting mode and associated with multicast SPS PDSCH receptions, when the UE is provided *moreThanOneNackOnlyMode* and the UE provides the HARQ-ACK information according to the first HARQ-ACK reporting mode, the UE determines a PUCCH resource from *SPS-PUCCH-AN-List* for unicast SPS PDSCH receptions as described in clause 9.2.1. |
| ZTE-Dis-x09470, | ***Proposal 5:*** *PUCCH resource configured by PUCCH-Config/sps-PUCCH-AN-List can be used for HARQ-ack information for SPS PDSCH for MBS transferred from NACK-only when PUCCH-Config/PUCCH-ConfigurationList is not configured for MBS.* |
| Ssmsung-TP-x09708,  | If a UE multiplexes in a PUCCH only first HARQ-ACK information associated with multicast SPS PDSCH receptions and second HARQ-ACK information associated with multicast DCI formats and having same priority value as the first HARQ-ACK information, and the first and second HARQ-ACK information are according to different HARQ-ACK reporting modes, the UE determines the PUCCH resource based on:- *sps-PUCCH-AN-ListMulticast*, or *sps-PUCCH-AN-List* if *sps-PUCCH-AN-ListMulticast* is not provided, if the first HARQ-ACK information is according to the first HARQ-ACK reporting mode or - the last multicast DCI format, as described in clause 9.2.3, if the second HARQ-ACK information is according to the first HARQ-ACK reporting mode.  |
| Huawei-Dis-x09822 | *Proposal 5: For the case of NACK-only converted into ACK/NACK HARQ-ACK bits, the PUCCH resource used for transmitting the multiplexed HARQ-ACK bits is determined from SPS-PUCCH-AN-List configured for multicast with NACK-only mode1. If SPS-PUCCH-AN-List configured for multicast with NACK-only mode1 is not configured, the SPS-PUCCH-AN-List configured for unicast is used.* |

### Round-1

***FL’s analysis:***

The discussion is to resolve the FFS from the following agreement:

***Agreement***

* *For the case when the PUCCH transmission for the NACK-only based feedback for one G-RNTI collides with the PUCCH transmission for ACK/NACK feedback for another G-RNTI with the same priority and then UE multiplexes the NACK-only based feedback with the ACK/NACK feedback onto the same PUCCH by transforming NACK-only into the ACK/NACK based HARQ-ACK bit,* *the PUCCH resources for transmitting the multiplexed HARQ-ACK bits is from the PUCCH-Config/PUCCH-ConfigurationList configured for* ***multicast*** *with ACK/NACK based feedback.*
* *For a UE configured with G-RNTI(s) with NACK-only HARQ-ACK feedback, when NACK-only HARQ-ACK bits are transformed into ACK/NACK HARQ-ACK bits, the PUCCH resource used for transmitting the multiplexed HARQ-ACK bits is determined from PUCCH-Config/PUCCH-ConfigurationList configured for* ***multicast*** *with ACK/NACK based feedback based on the k1 and the PRI indication in the last DCI scheduling multicast. If PUCCH-Config/PUCCH-ConfigurationList configured for* ***multicast*** *with ACK/NACK based feedback is not configured, the PUCCH-Config/PUCCH-ConfigurationList configured for* ***unicast*** *is used.*
* *FFS: the case NACK-only is for multicast SPS PDSCH only.*

Note that the above agreement did not consider that UE can be configured with UE specific PUCCH resources for NACK-only mode1. Therefore, when NACK-only HARQ-ACK bits are transformed into ACK/NACK HARQ-ACK bits, the PUCCH resource used for transmitting the multiplexed HARQ-ACK bits does not have to use the resources configured for ACK/NACK based feedback for another G-RNTI since UE may only support a single G-RNTI, or have to use the resources configured for unicast when *PUCCH-Config/PUCCH-ConfigurationList* configured for **multicast** with ACK/NACK based feedback is not configured.

Based on the submitted resolutions, at least the CR for the missing part “the resource determination for a PUCCH with HARQ-ACK for multicast DCI-based PDSCHs and HARQ-ACK for multicast SPS PDSCHs when corresponding HARQ-ACK reporting modes are different” is needed as proposed by SS. In addition, for the case NACK-only is for multicast SPS PDSCH only, how to determine the resources for the converted ACK/NACK, maybe using the resources configured for unicast is more agreeable.

#### Draft CR 3.5.1

**The draft CR in** [***Moderator Draft CR on issue 1-5***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-5_v000_Mod.docx) **(to be replaced by the link to the draft CR in the inbox) is endorsed**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Support |
| Qualcomm | Ok in principle |
| NTT DOCOMO | Support |
| ZTE | For the first bullet, additional condition is that the second HARQ-ACK information is also associated with multicast SPS PDSCH receptions, which should also be captured. |
| CATT | OK |
| Nokia, NSB | Ok. |

#### Proposal 3.5.1

**For a UE configured with G-CS-RNTI(s) with NACK-only HARQ-ACK feedback, when NACK-only HARQ-ACK bits are transformed into ACK/NACK HARQ-ACK bits, the PUCCH resource used for transmitting the multiplexed HARQ-ACK bits is determined from the *sps-PUCCH-AN-List* configured for unicast, if *sps-PUCCH-AN-ListMulticast* is not configured.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Support |
| NTT DOCOMO | Support |
| ZTE | We are fine with this proposal. |
| CATT | Support |
| Nokia, NSB | In our view, sps-PUCCH-AN-ListMulticast would be configured to provide NACK-only feedback in such a scenario (group-common resources). Therefore, the UE shall use UE-specific unicast resources. Does the group have a view that the orthogonal resources would also be configured in SPS-PUCCH-AN-ListMulticast? |

##  (1-6)Type1 CB and ‘dci-enabler’ not configured simultaneously

|  |  |
| --- | --- |
| Qulacomm-CR-x09954, | A UE can be configured per G-RNTI or per G-CS-RNTI, by *harq-FeedbackEnablerMulticast* with value set to ‘enabled’, to provide HARQ-ACK information for PDSCH receptions. When the UE is not provided *harq-FeedbackEnablerMulticast* for a G-RNTI or G-CS-RNTI, the UE does not provide HARQ-ACK information for respective PDSCH receptions. If a UE is provided *harq-FeedbackEnablerMulticast* with value set to ‘dci-enabler’ for a G-RNTI or a G-CS-RNTI and *pdsch-HARQ-ACK-Codebook = dynamic* for multicast HARQ-ACK information, the UE determines whether or not to provide the HARQ-ACK information for PDSCH receptions based on an indication by the multicast DCI format associated with the G-RNTI or the G-CS-RNTI [4, TS 38.212]. If a UE is configured with *pdsch-HARQ-ACK-Codebook = semi-static* for multicast HARQ-ACK information, the UE is not expected to be provided *harq-FeedbackEnablerMulticast* with value set to ‘dci-enabler’ for a G-RNTI or a G-CS-RNTI. |
| Lenovo-CR-x10158 | A UE can be configured per G-RNTI or per G-CS-RNTI, by *harq-FeedbackEnablerMulticast* with value set to ‘enabled’, to provide HARQ-ACK information for PDSCH receptions. When the UE is not provided *harq-FeedbackEnablerMulticast* for a G-RNTI or G-CS-RNTI, the UE does not provide HARQ-ACK information for respective PDSCH receptions. If a UE is provided *harq-FeedbackEnablerMulticast* with value set to ‘dci-enabler’ for a G-RNTI or a G-CS-RNTI, the UE determines whether or not to provide the HARQ-ACK information for PDSCH receptions based on an indication by the multicast DCI format associated with the G-RNTI or the G-CS-RNTI [4, TS 38.212] if the UE is provided *pdsch-HARQ-ACK-Codebook = dynamic*, or provides the HARQ-ACK information for PDSCH receptions and ignores an indication in the multicast DCI format associated with the G-RNTI or the G-CS-RNTI [4, TS 38.212] if the UE is provided *pdsch-HARQ-ACK-Codebook = semi-static*. |

### Round-1

***FL’s analysis:***

The difference between the two submitted draft CRs is whether UE is not expected to be configured with ‘dci-enabler’ or whether UE ignores the indication of ‘dci-enabler’. Since the codebook type is configured per UE for multicast, FL assesses the former makes more sense. In addition, to harmonize the draft CR to the issue in section 3.2, FL suggests taking x09954 as the baseline for themoderator draft CR.

