**3GPP TSG RAN WG1 Meeting #104b-e R1-21xxxxx**

**E-meeting, April 12 – April 20, 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.

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

* Issue A-1: Correction on RRC parameters for DMRS reception procedure for DCI format 1\_2
* Issue A-2: Correction on UE PDSCH processing time for DCI format 1\_2
* Issue A-3: Correction on the upper limit of the number of PDCCHs to receive for PDSCH and PUSCH for Rel-16 PDCCH monitoring capability
* Issue A-5: Corrections on parameter of MCS table set to qam256
* Issue A-7: Correction/clarification on new SLIV reference for Type 1 HARQ codebook
* (editorial/clarification): Correction on RRC parameter UE-NR-Capability-v16 for receiving control information
* Discussion/decision by April 15 and TP(s) by April 20

This document summarizes the above issue and provide some initial proposals for discussion. Companies are encouraged to provide the first round views by 04/14, 8:00am UTC, then we can adjust the proposals and/or prepare the TPs for the next step discussions.

# Issue A-1: Correction on RRC parameters for DMRS reception procedure for DCI format 1\_2

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| *ZTE R1-2102488* Issue #1: RRC parameter correction for DM-RS reception procedure In Section 5.1.6.2 in TS 38.214, the highlighted RRC parameter for DMRS configuration for DCI format 1\_2 is not aligned with that defined in TS 38.331, and should be corrected.   |  | | --- | | 5.1.6.2 DM-RS reception procedure  **<Unchanged parts are omitted>**  If a UE receiving PDSCH scheduled by DCI format 1\_2 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2* or *dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2* or a UE receiving PDSCH scheduled by DCI format 1\_0 or DCI format 1\_1 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA* or *dmrs-DownlinkForPDSCH-MappingTypeB*, the UE may assume that the following configurations are not occurring simultaneously for the received PDSCH:  - any DM-RS ports among 1004-1007 or 1006-1011 for DM-RS configurations type 1 and type 2, respectively are scheduled for the UE and the other UE(s) sharing the DM-RS REs on the same CDM group(s), and  - PT-RS is transmitted to the UE.  **<Unchanged parts are omitted>** |   Given the discussing UE behavior applies to all receiving PDSCH configured with *phaseTrackingRS* in *DMRS-DownlinkConfig,* the specification description could simply revised back to Rel-15 version. This also aligns with the corresponding description for PUSCH in Section 6.2.2.  Therefore, we propose the following text proposal for Issue#1:  ***Proposal 1:*** *Adopt Text Proposal #1 below for DM-RS reception procedure.*  **----------------------------------------**Text Proposal #1 for Section 5.1.6.2 in TS 38.214 g50**-------------------------------------**   |  | | --- | | 5.1.6.2 DM-RS reception procedure **<Unchanged parts are omitted>**  If a UE receiving PDSCH ~~scheduled by DCI format 1\_2~~ is configured with the higher layer parameter *phaseTrackingRS* in *DMRS-DownlinkConfig ~~dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2~~* ~~or~~ *~~dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2~~* ~~or a UE receiving PDSCH scheduled by DCI format 1\_0 or DCI format 1\_1 is configured with the higher layer parameter~~ *~~phaseTrackingRS~~* ~~in~~ *~~dmrs-DownlinkForPDSCH-MappingTypeA~~* ~~or~~ *~~dmrs-DownlinkForPDSCH-MappingTypeB~~*, the UE may assume that the following configurations are not occurring simultaneously for the received PDSCH:  - any DM-RS ports among 1004-1007 or 1006-1011 for DM-RS configurations type 1 and type 2, respectively are scheduled for the UE and the other UE(s) sharing the DM-RS REs on the same CDM group(s), and  - PT-RS is transmitted to the UE.  **<Unchanged parts are omitted>** | |

**Feature lead view**: The issue is valid and needs to be addressed. As to the potential TP, we need some further discussion on which option to choose:

**Option 1**:

- Change the RRC parameters “*dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2*” and “*dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2*” in section 5.1.6.2 in TS 38.214 to “*dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2*” and “*dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2*”, respectively;

- Update section 6.2.2 in TS 38.214 to align with section 5.1.6.2 as below:

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If a UE transmitting PUSCH scheduled by DCI format 0\_2 is configured with the higher layer parameter *phaseTrackingRS* in *UplinkForPUSCH-MappingTypeA-DCI-0-2* or *dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2*, or a UE transmitting PUSCH scheduled by DCI format 0\_1 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB**~~DMRS-UplinkConfig~~*, the UE may assume that the following configurations are not occurring simultaneously for the transmitted PUSCH

- any DM-RS ports among 4-7 or 6-11 for DM-RS configurations type 1 and type 2, respectively are scheduled for the UE and PT-RS is transmitted from the UE.

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**Option 2**:

- Update section 5.1.6.2 to align with section 6.2.2 as below:

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If a UE receiving PDSCH ~~scheduled by DCI format 1\_2~~ is configured with the higher layer parameter *phaseTrackingRS* in *DMRS-DownlinkConfig ~~dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2~~* ~~or~~ *~~dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2~~* ~~or a UE receiving PDSCH scheduled by DCI format 1\_0 or DCI format 1\_1 is configured with the higher layer parameter~~ *~~phaseTrackingRS~~* ~~in~~ *~~dmrs-DownlinkForPDSCH-MappingTypeA~~* ~~or~~ *~~dmrs-DownlinkForPDSCH-MappingTypeB~~*, the UE may assume that the following configurations are not occurring simultaneously for the received PDSCH:

- any DM-RS ports among 1004-1007 or 1006-1011 for DM-RS configurations type 1 and type 2, respectively are scheduled for the UE and the other UE(s) sharing the DM-RS REs on the same CDM group(s), and

- PT-RS is transmitted to the UE.

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***Question A-1*: *Which option (i.e. option 1 or option 2 above) do you prefer for DMRS reception/transmission in case of DCI format 1\_2/0\_2?***

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| *Company* | *View* |
| Feature lead | The benefit of option 1 is to enable independent operation of DCI format 1\_1 and DCI format 1\_2, and independent operation of DCI format 0\_1 and DCI format 0\_2, which is aligned with the original motivation to set different RRC parameter for existing DCI formats and new DCI formats. |
| ZTE | Both options are fine, and we slightly prefer Option 2 for simplicity. Note that, at the beginning of 5.1.6.2 and 6.2.2, it already states that new RRC parameters are introduced for new DCI formats. 5.1.6.2 DM-RS reception procedure The DM-RS reception 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 *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* instead of *dmrs-DownlinkForPDSCH-MappingTypeA* and *dmrs-DownlinkForPDSCH-MappingTypeB*. 6.2.2 UE DM-RS transmission procedure The DM-RS transmission procedures for PUSCH scheduled by PDCCH with DCI format 0\_1 described in this clause equally apply to PUSCH scheduled by PDCCH with DCI format 0\_2, by applying the parameters of *dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2* and *dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2* instead of *dmrs-UplinkForPUSCH-MappingTypeA* and *dmrs-UplinkForPUSCH-MappingTypeB*. |
| Ericsson | We slightly prefer Option 1.  This section was discussed and TP in R1-2005065 was endorsed. The only issue is that the RRC parameter name was modified by RAN2. Thus the only change necessary is to apply the new RRC parameter names. |
| LG | We can live with either option. And we slightly prefer Option 2 for simplicity. According to ZTE’s comment, it could be duplicated description. |
| Sharp | We slightly prefer Option 1.  Regarding the proposed TP for session 6.2.2 in option 1, ‘*dmrs-’* is missed in the *UplinkForPUSCH-MappingTypeA-DCI-0-2*. |
| HW/HiSi | We support Option 1, as it is in-line with the original intention to set different RRC parameters for existing and new DCI formats |
| Samsung | Fine with Option 2. |
| Qualcomm | We are fine with Option 1. |
| Nokia | Prefer Option 1  Minor fix to the part of the PUSCH PTRS:  If a UE transmitting PUSCH scheduled by DCI format 0\_2 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2* or *dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2*, or a UE transmitting PUSCH scheduled by DCI format 0\_1 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB**~~DMRS-UplinkConfig~~*, the UE may assume that the following configurations are not occurring simultaneously for the transmitted PUSCH |
| Intel | We agree that either option could work, but considering current specs already in place, Option 1 is slightly preferred. |
| CATT | Agree with ZTE’s assessment. Prefer option 1. |
| Vivo | Both options are workable. We slightly support option 2 for simplicity of description. |
| DOCOMO | We slightly prefer Option 1.  Agree with Ericsson. Besides, it should be better to keep consistency with PT-RS, where independent parameters are described. |
| OPPO | Fine with both options and slightly prefer option 1 to align with the original intention. |

#### Summary of the status for issue A-1 based on first round email discussion

* **Option 1 (**with typo corrected**)**:
  + **Support:**  *Ericsson, LG, Sharp, Huawei, HiSilicon, Qualcomm, Nokia, Intel, CATT, NTT DCM, ZTE (fine), OPPO*
* **Option 2**:
  + **Support:**  *ZTE, LG, Samsung, Vivo*
* **Feature lead recommendation:** All companies agree that both options can work and each company has some slightly preference, therefore I would recommend to go with option 1 to follow the majority view.

