**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:

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| ***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 formats  The 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\_1  DCI 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\_2  DCI 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?**

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| Yes - support: |  |
| 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?**

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| Refer to Editor CR |  |
| Separate CR |  |

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

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| *Company* | *Comments* |
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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:

|  |  |
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| ***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 () 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, should also be considered for processing time of Type-3 HARQ-ACK codebook. |
|  |  |
| ***Summary of change:*** | Remove the limitation that only 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 1  the 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 and a number of indicated HARQ processes for each indicated serving cell 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 symbols from the last symbol of a PDCCH providing the DCI format, where the value of ~~for~~  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: |  |
| 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?**

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| Refer to Editor CR |  |
| Separate CR |  |

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

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| *Company* | *Comments* |
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# 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:

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| ***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:

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| --- |
| 9.1.4 Type-3 HARQ-ACK codebook determination If a UE is provided *pdsch-HARQ-ACK-OneShotFeedback*, the UE determines HARQ-ACK information bits, for a total number of 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 and a size of a set of indicated ~~numbers of~~ HARQ processe numbers 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?**

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| --- | --- |
| Yes - support: |  |
| 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?**

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| Refer to Editor CR |  |
| Separate CR |  |

**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.):**

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| *Company* | *Comments* |
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# 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):

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| --- |
| ...  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{ , } 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 and , 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:

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| --- |
| 9.1.4 Type-3 HARQ-ACK codebook determination **<Unchanged parts are omitted>**  Set to the maximum number of HARQ-ACK information bits per TB for PDSCH receptions on serving cell as described in clause 9.1.1 if *maxCodeBlockGroupsPerTransportBlock* in *codeBlockGroupTransmission* or *pdsch-CodeBlockGroupTransmissionList* is provided for serving cell and *pdsch-HARQ-ACK-OneShotFeedbackCBG* or *pdsch-HARQ-ACK-EnhType3CBG* is provided; else, set  **<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?**

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| Yes - support: |  |
| 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?**

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| --- | --- |
| Refer to Editor CR |  |
| Separate CR |  |

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

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| *Company* | *Comments* |
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# 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:

|  |  |
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| ***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:

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| --- |
| 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: |  |
| 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?**

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| --- | --- |
| Refer to Editor CR |  |
| Separate CR |  |

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

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| *Company* | *Comments* |
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# Outcome

TBA