#### Draft CR 3.6.1

**The draft CR in** [***Moderator Draft CR on issue 1-6***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-6_v000_Mod.docx) **(to be replaced by the link to the draft CR in the inbox) is endorsed**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Support. Suggest the following rewording (e.g. by whom is the “UE is not expected”? – “UE does not expect” is clearer).If a UE is ~~configured with~~ provided *pdsch-HARQ-ACK-Codebook = semi-static* for multicast HARQ-ACK information, the UE ~~is~~ does not expect~~ed~~ to be provided *harq-FeedbackEnablerMulticast* with value set to ‘dci-enabler’ for a G-RNTI or a G-CS-RNTI. |
| Qualcomm | SupportAlso fine with Editor’s suggested wording. |
| NTT DOCOMO | Support |
| ZTE | We are fine with this draft CR and also Samsung’s suggestion. |
| MTK | Ok |
| CATT | Support |
| Nokia, NSB | Ok. |

## (1-7)NACK-only mode2 for case2 and case3

|  |  |
| --- | --- |
| Nokia-TP-x08701, | Clarify how the UE counts and orders the HARQ-ACK bits for multiple NACK-only feedback when configured with Alt-4. For Case 2, the UE counts the total number of HARQ-ACK bits based on the sum of C-DAI included in the last scheduling DCI from each G-RNTI. For Case 3, the UE does not support Alt4. Delete “ for only one G-RNTI”. |
| NEC-Dis-x09137, | Proposal 1: *The HARQ-ACK-to-PUCCH mapping table is applicable to both case2 and case3 for supporting NACK-only mode2.* |
| CMCC-Dis-x09310, | Proposal 1. For addressing how to count and order the HARQ-ACK bits for NACK-only for Alt4, Opt 2-1-1 and Opt 3-1-1 are supported. |
| ZTE-Dis-x09470, | *Proposal 3: For multicast, the following options are adopted for addressing to count and order the HARQ-ACK bits for NACK-only for NACK-only mode2:** *Case 2: for the case of all UEs configured with the same set of G-RNTIs*
* *Opt2-1-2 is supported for NACK-only mode2*
	+ *Opt2-1-2: based on C-DAI\* included in the last scheduling DCI for counting the number of HARQ-ACK bits and for ordering the HARQ-ACK bits. The C-DAI\* is accumulating the scheduled TBs across different G-RNTIs*
* *Case 3: for the case of different UEs configured with different G-RNTIs*
* *Opt3-1-2 is supported for NACK-only mode2*
	+ *Opt3-1-2: based on C-DAI\* included in the last scheduling DCI for counting the number of HARQ-ACK bits and for ordering the HARQ-ACK bits. The C-DAI\* is accumulating the scheduled TBs across different G-RNTIs.*
 |
| MediaTek-Dis-x09527, | *Proposal 1: For the NACK-only case, the mapping table between HARQ-ACK values and the PUCCH resources can be applied to multiple configured G-RNTIs.**Proposal 2: For the NACK-only HARQ codebook generation, the DAI is counted per all G-RNTIs.* |
| Apple-Dis-x09566, | Proposal 2: For case 2 and case3, adopt the above HARQ-ACK bit mapping to PUCCH resource table for NACK-only feedback mode Alt4 to support two G-RNTIs. |
| Samsung-TP-x09708, | **From a UE perspective, there is no difference between Case 2 and Case 3**. Case 2 is rather straightforward. From a network perspective, Case 3 can be supported with a joint DAI across G-RNTIs – e.g., if a UE is not configured a G-RNTI for a given DCI format, the UE behavior will be as if the UE missed the DCI format and the UE will then generate a NACK for that DCI format since the DAI value will be incremented in the next DCI format with a G-RNTI that is configured to the UE (C-DAI is assumed to run jointly over all scheduled G-RNTIs). Although that would be unnecessary additional HARQ-ACK for a UE configured with fewer G-RNTIs than the scheduled ones for a HARQ-ACK codebook, it is up to the NW to deploy Case 3 and a UE does not care. By removing the current “UE configured with only one G-RNTI” restriction, a network is given all flexibility to deploy the NACK-only mode 2 and there is practically no impact to UE implementation or to the specifications.**If Case 3 is to be supported, a joint C-DAI across G-RNTIs for NACK only mode 2 should apply and the following text in Clause 9.1.3.1 of TS 38.213 v17.3.0 will need to be updated (joint C-DAI will also apply for Case 2 as a UE cannot differentiate – that would also be preferable in terms of performance/reliability as the “missed last DCI” problem is then generally suppressed).** If Case 3 is not to be supported, or a reliability to the Type-2 HARQ-ACK CB for NACK-only mode 2 is to not be improved, the update for Clause 9.1.3.1 of TS 38.213 v.17.3.0 is not needed. As the specification impact from supporting Case 3 and improving Type-2 CB reliability for NACK-only mode 2 is rather trivial, it is preferable to operate the Type-2 CB assuming a joint C-DAI across G-RNTIs. |
| DOCOMO-CR-x09884, | Delete “ for only one G-RNTI”. |
| Lenovo-Dis-x10159, | *Proposal 4: For multiplexing multiple NACK-only based feedback into one HARQ-ACK codebook, the number of HARQ-ACK information bits and ordering is based cDAI\* accumulating the scheduled TBs across different G-RNTIs (support Option 2-1-2 and Option 3-1-2).* |
| Ericsson-Dis-x10173 | cDAI\* (former Opt2-1-2) is supported for Case 2.Using cDAI\* for Case 3 (former Opt3-1-2) offers a working solution when all PDCCHs of the target G-RNTIs are received correctly.Support an additional 2-bit field for cDAI\* in Type I and Type II CB DCI formats. |

### Round-1

***FL’s analysis:***

The following is the agreement made in RAN1#109e:

***Agreement***

*For multicast, for addressing how to count and order the HARQ-ACK bits for NACK-only for Alt4, further down-selection on the following cases/options in the next meeting:*

* *Case 2: for the case of all UEs configured with the same set of G-RNTIs*
* ***Opt2-1****: support Alt4 for this case*
	+ ***Opt2-1-1****: based on the sum of C-DAI included in the last scheduling DCI from each G-RNTI for counting the total number of HARQ-ACK bits. The ordering of HARQ-ACK bits is per C-DAI from each G-RNTI and in the ascending order of G-RNTI values.*
	+ ***Opt2-1-2****: based on C-DAI\* included in the last scheduling DCI for counting the number of HARQ-ACK bits and for ordering the HARQ-ACK bits. The C-DAI\* is accumulating the scheduled TBs across different G-RNTIs*
* ***Opt2-2****: does not support Alt4 for this case.*
* *Case 3: for the case of different UEs configured with different G-RNTIs*
* ***Opt3-1****: support Alt4 for this case*
	+ ***Opt3-1-1****: based on the sum of C-DAI included in the last scheduling DCI from each G-RNTI for counting the total number of HARQ-ACK bits. The ordering of HARQ-ACK bits is per C-DAI from each G-RNTI and in the ascending order of G-RNTI values.*
	+ ***Opt3-1-2****: based on C-DAI\* included in the last scheduling DCI for counting the number of HARQ-ACK bits and for ordering the HARQ-ACK bits. The C-DAI\* is accumulating the scheduled TBs across different G-RNTIs.*
* ***Opt3-2****: does not support Alt4 for this case.*

As mentioned in the preparation phase, introducing any RRC parameters should be refrained at this stage and it is doubtful to reach a solution with consensus to either support case 2/3 (*Opt2-1-2, Opt3-1-2*) or not support. To support case 2 (and case 3), the spec needs to be updated as mentioned by some company. The current baseline is that the mapping table for NACK-only is for only one G-RNTI that implies case 2 and case 3 is NOT supported.