## Second round discussion

***Proposal A-1****: Endorse the text proposal in R1-2xxxxxx for TS 38.214 Section 5.1.6.2 and Section 6.2.2.*

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| ---------------------------------Start of Text Proposal to TS 38.214 v16.5.0----------------------- 5.1.6.2 DM-RS reception procedure < Unchanged parts are omitted >  If a UE receiving PDSCH scheduled by DCI format 1\_2 is configured with the higher layer parameter *phaseTrackingRS* in *~~dmrs-DownlinkForPDSCH-MappingTypeA-ForDCI-Format1-2~~ dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* or *~~dmrs-DownlinkForPDSCH-MappingTypeB-ForDCI-Format1-2~~ dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* or a UE receiving PDSCH scheduled by DCI format 1\_0 or DCI format 1\_1 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-DownlinkForPDSCH-MappingTypeA* or *dmrs-DownlinkForPDSCH-MappingTypeB*, the UE may assume that the following configurations are not occurring simultaneously for the received PDSCH:  - any DM-RS ports among 1004-1007 or 1006-1011 for DM-RS configurations type 1 and type 2, respectively are scheduled for the UE and the other UE(s) sharing the DM-RS REs on the same CDM group(s), and  - PT-RS is transmitted to the UE.  < Unchanged parts are omitted > 6.2.2 UE DM-RS transmission procedure < Unchanged parts are omitted >  If a UE transmitting PUSCH scheduled by DCI format 0\_2 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-UplinkForPUSCH-MappingTypeA-DCI-0-2* or *dmrs-UplinkForPUSCH-MappingTypeB-DCI-0-2*, or a UE transmitting PUSCH scheduled by DCI format 0\_1 is configured with the higher layer parameter *phaseTrackingRS* in *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB**~~DMRS-UplinkConfig~~*, the UE may assume that the following configurations are not occurring simultaneously for the transmitted PUSCH  - any DM-RS ports among 4-7 or 6-11 for DM-RS configurations type 1 and type 2, respectively are scheduled for the UE and PT-RS is transmitted from the UE.  < Unchanged parts are omitted >  --------------------------------- End of Text Proposal to TS 38.214 v16.5.0----------------------- |

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| *Company* | *View* |
| Intel | Fine with the proposal. |
| Qualcomm | Fine with the proposal. |
| Nokia, NSB | Fine with the proposal. |
| CATT | Fine with the proposal. |
| ZTE | Though we see some redundancy for Option 1, we are also fine if it is majority view. |
| DOCOMO | Fine with the proposal. |
| Ericsson | Support |
| Vivo | We are fine with the proposal. |
| LG | Support |

#### Summary of the status for issue A-1 based on second round email discussion

* **Support:**  *Intel, Qualcomm, Nokia, NSB, CATT, ZTE, NTT DOCOMO, Ericsson, Vivo, LG*
* **Feature lead recommendation:** The proposal is agreeable.

# Issue A-2: Correction on UE PDSCH processing time for DCI format 1\_2

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| *ZTE R1-2102488* Issue #2: UE PDSCH processing time In Rel-15, PDSCH processing time for PDSCH processing capability 1 and capability 2 depends on whether additional DMRS is configured. However, new DMRS parameters *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* are introduced for DCI format 1\_2 in Rel-16, and it hasn’t been reflected in current Rel-16 specification.  Note that, the legacy RRC parameter *dmrs-DownlinkForPDSCH-MappingTypeA and dmrs-DownlinkForPDSCH-MappingType* only apply to DCI format 1\_1. For DCI format 1\_0, our understanding is that UE will always use PDSCH processing capability 1 with a longer processing time (right column in Table 5.3-1) since *dmrs-AdditionalPosition* = 'pos2' is assumed for PDSCH scheduled by DCI format 1\_0.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Table 5.3-1: PDSCH processing time for PDSCH processing capability 1**   |  |  |  | | --- | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB* | *dmrs-AdditionalPosition* ≠ 'pos0' in  *DMRS-DownlinkConfig* in either of  *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB*  *or if the higher layer parameter is not configured* | | 0 | 8 | *N1,0* | | 1 | 10 | 13 | | 2 | 17 | 20 | | 3 | 20 | 24 |   Table 5.3-2: PDSCH processing time for PDSCH processing capability 2   |  |  | | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB* | | 0 | 3 | | 1 | 4.5 | | 2 | 9 for frequency range 1 | |   For PDSCH processing capability 1, there could be two options to include the new introduced RRC parameters for DCI format 1\_2.   * Option 1: The PDSCH processing time is independent from DCI formats. That is, only when *dmrs-AdditionalPosition* = 'pos0' is configured in *DMRS-DownlinkConfig* in all of *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB, dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2,* the PDSCH decoding time *N1* follows the shorter processing time (left column in Table 5.3-1). Otherwise it follows the longer processing time for PDSCH processing capability 1 (right column in Table 5.3-1). This would cause a larger processing time even when a PDSCH is scheduled without additional DMRS for PDSCH processing capability 1. * Option 2: The PDSCH processing time is defined per DCI format. In other words, the PDSCH processing time can be different for PDSCH scheduled by DCI format DCI 1\_1 and DCI format 1\_2. This is more flexible while it requires UE can dynamically change the UE PDSCH processing time for different PDSCHs scheduled by different DCI formats. It seems not a big issue since the processing time for PDSCH scheduled by DCI format 1\_0 may also different from the PDSCH scheduled by DCI format 1\_1 in legacy Rel-15.   For PDSCH processing capability 2, Option 2 seems the only feasible option. Because a UE may be only configured with DCI format DCI 1\_1/0\_1 or only DCI format 1\_2/0\_2. In such case, only the DMRS configuration associated with the configured DCI format matters. Option 1 would make the processing time dependent on all DMRS configurations from both two non-fallback DCI formats even when only one non-fallback DCI format is configured.  Based on above analysis, the following Text proposal #2 is proposed.  ***Proposal 2:*** *Adopt Text Proposal #2 below for UE PDSCH processing procedure time.*  **----------------------------------------**Text Proposal #3 for Section 5.3 in TS 38.214 g50**------------------------------------**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 5.3 UE PDSCH processing procedure time  **<Unchanged parts are omitted>**  Table 5.3-1: PDSCH processing time for PDSCH processing capability 1   |  |  |  | | --- | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2, dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2* | *dmrs-AdditionalPosition* ≠ 'pos0' in  *DMRS-DownlinkConfig* in either of  *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or in either of dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2, dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2,*  *or if the higher layer parameter is not configured* | | 0 | 8 | *N1,0* | | 1 | 10 | 13 | | 2 | 17 | 20 | | 3 | 20 | 24 |   Table 5.3-2: PDSCH processing time for PDSCH processing capability 2   |  |  | | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2, dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2* | | 0 | 3 | | 1 | 4.5 | | 2 | 9 for frequency range 1 | | |

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

***Proposal A-2****: Endorse the text proposal in R1-2xxxxxx for TS 38.214 Section 5.3.*

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| 5.3 UE PDSCH processing procedure time  **<Unchanged parts are omitted>**  Table 5.3-1: PDSCH processing time for PDSCH processing capability 1   |  |  |  | | --- | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*~~,~~ and *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2* | *dmrs-AdditionalPosition* ≠ 'pos0' in  *DMRS-DownlinkConfig* in either of  *dmrs-DownlinkForPDSCH-MappingTypeA*~~,~~ and *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or in either of dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2,*  *or if the higher layer parameter is not configured* | | 0 | 8 | *N1,0* | | 1 | 10 | 13 | | 2 | 17 | 20 | | 3 | 20 | 24 |   Table 5.3-2: PDSCH processing time for PDSCH processing capability 2   |  |  | | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2* | | 0 | 3 | | 1 | 4.5 | | 2 | 9 for frequency range 1 | |

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| *Company* | *View* |
| ZTE | Support the proposed TP. |
| Ericsson | Fine with the TP |
| LG | We are fine with the TP. |
| Sharp | We support the TP. |
| HW/HiSi | Fine with the TP. |
| Samsung | Support the TP. |
| Qualcomm | We are not sure what “or” means. As an example, for capability #2, what is the UE assumption if pos = 0 for DCI FMT 1\_1, but not for 1\_2? As another question, what is the reason to not have a single behavior for different DCI formats? |
| Nokia, NSB | Support the TP |
| Intel | We do not support the TP.  As indicated by Qualcomm, this implies that the UE is expected to follow different processing timelines depending on DCI formats. This would be an issue in terms of impacting pipelining operations for UE implementation whenever a PDSCH following a slower timeline is followed by a PDSCH following a faster timeline. To avoid this, it was specified in Rel-15 that the assumption on Additional DMRS presence follows RRC configuration, regardless of actual presence of additional DMRS in a PDSCH (which depends on length of the PDSCH).  On the other hand, we acknowledge that this problem may already exist between DCI format 1\_0 and 1\_1/1\_2 since for PDSCH scheduled by DCI format 1\_0, the UE always assumes additional DMRS per ‘pos2’. While the mismatch between the two columns of Table 5.3-1 (Cap #1 front-loaded vs. additional DMRS) can be left up to gNB to address (e.g., there are several other cases wherein additional margin is added to the minmimum UE processing times resulting in dynamic changes, and these are expected to be handled by gNB to avoid impact to UE pipelining. This is because the difference is within 3-4 symbols.  However, if Cap #2 is configured in a serving cell, then the issue is much more critical as the gap between Cap #1 w/ additional DMRS and Cap #2 processing times are significant (more than 10 symbols of difference in processing times), and needs to be addressed. This is perhaps a topic for Rel-15 maintenance and beyond the scope of the current discussion.  Thus, for the discussion at hand, we propose to consider both DCI formats 1\_1 and 1\_2 together in both Cap #1 and Cap #2 tables (i.e., instead of “or” it should be an “and” for the ‘pos0’ column in Table 5.3-1 and Table 5.3-2, and to something like this: “dmrs-AdditionalPosition ≠ 'pos0' in DMRS-DownlinkConfig in either of dmrs-DownlinkForPDSCH-MappingTypeA dmrs-DownlinkForPDSCH-MappingTypeB, dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2, or dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2, or if the higher layer parameter is not configured” for the right-side column (“additional DMRS column”) in Table 5.3-1.”  Then, we should address the issue regarding DCI format 1\_0 as part of regular maintenance at the next meeting. |
| CATT | We are fine with the TP. As mentioned by ZTE, PDSCHs scheduled by different DCI formats have different processing time already exists in Rel-15. It should be OK to follow the same logic to handle the case for DCI format 1-2. |
| *vivo* | Agree with the TP. |
| *DOCOMO* | Support the TP |
| *OPPO* | Share the same view as Qualcomm and Intel and support modification from Intel. |

