**3GPP TSG-RAN WG1 Meeting #112bis-eR1-23XXXXX**

E-meeting, April 17th – 26th, 2023

**Agenda item: 7.2**

**Source: Moderator (Nokia)**

**Title: Moderator summary #X of [112bis-e-R17-URLLC-01] Rel-17 URLLC & IIoT maintenance (HARQ-ACK)**

**Document for: Discussion and Decision**

# Introduction

As per chairman’s guidance, the email discussion is planned according to the following schedule:

[112bis-e-R17-URLLC-01] Email discussion on Rel-17 URLLC & IIoT maintenance (HARQ-ACK) by April 21 – Klaus (Nokia)

**The following TDocs have been allocated to this email thread by Mr. Chairman:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TDoc** **Number** | **Tdoc title** | **company** | **Specs & clause** | **Moderator comments:** |
| [**R1-2302395**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302395.zip) | Correction on URLLC/IIoT functionalities of DCI formats 1\_1 and 1\_2 | Nokia, Nokia Shanghai Bell | 38.212, clauses 7.3.1, 7.3.1.2.2 & 7.3.1.2.3 | Issue #1 |
| [**R1-2302655**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302655.zip) | Correction on the applicable subcarrier spacings of Type-3 HARQ-ACK codebook | CATT | 38.213, clause 9.1.4 | Issue #2 |
| [**R1-2302656**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302656.zip) | Clarification of configurations of serving cells and HARQ processes for enhanced Type-3 HARQ-ACK codebook | CATT | 38.213, clause 9.1.4 | Issue #3 |
| [**R1-2303567**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303567.zip) | Clarification on CBG based Type 3 HARQ-ACK codebook including HARQ-ACK processes with different max number of CBGs | Qualcomm Incorporated | 38.213, clause 9.1.4 | Issue #4(no draft CR available) |
| [**R1-2303852**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303852.zip) | Correction on adding PUCCH-sSCell for the BWP operation | Huawei, HiSilicon | 38.213, clause 12 | Issue #5 |

**Overall, suggested handling by moderator:**

* **Let’s have a relatively quick round 0 of discussions, with the aim to identify:**
	+ **Is this to be discussed / handled during RAN1#112bis-e?**
	+ **And if so, could this be referred to the editor CR or do we need a separate CR?**
	+ **Deadline of the round 0 as given by Mr. Chairman:**
		- ***Companies are recommended to provide their initial views by 11:59pm (UTC) on Day1 of RAN1#112bis-e***
* As in Athens in Feb/March, for issues where an approved CR is seen as needed, the moderator is planning to combine some issues in a single/joint CR (to keep the number of CRs low and reduce the needed handling for moderator, delegates and Mr. Chairman/Secretary)
	+ I will provide the CRs after the first round in the respective drafts folder.

# Issue#1: Missing functionalities in DCI format description (38.212)

* 1. Background & companies’ inputs

Nokia/NSB in [**R1-2302395**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302395.zip) based on the following reasoning:

|  |  |
| --- | --- |
| ***Reason for change:*** | Rel-17 URLLC introduced Type 3 HARQ-ACK codebook triggering for DCI format 1\_2 and HARQ-ACK codebook re-transmission for DCI formats 1\_1 and 1\_2 which are currently not captured in DCI format overview Table 7.3.1-1 and in the description of the functionalities of DCI format 1\_1 in 7.3.1.2.2 and DCI format 1\_2 in 7.3.1.2.3  |
|  |  |
| ***Summary of change:*** | * Capture the support for Type-3 HARQ-ACK codebook triggering for DCI format 1\_2 and HARQ-ACK re-transmission triggerin for DCI formats 1\_1 and 1\_2 in the DCI format overview table Table 7.3.1-1
* Capture the support for Type-3 HARQ-ACK codebook triggering and HARQ-ACK re-transmission triggerin for DCI formats 1\_1 in 7.3.1.2.2
* Capture the support for Type-3 HARQ-ACK codebook triggering and HARQ-ACK re-transmission triggerin for DCI formats 1\_2 in 7.3.1.2.3
 |
|  |  |
| ***Consequences if not approved:*** | Incomplete list of DCI functionalities for DCI formats 1\_1 and 1\_2 in clauses 7.3.1, 7.3.1.2.2 and 7.3.1.2.3 |

