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

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| *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.*

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| ---------------------------------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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# 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 ----------------------------------- |

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# 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 signalling 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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# 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