#### Summary of the status for proposal A-2 based on first round email discussion

* **Support:**  *ZTE, Ericsson, LG, Sharp, Huawei, HiSilicon, Samsung, Nokia, CATT, Vivo, NTT DCM*
* **Not support:** *Qualcomm, Intel, OPPO*
  + ***Qualcomm:*** *What does “or” mean? For capability #2, if pos=0 for DCI format 1\_1 but not for DCI format 1\_2, what the UE behaviour is? Why not to apply the same UE behaviour for different DCI formats?*
  + ***Feature lead:*** *“Or” means that the processing capability is determined according to the corresponding DCI formats, i.e. the processing capability for PDSCH scheduled by DCI format 1\_1 will only be determined by the configuration for DCI 1\_1, while the processing capability for PDSCH scheduled by DCI format 1\_2 will only be determined by the configuration for DCI 1\_2. For example, if pos=0 for DCI format 1\_1 but not for DCI format 1\_2, then the processing capability for PDSCHs scheduled by DCI format 1\_1 and DCI format 1\_2 are different.*
  + ***Intel:*** *Different processing timelines for different DCI formats would have impact on pipelining operations.*
  + ***Feature lead:*** *Understand your point. But as many companies mentioned, since anyway different processing timelines for different DCI formats already exist in Rel-15, it should be ok to support here also. In addition, not sure if we can change Rel-15 behavior since it may have NBC issue.*
* ***Feature lead recommendation:*** *Recommend to take proposal A-2 with some minor editorial change from me. Of course since UE processing timeline is always a very serious topic, so if companies would like to leave enough time to check we can do that also.*

## Second round discussion

***Proposal A-2****: Endorse the text proposal in R1-2xxxxxx for TS 38.214 Section 5.3.*

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| 5.3 UE PDSCH processing procedure time  **<Unchanged parts are omitted>**  Table 5.3-1: PDSCH processing time for PDSCH processing capability 1   |  |  |  | | --- | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*~~,~~ and *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2* | *dmrs-AdditionalPosition* ≠ 'pos0' in  *DMRS-DownlinkConfig* in either of  *dmrs-DownlinkForPDSCH-MappingTypeA*~~,~~ and *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or in either of dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2,*  *or if the higher layer parameter is not configured* | | 0 | 8 | *N1,0* | | 1 | 10 | 13 | | 2 | 17 | 20 | | 3 | 20 | 24 |   Table 5.3-2: PDSCH processing time for PDSCH processing capability 2   |  |  | | --- | --- | |  | PDSCH decoding time *N1* [symbols] | | *dmrs-AdditionalPosition* = 'pos0' in  *DMRS-DownlinkConfig* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA*~~,~~ and *dmrs-DownlinkForPDSCH-MappingTypeB for DCI format 1\_1, or* in both of  *dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 for DCI format 1\_2* | | 0 | 3 | | 1 | 4.5 | | 2 | 9 for frequency range 1 | |

**Please comment if you have strong concern.**

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| *Company* | *View* |
| Feature lead | @ Qualcomm @ Intel  Please check my replies in the above section and see if it is ok for you. In addition, since UE processing timeline highly related to implementation, if people would like more time to check, please let me know also.  @ all  Please also double check the comments from Intel and can indicate if you would like to change your position. |
| Intel | Unfortunately, we cannot agree to this proposal.  It can be seen clearly that there is an issue here and we cannot accept just based on majority view.  As we explained before, while it may be left for gNB to address the gaps between left and right columns (front-loaded DMRS-only vs. front-loaded and additional DMRS) for Cap #1, for Cap #2, it simply does not work. It is true that this issue is applicable for Rel-15. However, that just means we need to address it for Rel-15 as well.  While we acknowledge that the current email discussion may not be the right forum for addressing Rel-15 maintenance, we would like to share our understanding on potential NBC changes for Rel-15 for appropriate context.  If there are concerns on NBC change, we would like to understand how any existing UE and NW implementations (that may be apparently affected by any NBC change) are currently handling the issue. Specifically,   * how a UE supporting Cap #2 operates in a cell when it may be scheduled with DCI format 1\_0 when Cap #2 is configured in the cell, in light of the fact that there is a difference in processing timelines of around 10+ symbols between a Cap #2-based N1 and a Cap#1-based N1 (latter w/ additional DMRS)? * Does the UE fallback to Cap #1 for PDSCH scheduled by DCI 1\_0 or can the UE somehow still process the PDSCH scheduled by DCI 1\_0 (and with additional DMRS) based on Cap #2?   + If it processes using Cap #1, then what happens to the processing pipeline for a scenario when there may not be sufficient gap between a “slow” and a “fast” PDSCH? (Note that we do not even support OOO HARQ-ACK that involves just storing of HARQ-ACK information in consideration of impact to overlapping processing timelines.)   Unless these are clarified, we are not sure Rel-15 can be claimed to work as intended and thus, perhaps Rel-15 may not be used as a reason to justify the current proposal.  It would indeed be understandable if companies may need time to check on this further. |
| Qualcomm | As we mentioned earlier too, we are not sure why a separate timeline per DCI format should be followed. Besides, based on the additional comments brought up by Intel too, it seems this topic requires more time and discussion. |
| MediaTek | We share the same view as Intel. More time will be needed to check this issue. |
| ZTE | We of course support our proposed TP, and it is not acceptable for us to make any NBC change to Rel-15. On the other hand, we are open to discuss different potential Rel-16 TPs for this issue, if some UE vendors have concerns on the processing timeline.  We’d like to first ask some clarifications from companies, especially UE vendors.   1. Except for the case elaborated by Intel (the case with Cap#1 for DCI 1\_0 and Cap#2 for DCI format 1\_1), there are also other similar cases in Rel-15. For instance, the difference of *d1,1* for PDSCH mapping type A scheduled by a single DCI format could be up to 5 OS according to the following texts. Would this would be a problem for UE? For a UE supporting Cap#1, the N1 difference could be up to 6 OS (left column vs right column in Table 5.3.1), then the timeline difference would be up to 5+6 =11 OS. Do you think we also need to change this case from Rel-15?   *‘For the PDSCH mapping type A as given in clause 7.4.1.1 of [4, TS 38.211]: if the last symbol of PDSCH is on the i-th symbol of the slot where i < 7, then d1,1 = 7 - i, otherwise d1,1 = 0’*   1. For the concerned case with a “slow” PDSCH followed by a “fast” PDSCH, if the corresponding HARQ-ACK to the ‘fast’ PDSCH is later than that of ‘slow’ PDSCH, i.e., no OOO HARQ-ACK, what’s main issue of UE implementation for processing the two PDSCHs? 2. Back to the TP, if we want to avoid such issues here, how should we change the specs for Cap#2 in Table 5.3.2? Should the capability depend on all the DMRS configurations from different DCI formats? What if a UE only configures DCI format 1\_1 while not format 1\_2, should the processing of a PDSCH scheduled by DCI format 1\_1 also depend on the DMRS configuration of DCI format 1\_2 even the format 1\_2 itself is not configured? |
| Samsung | We recognize the issues mentioned above – further consideration/checks are needed and would be better to revisit the proposal. |
| Ericsson | We acknowledge the issues raised, and are OK to discussion further |
| vivo | We are fine to further discuss the issue. |
| Spreadtrum | We are fine to discuss this issue next meeting. |
| OPPO | We are fine to discuss this issue next meeting. |
| LG | Based on comments above, we are also fine to discuss in the next meeting. |
| Apple | We are still doing internal checking, would like to study further. |

#### Summary of the status for proposal A-2 based on second round email discussion

* ***Feature lead:*** *Recommend to discuss next meeting.Many companies feel more time needed to think about this issue and figure out what we need to do. I think it is fair to leave people more time, since UE processing timeline is highly related to implementation we can treat it more carefully.*

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| Ericsson | For the Rel-15 fall-back DCI issue: this should be discussed under Rel-15 maintenance.  For the purpose of this agenda item, the following edits can resolve the issue:   1. For both Table 5.3-1 left column and Table 5.3-2: “***dmrs-AdditionalPosition* = 'pos0' in *DMRS-DownlinkConfig* in ~~both~~ all of *dmrs-DownlinkForPDSCH-MappingTypeA*, *dmrs-DownlinkForPDSCH-MappingTypeB, dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2,* and *dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2 if configured***” 2. For Table 5.3-1, right column: “***dmrs-AdditionalPosition* ≠ 'pos0' in *DMRS-DownlinkConfig* in any of *dmrs-DownlinkForPDSCH-MappingTypeA, dmrs-DownlinkForPDSCH-MappingTypeB, dmrs-DownlinkForPDSCH-MappingTypeA-DCI-1-2, dmrs-DownlinkForPDSCH-MappingTypeB-DCI-1-2* if configured, or if none of the higher layer parameters is configured**” |