Now the question is that, if case 2 and case 3 are NOT supported, whether additional spec change is needed to clarify UE behavior for this case, e.g., UE is not expected to provide HARQ-ACK for NACK-only mode2 corresponding to PDSCHs with more than one G-RNTIs in the same PUCCH, or if case 2/3 happen UE only provide HARQ-ACK for NACK-only mode2 corresponding to PDSCHs with the lowest G-RNTI value in the same PUCCH?

Maybe we can also collect views whether only deleting “for only one G-RNTI” is agreeable, which means case 2/3 can be up to the NW to deploy and there is no impact to UE implementation because UE behaviors just follows the legacy, i.e., generating HARQ-ACK per C-DAI.

#### Question 3.7.1-1

**If case 2 and case 3 are NOT supported with NACK-only mode2, whether additional spec change is needed to clarify UE behavior for this case? e.g.,**

* **UE is not expected to provide HARQ-ACK for NACK-only mode2 corresponding to PDSCHs with more than one G-RNTIs in the same PUCCH, or**
* **if case 2 or case 3 happen UE only provides HARQ-ACK for NACK-only mode2 corresponding to PDSCHs with the lowest G-RNTI value in the same PUCCH for example.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Given the current specifications for the above case, a non-consistent configuration can be viewed as gNB misconfiguration without any spec impact – UE behavior is undefined regardless of a “UE does not expect …” (e.g. similar to the UE indicating a capability for X G-RNTIs and being configured with X+1 G-RNTIs – nothing needs to be said). |
| Qualcomm | To make it clear that case 2/3 are error cases, we prefer to limit only one G-RNTI with second HARQ-ACK feedback mode if *moreThanOneNackOnlyMode* is configured, which corresponds to this in the following spec of 38.213:“A UE that is indicated the second HARQ-ACK reporting mode for only one G-RNTI can be indicated by *moreThanOneNackOnlyMode* to provide associated HARQ-ACK information bits in a PUCCH by selecting a PUCCH resource from a set of PUCCH resources for the PUCCH transmission based on the values of the HARQ-ACK information bits as described in Table 18-1.”  |
| vivo | We think the current spec is clear that only for the case that UE is configured with one G-RNTI, UE can be indicated with moreThanOneNackOnlyMode. Otherwise, moreThanOneNackOnlyMode can’t be provided. Then the default mode is mode 1.if company wants minor change to make it clearer, we can also accept. |
| ZTE | We think at least Case 2 should be supported. We don’t think a big spec impact is needed because the UE can select the PUCCH resource by following the DAI order for ACK/NACK mode. In addition, even if we exclude Case 2 and Case 3, the spec impact may still be needed. There is no new RRC parameters needed. For Case 3, we think it may be difficult to resolve, it can be excluded.  |
| MTK | For the one G-RNTI case, we think the current spec description is clear. If case 2 and case 3 is not supported for NACK only mode 2, the corresponding clarification is needed, and the 1st sub-bullet is preferred. |
| CATT | It should clarify that only one G-RNTI of UE can be configured with both of NACK-only mode2 and moreThanOneNackOnlyMode. |
| Nokia, NSB | We agree with ZTE’s view. |

#### Question 3.7.1-2

**Whether only deleting “for only one G-RNTI” from applying the table 18-1 in TS38.213 is agreeable,**

* **which means case 2 and case 3 can be up to the NW to deploy and there is no impact to UE implementation because UE just follows the legacy behaviour, i.e., generating HARQ-ACK per C-DAI.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | We support deleting the “for only one G-RNTI” restriction as it places an unnecessary restriction on deployments, it practically has no spec impact, and no other supporting spec impact is necessary. |
| Qualcomm | No |
| vivo | No.  |
| NTT DOCOMO | We support deleting the statement “for only one G-RNTI” |
| ZTE | No |
| MTK | No |
| CATT | Don’t support. |
| Nokia, NSB | We support the proposal. Note that the current text also limits the operation of “NACK-only mode-1” to only 1 G-RNTI, therefore, this part needs to be reformed. |

## (1-8)DAI vs. ‘dci-enabler’

|  |  |
| --- | --- |
| Langbo-CR-x08995, | 38.213 9.1.3.1A value of the counter downlink assignment indicator (DAI) field in DCI formats denotes the accumulative number of {serving cell, PDCCH monitoring occasion}-pairs in which PDSCH receptions, excluding PDSCH receptions that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if *donwlinkHARQ-FeedbackDisabled* is provided or PDSCH receptions scheduled by DCI formats indicating not to provide HARQ-ACK information if *harq-FeedbackEnablerMulticast* is provided with value set to 'dci-enabler', or HARQ-ACK information bits that are not in response for PDSCH receptions, associated with the DCI formats, excluding the SPS activation DCI, is present up to the current serving cell and current PDCCH monitoring occasion, //The value of the total DAI, when present [5, TS 38.212], in a DCI format denotes the total number of {serving cell, PDCCH monitoring occasion}-pair(s) in which PDSCH reception(s), excluding PDSCH receptions that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if *donwlinkHARQ-FeedbackDisabled* is provided or PDSCH receptions scheduled by DCI formats indicating not to provide HARQ-ACK information if *harq-FeedbackEnablerMulticast* is provided with value set to 'dci-enabler', or HARQ-ACK information that does not correspond to PDSCH receptions, associated with DCI formats, excluding the SPS activation DCI, is present, up to the current PDCCH monitoring occasion and is updated from PDCCH monitoring occasion to PDCCH monitoring occasion. //elseif there is a PDSCH providing a transport block for a HARQ process with enabled HARQ-ACK information or a PDSCH scheduled by a DCI format indicating to provide HARQ-ACK information on serving cell associated with PDCCH in PDCCH monitoring occasion , or there is a PDCCH providing a DCI format associated with HARQ-ACK information without scheduling PDSCH reception on serving cell  |
| Lenovo-CR-x10157 | 38.213 9.1.3.1A value of the counter downlink assignment indicator (DAI) field in DCI formats denotes the accumulative number of {serving cell, PDCCH monitoring occasion}-pairs in which PDSCH receptions, excluding PDSCH receptions that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if *donwlinkHARQ-FeedbackDisabled* is provided and PDSCH receptions for multicast if the corresponding HARQ-ACK feedback is disabled by Enabling/disabling HARQ-ACK feedback indication in associated DCI format 4-2 if higher layer parameter *harq-FeedbackEnabler-Multicast* indicates *dci-enabler* or if the high layer parameter *harq-FeedbackEnabler-Multicast* is not provided, or HARQ-ACK information bits that are not in response for PDSCH receptions, associated with the DCI formats, excluding the SPS activation DCI, is present up to the current serving cell and current PDCCH monitoring occasion, //The value of the total DAI, when present [5, TS 38.212], in a DCI format denotes the total number of {serving cell, PDCCH monitoring occasion}-pair(s) in which PDSCH reception(s), excluding PDSCH receptions that provide only transport blocks for HARQ processes associated with disabled HARQ-ACK information if *donwlinkHARQ-FeedbackDisabled* is provided and PDSCH receptions for multicast if the corresponding HARQ-ACK feedback is disabled by Enabling/disabling HARQ-ACK feedback indication in associated DCI format 4-2 if higher layer parameter *harq-FeedbackEnabler-Multicast* indicates *dci-enabler* or if the high layer parameter *harq-FeedbackEnabler-Multicast* is not provided, or HARQ-ACK information that does not correspond to PDSCH receptions, associated with DCI formats, excluding the SPS activation DCI, is present, up to the current PDCCH monitoring occasion and is updated from PDCCH monitoring occasion to PDCCH monitoring occasion. |

### Round-1

***FL’s analysis:***

The two submitted draft CRs are basically proposing the same thing, C-DAI and T-DAI should not count the PDCCH with ‘dci-enabler’ in the DCI indicating value 0 (i.e., disabling HARQ-ACK feedback) and x08995 also makes the change to the pseudo-code for Type2 HARQ-ACK generation.

Moreover, there is no T-DAI in DCI format 4\_2, so the change made to T-DAI is not needed. Mentioning format 4\_2 is not so necessary for conciseness because it is clear from TS38.212 and the draft CR for the issue in section 3.3 has already clarified it also.