provided the following draft CR to 38.212, Sec. 7.3.1, 7.3.1.2.2 and 7.3.1.2.3

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| < Unchanged parts are omitted >7.3.1 DCI formatsThe DCI formats defined in table 7.3.1-1 are supported.**Table 7.3.1-1: DCI formats**

|  |  |
| --- | --- |
| **DCI format** | **Usage** |
| 0\_0 | Scheduling of PUSCH in one cell |
| 0\_1 | Scheduling of one or multiple PUSCH in one cell, or indicating downlink feedback information for configured grant PUSCH (CG-DFI) |
| 0\_2 | Scheduling of PUSCH in one cell |
| 1\_0 | Scheduling of PDSCH in one cell |
| 1\_1 | Scheduling of one or multiple PDSCH in one cell, and/or triggering one shot HARQ-ACK codebook feedback, or triggering HARQ-ACK codebook retransmission |
| 1\_2 | Scheduling of PDSCH in one cell, and/or triggering one shot HARQ-ACK codebook feedback, or triggering HARQ-ACK codebook retransmission |
| 2\_0 | Notifying a group of UEs of the slot format, available RB sets, COT duration and search space set group switching |
| 2\_1 | Notifying a group of UEs of the PRB(s) and OFDM symbol(s) where UE may assume no transmission is intended for the UE |
| 2\_2 | Transmission of TPC commands for PUCCH and PUSCH |
| 2\_3 | Transmission of a group of TPC commands for SRS transmissions by one or more UEs |
| 2\_4 | Notifying a group of UEs of the PRB(s) and OFDM symbol(s) where UE cancels the corresponding UL transmission from the UE |
| 2\_5 | Notifying the availability of soft resources as defined in Clause 9.3.1 of [10, TS 38.473] |
| 2\_6 | Notifying the power saving information outside DRX Active Time for one or more UEs |
| 2\_7 | Notifying paging early indication and TRS availability indication for one or more UEs. |
| 3\_0 | Scheduling of NR sidelink in one cell |
| 3\_1 | Scheduling of LTE sidelink in one cell |
| 4\_0 | Schedulng of PDSCH with CRC scrambled by MCCH-RNTI/G-RNTI for broadcast |
| 4\_1 | Schedulng of PDSCH with CRC scrambled by G-RNTI/G-CS-RNTI for multicast |
| 4\_2 | Schedulng of PDSCH with CRC scrambled by G-RNTI/G-CS-RNTI for multicast |

< Unchanged parts are omitted >7.3.1.2.2 Format 1\_1DCI format 1\_1 is used for the scheduling of one or multiple PDSCH in one cell, and/or triggering one shot HARQ-ACK codebook feedback, or triggering HARQ-ACK codebook retransmission. < Unchanged parts are omitted >7.3.1.2.3 Format 1\_2DCI format 1\_2 is used for the scheduling of PDSCH in one cell, and/or triggering one shot HARQ-ACK codebook feedback, or triggering HARQ-ACK codebook retransmission. < Unchanged parts are omitted > |

* 1. Initial moderator assessment & suggested handling

**The issues seem to be valid and should be discussed.**

**This is maybe an editorial issue that could be referred to the 38.212 editor CR.**

* 1. Issue to be handled during RAN1#112bis-e?

**Question: Do you support discussing the Issue (overall) during RAN1#112bis-e?**

|  |  |
| --- | --- |
| Yes - support:  | QC,New H3C, ZTE Huawei/HiSi, LG, vivo, Nokia/NSB, Ericsson, Intel, CATT |
| No - not support:  | [Samsung] |

**Question: If to be handled during RAN1#112bis-e, do you think this could be referred to the editor CR or is a separate CR needed?**

|  |  |
| --- | --- |
| Refer to Editor CR  | QC,New H3C, ZTE Huawei/HiSi, LG, [Samsung], Ericsson, Intel, CATT |
| Separate CR |  |

**Comments on the moderator comments / suggested handling or any other comments on the draft CR:**

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| Samsung | It is not an essential correction and the functionality of the DCI formats is captured by the description of the fields and their use in 38.213 and 38.214. There is no ambiguity.If an update is to be made, it would be simpler and cleaner to remove the current text at the beginning of 7.3.1.2.2/7.3.1.2.3 for DCI format 1\_1/1\_2 instead of also possibly adding/updating in next releases. |
| CATT | Following the text proposal, DCI format 1\_1 for indicating SCell dormancy without scheduling a PDSCH reception and DCI format 1\_1/1\_2 for indicating a TCI state update without scheduling PDSCH reception should also be included. |
|  |  |
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# Issue#2: Type 3 HARQ-ACK CB – applicable SCS (clause 9.1.4 of 38.213)