# Issue A-3: Correction on the upper limit of the number of PDCCHs to receive for PDSCH and PUSCH for Rel-16 PDCCH monitoring capability

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| *Ericsson R1-2102742*  Rel-16 URLLC work on PDCCH monitoring introduced Rel-16 monitoring capability, in addition to the existing Rel-15 monitoring capability. This results in two new scenarios for PDCCH monitoring in Rel-16, as compared to Rel-15:   1. When all serving cells are monitored with Rel-16 monitoring capability. 2. Mixed Rel-15 monitoring and Rel-16 monitoring capability for the serving cells.   The new scenarios (a) and (b) apply to both CA and NR-DC. There is no explicit differentiation of (a) vs (b), since the PDCCH monitoring capability is indicated by RRC parameter *monitoringCapabilityConfig* **for each serving cell**, see Appendix. Thus, to differentiate (a) vs (b), the presence/absence, and value of *monitoringCapabilityConfig*, across all serving cells need to be considered.  For Rel-15 monitoring only case, the specification texts exist to provide the upper limit on the number of PDCCHs to receive for PDSCH and PUSCH, respectively. The only issue is the description of conditions for Rel-15 monitoring only. In our understanding, Rel-15 monitoring only means that for each serving cells either   1. *monitoringCapabilityConfig* is absent from *PDCCH-Config* of the cell, or 2. *monitoringCapabilityConfig* = *r15monitoringcapability.*   This condition should be described in the specification.   1. The condition for Rel-15 monitoring only should be specified.   Furthermore, when *monitoringCapabilityConfig* is configured, no upper limit is stipulated for the number of PDCCHs to receive for PDSCH and PUSCH, respectively. This results in an unlimited number of PDCCHs the UE should store across all carriers for CA and NR-DC. To ensure proper UE PDCCH reception implementation, similar limits as those in Rel-15 should be provided.   1. When *monitoringCapabilityConfig* is configured, upper limit on the number of PDCCHs to receive for PDSCH and PUSCH, respectively, should be specified.   Accordingly, the specification change is recommended below.   |  | | --- | | ---------------------------------Start of Text Proposal to TS 38.213 v16.5.0-----------------------  10.1 UE procedure for determining physical downlink control channel assignment  < Unchanged parts are omitted >  For a scheduled cell and at any time, a UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.  If a UE is not provided *monitoringCapabilityConfig* or if the UE is provided with *monitoringCapabilityConfig* = *r15monitoringcapability* for all serving cells, and  - is not configured for NR-DC operation and indicates through *pdcch-BlindDetectionCA* ~~or pdcch-MonitoringCA~~ a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  If a UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability* for all serving cells*,* and  - is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.  If a UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell while not all serving cells are provided with *monitoringCapabilityConfig* = *r16monitoringcapability*,and  - is not configured for NR-DC operation, and indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  --------------------------------- End of Text Proposal to TS 38.213 v16.5.0----------------------- | |

**Feature lead view**: The issue is valid and the TP from R1-2102742 can be taken as the starting point.

***Proposal A-3****: Endorse the text proposal in R1-2xxxxxx for TS 38.213 Section 10.1.*

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| ---------------------------------Start of Text Proposal to TS 38.213 v16.5.0-----------------------  10.1 UE procedure for determining physical downlink control channel assignment  < Unchanged parts are omitted >  For a scheduled cell and at any time, a UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.  If a UE is not provided *monitoringCapabilityConfig* or if the UE is provided with *monitoringCapabilityConfig* = *r15monitoringcapability* for all serving cells, and  - is not configured for NR-DC operation and indicates through *pdcch-BlindDetectionCA* ~~or pdcch-MonitoringCA~~ a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  If a UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability* for all serving cells*,* and  - is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.  If a UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell while not all serving cells are provided with *monitoringCapabilityConfig* = *r16monitoringcapability*,and  - is not configured for NR-DC operation, and indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  --------------------------------- End of Text Proposal to TS 38.213 v16.5.0----------------------- |

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| *Company* | *View* |
| ZTE | Agree with the intention of the TP. We suggest the following minor changes:   * If a UE is not provided *monitoringCapabilityConfig* or if the UE is provided with *monitoringCapabilityConfig* = *r15monitoringcapability* for all ~~serving~~ downlink cells, and * If a UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability* for all ~~serving~~ downlink cells*,* and * If a UE is provided with both *monitoringCapabilityConfig = r15monitoringcapability* and *monitoringCapabilityConfig = r16monitoringcapability* for downlink cells *~~monitoringCapabilityConfig~~* ~~=~~ *~~r16monitoringcapability~~* ~~for at least one serving cell while not all serving cells are provided with~~ *~~monitoringCapabilityConfig~~* ~~=~~ *~~r16monitoringcapability~~*,and |
| Ericsson | Support Proposal A-3.  (A) Regarding “serving cell” vs “downlink cell”: “serving cell” is consistent with existing text in 38.213. As an example, see below sentence from 38.213 that uses “serving cell”.  (B) We do not agree with ZTE change “both *monitoringCapabilityConfig = r15monitoringcapability* and *monitoringCapabilityConfig = r16monitoringcapability*”. The reason is, *monitoringCapabilityConfig* is an optional parameter. If not provided, the serving cell is monitored in Rel-15 manner, i.e., per slot. Thus “not all serving cells are provided with *monitoringCapabilityConfig* = *r16monitoringcapability*” includes both:   1. *monitoringCapabilityConfig* is not provided; or 2. *monitoringCapabilityConfig* is provided, and *monitoringCapabilityConfig* = *r15monitoringcapability.*   TS 38.213 V16.5.0, section 10:  “If the UE is not provided *monitoringCapabilityConfig*, the UE monitors PDCCH on the serving cell for a maximum number of PDCCH candidates and non-overlapping CCEs per slot.” |
| Sharp | We support the TP. Given *monitoringCapabilityConfig* is cell-specific, we propose a small clarification by adding ‘for any serving cell’ as below.  If a UE is not provided *monitoringCapabilityConfig* for any serving cell or if the UE is provided with *monitoringCapabilityConfig* = *r15monitoringcapability* for all serving cells, and |
| Hw/HiSi | We support the intention of the TP, but also have our own version of the detailed wording (see below).  Maybe we can first agree on the issue and then discuss the accurate TP in the next round?  For only Rel-15 monitoring   * If a UE is configured with downlink cells for which the UE is not provided *monitoringCapabilityConfig* and ~~if the UE~~ is provided with *monitoringCapabilityConfig* = *r15monitoringcapability* for all otherserving cells, and   For only rel-16 monitoring   * If a UE is only configured with downlink cells for which the UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability,* and   For mixed monitoring   * If a UE is configured with at least one, but not only with downlink cells for which the UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability*,and |
| Samsung | OK in principle with the TP to include the missing cases – the TP needs some revisions that can be discussed later. The main comment is on the following.  If a UE is provided with *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell while not all serving cells are provided with *monitoringCapabilityConfig* = *r16monitoringcapability*,and  …  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  It should be as follows to differentiate ‘R15’ cells and ‘R16’ cells – they should be considered separately, not jointly.  the UE expects to have respectively received  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling at most PDSCH receptions or PUSCH transmissions for which the UE has not received any corresponding PDSCH symbol or transmitted any corresponding PUSCH symbol, respectively, for serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling at most PDSCH receptions or PUSCH transmissions for which the UE has not received any corresponding PDSCH symbol or transmitted any corresponding PUSCH symbol, respectively, for serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability* |
| Qualcomm | We agree that the issue needs to be addressed. As seen above, there are many different TPs proposed. The suggest to discuss the exact TP as the next step. |
| Intel | Acknowledge the missing cases, and as commented by others, perhaps the detailed TP can be discussed in the next phase. As such, we tend to agree with Samsung that for the “mixed” case, the limits should be applied separately for R15 and Rl6. |
| CATT | Agree the TP in principle. Further modification may be needed to address companies’ comments. |
| *vivo* | Agree with the intention of the TP. The exact TP can be discussed in the next step. |
| DOCOMO | Agree with the intention of the TP. Exact TP can be discussed as the next step. |
| OPPO | Agree with the intention of the TP. Exact TP can be discussed as the next step. |

#### Summary of the status for proposal A-3 based on first round email discussion

* *All companies agree with the TP in principle just some editorial comments. Based on the comment I made some revision to the TP as shown in revised proposal A-3 in section 4.1.1. Some points for the revision as below:* 
  + *Regarding “serving cell” vs “downlink cell”, I think both are ok and indeed we have both the specification. In TS 38.331, for monitoringCapabilityConfig description “serving cell” is used, therefore probably we can use “serving cell” here.*
  + *Regarding whether to split Rel-15 and Rel-16 cells as commented by Aris, I think we can split. In addition, to align with Rel-15 description better, I also split DL and UL.*