The moderator draft CR is provided based the above.

#### Draft CR 3.8.1

**The draft CR in** [***Moderator Draft CR on issue 1-8***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-8_v000_Mod.docx) **(to be replaced by the link to the draft CR in the inbox) is endorsed.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | OK in principle – an editorial revision is suggested below.or PDSCH receptions scheduled by DCI formats indicating absence of corresponding HARQ-ACK information if *harq-FeedbackEnablerMulticast* is provided with value set to 'dci-enabler' |
| Qualcomm | Ok |
| vivo | Generally fine. |
| NTT DOCOMO | OK |
| Langbo | OK, also fine with Samsung’s revision. |
| ZTE | We are fine with this draft CR and also fine with Samsung’s updates. |
| Ok | Ok |
| CATT | OK |
| Nokia, NSB | Ok. |

## (1-9)Type2 CB for multicast SPS

|  |  |
| --- | --- |
| vivo-CR-x08619 | If a UE is configured to monitor PDCCH for multicast DCI formats with CRC scrambled by one or more G-RNTIs or G-CS-RNTIs that the UE generates a Type-2 HARQ-ACK codebook, the UE separately applies the procedures in this clause except the procedures for SPS PDSCHs per G-RNTI or per G-CS-RNTI and determines the Type-2 HARQ-ACK codebook by concatenating the Type-2 HARQ-ACK codebook for unicast DCI formats, followed by the HARQ-ACK codebooks for the multicast DCI formats in ascending order of the corresponding G-RNTI values, followed by the HARQ-ACK codebooks for the multicast DCI formats in ascending order of the corresponding G-CS-RNTI values, followed by the HARQ-ACK codebook for SPS PDSCHs. |

### Round-1

***FL’s analysis:***

The reason for change from x-8619 is: for type 2 codebook construction for unicast HARQ-ACK and multicast HARQ-ACK, the following agreements were made in previous meeting, based on which it can be concluded that the HARQ-ACK sub-codebook for both unicast SPS PDSCHs and multicast SPS PDSCHs are jointly constructed and concatenated with HARQ-ACK sub-codebook for unicast DG PDSCHs and sub-codebook for multicast DG PDSCHs and is placed after HARQ-ACK sub-codebook for multicast DG PDSCHs. However, the current specification in 9.1.3.1, it captures that the UE separately applies the procedures in this clause per G-RNTI or per G-CS-RNTI, which may lead HARQ-ACK sub-codebook for SPS PDSCHs would be generated in multiple times, since the procedure to generate HARQ-ACK sub-codebook for unicast SPS PDSCHs and multicast SPS PDSCHs is also included in “the procedures in this clause”.

*Agreement: (RAN1#104)*

*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 concatenating the codebooks.*
* *FFS whether to support concatenating more than one Type-2 HARQ-ACK codebook for multicast.*

*Agreement: (RAN1#104bis)*

*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.*

*Agreement: (RAN1#107bis)*

*When UE is configured with unicast SPS and multicast SPS with ACK/NACK based feedback for multiplexing on the same PUCCH for the same priority case, the HARQ-ACK codebook is constructed as for multiple SPS PDSCHs regardless of unicast SPS PDSCH or multicast SPS PDSCH.*

The current specification may cause confusion as mentioned by the source and the CR will be useful for the clarification. The moderator draft CR is provided based on x08619.

#### Draft CR 3.9.1

**The draft CR in** [***Moderator Draft CR on issue 1-9***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-9_v000_Mod.docx) **(to be replaced by the link to the draft CR in the inbox) is endorsed.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | OK although a correction is not necessary as the pseudocode applies to DCI formats and the text at the end of the pseudocode provides the necessary description for SPS PDSCH.  |
| Qualcomm | A question for clarification: Is the proposed concatenating order of unicast DG, multicast DG, multicast SPS, unicast SPS still aligned with the pseudocode equation? In current spec, the pseudocode equation seems bound unicast DG and unicast SPS together followed by multicast DG and multicast SPS. |
| vivo | Support.The proposed concatenating order is unicast DG + multicast DG+ multicast SPS and unicast SPS, and HARQ-ACK for multicast SPS and unicast SPS is jointly generated. This is aligned with our previous agreements. For Qualcomm question, I am not sure what exactly does “the pseudocode equation” mean? I think in the current spec, the pseudocode for SPS HARQ-ACK is for both unicast and multicast SPS. And the CR is aligned with it. |
| NTT DOCOMO | Support |
| ZTE | In our understanding, when the UE generates codebook for unicast, the SPS configuration for multicast is not considered if multicast is configured. In other words, the a SPS is skipped if it is for multicast transmission. So, the sub-codebook for SPS PDSCH is generated only once. No duplication for such sub-codebook. We don’t think the draft CR is needed.  |
| Nokia, NSB | Ok. |

## (1-10)number of HARQ-ACK codebook for multicast

|  |  |
| --- | --- |
| CMCC-CR-x09312 | If a UE is configured with *pdsch-HARQ-ACK-CodebookListMulticast-r17*, *pdsch-HARQ-ACK-Codebook* is replaced by the relevant entry in *pdsch-HARQ-ACK-CodebookListMulticast-r17* in clauses 7.3.1.1.2, 7.3.1.1.3 and 7.3.1.5.3 for multicast HARQ-ACK codebook. |

### Round-1

***FL’s analysis:***

Based on the submitted CR, the current description of the DCI formats scheduling multicast in TS38.212 does not support configuring more than one HARQ-ACK codebook for multicast, which is not aligned with the agreement. The moderator draft CR is provided based on input x09312.

#### Draft CR 3.10.1

**The draft CR in** [***Moderator Draft CR on issue 1-10***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-10_v000_Mod.docx) **(to be replaced by the link to the draft CR in the inbox) is endorsed.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | OK (suggest to put “in this clause” at the beginning of the sentence). |
| Qualcomm | ok |
| vivo | Ok  |
| NTT DOCOMO | OK |
| ZTE | We are fine with the draft CR. |
| MTK | Ok |
| CATT | OK |
| Nokia, NSB | Ok. |

## (1-11)config. of *moreThanOneNackOnlyMode*

|  |  |
| --- | --- |
| vivo-CR-x08618, | A UE that is indicated the second HARQ-ACK reporting mode for only one G-RNTI can be indicated by *moreThanOneNackOnlyMode* to provide associated HARQ-ACK information bits in a PUCCH either according to the first HARQ-ACK reporting mode or by selecting a PUCCH resource from a set of PUCCH resources for the PUCCH transmission based on the values of the HARQ-ACK information bits as described in Table 18-1 when a number of HARQ-ACK information bits is more than one. The UE generates HARQ-ACK information bits for the second HARQ-ACK reporting mode according to a Type-2 HARQ-ACK codebook as described in clause 9.1.3.1. For a PUCCH resource associated with PUCCH format 0, the UE transmits the PUCCH as described in [4, TS 38.211] by obtaining as described for HARQ-ACK information in clause 9.2.3 and by setting . For a PUCCH resource associated with PUCCH format 1, the UE transmits the PUCCH as described in [4, TS 38.211] by setting .//If a UE is provided *pucch-ConfigurationListMulticast1* or *pucch-ConfigurationListMulticast2* for PUCCH transmissions with a priority value, the UE transmits a PUCCH with the priority value according to *pucch-ConfigurationListMulticast1* or *pucch-ConfigurationListMulticast2* for each G-RNTI or G-CS-RNTI that the UE provides associated HARQ-ACK information according to the first HARQ-ACK reporting mode or the second HARQ-ACK reporting mode, respectively. For HARQ-ACK information associated only with the second HARQ-ACK reporting mode, when the UE is not provided *moreThanOneNackOnlyMode* and the UE provides the HARQ-ACK information according to the first HARQ-ACK reporting mode, the UE determines a PUCCH resource from *pucch-ConfigurationListMulticast1*, if provided; otherwise, the UE determines a PUCCH resource from *pucch-Config/pucch-ConfigurationList*. |
| Huawei-CR-x08468 | A UE that is indicated the second HARQ-ACK reporting mode for only one G-RNTI can be indicated to provide associated HARQ-ACK information bits in a PUCCH either according to the first HARQ-ACK reporting mode when *moreThanOneNackOnlyMode* is not configured and the UE determines a PUCCH or a PUSCH to provide the HARQ-ACK information as described in clause 9.2 or by selecting a PUCCH resource from a set of PUCCH resources for the PUCCH transmission based on the values of the HARQ-ACK information bits when *moreThanOneNackOnlyMode* is configured as described in Table 18-1. The UE generates HARQ-ACK information bits for the second HARQ-ACK reporting mode according to a Type-2 HARQ-ACK codebook as described in clause 9.1.3.1. For a PUCCH resource associated with PUCCH format 0, the UE transmits the PUCCH as described in [4, TS 38.211] by obtaining as described for HARQ-ACK information in clause 9.2.3 and by setting . For a PUCCH resource associated with PUCCH format 1, the UE transmits the PUCCH as described in [4, TS 38.211] by setting .**Table 18-1: Mapping of values of HARQ-ACK information bits to PUCCH resources for the second HARQ-ACK reporting mode when *moreThanOneNackOnlyMode* is configured** |