* 1. Companies’ inputs

CATT in [**R1-2302655**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302655.zip) provided a draft CR to 38.213 based on the following reasoning:

|  |  |
| --- | --- |
| ***Reason for change:*** | In Rel-16, Type-3 HARQ-ACK codebook was introduced for NR-U, which was supported in FR1 only. Accordingly, only subcarrier spacings of 15, 30 and 60kHz ($μ=0,1,2$) are considered for processing time of Type-3 HARQ-ACK codebook.However, Type-3 HARQ-ACK codebook is supported for HARQ-ACK retransmission in Rel-17, which should be supported in FR1, FR2-1 and FR2-2. Hence, $μ=3,5,6$ should also be considered for processing time of Type-3 HARQ-ACK codebook. |
|  |  |
| ***Summary of change:*** | Remove the limitation that only $μ=0,1,2$ is considered for processing time of Type-3 HARQ-ACK codebook. |
|  |  |
| ***Consequences if not approved:*** | There is no processing time defined for Type-3 HARQ-ACK codebook in FR2-1 and FR2-2. |

provided the following draft CR to clause 9.1.4 of 38.213:

|  |
| --- |
| 9.1.4 Type-3 HARQ-ACK codebook determination **<Unchanged parts are omitted>**If - a UE detects a DCI format that includes a One-shot HARQ-ACK request field with value 1, and- the CRC of the DCI is scrambled by a C-RNTI or an MCS-C-RNTI, and- *resourceAllocation* = *resourceAllocationType0* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0, or- *resourceAllocation* = *resourceAllocationType1* and all bits of the frequency domain resource assignment field in the DCI format are equal to 1, or- *resourceAllocation = dynamicSwitch* and all bits of the frequency domain resource assignment field in the DCI format are equal to 0 or 1the DCI format provides a request for a Type-3 HARQ-ACK codebook report and does not schedule a PDSCH reception. If the UE is provided *pdsch-HARQ-ACK-EnhType3ToAddModList* and the DCI format includes an enhanced Type 3 codebook indicator field that provides a value for *pdsch-HARQ-ACK-EnhType3Index*, the UE determines a number of indicated serving cells $N\_{cells}^{DL,ind}$ and a number of indicated HARQ processes $N\_{HARQ,c}^{DL,ind}$ for each indicated serving cell $c$ from the entry in *pdsch-HARQ-ACK-EnhType3ToAddModList* corresponding to the *pdsch-HARQ-ACK-EnhType3Index* value. If the DCI format does not include the enhanced Type 3 codebook indicator field, the *pdsch-HARQ-ACK-EnhType3Index* value is provided by the value of the MCS field for transport block 1 in the DCI format 1\_1 or the MCS field in the DCI format 1\_2. The UE is expected to provide HARQ-ACK information in response to the request for the Type-3 HARQ-ACK codebook after $N$ symbols from the last symbol of a PDCCH providing the DCI format, where the value of $N$ ~~for~~ $μ=0,1,2$ is provided in clause 10.2 by replacing "SPS PDSCH release" with "DCI format". If a UE multiplexes HARQ-ACK information in a PUSCH transmission, the UE generates the HARQ-ACK codebook as described in this clause except that *harq-ACK-SpatialBundlingPUCCH* is replaced by *harq-ACK-SpatialBundlingPUSCH*.< Unchanged parts are omitted > |

* 1. Initial moderator assessment & suggested handling

**The issues seem to be valid and should be discussed.**

**A CR seems to be needed, but could be at least combined in a single CR with other aspects of Type 3 HARQ-ACK CB (e.g. of Issue #3, #4) or even in a single 38.213 CR combining all of the 38.213 Issues (Issues #2 to #5).**

* 1. Issue to be handled during RAN1#112bis-e?