## Second round discussion

***Revised proposal A-3****: Endorse the text proposal in R1-2xxxxxx for TS 38.213 Section 10.1.*

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| ---------------------------------Start of Text Proposal to TS 38.213 v16.5.0-----------------------  10.1 UE procedure for determining physical downlink control channel assignment  < Unchanged parts are omitted >  For a scheduled cell and at any time, a UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.  If a UE is not provided *monitoringCapabilityConfig* for any serving cell or if the UE is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for all serving cells, and  - is not configured for NR-DC operation and indicates through *pdcch-BlindDetectionCA* ~~or pdcch-MonitoringCA~~ a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for all serving cells*,* and  - is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell while not all serving cells are provided *monitoringCapabilityConfig* = *r16monitoringcapability*,and  - is not configured for NR-DC operation, and indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cell or uplink cell, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  --------------------------------- End of Text Proposal to TS 38.213 v16.5.0----------------------- |

**Please provide your views on the above revised proposal A-3.**

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| *Company* | *View* |
| Intel | We are fine with the updated TP. |
| Qualcomm | We are fine with the TP. |
| Nokia, NSB | We are fine with the TP. |
| CATT | We are fine with the TP. |
| ZTE | We are fine with the TP. |
| DOCOMO | We are fine with the TP. |
| Samsung | As pairs of sub-bullets (1-2, 3-4) are identical except for “PDSCH receptions” vs. “PUSCH transmissions”, we prefer to combine them to minimize repetitive text and keep 38.213 compact (minimize size increase).  >> Feature lead  Thank you Aris. I checked your previous recommendation in the first round discussion, my worry is that for people who don’t know the background may misunderstand as the total of PDCCHs for PDSCH and PUSCH. Although we have “respectively” in the bullet also, we have two “or” there also. Therefore I was thinking splitting the DL and UL as what we did in Rel-15 is safer. Probably it is just my feeling, if you still feel the version from you is better, of course I will follow the suggestion from you as the editor. ☺  Also, suggest the following revision  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell while not all serving cells are provided *monitoringCapabilityConfig* = *r16monitoringcapability*,and  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell and is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell,and  >> Feature lead  Ok, I will update accordingly. |
| Ericsson | We are fine with the editorial changes. But we can not agree to split out the cells with Rel-15 monitoring and Rel-16 monitoring.  We agree that it makes sense to describe slot-based Rel-15 monitoring and span-based Rel-16 monitoring separately, as captured in existing spec. But the PDCCH reception text has nothing to do with how the PDCCHs are monitored. It’s only about how many PDCCHs can be stored before the corresponding PDSCH and PUSCH arrive. Thus there is no difference between cells monitored in slot-based manner vs span-based manner.  It is unnecessarily restrictive to split out slot-based cells from span-based cells. For example, if there is one cell of slot-based, one cell of span-based, then at any time, UE can store up to 16\*2=32 PDCCH receptions across the two cells, and the capacity of 32 can be shared between the two cells in any manner. In contrast, if the limitation is applied separately, then slot-based cells can store up to 16 PDCCH receptions, span-based cell can store up to 16. This is too restrictive, and not necessary. Recall that in Rel-15 spec, the storage capacity is shared among all cells.  >> Feature lead  Thank you, Yufei. My understanding is that since PDCCH monitoring capability is always treated separately for Rel-15 cells and Rel-16 cells, e.g. PDCCH scaling, it seems more straightforward to treat separately for the number of PDCCHs also. But let’s hear more views from other companies before updating the proposal. |
| vivo | We are fine with the TP. In our understanding, the description on ’ PDCCHs’ and’ PDCCH’ is about the maximum PDCCH monitoring capability for Rel-15 cells and Rel-16 cells for a UE. |
| Spreadtrum | We are fine with the TP. |
| OPPO | Fine with TP generally.  However, the case that if a UE is provided monitoringCapabilityConfig = r15monitoringcapability for at least one serving cell while a UE is not provided monitoringCapabilityConfig for remaining serving cell(s) is missed. So we suggest to modify it as following (highlighted by yellow):  If a UE is not provided *monitoringCapabilityConfig* for any serving cell or if the UE is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for all serving cells, or if a UE is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for at least one serving cell while a UE is not provided *monitoringCapabilityConfig* for remaining serving cell(s).  >> Feature lead  Thanks. The comment is valid. I updated accordingly in a simpler way I feel. |
| LG | Fine with TP. |

#### Summary of the status for proposal A-3 based on second round email discussion

* ***Support****: Intel, Qualcomm, Nokia, NSB, CATT, ZTE, DOCOMO, Spreadtrum, Vivo, LG*
* ***Not support:*** *Samsung, Ericsson, OPPO*
* ***Feature lead:***
  + *Please find my reply to Samsung and Ericsson comments in the table in section 4.1*
  + ***OPPO*** *commented that one case as highlight in purple below is missing. I think the comment from OPPO is valid. However, it seems we can use “*If a UE is not provided*~~monitoringCapabilityConfig~~ monitoringCapabilityConfig* = *r16monitoringcapability* for any serving cell*” to present all the three cases, which I updated in the revised proposal.*

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If a UE is not provided *monitoringCapabilityConfig* for any serving cell, or if the UE is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for all serving cells, or if a UE is provided *monitoringCapabilityConfig* = *r15monitoringcapability* for at least one serving cell while a UE is not provided *monitoringCapabilityConfig* for remaining serving cell(s)

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## Third round discussion

Based on the discussion in section 4.1 in the second round discussion, I updated the TP **as highlight in purple**.

***Revised proposal A-3****: Endorse the text proposal in R1-2xxxxxx for TS 38.213 Section 10.1.*

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| --- |
| ---------------------------------Start of Text Proposal to TS 38.213 v16.5.0-----------------------  10.1 UE procedure for determining physical downlink control channel assignment  < Unchanged parts are omitted >  For a scheduled cell and at any time, a UE expects to have received at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PDSCH receptions for which the UE has not received any corresponding PDSCH symbol and at most 16 PDCCHs for DCI formats with CRC scrambled by C-RNTI, CS-RNTI, or MCS-C-RNTI scheduling 16 PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol.  If a UE is not provided*~~monitoringCapabilityConfig~~ monitoringCapabilityConfig* = *r16monitoringcapability* for any serving cell, and  - is not configured for NR-DC operation and indicates through *pdcch-BlindDetectionCA* ~~or pdcch-MonitoringCA~~ a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for all serving cells*,* and  - is not configured for NR-DC operation and indicates through *pdcch-MonitoringCA* a capability to monitor PDCCH candidates for downlink cells and the UE is configured with downlink cells or uplink cells, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received at most PDCCHs for  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all downlink cells  - DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all uplink cells.  If a UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell and is not provided *monitoringCapabilityConfig* = *r16monitoringcapability* for at least one serving cell,and  - is not configured for NR-DC operation, and indicates a capability to monitor PDCCH candidates for downlink cells and downlink cells, and the UE is configured with downlink cell or uplink cell, or  - is configured with NR-DC operation and for a cell group with downlink cells or uplink cells  the UE expects to have respectively received  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are not provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PDSCH receptions for which the UE has not received any corresponding PDSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  - at most PDCCHs for DCI formats with CRC scrambled by a C-RNTI, or a CS-RNTI, or a MCS-C-RNTI scheduling PUSCH transmissions for which the UE has not transmitted any corresponding PUSCH symbol over all serving cells that are provided *monitoringCapabilityConfig* = *r16monitoringcapability*  --------------------------------- End of Text Proposal to TS 38.213 v16.5.0----------------------- |

**Please provide your views on the above revised proposal A-3.**

|  |  |
| --- | --- |
| *Company* | *View* |
| Feature lead | The text proposal is updated according to the comments from Samsung, Ericsson and OPPO.  @ Aris @ Jing @ Yufei  Please check my reply to your comments in section 4.1 in the table.  @ all  **Please check Ericsson comments in section 4.1 in the table on whether to split out the cells with Rel-15 monitoring and Rel-16 monitoring. And provide your views on whether you support Ericsson’s idea to split it.** |
| Samsung | Support the updated proposal |
| Ericsson | We can accept the updated proposal.  We still don’t think the PDCCH reception capability have any dependency to Rel-15 vs Rel-16 PDCCH monitoring. We still think the updated proposal imposes unnecessary PDCCH scheduling flexibility. But we are OK to compromise for the sake of progress. |

# Issue A-4: Correction on RRC parameter UE-NR-Capability-v16 for receiving control information

|  |  |
| --- | --- |
| *Ericsson R1-2102742*  In TS 38.213 V16.5.0, two IEs are cited: *UE-NR-Capability* and *UE-NR-Capability-r16*. However, *UE-NR-Capability-r16* is not an IE in 38.331 V16.4.1. Instead, the *UE-NR-Capability* IE contains several extensions, e.g., UE-NR-Capability-v1610 and UE-NR-Capability-v1640. Thus, *UE-NR-Capability-r16* should be removed, and only *UE-NR-Capability* is used.  Remove *UE-NR-Capability-r16* and use *UE-NR-Capability* only in RAN1 specifications.  Accordingly, the specification change is recommended below.   |  | | --- | | ---------------------------------Start of Text Proposal to TS 38.213 v16.5.0-----------------------  10 UE procedure for receiving control information  < Unchanged parts are omitted >  …  If a UE indicates in *UE-NR-Capability~~-r16~~* a carrier aggregation capability larger than two downlink cells, the UE includes in *UE-NR-Capability~~-r16~~* an indication for a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs that the UE can monitor per span when the UE is configured for carrier aggregation operation over more than two downlink cells with *monitoringCapabilityConfig* = *r16monitoringcapability*. When a UE is not configured for NR-DC operation and the UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for all downlink cell where the UE monitors PDCCH, the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per span that corresponds to downlink cells, where  …  < Unchanged parts are omitted >  …  If a UE indicates in *UE-NR-Capability* a carrier aggregation capability larger than one downlink cell with *monitoringCapabilityConfig* = *r15monitoringcapability* or larger than one downlink cell with *monitoringCapabilityConfig* = *r16monitoringcapability*, the UE includes in *UE-NR-Capability~~-r16~~* an indication for a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs the UE can monitor for downlink cells with *monitoringCapabilityConfig* = *r15monitoringcapability* or for downlink cells with *monitoringCapabilityConfig* = *r16monitoringcapability* when the UE is configured for carrier aggregation operation over more than two downlink cells with at least one downlink cell with *monitoringCapabilityConfig* = *r15monitoringcapability* and at least one downlink cell with *monitoringCapabilityConfig* = *r16monitoringcapability*. When a UE is not configured for NR-DC operation, the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per slot or per span that corresponds to downlink cells or to downlink cells, respectively, where  …  < Unchanged parts are omitted >  --------------------------------- End of Text Proposal to TS 38.213 v16.5.0----------------------- | |

**Feature lead view**: The issue is valid and the TP from R1-2102742 can be taken as the starting point. It was recommended to provide to editor directly. Please check if there is any concern from u.