### Round-1

***FL’s analysis:***

The commonality of the two submitted CRs is correcting providing *moreThanOneNackOnlyMode* actually meaning NACK-only mode2 and not providing *moreThanOneNackOnlyMode* meaning NACK-only mode1. Each submitted CRs also address other different corrections individually, e.g., PRI indication, which could be discussed separately.

The moderator draft CR is provided based on the two submitted CRs.

#### Draft CR 3.11.1

**The draft CR in** [***Moderator Draft CR on issue 1-11***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-11_v000_Mod.docx)**(to be replaced by the link to the draft CR in the inbox) is endorsed.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Support |
| Qualcomm | The issue is clear, but the CR is not correct, because NACK-only mode1 is only applied when NACK-only feedback collides with other PUCCH/PUSCH. Otherwise, 1TB NACK-only does not transform to ACK/NACK.So, we suggest the following TP for 38.213 (TS 38.212 is a typo in the draft CR):"A UE that is indicated the second HARQ-ACK reporting mode for only one G-RNTI can be indicated by moreThanOneNackOnlyMode to provide associated HARQ-ACK information bits in a PUCCH by selecting a PUCCH resource from a set of PUCCH resources for the PUCCH transmission based on the values of the HARQ-ACK information bits is configured as described in Table 18-1. A UE that is indicated the second HARQ-ACK reporting mode but not configured with *moreThanOneNackOnlyMode* is to provide associated HARQ-ACK information bits in a PUCCH or PUSCH according to the first HARQ-ACK reporting mode if colliding with other PUCCH/PUSCH" |
| vivo | SupportRegarding Qualcomm’s comment that NACK-only mode1 is not applied to the case of 1 TB and no collision with other channels. We agree with this. But we think this issue can be discussed in section 3.1. |
| NTT DOCOMO | Support |
| ZTE  | We are fine with this draft CR. |
| MTK | Ok |
| Nokia, NSB | Ok with Qualcomm’s intention, however, we can also leave this to a correction to be made for Section 3.1. |

## (1-12)Multiplexing one unicast SPS and DG multicast

|  |  |
| --- | --- |
| vivo-CR-x08887 | Proposal: When HARQ-ACK for unicast SPS PDSCHs only and HARQ-ACK for multicast dynamic grant PDSCHs with ACK/NACK based feedback with the same priority are indicated to be transmitted in the same PUCCH slot,* If *SPS-PUCCH-AN-List* for unicast is not configured, HARQ-ACK for multicast dynamic grant PDSCHs with ACK/NACK based feedback is dropped.
 |

### Round-1

***FL’s analysis:***

For the multiplexing of HARQ-ACK for unicast SPS PDSCHs and multicast dynamic grant PDSCHs with ACK/NACK based feedback with the same priority, it was agreed to multiplex these HARQ-ACK on the PUCCH configured by *SPS-PUCCH-AN-List* configured for unicast in previous meetings.

***Agreement*** *(RAN1#107bis)*

*When HARQ-ACK for unicast SPS PDSCHs and multicast dynamic grant PDSCHs with ACK/NACK based feedback are multiplexed on the same PUCCH for the same priority case, down-select from:*

* *Option 1: the PUCCH carrying the multiplexed HARQ-ACK is determined from the SPS-PUCCH-AN-List configured for unicast.*
* *Option 2: the PUCCH carrying the multiplexed HARQ-ACK is determined from PUCCH-Config/PUCCH-ConfigurationList configured for multicast.*

***Agreement*** *(RAN1#108)*

*When HARQ-ACK for unicast SPS PDSCHs and multicast dynamic grant PDSCHs with ACK/NACK based feedback are multiplexed on the same PUCCH for the same priority case, the following option 1 (from the previous agreement) is adopted:*

* *Option 1: the PUCCH carrying the multiplexed HARQ-ACK is determined from the SPS-PUCCH-AN-List configured for unicast.*
* *Option 2: the PUCCH carrying the multiplexed HARQ-ACK is determined from PUCCH-Config/PUCCH-ConfigurationList configured for multicast*

However, *SPS-PUCCH-AN-List* configured for unicast is based on the capability of supporting multiple of unicast SPS PDSCHs, i.e., FG12-2, which should be independent from R17 multiplexing of unicast HARQ-ACK and multicast HARQ-ACK with the same priority. It seems unreasonable to always bound these two features. Considering at least R17 UEs without capability of *SPS-PUCCH-AN-List* for unicast, the relevant UE behavior needs to be specified. Otherwise, gNB wouldn’t be able to schedule multicast PDSCHs to transmit HARQ-ACK in the same slot with unicast SPS HARQ-ACK.

When *SPS-PUCCH-AN-List* configured for unicast is not configured, one way is to multiplex HARQ-ACK for unicast SPS PDSCHs and multicast dynamic grant PDSCHs with ACK/NACK based feedback on one of the PUCCH resources configured for multicast. i.e., adopting option 2 in the above agreements in this case. Another simpler way is to drop one of these two kinds of HARQ-ACK. Either dropping unicast SPS HARQ-ACK, or dropping multicast DG HARQ-ACK is workable. Considering gNB may get HARQ-ACK information from other UEs in the same MBS group and use PTM for retransmission of multicast PDSCHs, it may make more sense to drop HARQ-ACK for multicast in this case.

#### Proposal 3.12.1

**For UEs not supporting more than one SPS configuration, when UE would multiplex HARQ-ACK for unicast SPS PDSCHs and multicast dynamic grant PDSCHs with ACK/NACK based feedback,**

* + **Alt1: the PUCCH carrying the multiplexed HARQ-ACK is determined from PUCCH-Config/PUCCH-ConfigurationList configured for multicast.**
	+ **Alt2: drop HARQ-ACK for multicast in this case.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Alt1 is preferable  |
| Qualcomm | We prefer gNB to avoid the collision in this case, i.e., If *SPS-PUCCH-AN-List* for unicast is not configured, the UE does not expect that the HARQ-ACK for multicast dynamic grant PDSCHs with ACK/NACK based feedback and unicast SPS feedback collide in the same PUCCH. |
| vivo | Similar issue was discussed in URLLC intra-UE in the last meeting where is t decouple the features of R17 intra-UE multiplexing of different priorities and multiple SPS configuration. Then it was agreed to drop low priority HARQ-ACK if SPS-PUCCH-AN-List for high priority is not provided. The situation is similar and similar solution i.e., Alt 2 can be supported.Regarding Qualcomm’s suggestion, it means gNB wouldn’t be able to schedule multicast PDSCHs to transmit HARQ-ACK in the same slot with unicast SPS HARQ-ACK, this is great restrictions on gNB’s scheduling, especially when unicast SPS PDSCH is configured with short periodicity. |
| ZTE | We prefer Alt 1. In addition, we also think it can be up to implementation to resolve this issue. Dropping the HACK-ACK for multicast is not good since this may affect the performance. |
| Nokia, NSB | Ok with Alt1. |

