**3GPP TSG RAN WG1 Meeting #104-e R1-20xxxxx**

**E-meeting, January 25 – February 5, 2021**

**Agenda Item: 7.2.5**

**Source: Moderator (Huawei)**

**Title: Summary #1 of email discussion [104-e-NR-L1enh-URLLC-01] on remaining issues on PDCCH enhancements**

**Document for: Discussion and Decision**

# Introduction

The email discussion is to discuss the remaining issues on PDCCH enhancements.

[104-e-NR-L1enh-URLLC-01] Email discussion/approval on remaining issues on PDCCH enhancements – Chengyan (Huawei) by Feb 3

* Issue A-1: Correction on dci-FormatsExt in section 10.1 in TS 38.213
* Issue A-5: PDSCH resource mapping with RE symbol level granularity

This document summarizes the above issue and provide some initial proposals for discussion. Companies are encouraged to provide the first round views by 01/26, 8:00pm PST, then we can adjust the proposals and prepare the TPs for the next step discussions.

# Issue A-1: Correction on *dci-FormatsExt* in section 10.1 in TS 38.213

**Issue A-1**: Correction on *dci-FormatsExt* in section 10.1 in TS 38.213

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| *Sharp R1-2101535*  In Rel-16, DCI format 0\_2 and DCI format 1\_2 have been introduced for Rel-16 URLLC operation. A *dci-FormatsExt* is used to indicate whether a UE to monitor the DCI format 0\_2 and DCI format 1\_2 in the USS. To be more specific, in TS 38.331 [1] as below, the *dci-FormatsExt* is used to indicate whether a UE to monitor PDCCH candidates for the DCI format 0\_2 and DCI format 1\_2, or for the DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2 in a USS.     |  | | --- | | ***dci-FormatsExt***  If this field is present, the field *dci-Formats* is ignored and *dci-FormatsExt* is used instead to indicate whether the UE monitors in this USS for DCI format 0\_2 and 1\_2 or formats 0\_1 and 1\_1 and 0\_2 and 1\_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 10.1). |   On the other hand, in TS 38.213 [2] as below, it seems that the *dci-FormatsExt* can be also used to indicate a UE to monitor PDCCH candidates for the DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, which are not allowed in the TS 38.331.   |  | | --- | | TS 38.213 V16.4.0 (2020-12)  10.1 UE procedure for determining physical downlink control channel assignment  - if search space set is a USS set, an indication by *dci-Formats* to monitor PDCCH candidates either for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or an indication by *dci-FormatsExt* to monitor PDCCH candidates for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for DCI format 0\_2 and DCI format 1\_2, or, if a UE indicates a corresponding capability, for DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2, or for DCI format 3\_0, or for DCI format 3\_1, or for DCI format 3\_0 and DCI format 3\_1 |   **Proposal:** Adopt the following TP relating to *dci-FormatsExt* in TS 38.213 to keep insistent with the description of the *dci-FormatsExt* in TS 38.331.   |  | | --- | | TP  TS 38.213 V16.4.0 (2020-12)  10.1 UE procedure for determining physical downlink control channel assignment  < Unchanged parts are omitted >  - if search space set is a USS set, an indication by *dci-Formats* to monitor PDCCH candidates either for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or an indication by *dci-FormatsExt* to monitor PDCCH candidates for ~~DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for~~ DCI format 0\_2 and DCI format 1\_2, or, if a UE indicates a corresponding capability, for DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2, or for DCI format 3\_0, or for DCI format 3\_1, or for DCI format 3\_0 and DCI format 3\_1  < Unchanged parts are omitted > | |

**Feature lead view**: The issue is valid and needs to be addressed.

***Proposal A-1****: Endorse the text proposal in R1-2xxxxxx for TS 38.213 Section 10.1.*

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| 10.1 UE procedure for determining physical downlink control channel assignment  < Unchanged parts are omitted >  - if search space set is a USS set, an indication by *dci-Formats* to monitor PDCCH candidates either for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or an indication by *dci-FormatsExt* to monitor PDCCH candidates for ~~DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for~~ DCI format 0\_2 and DCI format 1\_2, or, if a UE indicates a corresponding capability, for DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2, or for DCI format 3\_0, or for DCI format 3\_1, or for DCI format 3\_0 and DCI format 3\_1  < Unchanged parts are omitted > |