***Proposal A-4****: Provide the text proposal below to TS 38.213 editor.*

|  |
| --- |
| ---------------------------------Start of Text Proposal to TS 38.213 v16.5.0-----------------------  10 UE procedure for receiving control information  < Unchanged parts are omitted >  …  If a UE indicates in *UE-NR-Capability~~-r16~~* a carrier aggregation capability larger than two downlink cells, the UE includes in *UE-NR-Capability~~-r16~~* an indication for a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs that the UE can monitor per span when the UE is configured for carrier aggregation operation over more than two downlink cells with *monitoringCapabilityConfig* = *r16monitoringcapability*. When a UE is not configured for NR-DC operation and the UE is provided *monitoringCapabilityConfig* = *r16monitoringcapability* for all downlink cell where the UE monitors PDCCH, the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per span that corresponds to downlink cells, where  …  < Unchanged parts are omitted >  …  If a UE indicates in *UE-NR-Capability* a carrier aggregation capability larger than one downlink cell with *monitoringCapabilityConfig* = *r15monitoringcapability* or larger than one downlink cell with *monitoringCapabilityConfig* = *r16monitoringcapability*, the UE includes in *UE-NR-Capability~~-r16~~* an indication for a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs the UE can monitor for downlink cells with *monitoringCapabilityConfig* = *r15monitoringcapability* or for downlink cells with *monitoringCapabilityConfig* = *r16monitoringcapability* when the UE is configured for carrier aggregation operation over more than two downlink cells with at least one downlink cell with *monitoringCapabilityConfig* = *r15monitoringcapability* and at least one downlink cell with *monitoringCapabilityConfig* = *r16monitoringcapability*. When a UE is not configured for NR-DC operation, the UE determines a capability to monitor a maximum number of PDCCH candidates and a maximum number of non-overlapped CCEs per slot or per span that corresponds to downlink cells or to downlink cells, respectively, where  …  < Unchanged parts are omitted >  --------------------------------- End of Text Proposal to TS 38.213 v16.5.0----------------------- |

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| --- | --- |
| *Company* | *View* |
| ZTE | Fine to leave to editor. |
| Ericsson | Support Proposal A-4.  Since Younsun asked to include editorial issues in the email discussion, we understood that editorial issues like this are handled the same as other issues. In fact, proposals for A-1, A-2, A-4, A-5 are all editorial changes. |
| LG | Fine with the proposal. |
| Sharp | We are fine with the proposal. |
| HW/HiSi | This is a very minor correction and can be left to the editor. |
| Samsung | OK, editorial. |
| Qualcomm | Fine with the proposal. |
| Nokia, NSB | Fine to put this to editor CR |
| Intel | Fine with the proposal. |
| CATT | Fine with the proposal. |
| vivo | Fine with the proposal. |
| DOCOMO | Fine ith the proposal. |
| OPPO | Fine with the proposal |
| Ericsson | Support |

#### Summary of the status for proposal A-4 based on first round email discussion

* **Support:**  *ZTE, Ericsson, LG, Sharp, Huawei, HiSilicon, Samsung, Qualcomm, Nokia, NSB, Intel, CATT, Vivo, NTT DCM, OPPO*
  + ***Ericsson:*** *editorial issues like this are handled the same as other issues, e.g. proposals for A-1, A-2, A-4, A-5 are all editorial changes.*
  + ***Feature lead:*** *Usually for very simple editorial correction e.g. to correct the RRC parameter name following RAN2 spec can just directly go to editor. But if still some further discussion needed, e.g. issue A-1, then it cannot just go to editor, otherwise too much workload to editor.*
* ***Feature lead:*** *Proposal A-4 above is agreeable.*

# Issue A-5: Corrections on parameter of MCS table set to qam256

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| *Vivo R1-2102944*  In Rel-16 URLLC, DCI format 0-2 and 1-2 with the configurable fields are introduced. For DCI format 0-2 and 1-2, it can also be configured to use 256QAM with new RRC parameters. However, for some clauses, the new description on MCS table are missed, which leads to the lack of availability on the MCS table set to qam256.  For DCI format 1-2, it can be configured with 256QAM MCS table by parameter *mcs-TableDCI-1-2-r16, while for* DCI format 0-2, 256QAM MCS table can be configured by parameter *mcs-TableDCI-0-2-r16* or *mcs-TableTransformPrecoderDCI-0-2-r16.* In 38.212-5.4.2.1 section, these configurations are missed.   |  | | --- | | ---------------------------------Start of Text Proposal on TS 38.212 v16.5.0----------------------- 5.4.2.1 Bit selection <Unchanged parts are omitted>  - if the higher layer parameter *mcs-Table* or *mcs-TableDCI-1-2-r16* given by a *pdsch-Config* for at least one DL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for DL-SCH; otherwise a maximum modulation order  is assumed for DL-SCH;  - if the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* or *mcs-TableDCI-0-2-r16* or *mcs-TableTransformPrecoderDCI-0-2-r16* given by a *pusch-Config* or the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* given by a *configuredGrantConfig* for at least one UL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for UL-SCH; otherwise a maximum modulation order  is assumed for UL-SCH  ------------------------------------------End of Text Proposal ----------------------------------- |   ***Proposal 1: To correct the parameter of MCS table set to qam256 with the text proposal.*** |

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

***Proposal A-5****: Endorse the text proposal in R1-2xxxxxx for TS 38.212 Section 5.4.2.1.*

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| --- |
| ---------------------------------Start of Text Proposal on TS 38.212 v16.5.0----------------------- 5.4.2.1 Bit selection <Unchanged parts are omitted>  - if the higher layer parameter *mcs-Table* or *mcs-TableDCI-1-2* given by a *pdsch-Config* for at least one DL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for DL-SCH; otherwise a maximum modulation order  is assumed for DL-SCH;  - if the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* or *mcs-TableDCI-0-2* or *mcs-TableTransformPrecoderDCI-0-2* given by a *pusch-Config* or the higher layer parameter *mcs-Table* or *mcs-TableTransformPrecoder* given by *configuredGrantConfig* for at least one UL BWP of the serving cell is set to 'qam256', maximum modulation order  is assumed for UL-SCH; otherwise a maximum modulation order  is assumed for UL-SCH  ------------------------------------------End of Text Proposal ----------------------------------- |

|  |  |
| --- | --- |
| *Company* | *View* |
| ZTE | Fine with the TP. |
| Ericsson | Fine with the TP |
| LG | Fine with the TP |
| Sharp | Fine with the TP. |
| HW/HiSi | Fine with the TP |
| Samsung | Fine with the TP |
| Qualcomm | Fine with the proposal. |
| Nokia, NSB | Agree with the TP |
| Intel | Fine with the proposal. |
| CATT | Fine with the proposal. |
| vivo | Fine with the TP. |
| DOCOMO | Fine with the TP. |
| OPPO | Fine with the TP. |
| Ericsson | Fine with the TP. |

#### Summary of the status for proposal A-5 based on first round email discussion

* **Support:**  *ZTE, Ericsson, LG, Sharp, Huawei, HiSilicon, Samsung, Qualcomm, Nokia, NSB, Intel, CATT, Vivo, NTT DCM , OPPO*
* ***Feature lead:*** *Proposal A-5 above is agreeable.*