## (1-13)[POSTPONED]PTP retx for NACK-only when applicable

|  |  |
| --- | --- |
| Huawei-CR-x10207 | A PDSCH reception providing an initial transmission of a transport block is scheduled only by a multicast DCI format. A PDSCH reception providing a retransmission of the transport block can be scheduled either by a multicast DCI format using a same G-RNTI as the G-RNTI of the initial transmission of the transport block, or by a unicast DCI format using a C-RNTI when applicable [6, TS 38.214].An activation for SPS PDSCH receptions using a G-CS-RNTI for a corresponding SPS PDSCH configuration is provided only by a multicast DCI format as described in clause 10.2 by replacing CS-RNTI with the G-CS-RNTI. A release for SPS PDSCH receptions using a G-CS-RNTI for a corresponding SPS PDSCH configuration is provided by a multicast DCI format as described in clause 10.2 by replacing CS-RNTI with the G-CS-RNTI, or by a DCI format with CRC scrambled by CS-RNTI. For a transport block that a UE received in a SPS PDSCH, a PDSCH reception providing a retransmission of the transport block can be scheduled either by a unicast DCI format using a CS-RNTI when applicable or by a multicast DCI format using a same G-CS-RNTI as the G-CS-RNTI of the initial transmission of the transport block [6, TS 38.214]. |

The preparation phase concludes this issue is postponed to the next meeting.

## (1-14)deleting redundant descriptions

|  |  |
| --- | --- |
| Lenovo-CR-x10155 | Delete “if *pdsch-HARQ-ACK-Codebook-Multicast = semiStatic* is configured” and “if the higher layer parameter *pdsch-HARQ-ACK-Codebook-Multicast = dynamic* is configured” for 1st DAI and 3rd DAI in DCI format 0\_1 and DCI format 0\_2. |

### Round-1

***FL’s analysis:***

As the initial assessment states this submitted draft CR is editorial refinement but should be easily agreeable.

The moderator draft CR is provided based on x10155.

#### Draft CR 3.14.1

**The draft CR in** [***Moderator Draft CR on issue 1-14***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-14_v000_Mod.docx)**(to be replaced by the link to the draft CR in the inbox) is endorsed.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Support |
| Qualcomm | ok |
| vivo | Not necessary but ok |
| NTT DOCOMO | OK |
| ZTE | OK |
| CATT | OK |
| Nokia, NSB | Ok. |

## (1-14)aligning RRC parameter name for HARQ-ACK CB

|  |  |
| --- | --- |
| CMCC-CR-x09312 | Change “*pdsch-HARQ-ACK-Codebook-Multicast” to “pdsch-HARQ-ACK-Codebook”.* |

### Round-1

***FL’s analysis:***

As the initial assessment states this submitted draft CR is RRC parameters alignment and should be easily agreeable.

The moderator draft CR is provided based on x09312.

#### Draft CR 3.15.1

**The draft CR in** [***Moderator Draft CR on issue 1-15***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-15_v000_Mod.docx) ***(to be replaced by the link to the draft CR in the inbox)* is endorsed.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | OK – should go to the Rel-17 alignment CR. |
| Qualcomm | ok |
| vivo | Ok – should go to the Rel-17 alignment CR. |
| NTT DOCOMO | OK |
| ZTE | Agree that it should be alignment CR |
| Nokia, NSB | Ok. |

## (1-16)*pdsch-HARQ-ACK-retx* for multicast

|  |  |
| --- | --- |
| CATT-CR-x08925 | Summary of change:If *pdsch-HARQ-ACK-retx is configured by RRC*, the retransmission for multicast HARQ-ACK codebook can be triggered by DCI format 1\_1 or format 1\_2 when HARQ-ACK retransmission indicator is indicated as 1，the retransmission procedure is as described in clause 9.1.5. |

### Round-1

***FL’s analysis:***

As discussed in the preparation phase, the discussion at RAN1#110bis-e is only to clarify the issue and whether it is essential (to control the workload).

**Reason for change from the submitted CR**:

Current specification has supported HARQ-ACK codebook retransmission when the codebook is dropped due to multiplexing procedure between low and high priority HARQ-ACK codebook in a same PUCCH slot, but it is not clear whether the re-transmission codebook can include multicast HARQ-ACK information or not. To improve multicast transmission efficiency, it is suggested that retransmission HARQ-ACK codebook trigged by DCI format 1\_1/1\_2 can include multicast feedback.

#### Question 3.16.1

* **Whether the submitted CR is essential or not?**
* **If the submitted CR is not agreeable, any additional spec change is needed for clarification regarding the discussed issue?**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | The CR is not needed. The corresponding specifications do not differentiate/consider ‘unicast’ or ‘multicast’ HARQ-ACK CB. |
| Qualcomm | Even if the UE supports DCI 1\_1/1\_2 to trigger CB retransmission, it seems no spec impact that unicast DCI can trigger retransmission of the CB, which includes all the feedbacks for all HARQ processes, including unicast and multicast CB feedback. |
| vivo | The CR may not be needed. Type 3/enhanced type 3 CB can include HARQ-ACK for all HARQ processes, including unicast and multicast CB feedback. Conclusion may be enough if company wants to make it clearer. |
| ZTE | We share the same view with other companies that CR is not needed. |
| MTK | The CR is not needed and it does not have any additional spec change. |
| CATT | If it is a common understanding that HARQ-ACK CB retransmission can be applied to multicast CB as well, a CR or conclusion is required to make it clear since HARQ-ACK CB retransmission has not been discussed in MBS. |
| Nokia, NSB | No need to have additional spec changes at this point for a new Rel-17 feature. |

## (1-17)*spsHARQdeferral* for multicast SPS

|  |  |
| --- | --- |
| CATT-CR-x08926 | Summary of change:The HARQ-ACK information for SPS PDSCH can be deferred if *spsHARQdeferral* is configured in a multicast SPS configuration by RRC for first HARQ-ACK reporting mode, the detail is as described in clause 9.2.5.4. |

### Round-1

***FL’s analysis:***

As discussed in the preparation phase, the discussion at RAN1#110bis-e is only to clarify the issue and whether it is essential (to control the workload).

**Reason for change from the submitted CR**:

Current specification has supported deferring HARQ-ACK for SPS PDSCH when the codebook would drop due to PUCCH resource has overlapping with downlink symbols. But it is not clear whether RRC parameter IE *spsHARQdeferral* can be used for multicast SPS configuration. To improve multicast transmission efficiency, it is suggested that MBS also supports deferring HARQ-ACK for SPS PDSCH if first HARQ-ACK reporting mode is configured.

#### Question 3.17.1

* **Whether the submitted CR is essential or not?**
* **If the submitted CR is not agreeable, any additional spec change is needed for clarification regarding the discussed issue?**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | The CR is not needed.The corresponding specifications do not differentiate/consider ‘unicast’ or ‘multicast’ SPS HARQ-ACK. |
| Qualcomm | May need further clarification onIf sps-HARQ-Deferral can be applied to multicast feedback, why it only applies to **first** HARQ-ACK feedback mode for SPS multicast? |
| vivo | Same question as Qualcomm. |
| ZTE | Same question as Qualcomm |
| MTK | The CR is not needed and it does not have any additional spec change. |
| CATT | We think it is a common understanding that sps-HARQ-Deferral can be applied to multicast CB, a CR or conclusion is required to make it clear. If sps-HARQ-Deferral applies to **second** HARQ-ACK feedback, what we concern is that will trigger additional discussions. For example, if UE generates all ‘ACK’ for SPS PDSCH, the UE doesn’t require HARQ CB feedback. How to handle this case for UE? But if most of companies think sps-HARQ-Deferral can be applied to **second** HARQ-ACK feedback as well, we are also ok with it.  |
| Nokia, NSB | No need to introduce spec changes at this stage for a new Rel-17 feature. |

## (1-18)Type3 for NACK-only mode

|  |  |
| --- | --- |
| Langbo-CR-x08996 | Summary of change:For generating a Type-3 HARQ-ACK codebook with , the UE considers the HARQ-ACK information corresponding to a PDSCH reception has been reported if a PUCCH was not transmitted due to all values of HARQ-ACK information including the one for the PDSCH reception being ‘ACK’ according to the second HARQ-ACK reporting mode.  |

### Round-1

***FL’s analysis:***

As discussed in the preparation phase, the discussion at RAN1#110bis-e is only to clarify the issue and whether it is essential (to control the workload).