**Question: Do you support discussing the Issue (overall) during RAN1#112bis-e?**

|  |  |
| --- | --- |
| Yes - support:  | QC,New H3C, ZTE, vivo, Nokia/NSB, Ericsson, Intel, CATT |
| No - not support:  | Huawei/HiSi, Samsung |

**Question: If to be handled during RAN1#112bis-e, do you think this could be referred to the editor CR or is a separate CR needed?**

|  |  |
| --- | --- |
| Refer to Editor CR  | Ericsson |
| Separate CR | QC,New H3C, ZTE, vivo, Nokia/NSB, CATT |

**Comments on the moderator comments / suggested handling or any other comments on the draft CR:**

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| Huawei/HiSi | “However, Type-3 HARQ-ACK codebook is supported for HARQ-ACK retransmission in Rel-17, which should be supported in FR1, FR2-1 and FR2-2.” – in R17 URLLC, we have no specific enhancements on FR2, so in our understanding, R17 URLLC is the enhancements on FR1. As there is no agreement on expanding the value of $N$ , an agreement is needed before discussing the CR. |
| Nokia/NSB | Agree with HW that there is on agreement on it (and actually maybe would have been better fitted to the >52.6GHz discussions – as the baseline Type 3 HARQ-ACK codebook is not really a R17 URLLC feature). I guess we could have a combination here – have an agreement to support this case and also have the CR approved. But this would require making an agreement on >52.6GHz operation in the Rel-17 URLLC maintenance...  |
| Samsung | Agree with Huawei. It is clearly neither an essential correction nor the type of agreement that should be made for a new feature (which does not exist in corresponding UE features for FR2-2) deep into maintenance.  |
| Ericsosn | In Rel-16, the corresponding feature (FG10-16) was agreed to not to be limited to unlicensed. For corresponding RRC parameters in 38.331 (see e.g. ***pdsch-HARQ-ACK-OneShotFeedback )* there is no mention of SCS.**This means that this CB should be treated similary to other CBs, like Type.1 and Type.2.The CATT CR identifies **the misalignment between spec (38.331 and 38.213) for Rel-17** because of introduction of new SCS in general for Rel-17. We don’t think that a new agreement is needed. If one takes this approach, for every feature, we have to do this tedious exercise, and it is not a proper approach. |
| Intel | R17 URLLC was not limited to FR1, thus the issue seems valid. |
| CATT | We found the following discussion in R1-2002922.

|  |  |
| --- | --- |
| FL summary | Here is the summary of companies’ views on 120 kHz:- keep 120 kHz: Nokia, Qualcomm, Ericsson, OPPO- remove 120 kHz: Lenovo, Sharp, vivoI am not sure if Intel and LG agreed with keeping or removing 120 kHz, but in any cases there is no consensus on how to proceed with 120 kHz. Considering that applicability of type-3 HARQ-ACK codebook is not yet agreed for licensed bands, I propose to proceed with the TP without 120 kHz and discuss later whether to introduce 120 kHz after the relevant decision in the NR-U UE FG discussion.@ Ericsson: it is fine to discuss a simpler TP. We can focus on agreeing to the principle in this phase. Please refer to the conclusion part for the updated proposal. |

According to TS38.306, type-3 HARQ-ACK codebook is applicable to licensed bands as well. We are not sure whether there was follow-up discussion after UE FG discussion on whether to include 120kHz for Rel-16, e.g. whether it was discussed but not agreed or it was not discussed.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***oneShotHARQ-feedback-r16***Indicates whether the UE supports one shot HARQ ACK feedback comprised of the following functional components:- Support feedback of type 3 HARQ-ACK codebook, triggered by a DCI 1\_1 scheduling a PDSCH;- Support feedback of type 3 HARQ-ACK codebook, triggered by a DCI 1\_1 without scheduling a PDSCH using a reserved FDRA value.This capability is also applicable to a frequency band that does not require shared spectrum access. | Band | No | N/A | N/A |

It seems that it may be an issue from Rel-16 and we appreciate if companies can provide more information on Rel-16 discussions. |

# Issue#3: Enhanced Type 3 CB: perHARQ & per CC subcodebook definition (9.1.4 in 38.213)

* 1. Companies’ inputs

CATT in [**R1-2302656**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2302656.zip) provided a draft CR to clause 9.2.5 of 38.213 based on the following reasoning:

|  |  |
| --- | --- |
| ***Reason for change:*** | For enhanced Type-3 HARQ-ACK codebook determination, it is not clear how serving cells and HARQ processes to be included in enhanced Type-3 HARQ-ACK codebook are configured.  |
|  |  |
| ***Summary of change:*** | 1. Clarify the mapping relationship between bitmap of *perCC* and corresponding serving cell index, and the mapping relationship between bitmap of *perHARQ* and corresponding serving cell index and HARQ process number;
2. Clarify the meaning of bit 0/1 indicated by *perCC* or *perHARQ*;
3. If the number of configured HARQ processes for PDSCH is smaller than 16 for a serving cell, clarify the mapping relationship between 16 bit for the serving cell provided by *perHARQ* and HARQ process numbers.
 |
|  |  |
| ***Consequences if not approved:*** | Unclear UE behavior for enhanced Type-3 HARQ-ACK codebook determination. |