**Please provide your views on the above proposal A-1.**

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| *Company* | *View* |
| CATT | We support the TP. |
| ZTE | Agree with the TP. |
| HW/HiSI | We agree with the TP. |
| Intel | Support in principle.  While the proposed TP does address part of the issue, the TP still seems to indicate that ***dci-FormatsExt*** can also indicate monitoring for DCI formats 3\_x that seem related to SL (***dci-FormatsSL)***. It may be good to address this as well. |
| DOCOMO | Support the TP. Regarding DCI formats 3\_x, we think the proposed TP is fine because ‘corresponding capability’ addresses the potential ambiguity raised by Intel. |
| Nokia, NSB | Agree with the TP.  On the comment by Intel, if there is an issue with SL – SL maintenance to fix. Moreover, we do agree with DoCoMo comment here. |
| Spreadtrum | We support the TP. |
| Ericsson | Support in principle.  For *dci-FormatsExt*, the proposed TP is still problematic. It’s unclear to us what “corresponding capability” means, and why this condition is applied to formats0-1-And-1-1And-0-2-And-1-2 , but not to formats0-2-And-1-2.  For *dci-FormatsSL,* we are fine either way to fix it here or leave to SL maintenance. But it seems easier to fix it here. Otherwise, proposed TP reads as if *dci-FormatsExt* can indicate DCI format 3\_0, 3\_1. |
| vivo | We agree with the TP in principle. For ‘corresponding capability’ part, the further clarification is needed as Intel mentioned. |
| Sharp | Regarding the “corresponding capability”, our view is the “corresponding capability” means a capability that UE can monitor both DCI format 0\_1/1\_1 and DCI format 0\_2/1\_2 in one search space set. It intended to reflect the agreement reached in RAN1#99 meeting.  Agreement  It is allowed to configure both DCI format 0\_1/1\_1 and DCI format 0\_2/1\_2 to be monitored in a certain search space set for scheduling the same cell.   * This feature is UE optional   Regarding *dci-FormatsSL*, our SL colleagues proposed a change (one part of TP#1 in R1-2101533) as below to address the missing indication *dci-FormatsSL*. In addition, vivo proposed in SL topic to clarify the *dci-FormatsSL* in section 2.2 in R1-2100411. It seems the relevant issues are not treated in SL email discussions in this meeting.  --------------------------One part of TP#1 in R1-2101533---------------  if search space set is a USS set, an indication by *dci-Formats* to monitor PDCCH candidates either for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or an indication by *dci-FormatsExt* to monitor PDCCH candidates for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for DCI format 0\_2 and DCI format 1\_2, or, if a UE indicates a corresponding capability, for DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2, or an indication by *dci-FormatsSL* to monitor PDCCH candidates for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for DCI format 3\_0, or for DCI format 3\_1, or for DCI format 3\_0 and DCI format 3\_1  ----------------------------------------  Lastly, we are fine with either way to fix the issue *dci-FormatsSL* in URLLC if URLLC session can have a CR including the SL as below or leave it to the SL.  - if search space set is a USS set, an indication by *dci-Formats* to monitor PDCCH candidates either for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or an indication by *dci-FormatsExt* to monitor PDCCH candidates for ~~DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for~~ DCI format 0\_2 and DCI format 1\_2, or, if a UE indicates a corresponding capability, for DCI format 0\_1, DCI format 1\_1, DCI format 0\_2, and DCI format 1\_2, or for DCI format 3\_0, or an indication by *dci-FormatsSL* to monitor PDCCH candidates for DCI format 0\_0 and DCI format 1\_0, or for DCI format 0\_1 and DCI format 1\_1, or for DCI format 3\_1, or for DCI format 3\_0 and DCI format 3\_1 |
| OPPO | Agree with TP |
| Qualcomm | Agree with TP. For the SL related discussion, we prefer to leave it to SL maintenance. |
| Samsung | Agree with the TP.  Also fine to fix the SL here as it is trivial and simpler. |
| Apple | Agree with the TP, but the fix should not include that for sidelink. |