**Reason for change from the submitted CR**:

For a type-3 HARQ-ACK codebook, if NDI values are not included, a UE determines the value of a HARQ-ACK information bit according to whether HARQ-ACK information for a PDSCH reception of corresponding HARQ process number has been reported or not. For NACK-only reporting mode, it is unclear whether HARQ-ACK information corresponding to a PDSCH reception should be considered reported or not reported if the PUCCH was not transmitted due to only ACK values were generated. In order to avoid misalignment between UE and gNB, it is reasonable for the UE to consider in this case that the HARQ-ACK information for the PDSCH reception has been reported and the corresponding HARQ-ACK bits in the type-3 HARQ-ACK codebook is set to the default value of NACK.

#### Question 3.18.1

* **Whether the submitted CR is essential or not?**
* **If the submitted CR is not agreeable, any additional spec change is needed for clarification regarding the discussed issue?**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | The CR is not needed.Type-3 operates on HARQ processes (for corresponding ACK/NACK values). |
| Qualcomm | Probably we can assume NACK-only mode1 feedback for this case, since the NACK-only feedback is to be multiplexed with other feedback.  |
| vivo | We think it is reasonable for the UE to consider in this case that the HARQ-ACK information for the PDSCH reception has been reported and the corresponding HARQ-ACK bits in the type-3 HARQ-ACK codebook is set to the default value of NACK.  |
| Langbo | An example is shown below to have a better picture of this issue:* a PUCCH for HARQ process #0 was triggered but not transmitted due to ‘ACK’ in NACK-only mode;
* a DCI triggers a Type-3 HARQ-ACK codebook operating on all HARQ processes without NDI bits ;
* a HARQ-ACK bit value for HARQ process #0 is determined based on whether HARQ-ACK information corresponding to the PUCCH has been reported;
* Is the ‘ACK’ considered as reported or not reported?

We think this issue is essential. It will lead to ambiguous understandings on type-3 HARQ-Ack codebook construction. We are open to solutions to address this issue. |
| ZTE | For the NACK-only mode, it should be assumed that UE has reported the ACK/NACK after the PUCCH resource even though it is ACK because the network will assume ACK for the PDSCH if nothing is received on the PUCCH resource. We don’t think CR is needed. |
| Nokia, NSB | Agree with vivo that UE shall consider already HARQ-ACK has been reported and put the default “NACK” value. Perhaps a clarification on this in the spec is needed. |

## (1-19)three issues from x09449

|  |  |
| --- | --- |
| LGE-Dis-x09449 | ***For issue A: NACK-only mode2 multiplexed with other UCI/PUSCH is supported****Proposal 1: If the resultant NACK-only based PUCCH selected for multiplexing multiple NACK-only HARQ-ACK bits in Alt4 is overlapped with other PUCCH or PUSCH, the resultant NACK-only based HARQ-ACKs in Alt4 are transformed to ACK/NACK based HARQ-ACK for multiplexing the NACK-only HARQ-ACK bits in the PUSCH.****For issue B: SR and ack/nack based multiplexing with 1bit for unicast and 1 bit for multicast.****Proposal 2: For multiplexing a positive SR and two HARQ-ACK bits for unicast and multicast respectively of a same priority,** *For PUCCH format 0 for unicast HARQ-ACK,*
	+ *Three bits are multiplexed on the PUCCH resource with PUCCH format 0 allocated for unicast HARQ-ACK according to the existing rules.*
* *For PUCCH format 1 for unicast HARQ-ACK and SR,*
	+ *Two HARQ-ACK bits are multiplexed on the SR PUCCH resource according to the existing rules*
* *For PUCCH format 1 for unicast HARQ-ACK and PUCCH format 0 for SR*
	+ *SR is dropped and Two HARQ-ACK bits are multiplexed on the PUCCH resource with PUCCH format 1 allocated for unicast HARQ-ACK according to the existing rules.*

***For issue C: HARQ-ACK multiplexing for u-cast and m-cast is per priority and then applying the intra-UE multiplexing****Proposal 3: For multiplexing HARQ-ACK information for unicast and multicast respectively and other UCIs of both LP and HP,** *HARQ-ACKs for unicast and HARQ-ACKs for multicast are multiplexed per each priority before applying R17 intra-UE multiplexing rules.*
* *Afterwards, R17 intra-UE multiplexing rules are applied to multiplexing PUCCH for HP and PUCCH for LP, assuming that the multiplexed unicast/multicast HARQ-ACKs of different priorities are considered HP/LP HARQ-ACKs respectively in the rules.*
 |

### Round-1

***FL’s analysis:***

As discussed in the preparation phase, the discussion at RAN1#110bis-e is only to clarify the issue and whether it is essential (to control the workload).

The submitted tdoc discusses three issues without TP or draft CR.

***For issue A: NACK-only mode2 multiplexed with other UCI/PUSCH is supported***

**Issue description**: A resultant PUCCH resource selected for multiplexing four NACK-only based HARQ-ACK bits according to Alt4 could be overlapped with other PUCCH or PUSCH in time. In this case, it is not clear whether the multiplexed NACK-only based HARQ-ACK can be transformed to ACK/NACK based HARQ-ACK for multiplexing NACK-only based PUCCH and other PUCCH/PUSCH in a same slot, even when Alt4 is configured for multiplexing NACK-only based HARQ-ACKs.

***For issue B: SR and ack/nack based multiplexing with 1bit for unicast and 1 bit for multicast.***

**Issues description and solutions:** It seems not discussed yet how to multiplex positive SR, 1 HARQ-ACK bit for unicast and 1 HARQ-ACK bit for multicast for PUCCH format 0/1. Considering the existing multiplexing rules, for a same priority, we propose to multiplex a positive SR and two HARQ-ACK bits for unicast and multicast respectively.

***For issue C: HARQ-ACK multiplexing for u-cast and m-cast is per priority and then applying the intra-UE multiplexing***

**Issues description:** For Rel-17 intra-UE multiplexing, RAN1 agreed that for multiplexing a high-priority (HP) HARQ-ACK and a low-priority (LP) HARQ-ACK into a PUCCH or a PUSCH in R17, separate coding for the two HARQ-ACKs are supported. Considering this agreement, we propose that HARQ-ACKs for unicast and HARQ-ACKs for multicast are multiplexed per each priority before applying R17 intra-UE multiplexing rules. Afterwards, R17 intra-UE multiplexing rules can be applied to multiplexing PUCCH for HP and PUCCH for LP, assuming that the multiplexed unicast/multicast HARQ-ACKs of different priorities are considered HP/LP HARQ-ACKs respectively in the rules.

#### Question 3.19.1

* **Whether the discussed issues are essential or not?**
* **If the discussed issues are not essential, any additional spec change is needed for clarification regarding the discussed issues?**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | For all above issues, the specifications are clear and no further update is needed.If the proponent thinks otherwise, we can discuss draft CRs next time. |
| ZTE | For the first issue, we think the spec is clear that NACK-only should be transferred to ACK/NACK when it overlaps with other PUCCH or PUSCH. It is applied to both mode 1 and mode 2.For the second issue, we think the current mechanism for unicast is reused.For the third issue, it is the same as the unicast HARQ-ACK with different priorities. |

## (1-20)NTN multicast

|  |  |
| --- | --- |
| Qualcomm-CR-x09960 | Summary of change:If a UE is configured with *harq-FeedbackEnablerMulticast*, the UE is not expected to receive a transport block reception associated with a G-RNTI or a G-CS-RNTI for a HARQ process with disabled HARQ-ACK information as indicated by *HARQ-feedbackEnabling-disablingperHARQprocess*, if provided. |

### Round-1

***FL’s analysis:***

As discussed in the preparation phase, the discussion at RAN1#110bis-e is only to clarify the issue and whether it is essential (to control the workload).