... with the following draft CR to clause 9.1.4 of 38.213:

|  |
| --- |
|  9.1.4 Type-3 HARQ-ACK codebook determination If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback*, the UE determines $\tilde{o}\_{0}^{ACK},\tilde{o}\_{1}^{ACK},…,\tilde{o}\_{O\_{ACK}-1}^{ACK}$ HARQ-ACK information bits, for a total number of $O\_{ACK}$ HARQ-ACK information bits, of a Type-3 HARQ-ACK codebook according to the following procedure. If the UE is provided *pdsch-HARQ-ACK-EnhType3ToAddModList* and a DCI format scheduling PDSCH reception and triggering the Type-3 HARQ-ACK codebook includes an enhanced Type 3 codebook indicator field that provides a value for *pdsch-HARQ-ACK-EnhType3Index*, the UE determines a size of a set of indicated serving cells $N\_{cells}^{DL,ind}$ and a size of a set of indicated ~~numbers of~~ HARQ processe numbers $N\_{HARQ,c}^{DL,ind}$ for each indicated serving cell and each indicated HARQ process number from the entry in *pdsch-HARQ-ACK-EnhType3ToAddModList* corresponding to the *pdsch-HARQ-ACK-EnhType3Index* value. Each bit from MSB to LSB provided by *perCC* corresponds to a serving cell in ascending order of serving cell index, where value ‘1’ or value ‘0’ indicate HARQ-ACK for the corresponding serving cell is included or not included in enhanced Type 3 HARQ-ACK codebook, respectively. Each 16-bit from MSB to LSB provided by *perHARQ* corresponds to a serving cell in ascending order of serving cell index, each bit within 16 bits corresponds to a HARQ process number on the serving cell in ascending order of HARQ process number, where value ‘1’ or value ‘0’ indicate HARQ-ACK for the corresponding HARQ process number on the corresponding serving cell is included or not included in enhanced Type 3 HARQ-ACK codebook, respectively. If the number of configured HARQ processes *N* for PDSCH for a serving cell is smaller than 16, the most significant *N* bits within the 16 bits are used to indicate whether HARQ-ACK for the HARQ process of the serving cell is included in enhanced Type 3 HARQ-ACK codebook. If the DCI format does not include the enhanced Type 3 codebook indicator field, the *pdsch-HARQ-ACK-EnhType3Index* value is zero.**<Unchanged parts are omitted>** |

* 1. Initial moderator assessment & suggested handling

**The provided draft CR would for sure clarify for me the intended configuration options per HARQ and per CC – so some discussion could be good to have here:**

* **On the 1. and 2. reason for change, the moderator agrees with the intention – that clarification here on the meaning of the bit could be useful**
* **In contrast, the moderator does not see a need for the 3rd clarification, as saying we ‘start from MSB to LSB’ should be clear enough to indicate which HARQ processes are up for activation. The pseudo-code is anyhow limited by the number of DL HARQ processes configured per DL serving cell, so this additional clarification seems to be clearly not needed here.**

**This is maybe an editorial issue that could be referred to the 38.213 editor CR (based on an agreed TP), or could be combined with other issues (such as Issue #2 & #4 – and potentially even Issue #5) in a single CR to 38.213.**

* 1. Issue to be handled during RAN1#112bis-e?

**Question: Do you support discussing the Issue (overall) during RAN1#112bis-e?**

|  |  |
| --- | --- |
| Yes - support:  | QC,New H3C, ZTE Huawei/HiSi, LG, vivo, Nokia/NSB, Samsung, Intel, CATT |
| No - not support:  | Ericsson |

**Question: If to be handled during RAN1#112bis-e, do you think this could be referred to the editor CR or is a separate CR needed?**

|  |  |
| --- | --- |
| Refer to Editor CR  | Samsung |
| Separate CR | QC,New H3C Huawei/HiSi, LG, vivo, Nokia/NSB, CATT |

**Comments on the moderator comments / suggested handling or any other comments on the draft CR (if all 3 reasons for change need to be addressed etc.):**