# Issue A-5: PDSCH resource mapping with RE symbol level granularity

## Issue A-5: PDSCH resource mapping with RE symbol level granularity

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| *Sharp (R1-2101536)*  In Rel-16 URLLC, a new higher layer parameter *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* had been introduced to configure aperiodic zero-power CSI-RS resource sets for DCI format 1\_2. A general statement on the top of the subclause 5.1.4.2 of TS 38.214 [1], ‘The procedures for PDSCH scheduled by PDCCH with DCI format 1\_1 described in this clause equally apply to PDSCH scheduled by PDCCH with DCI format 1\_2, by applying the parameters of *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* instead of *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList*.’, is used to specify a PDSCH rate matching procedure with the aperiodic ZP CSI-RS resource sets for the PDSCH scheduled by DCI format 1\_2.  In the meantime, TS 38.214 only states that the Res corresponding to configured resources in *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* are available for PDSCH scheduled by DCI format 1\_0 as below highlighted in yellow. However, it cannot be inferred from the current TS 38.214 whether the Res corresponding to configured resources in *aperiodic-ZP-CSI-RS-ResourceSetsToAddModListForDCI-Format1-2-r16* are available for the PDSCH scheduled by DCI format 1\_0. In addition, even taking the general statement into consideration, it is also not clear that, for a given PDSCH scheduled by DCI format 1\_0, whether Res corresponding to configured resources in *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* are available for the PDSCH given the general statement only described the rate matching procedures for PDSCH scheduled by DCI format 1\_1 apply to PDSCH scheduled by DCI format 1\_2.  **Observation**: For a PDSCH scheduled by DCI format 1\_0, TS 38.214 describes that the Res corresponding to configured resources in *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* are available for the PDSCH, while TS 38.214 does not describe whether Res corresponding to configured resources in *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* are available for the PDSCH.  Simply following the principle of Rel-15 rate matching behavior with aperiodic ZP CSI-RS that the UE does not rate match PDSCH around the overlapped aperiodic ZP CSI-RS resource by a DL DCI other than the one which scheduled this PDSCH, TS 38.214 should also describe that, for a PDSCH scheduled by the DCI format 1\_0, the Res corresponding to configured resources in *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* are available for the PDSCH.  **Proposal:** Adopt the following TP in TS 38.214 to describe that, for PDSCH scheduled by DCI format 1\_0 or PDSCHs with SPS activated by DCI format 1\_0, the Res corresponding to configured resources in *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* are available for the PDSCH, just as the Res corresponding to configured resources in *aperiodicZP-CSI-RS-ResourceSetsToAddModList* are available for the PDSCH.   |  | | --- | | TP  TS 38.214 V16.4.0 (2020-12)  5.1.4.2 PDSCH resource mapping with RE level granularity  < Unchanged parts are omitted >  The UE may be configured with a DCI field for triggering the aperiodic ZP CSI-RS. A list of *ZP-CSI-RS-ResourceSet(s)*, provided by higher layer parameter *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* in *PDSCH-Config*, is configured for aperiodic triggering. The maximum number of aperiodic *ZP-CSI-RS-ResourceSet(s)* configured per BWP is 3. The bit-length of DCI field *ZP CSI-RS trigger* depends on the number of aperiodic *ZP-CSI-RS-ResourceSet(s)*configured (up to 2 bits). Each non-zero codepoint of ‘*ZP CSI-RS’ trigger* in DCI format 1\_1 triggers one aperiodic ‘ZP-CSI-RS-ResourceSet’ in the list *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* by indicating the aperiodic ZP CSI-RS resource set ID. The DCI codepoint ‘01’ triggers the resource set with ‘ZP-CSI-RS-ResourceSetId’ set to ‘1’, the DCI codepoint ‘10’ triggers the resource set with ‘ZP-CSI-RS-ResourceSetId’ set to ‘2’, and the DCI codepoint ‘11’ triggers the resource set with ‘ZP-CSI-RS-ResourceSetId’ set to ‘3’. Codepoint ‘00’ is reserved for not triggering aperiodic ZP CSI-RS. When receiving PDSCH scheduled by DCI format 1\_0 or PDSCHs with SPS activated by DCI format 1\_0, the Res corresponding to configured resources in *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* or in *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* are available for PDSCH.  < Unchanged parts are omitted > | |

**Feature lead view**: The issue is valid and needs to be discussed.

***Proposal A-5****: Endorse the text proposal in R1-2xxxxxx for TS 38.214 Section 5.1.4.2.*

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| 5.1.4.2 PDSCH resource mapping with RE level granularity  < Unchanged parts are omitted >  The UE may be configured with a DCI field for triggering the aperiodic ZP CSI-RS. A list of *ZP-CSI-RS-ResourceSet(s)*, provided by higher layer parameter *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* in *PDSCH-Config*, is configured for aperiodic triggering. The maximum number of aperiodic *ZP-CSI-RS-ResourceSet(s)* configured per BWP is 3. The bit-length of DCI field *ZP CSI-RS trigger* depends on the number of aperiodic *ZP-CSI-RS-ResourceSet(s)*configured (up to 2 bits). Each non-zero codepoint of ‘*ZP CSI-RS’ trigger* in DCI format 1\_1 triggers one aperiodic ‘ZP-CSI-RS-ResourceSet’ in the list *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* by indicating the aperiodic ZP CSI-RS resource set ID. The DCI codepoint ‘01’ triggers the resource set with ‘ZP-CSI-RS-ResourceSetId’ set to ‘1’, the DCI codepoint ‘10’ triggers the resource set with ‘ZP-CSI-RS-ResourceSetId’ set to ‘2’, and the DCI codepoint ‘11’ triggers the resource set with ‘ZP-CSI-RS-ResourceSetId’ set to ‘3’. Codepoint ‘00’ is reserved for not triggering aperiodic ZP CSI-RS. When receiving PDSCH scheduled by DCI format 1\_0 or PDSCHs with SPS activated by DCI format 1\_0, the Res corresponding to configured resources in *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* or in *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* are available for PDSCH.  < Unchanged parts are omitted > |