**Reason for change from the submitted CR is**:

UE may support both NTN and multicast features. However, for HARQ-ACK feedback enabling/disabling, there are two different schemes for the two features.

* For NTN unicast, the enabling/disabling is configured per HARQ process ID by RRC signaling. The UE will report the NACK in the Type-1 CB for the HARQ process with disabled feedback.
* For TN multicast, the enabling/disabling is configured per G-RNTI/G-CS-RNTI by RRC or indicated in the DCI with the G-RNTI/G-CS-RNTI. It is up to UE to report NACK or ACK/NACK in the Type-1 CB for G-RNTI/G-CS-RNTI with disabled feedback.

When UE is configured to receive NTN multicast with enabled/disabled HARQ-ACK feedback, the UE behavior needs to be clarified whether the UE can be configured to receive multicast PDSCH with a HARQ process configured with disabled HARQ-ACK as indicated by *HARQ-feedbackEnabling-disablingperHARQprocess*.

#### Question 3.20.1

* **Whether the submitted CR is essential or not?**
* **If the submitted CR is not agreeable, any additional spec change is needed for clarification regarding the discussed issue?**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | The CR is not needed.No need to mix MBS and NTN. Also, there is no scenario where the UE will be connected to a NTN for unicast and to TN for MBS – several aspects will then be problematic, including PDCCH monitoring, MBS HARQ-ACK reporting (when multiplexed with unicast), power control, …. |
| Qualcomm | support the CR.The key thing is that the spec is not clear whether/when a HARQ process with disabled feedback can be scheduled for multicast or not. It is a scenario that UE can support NTN for both unicast and multicast, not the scenario of NTN for unicast and TN for MBS. |
| ZTE | We don’t think this CR is needed. The network can avoid this issue. For example, the network does not use the HARQ process with disabling for scheduling multicast. |
| MTK | The CR is not needed.If we want to discuss the CR, one issue is needed to be clarified firstly whether the NTN UE can receive the MBS multicast service since there is not any conclusion for this. However, for the NTN and MBS, there are two separate features defined in Rel-17, we do not suggest discussing the two FGs together in this late stage and make the discussion complexity. |
| Nokia, NSB | Agree with MTK’s view. |

## (1-21)missing statement for mode1

|  |  |
| --- | --- |
| ZTE-CR-x09476 | Summary of change:If a UE would multiplex multicast HARQ-ACK information according to the second HARQ-ACK reporting mode with multicast HARQ-ACK information according to the first HARQ-ACK reporting mode, or unicast HARQ-ACK information, or CSI reports in a first PUCCH or in a PUSCH, as described in clauses 9 and 9.2.5, the UE provides the HARQ-ACK information according to the first HARQ-ACK reporting mode. For resolving an overlapping among a second PUCCH with HARQ-ACK information according to the second HARQ-ACK reporting mode and other PUCCHs or PUSCHs prior to multiplexing the HARQ-ACK information in a PUCCH or PUSCH when the UE is provided *moreThanOneNackOnlyMode*, the UE considers that the UE would transmit the second PUCCH using any PUCCH resource from the PUCCH resources associated with the second HARQ-ACK reporting mode when all values of the HARQ-ACK information are 'ACK'; otherwise, the UE considers that the UE would transmit the second PUCCH when all values of the HARQ-ACK information are 'ACK'. |

### Round-1

**Reason for change from the submitted CR is**:

For multiplexing between NACK-only PUCCH and the other PUCCH or PUSCH, it is assumed that the UE would transmit the NACK-only PUCCH regardless the PDSCH decoding results according to the agreement. The reason is that the UE will not transmit NACK-only PUCCH when the HARQ-ACK information is ‘ACK’. This has been reflected in the specification when the UE is configured with NACK-only mode 2. However, the description for UE configured with NACK-only mode 1 is still missing since the HARQ-ACK feedback is still NACK-only mode when there is only one PDSCH for MBS. It should be added in the specification.

***FL’s analysis:***

After further clarification from proponent during the preparation phase, the intent of the CR is better understood now. Basically,

* For both NACK-only mode1 and mode2, when UE would multiplex multicast HARQ-ACK with others, the UE considers that the UE would transmit the second PUCCH when all values of the HARQ-ACK information are 'ACK.
* Later when reflect the agreement of all PUCCH resources being configured with the same starting symbol and duration, the above bullet is restricted to NACK-only mode2.
* Therefore, the CR needed for now is to correct “the UE considers that the UE would transmit the second PUCCH when all values of the HARQ-ACK information are 'ACK” should still apply to NACK-only mode1.

However, the submitted CR may cause confusion by using ‘otherwise’. The moderator CR is provided based on the reason for change from the submitted CR in x09476.

#### Draft CR 3.21.1

**The draft CR in** [***Moderator Draft CR on issue 1-21***](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.12%28NR_MBS%29/%5B110bis-e-R17-MBS-02%5D/Moderator%20Draft%20CR%20on%20issue%201-21_v000_Mod.docx)**(to be replaced by the link to the draft CR in the inbox) is endorsed.**

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | Support |
| Qualcomm | Ok in general |
| vivo | Ok |
| NTT DOCOMO | OK |
| ZTE | We support this draft CR. |
| Nokia, NSB | Ok. |

## (1-22)NACK-only multiplexing SR

|  |  |
| --- | --- |
| Nokia-TP-x08701,NEC-Dis-x09137,ZTE-Dis-x09470,MediaTek-Dis-x09527,DOCOMO-CR-x09885 |  |

### Round-1

***FL’s analysis:***

This open issue has been discussed for several times. As clarified, if no consensus for the solution, it means not support the multiplexing and it is up to UE so UE behavior is not needed.

The preparation phase discussion concluded CRs are not pursued but a potential conclusion is to be discussed since some company commented that whether we can have a chair’s note to conclude that this is left to UE implementation on which one to drop – i.e., SR or NACK-only.

####  Suggested conclusion 3.22.1

It is up to UE implementation on which one to drop (i.e., SR or NACK-only) when NACK-only collides with SR.

***Company views:***

|  |  |
| --- | --- |
| Company | Comments |
| Samsung | OK with the conclusion. |
| Qualcomm | We prefer to specify the error case asThe UE does not expect to be scheduled with NACK-only and SR in the same PUCCH. |
| Vivo | Same view as Qualcomm |
| NTT DOCOMO | OK |
| ZTE | We still prefer to have a solution to resolve this issue. If no consensus, we can accept this proposal. Defining as error case is not acceptable since it may bring restriction for the network configuration. |
| MTK | QC’s suggestion is fine |
| Nokia, NSB  | Support the FL’s proposal.We can add the following in the specification for clarification:A UE is not required to multiplex in a PUCCH multicast HARQ-ACK information according to second HARQ-ACK reporting mode and an SR. |

# Proposals for GTW

TBD…

# References

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67. [R1-2210159](file:///D%3A%5C2022%5CDocs%5CR1-2210159.zip) Remaining issues on HARQ-ACK feedback for NR MBS Lenovo
68. [R1-2210173](file:///D%3A%5C2022%5CDocs%5CR1-2210173.zip) Maintenance on NR Multicast and Broadcast Services Ericsson
69. [R1-2210207](file:///D%3A%5C2022%5CDocs%5CR1-2210207.zip) Correction on retransmission schemes for MBS HARQ-ACK feedback to TS38.213 Huawei, HiSilicon, CBN
70. [R1-2210208](file:///D%3A%5C2022%5CDocs%5CR1-2210208.zip) Correction on the channel combinations for MBS UE handling to TS38.213 Huawei, HiSilicon, CBN
71. [R1-2210209](file:///D%3A%5C2022%5CDocs%5CR1-2210209.zip) Correction on the channel combinations for MBS UE handling to TS38.214 Huawei, HiSilicon, CBN
72. [R1-2210210](file:///D%3A%5C2022%5CDocs%5CR1-2210210.zip) Correction on the channel combinations for MBS UE handling to TS38.202 Huawei, HiSilicon, CBN