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| LG | We are fine with the intention, and we also agree that FL’s comment on third point. In general, we think it would be better to include a description on how to interpret RRC parameters in the "field descriptions" section of 3GPP specification 38.331. |
| Nokia/NSB | Agree with the moderator, that the 3rd clarification seems to be not needed (but support the intention of 1. and 2.)  |
| Samsung | OK in principle with the CR but the text needs to be refined. Agree with the comments by the moderator. In our view, this is an alignment/clarification CR and does not correct a UE behavior/procedure – it is therefore a typical case for inclusion in Rel-17 alignment CR. |
| Ericsson | Regarding reason 1) If we follow the psedue code, it is clear how to loop on cells and HARq process configured per cell. We don’t see any ambiguity. Regarding reason 2) It is clear how to allocate 0 or 1 for the corresponding place holder in the CB, see e.g.:$\tilde{o}\_{j}^{ACK}$= HARQ-ACK information bit for TB $t$ for HARQ process index $h$ in the set of numbers of HARQ processes of serving cell $c$, if any; else, $\tilde{o}\_{j}^{ACK}=0$Regarding reason 3) It is not clear for us the ambiguity. Basically, based on the configuraitons, the size is clear. And how to find the corresponding value for each placeholder in CB is clear.Set $N\_{HARQ,c}^{DL}$ to the value of *nrofHARQ-ProcessesForPDSCH* for serving cell $c$, if provided; else, set $N\_{HARQ,c}^{DL}=8$ .Maybe, more explanation is needed to understand the short-coming of the current spec. |
| CATT | @Ericsson, for reason 1), it is to clarify the mapping relationship between RRC parametres (*perCC*/*perHARQ*) and the serving cell/HARQ process number, which is missing in current spec. For reason 2), the 0/1 is still for RRC configuration, not the HARQ-ACK generation.For reason 3), there are 16 bits for HARQ process configuration but the number of configured HARQ processes may be less than 16. The intention is to clarify how to interpret the 16-bit RRC configuration.In general, there seems to be misunderstanding on the intention of our CR. What we try to clarify is the interpretation of *perCC* and *perHARQ* in order to determine which CC/HARQ process should be included in the HARQ-ACK codebook. |

# Issue#4: Type 3 HARQ-ACK codebook: CBG handling for different number of CBGs per PHY priority (no draft CR provided, 38.314 clause 9.1.4)

* 1. Companies’ inputs

Qualcomm provided a discussion document in [**R1-2303567**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303567.zip) (no draft CR provided):

|  |
| --- |
| ...Therefore, one issue could occur in the following scenario, as illustrated in **Fig 1**. * Type-3/eType-3 codebook is configured to report CBG-based HARQ-ACK (by RRC parameter pdsch-HARQ-ACK-OneShotFeedbackCBG-r16)
* Two HARQ processes (with different PHY priorities) are configured with different number of CBGs per TB (by RRC parameter pdsch-CodeBlockGroupTransmissionList-r16)
* Type-3/eType-3 codebook includes the two HARQ processes (with different PHY priorities)

The problem in this scenario is that, when UE generate the CBG based type-3 or eType-3 HARQ-ACK codebook, how many CBGs UE should report per TB?**Fig 1:** **CBG based Type 3/eType3 HARQ-ACK codebook including inter PHY priorities HARQ-ACK processes**A few solutions can be considered for this issue. * Option 1 (max of the two): Number of HARQ-Ack bits for each TB of a HARQ process for that CC in the type-3/eType-3 HARQ-ACK codebook consists of max{$N\_{HARQ-ACK,c,1}^{CBG/TB,max}$ , $N\_{HARQ-ACK,c,2}^{CBG/TB,max}$} bits. In this case, if actual number of CBGs for a given TB of a HARQ process in a CC is less than the number determined above, UE generates a NACK for each of the last remaining positions in the codebook.
* Option 2: The priority indicator field of the DCI that triggers type-3/eType 3 HARQ-ACK codebook determines the max number of CBGs and the number of HARQ-Ack bits for each TB of a HARQ process number for that CC. For example, in **Fig 1**, if the DCI trigger high priority type-3 codebook, max of 2 CBGs are assumed; otherwise, max of 8 CBGs are assumed.
	+ If a TB is scheduled originally with a larger number of CBGs than the max number of CBGs determined as above for type-3/eType-3 HARQ-ACK codebook, UE generates HARQ-ACK bit for a new CBG that consists of two or more original CBGs by the binary AND operation of the HARQ-ACK information bits corresponding the original CBGs.
* Option 3: if the max number of CBGs for the two priorities are different, or if only one is CBG based while the other is TB based, the UE is only expected to be configured with TB level A/N reporting for type-3/eType 3 codebook (does not expect to be configured with pdsch-HARQ-ACK-OneShotFeedbackCBG-r16)