**Please provide your views on the above proposal A-5.**

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| *Company* | *View* |
| CATT | We agree with the intention of the above TP.  A UE can be configured with *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* and *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* simultaneously. All the ZP CSI RS included in the two lists should be available for the PDSCH scheduled by DCI format 1\_0. Hence the ‘or’ in the above TP should be ‘and’. |
| ZTE | Agree with the TP. |
| HW/HiSi | Agree with the TP with the modification proposed by CATT. |
| Intel | Agree with the modification from CATT. Also, perhaps we can use this opportunity to fix “Res” to “REs” in the last sentence. |
| DOCOMO | Agree with the modification from CATT and also Intel’s suggestion for ‘Res.’ |
| Nokia, NSB | Agree with Intel & DOCOMO – i.e. the TP with the modification proposed by CATT (‘or’ 🡪 ‘and’) and the fix of ‘REs’ typo proposed by Intel. |
| Spreadtrum | Agree with Intel & DOCOMO. |
| Ericsson | Agree with the TP.  Regarding CATT comment, it is not necessary to change to ‘and’ in our view. TP with ‘or’ is OK for simultaneously configured case --- REs corresponding to either are available to PDSCH. Change to ‘and’ could incorrectly imply that both HAVE to be simultaneously configured. |
| vivo | Agree with the TP. We also have the same view with Ericsson. |
| Sharp | We also share the same view with Ericsson regarding the ‘or’.  Regarding the Res, I further check the TS38.214-g40 and “REs” other than “Res” is used in specification as below. It is my mistake when I made the TP. I apologize for my mistake.  -------------  The UE may be configured with a DCI field for triggering the aperiodic ZP-CSI-RS. A list of *ZP-CSI-RS-ResourceSet(s)*, provided by higher layer parameter *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* in*PDSCH-Config* , is configured for aperiodic triggering. The maximum number of aperiodic *ZP-CSI-RS-ResourceSet(s)* configured per BWP is 3. The bit-length of DCI field *ZP CSI-RS trigger* depends on the number of aperiodic *ZP-CSI-RS-ResourceSet(s)*configured (up to 2 bits). Each non-zero codepoint of *ZP CSI-RS trigger* in DCI format 1\_1 triggers one aperiodic *ZP-CSI-RS-*ResourceSet in the list *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* by indicating the aperiodic ZP CSI-RS resource set ID. The DCI codepoint '01' triggers the resource set with ZP-CSI-RS-ResourceSetIds = 1, the DCI codepoint '10' triggers the resource set with ZP-CSI-RS-ResourceSetIds = 2, and the DCI codepoint '11' triggers the resource set with ZP-CSI-RS-ResourceSetIds = 3. Codepoint '00' is reserved for not triggering aperiodic ZP CSI-RS. When receiving PDSCH scheduled by DCI format 1\_0 or PDSCHs with SPS activated by DCI format 1\_0, the REs corresponding to configured resources in *aperiodic-ZP-CSI-RS-ResourceSetsToAddModList* or in *aperiodicZP-CSI-RS-ResourceSetsToAddModListDCI-1-2* are available for PDSCH. |
| OPPO | Agree with TP and share view with Ericsson. |
| Qualcomm | Agree with the TP and share same view with Ericsson. |
| Samsung | Agree with the TP and with Ericsson’s comment. |
| Apple | Agree with Ericsson’s suggestion |

# References

1. R1-2101535 Correction on inconsistence between TS 38.213 and TS 38.331 in terms of the *dci-FormatsExt* for NR URLLC Sharp
2. [R1-2101177](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007703.zip) Remaining issues on PDCCH as PDSCH SLIV reference Samsung
3. [R1-2101262](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007732.zip) Corrections on PDCCH enhancements Huawei, HiSilicon
4. [R1-2100792](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007814.zip) Remaining issues of PDCCH enhancements for URLLC Spreadtrum Communications
5. [R1-2101536](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2101536.zip) Remaining issue on PDSCH rate matching for DCI format 1\_0 for NR URLLC Sharp