# Issue A-7: Correction/clarification on new SLIV reference for Type 1 HARQ codebook

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| --- | --- | --- |
| *Samsung R1-2103215*  Using PDCCH as PDSCH SLIV reference can help reducing TDRA bits in DCI format 1\_2, this is an important feature introduced in Rel-16 URLLC WI. PDSCH repetition is another important feature for URLLC and it can help increase the reliability of PDSCH transmission. When both features are used in Type-1 HAR-ACK codebook, the candidate PDSCHs in a slot can be impacted by both PDCCH monitoring occasions and the number of PDSCH repetitions. A simple example is given in Figure 1.    **Figure 1**  In the TDRA table, there is only one entry, i.e., SLIV1. In slot 0, there are two PDCCH monitoring occasions. SLIV2 is an extended SLIV using PDCCH as reference. In slot 1, there is one PDCCH monitoring occasion. Without considering PDSCH repetition, SLIV1 is the only possible SLIV in slot 1. If UE is configured with PDSCH repetition, for example, *pdsch-AggregationFactor =* 2 configured in PDSCH-Config, in this case SLIV2 can be a valid SLIV in slot 1 as well. If *pdsch-AggregationFactor* is configured in PDSCH-Config, PDCCH monitoring occasions in slot n-*pdsch-AggregationFactor*+1 should be used for determining the candidate PDSCHs scheduled by DCI format 1\_2 in slot n.  In Rel-16 IIOT, multiple SPS configurations are introduced and this feature is essential for URLLC because it can help reduce the latency as well as PDCCH ignaling overhead. The number of PDSCH repetitions can also be configured in SPS-Config and there can be multiple SPS configurations with different values of *pdsch-AggregationFactor.* All the values of *pdsch-AggregationFactor* in all SPS-Config and PDSCH-Config should be considered for determining the candidate PDSCHs activated/scheduled by DCI format 1\_2.  Another impact is the periodicity of SPS PDSCH configuration. If PDSCH is determined using PDCCH as SLIV reference, the SPS PDSCH is determined using the PDCCH carrying the activating DCI as SLIV reference. The location of the activating DCI should also be taken into consideration when determining the candidate PDSCHs in Type-1 HARQ-ACK codebook.  In Rel-16 MIMO, dynamic indication of the number of PDSCH repetitions is introduced. If this feature is enabled using DCI format 1\_2, all the possible number of PDSCH repetitions should be considered when determining the candidate PDSCHs in Type-1 HARQ-ACK codebook.  Based on the above analysis, if UE is configured to use PDCCH as PDSCH SLIV reference and configured with Type-1 HARQ-ACK codebook, to ensure there are always HARQ-ACK bits for all possible PDSCH receptions following parameters need to be considered when determining the candidate PDSCHs in Type-1 HARQ-ACK codebook.   * the value of *pdsch-AggregationFactor* PDSCH-Config, * the values of *pdsch-AggregationFactor* in all SPS-Config * the values of periodicity of all the SPS PDSCH configurations * all the possible numbers of PDSCH repetitions that can be dynamic indicated by DCI format 1\_2   The size of Type-1 HARQ-ACK codebook would be increased if it is determined considering all the above parameters. An alternative solution is using slot boundary as PDSCH SLIV reference when UE is configured with Type-1 HARQ-ACK codebook. This solution is much easier compared with the former one.  ***Proposal: Slot boundary should be used as the reference of PDSCH SLIV if UE is configured with Type-1 HARQ-ACK codebook. The following 2 TPs should be adopted.***  TP #1   |  | | --- | | TS 38.214 5.1.2.1 Resource allocation in time domain When the UE is scheduled to receive PDSCH by a DCI, the *Time domain resource assignment* field value *m* of the DCI provides a row index *m* + 1 to an allocation table. The determination of the used resource allocation table is defined in Clause 5.1.2.1.1. The indexed row defines the slot offset *K0*, the start and length indicator *SLIV*, or directly the start symbol *S* and the allocation length *L*, and the PDSCH mapping type to be assumed in the PDSCH reception.  Given the parameter values of the indexed row:  - The slot allocated for the PDSCH is *Ks*, where , if UE is configured with ca-SlotOffset for at least one of the scheduled and scheduling cell, and *Ks* = , otherwise, and where *n* is the slot with the scheduling DCI, and *K0* is based on the numerology of PDSCH, and  and are the subcarrier spacing configurations for PDSCH and PDCCH, respectively, and  - and are the and the, respectively, which are determined by higher-layer configured ca-SlotOffset, for the cell receiving the PDCCH respectively, and are the and the, respectively, which are determined by higher-layer configured ca-SlotOffset for the cell receiving the PDSCH, as defined in clause 4.5 of [4, TS 38.211].  - The reference point *S0* for starting symbol *S* is defined as:  - if configured with *pdsch-HARQ-ACK-Codebook = dynamic* and configured with *referenceOfSLIVForDCI-Format1-2-r16*, and when receiving PDSCH scheduled by DCI format 1\_2 with CRC scrambled by C-RNTI, MCS-C-RNTI, CS-RNTI with *K0=0*, and PDSCH mapping Type B, the starting symbol *S* is relative to the starting symbol *S0* of the PDCCH monitoring occasion where DCI format 1\_2 is detected;  - otherwise, the starting symbol *S* is relative to the start of the slot using *S0=0.*  … |   TP #2   |  | | --- | | TS 38.213 9.1.2.1 Type-1 HARQ-ACK codebook in physical uplink control channel For a serving cell , an active DL BWP, and an active UL BWP, as described in Clause 12, the UE determines a set of occasions for candidate PDSCH receptions for which the UE can transmit corresponding HARQ-ACK information in a PUCCH in slot . If serving cell is deactivated, the UE uses as the active DL BWP for determining the set of occasions for candidate PDSCH receptions a DL BWP provided by *firstActiveDownlinkBWP-Id*. The determination is based:  a) on a set of slot timing values associated with the active UL BWP  a) If the UE is configured to monitor PDCCH for DCI format 1\_0 and is not configured to monitor PDCCH for either DCI format 1\_1 or DCI format 1\_2 on serving cell , is provided by the slot timing values {1, 2, 3, 4, 5, 6, 7, 8}  b) If the UE is configured to monitor PDCCH for DCI format 1\_1 and is not configured to monitor PDCCH for DCI format 1\_2 for serving cell , is provided by *dl-DataToUL-ACK*  c) If the UE is configured to monitor PDCCH for DCI format 1\_2 and is not configured to monitor PDCCH for DCI format 1\_1 for serving cell ,  is provided by *dl-DataToUL-ACK-ForDCIFormat1\_2*  d) If the UE is configured to monitor PDCCH for DCI format 1\_1 and DCI format 1\_2 for serving cell ,  is provided by the union of *dl-DataToUL-ACK* and *dl-DataToUL-ACK-ForDCIFormat1\_2*  b) on a set of row indexes of a table that is associated with the active DL BWP and defining respective sets of slot offsets , start and length indicators *SLIV*, and PDSCH mapping types for PDSCH reception as described in [6, TS 38.214], where the row indexes of the table are provided by the union of row indexes of time domain resource allocation tables for DCI formats the UE is configured to monitor PDCCH for serving cell  ~~a) if the UE is provided~~ *~~ReferenceofSLIV-ForDCIFormat1\_2~~*~~, for each row index with slot offset~~ ~~and PDSCH mapping Type B in a set of row indexes of a table for DCI format 1\_2 [6, TS 38.214], for each PDCCH monitoring occasion in a set of PDCCH monitoring occasions with different starting symbols within a slot where the UE monitors PDCCH for DCI format 1\_2 and with starting symbol , if for normal cyclic prefix and for extended cyclic prefix, add a new row index in the set of row indexes of the table by replacing the starting symbol of the row index by~~  … | |

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| *Huawei/Hisilicon R1-2103397*  In RAN1#104-e, the issue was raised whether the new SLIV reference (i.e. the starting symbol of the PDCCH monitoring occasion)can be applied to the Type-1 HARQ-ACK codebook. Due to lack of time, it was not discussed.  Based on the current specification text in 38.213, if the UE is configured with *referenceOfSLIVDCI-1-2*, then for each row index with *K0=*0and each PDCCH monitoring occasion with starting symbol , a new row index is added into the TDRA table.   |  | | --- | | *b) on a set of row indexes of a table that is associated with the active DL BWP and defining respective sets of slot offsets , start and length indicators SLIV, and PDSCH mapping types for PDSCH reception as described in [6, TS 38.214], where the row indexes of the table are provided by the union of row indexes of time domain resource allocation tables for DCI formats the UE is configured to monitor PDCCH for serving cell*  *a) if the UE is provided referenceOfSLIVDCI-1-2, for each row index with slot offset and PDSCH mapping Type B in a set of row indexes of a table for DCI format 1\_2 [6, TS 38.214], for each PDCCH monitoring occasion in a set of PDCCH monitoring occasions with different starting symbols within a slot where the UE monitors PDCCH for DCI format 1\_2 and with starting symbol , if for normal cyclic prefix and for extended cyclic prefix, add a new row index in the set of row indexes of the table by replacing the starting symbol of the row index by* |   Based on the discussion in RAN1#104-e, there are two different interpretations of the above descriptions among companies:   * **Interpretation 1:** The extended SLIV applies in every slot (i.e. even for the slot(s) with no PDCCH monitoring occasion with starting symbol ). Interpretation 1 ensures the same number of the set of row indexes of the TDRA tables for type-1 codebook construction for every slot. With this interpretation, there is no problem related to the Type 1 codebook size. * **Interpretation 2:** The extended SLIV is only applied to the slot(s) with PDCCH monitoring occasion with starting symbol . The candidate PDSCHs in a slot can be impacted by both PDCCH Mos and the number of PDSCH repetitions as illustrated in [2]. With this understanding, there is a problem with the Type-1 codebook size in case that PDSCH repetition is used and a TP is needed to resolve it.   In our understanding, the current specification reflects interpretation 1 above and it seems straightforward to take interpretation 1 also. In Rel-15, when different TDRA tables are configured for DCI format 1\_0 and DCI format 1\_1, the union of row indexes of all TDRA tables is applicable for all slots. With the same rules, the extended SLIVs based on the new SLIV reference should also be applicable for all slots regardless of whether there is PDCCH monitoring occasion with starting symbol existing in the slot or not. However, if people feel there is ambiguity for current spec, for simplicity probably we can make some conclusion in the chairman notes to further clarify.  ***Proposal: It is recommended to conclude that,***   * ***If a UE is provided referenceOfSLIVDCI-1-2,******R defined in section 9.1.2.1 of 38.213 is applicable for all slots, including the slot(s) with no PDCCH monitoring occasion with starting symbol .*** |

**Feature lead view**: It seems there is different understanding on the current specification and thus would be good to discuss and align the understanding. As to the proposal from Samsung, if companies feel the current specification reflect interpretation 2 below, then we can further discuss what solutions to take.