Among the three options, option 1 is the simplest with some additional HARQ-ACK feedback overhead. Option 2 is more complicated because of the AND operation to merge HARQ-ACK feedback for multiple CBGs. Option 3 put restriction on gNB scheduling. We slightly prefer option 1 and propose resolve the issue with option 1. Proposal 1: When Type-3/eType-3 codebook is configured to report CBG-based HARQ-ACK which includes HARQ processes with two different max number of CBGs $N\_{HARQ-ACK,c,1}^{CBG/TB,max}$ and $N\_{HARQ-ACK,c,2}^{CBG/TB,max}$, max{$N\_{HARQ-ACK,c,1}^{CBG/TB,max}$ , $N\_{HARQ-ACK,c,2}^{CBG/TB,max}$} is assumed to generate the CBG based Type-3/eType-3 codebook.  |

* 1. Initial moderator assessment & suggested handling

**The issue is clearly valid and some solution /option would need to be chosen to clarify the Type 3 HARQ-ACK CB operation.**

**A possible change is clearly not just editorial (so a CR would be needed) but could be combined with at least with Issue #2 & #3 also on Type 3 CB (or even with Issue #5) in a single CR to 38.213.**

As the proponent of the change did not provide a potential draft CR, based on the understanding of the proponent’s intention, a draft CR may be looking as follows:

|  |
| --- |
| 9.1.4 Type-3 HARQ-ACK codebook determination **<Unchanged parts are omitted>**Set $N\_{HARQ-ACK,c}^{CBG/TB,max}$ to the maximum number of HARQ-ACK information bits per TB for PDSCH receptions on serving cell $c$ as described in clause 9.1.1 if *maxCodeBlockGroupsPerTransportBlock* in *codeBlockGroupTransmission* or *pdsch-CodeBlockGroupTransmissionList* is provided for serving cell $c$ and *pdsch-HARQ-ACK-OneShotFeedbackCBG* or *pdsch-HARQ-ACK-EnhType3CBG* is provided; else, set $N\_{HARQ-ACK,c}^{CBG/TB,max}=0$**<Unchanged parts are omitted>** |

* 1. Issue to be handled during RAN1#112bis-e?

**Question: Do you support discussing the Issue (overall) during RAN1#112bis-e?**

|  |  |
| --- | --- |
| Yes - support:  | QC,New H3C, ZTE, Nokia/NSB, CATT |
| No - not support:  | Huawei/HiSi, Samsung, Ericsson, Intel |

**Question: If to be handled during RAN1#112bis-e, do you think this could be referred to the editor CR or is a separate CR needed?**

|  |  |
| --- | --- |
| Refer to Editor CR  |  |
| Separate CR | QC,New H3C, ZTE, LG, vivo, Nokia/NSB, CATT |

**Comments on the moderator comments / suggested handling or any other comments on the draft TP / CR (by the moderator):**

|  |  |
| --- | --- |
| *Company* | *Comments*  |
| QC | We thank FL very much for providing the TP. Our intention was having a discussion with the group and identifying a solution first. Then we can provide the TP. Thanks FL taking the effort to provide the TP. But we think in the TP, it is still not clear that $N\_{HARQ-ACK,c}^{CBG/TB,max}$ is set to the max of maxCodeBlockGroupsPerTransportBlock for the two priorities. We suggest to go with the following TP, which is longer but clearer. Set $N\_{HARQ-ACK,c}^{CBG/TB,max}$ to the number of HARQ-ACK information bits per TB for PDSCH receptions on serving cell $c$ as described in clause 9.1.1 if *maxCodeBlockGroupsPerTransportBlock* is provided for serving cell $c$ and *pdsch-HARQ-ACK-OneShotFeedbackCBG* or *pdsch-HARQ-ACK-EnhType3CBG* is provided; if pdsch-CodeBlockGroupTransmissionList is provided for serving cell c and pdsch-HARQ-ACK-OneShotFeedbackCBG or pdsch-HARQ-ACK-EnhType3CBG is provided, set $N\_{HARQ-ACK,c}^{CBG/TB,max}$ to the maximum of the value of maxCodeBlockGroupsPerTransportBlock for the first priority and the value of maxCodeBlockGroupsPerTransportBlock for the second priority; else, set $N\_{HARQ-ACK,c}^{CBG/TB,max}=0$.  |
| Huawei/HiSi | We already have the agreement that UE is not supposed to be configured with different number of CBGs/NDIs.**RAN1#106bis-e****Agreement**For one enhanced Type 3 HARQ-ACK CB, the same CBG and NDI configuration applies to both PHY priorities following the RAN1#106-e agreement. |
| LG | We are fine to leave current specification as it is, if we already have common understanding on the previous agreement that Huawei/HiSi. |
| vivo | Based on Huawei/HiSi’s comments, need to check whether the agreement @106bis is captured in the specification or not. If not yet, it should be captured.  |
| Nokia/NSB | Thanks to HW for pointing this out. We can then check, if a different clarification would be needed in 38.213 to capture the earlier agreement instead having the max as proposed by QC.  |
| Samsung | Agree with Huawei. Even without the referenced agreement from RAN1#106bis-e, the issue is not an essential correction as it would be a gNB misconfiguration and something that the gNB can control. We do not think any specification change is needed. |
| Ericsson | We also agree with HW. Also, share the same view as vivo that if the agreement is not captured, we should capture it in the spec. |
| Intel | Given the agreement cited by Huawei/HiSi, it seems there is already a solution for this issue, but whether it is already present in specs or requires a CR needs to be checked. |