* **Interpretation 1:** The extended SLIV applies in every slot (i.e. even for the slot(s) with no PDCCH monitoring occasion with starting symbol ). Interpretation 1 ensures the same number of the set of row indexes of the TDRA tables for type-1 codebook construction for every slot.
  + *Note: With this interpretation, there is no problem related to the Type 1 codebook size and at most some conclusion can be provided for clarification.*
* **Interpretation 2:** The extended SLIV is only applied to the slot(s) with PDCCH monitoring occasion with starting symbol . The candidate PDSCHs in a slot can be impacted by both PDCCH Mos and the number of PDSCH repetitions as discussed in Samsung paper.
  + *Note: With this understanding, there is a problem with the Type-1 codebook size and further solutions need to be considered.*

***Question A-7*: *Which interpretation (i.e. interpretation 1 or interpretation 2 above) do you think the current specification reflect?***

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| *Company* | *View* |
| ZTE | Interpretation 1.  We agree with FL’s analysis above. Interpretation 1 aligns with the logic used in Rel-15. |
| Ericsson | We agree with the intention of Interpretation 1, i.e., extended SLIV is applied in every slot, and the same set of row indices of TDRA table is used in every slot for Type-1 HARQ-ACK codebook.  However, the existing spec needs to be modified to achieve this effect. In current spec, S0 refers to the starting symbols of the PDCCH monitoring occasions in the slot. Since the monitoring occasions can vary from slot to slot, the set of values for S0 can vary from slot to slot as well. See example below.    Thus, restrictions are needed to ensure that each slot has the same set of S0, see example below. The restriction can be achieved by adding this TP: “If the UE is provided *referenceOfSLIVDCI-1-2*, the gNB configures Type-1 HARQ-ACK codebook only if the starting symbols of PDCCH monitoring occasions are configured the same in all slots.” |
| LG | We think interpretation 1 is more aligned with our understanding. As contributions said, only interpretation 1 ensure static HARQ-ACK codebook size.  At the same time, it is also true that the codebook size becomes much bigger than our expectations since features from URLLC and MIMO are combined. Considering worst case of HARQ-ACK codebook when interpretation 1 is used, we are fine with Samsung’s proposal as well. |
| Sharp | Interpretation 1. A united Table should be applied to each slot as Rel-15 did. |
| HW/HiSi | Interpretation 1. |
| Samsung | Interpretation 2. |
| Qualcomm | Interpretation 1. |
| Intel | Interpretation 1, but some updates to current specs may be necessary. |
| CATT | Interpretation 1. The same SLIV should be applied across the slots on which PDSCH repetition occupies. |
| vivo | Interpretation 1. |
| DOCOMO | Interpretation 1. |
| OPPO | Interpretation 1. |

#### Summary of the status for issue A-7 based on first round email discussion

* **Interpretation 1**:
  + **Support:**  *ZTE, Ericsson, LG, Sharp, Huawei, HiSilicon, Qualcomm, Intel, CATT, NTT DCM, Vivo, OPPO*
  + **Ericsson:** The following restriction should be added to ensure that each slot has the same set of row indices, since it is possible that the monitoring occasions can vary from slot to slot.

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If the UE is provided *referenceOfSLIVDCI-1-2*, the gNB configures Type-1 HARQ-ACK codebook only if the starting symbols of PDCCH monitoring occasions are configured the same in all slots.

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* + **Feature lead:** For the restriction proposed by Ericsson above, more views are needed from other companies. It can be a simple way to ensure same set of row indices for all slots. Another way is to apply the union of all slots for R. However, I feel it is simpler to just directly adopt the restriction from Ericsson above.
* **Interpretation 2**:
  + **Support:**  *LG, Samsung,*
* **Feature lead recommendation**: Based on the situation here, I would like to recommend to conclude the following two points. As to whether any specification change needed, we can further discuss.
  + *If a UE is provided referenceOfSLIVDCI-1-2, R defined in section 9.1.2.1 of 38.213 is applicable for all slots, including the slot(s) with no PDCCH monitoring occasion with starting symbol .*
  + *If a UE is provided referenceOfSLIVDCI-1-2, the gNB configures Type-1 HARQ-ACK codebook only if the starting symbols of PDCCH monitoring occasions are configured the same in all slots.*

## Second round discussion

***Proposal A-7****: It is recommended to conclude that,*

* *If a UE is provided referenceOfSLIVDCI-1-2, R defined in section 9.1.2.1 of 38.213 is applicable for all slots, including the slot(s) with no PDCCH monitoring occasion with starting symbol .*
* *If a UE is provided referenceOfSLIVDCI-1-2, the gNB configures Type-1 HARQ-ACK codebook only if the starting symbols of PDCCH monitoring occasions are configured the same in all the slots with PDCCH monitoring occasion with starting symbol .*

**Please provide your views on the above Proposal A-7.**

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| *Company* | *View* |
| Intel | We can accept Proposal A-7 to be able to move on, although we feel the use-cases for using PDCCH as reference for PDSCH TDRA gets even more restrictive now. In this regard, we would also be open to the original proposal from Samsung to preclude the combination of this feature with Type 1 HARQ-ACK CB. |
| Qualcomm | We are fine with the proposal. We just would like to point out that with the second constraint, the first one is redundant.  >> Feature lead  Update a little bit to allow slots with no *PDCCH monitoring occasion with starting symbol .* |
| Nokia, NSB | We are fine/agree with the proposal. But as Intel pointed out, clearly with Type 1 CB using this feature may not be that useful in the end. |
| CATT | Not sure on the necessity to introduce the additional restriction on PDCCH monitoring occasion. The original proposal is better from our perspective. |
| ZTE | Fine with the proposal. |
| DOCOMO | Fine with the proposal, while we share similar concern as Nokia. |
| Samsung | First, we would like to clarify that the issue was not “Interpretation 1” vs. “Interpretation 2” for the construction of Type-1 codebook. The issue was that under the current Type-1 construction method when DCI 1\_2 is configured to a UE, the Rel-15 size problems of Type-1 are multiplied and Type-1 becomes even less usable.  Now, to mitigate that problem, another problem is introduced by having a restriction on how a gNB can configure PDCCH MOs in order to use Type-1. As a side note, the proposal also appears to be conflicting – the first sub-bullet considers the union of all slots while the second one restricts the applicable slots to have the same pattern for MOs (not sure if the intention is now to remove the first sub-bullet).  We prefer to revisit this issue in RAN1#105. |
| Ericsson | We are fine to resolve the issue following the spirit of the proposal.  Our understanding is similar as QC and Samsung. It’s sufficient to have second bullet only, i.e., all monitoring occasions are the same in all slots. Union over all slots = MO in one slot. In this sense, we do not see the point of adding *starting symbol* |
| vivo | We agree with the intention of proposal. We also think second bullet only is sufficient. |
| Spreadtrum | We are basically fine with Proposal A-7 as conclusion.  We think the first bullet is necessary, since there may be misunderstanding that this extended R only applies in the slots with PDCCH monitoring with starting symbol . However, there may be some cases that the period of SS sets associated with DCI 1\_2 is larger than 1 slot. Then in those slots without PDCCH monitoring for DCI 1\_2 SS sets, whether same extended R should be used is still not clear. That is why we want to keep the first bullet.  For second bullet, we agree that this is a restriction for gNB configuration. But considering if one search space sets are associated with DCI 1\_2, the slots with monitoring occasion always have same starting monitoring symbol. One SS sets may be the most typical configuration.  We also agree that this clarification greatly increase the Type 1 CB size, which reduce the possibility of type 1 HARQ-ACK CB for URLLC when *referenceOfSLIVDCI-1-2* is configured. |
| OPPO | We share view with QC and Samsung.  The second bullet is enough and it is not necessary to add “*starting symbol* ” |
| LG | We are basically fine with the proposal. But also share intel and Nokia’s view. |

#### Summary of the status for proposal A-7 based on second round email discussion

* ***Feature lead:*** *I do agree with some of the companies with these restrictions that the feature is not that useful. During the meeting people are always overloaded and no time to figure out whether any better or not. I think it is fair to leave more time for people to figure out whether any better way to solve this issue as commented by Samsung. If there is no objection, I would recommend to postpone the discussion to next meeting.*

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| Ericsson | We don’t understand why this issue should be postponed to next meeting. Majority companies are basically fine with the proposal. Comments were only to improve the description. |

# References

1. R1-2102488 Corrections on issues related to DMRS configuration for DCI format 1\_2 ZTE
2. [R1-2102742](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007703.zip) Maintenance of PDCCH for Rel-16 NR URLLC Ericsson
3. [R1-2102944](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007732.zip) Corrections on parameter of MCS table set to qam256 Vivo
4. [R1-2103082](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_103\Docs\R1-2007814.zip) Correction to VRB-to-PRB in DCI Format 1\_2 Apple
5. [R1-2103215](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_104\Docs\R1-2101536.zip) Maintanence on PDCCH as PDSCH SLIV reference Samsung
6. R1-2103397 Discussion on new SLIV reference for Type 1 HARQ codebook Huawei, HiSilicon