# Issue#5: PUCCH-sSCell for the BWP operation (38.213, clause 12)

* 1. Companies’ inputs

Huawei proposed a draft CR in [**R1-2303852**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_112b-e/Docs/R1-2303852.zip) based on the following reasons:

|  |  |
| --- | --- |
| ***Reason for change:*** | PUCCH configuration in pucch-sSCell is missing in the BWP operation clause. |
|  |  |
| ***Summary of change:*** | Add PUCCH-sSCell in the bandwidth part operation. |
|  |  |
| ***Consequences if not approved:*** | PUCCH configuration in pucch-sSCell is not supported in the BWP operation. |

.. with the draft CR reading as:

|  |
| --- |
| 12 Bandwidth part operation ========================= Unchanged parts =========================If a UE is provided *controlResourceSetZero* and *searchSpaceZero* in *PDCCH-ConfigSIB1* or *PDCCH-ConfigCommon*, the UE determines a CORESET for a search space set from *controlResourcesetZero* as described in clause 13 and for Tables 13-1 through 13-10, and determines corresponding PDCCH monitoring occasions as described in clause 13 and for Tables 13-11 through 13-15. If the active DL BWP is not the initial DL BWP, the UE determines PDCCH monitoring occasions for the search space set only if the CORESET bandwidth is within the active DL BWP and the active DL BWP has same SCS configuration and same cyclic prefix as the initial DL BWP.For each UL BWP in a set of UL BWPs of the PCell or of the PUCCH-SCell or of the PUCCH-sSCell, the UE is configured resource sets for PUCCH transmissions as described in clause 9.2.1.A UE receives PDCCH and PDSCH in a DL BWP according to a configured SCS and CP length for the DL BWP. A UE transmits PUCCH and PUSCH in an UL BWP according to a configured SCS and CP length for the UL BWP. ========================= Unchanged parts =========================  |

* 1. Initial moderator assessment & suggested handling

**The issue is clearly valid and should be handled.**

**This is maybe an editorial issue that could be referred to the 38.213 editor CR (based on an agreed TP), or could be combined with other issues in a single CR to 38.213 (Issue #2 to Issue #4).**

* 1. Issue to be handled during RAN1#112bis-e?

**Question: Do you support discussing the Issue (overall) during RAN1#112bis-e?**

|  |  |
| --- | --- |
| Yes - support:  | QC,New H3C, ZTE Huawei/HiSi, LG, vivo, Nokia/NSB, Samsung, Ericsson, Intel, CATT |
| No - not support:  |  |

**Question: If to be handled during RAN1#112bis-e, do you think this could be referred to the editor CR or is a separate CR needed?**

|  |  |
| --- | --- |
| Refer to Editor CR  | QC,New H3C, ZTE Huawei/HiSi, LG, vivo, Nokia/NSB, Samsung, Ericsson, Intel, CATT |
| Separate CR |  |

**Comments on the moderator comments / suggested handling or any other comments on the draft CR:**

|  |  |
| --- | --- |
| *Company* | *Comments*  |
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|  |  |
|  |  |
|  |  |

# Outcome

TBA