**3GPP TSG RAN WG1 Meeting #107-e R1-21xxxxx**

**e-Meeting, November 11th – 19th, 2021**

**Agenda Item: 7.1**

**Source: Moderator (Huawei)**

**Title: Summary of [107-e-NR-7.1CRs-13]: Correction on PDCCH detection for common search space set in TS38.213**

**Document for: Discussion and Decision**

# Introduction

This document is created to collect company views on the proposed changes in [1].

# Background

In RAN1#94, it was agreed that a UE does not expect to process more than one DCI scrambled with a RNTI from any of SI-RNTI, P-RNTI, RA-RNTI, SFI-RNTI, INT-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI and TPC-SRS-RNTI in each of type0/0A/1/2/3 CSS per slot.

Agreements:

* Capture the following conclusion in 38.213 (with the clarification that “DCI” refers to “consistent DCI”)

*7) Processing no more than one DCI with each RNTI in each of Type 0 CSS, Type 0A CSS, Type 1 CSS, Type 2 CSS, Type 3 CSS excluding unicast DCI per slot*

The above agreement has been captured in TS38.213 as follows

If a UE is provided

- one or more search space sets by corresponding one or more of *searchSpaceZero, searchSpaceSIB1*, *searchSpaceOtherSystemInformation*, *pagingSearchSpace*, *ra-SearchSpace*, or a CSS set by *PDCCH-Config*, and

- a SI-RNTI, a P-RNTI, a RA-RNTI, a SFI-RNTI, an INT-RNTI, a TPC-PUSCH-RNTI, a TPC-PUCCH-RNTI, or a TPC-SRS-RNTI

then, for a RNTI from any of these RNTIs, the UE does not expect to process information from more than one DCI format with CRC scrambled with the RNTI per slot.

# Discussion

The intention of the RAN#94 agreement is to limit **the number of DCIs** instead of **the number of DCI formats** for each of the RNTIs per slot for a given UE. As a matter of fact, for SI-RNTI, P-RNTI and RA-RNTI in Type 0/0A/1/2 CSS set, only one DCI format (DCI format 1\_0) is allowed as specified in section 10.1 TS 38.213. Similarly, for Type 3 CSS, only one DCI format scrambled by each of the RNTIs (SFI-RNTI, INT-RNTI, TPC-PUSCH-RNTI, TPC-PUCCH-RNTI and TPC-SRS-RNTI) is allowed, e.g., DCI format 2\_0 scrambled by SFI-RNTI, DCI format 2\_1 scrambled by INT-RNTI, etc. Therefore, it is not even possible to transmit **more than one DCI format** with CRC scrambled with one of the RNTIsper slot to a given UE. From this perspective, even though the current wording is correct, it has not captured the intention of RAN1#94 agreement and there is nowhere else in the specification capture the agreement.

On the concerns there may be some other changes required to the other part of the TS 38.213 specification with similar wording with “one DCI format”, the moderator’s view is that it may be good to look at concrete examples. After checking several occurrences in TS38.213, the moderator has not found similar wordings that require a change. This of course does not prevent companies to further check and bring up proposals in further meetings if such modifications have been identified.

On the comment that “DCI format” is used to imply a single instance of DCI carried in a PDCCH in many other places in 38.213, it is not clear whether other companies share the same view and it will be good that the proponent can provide some detailed examples.

# Company views

**Q1: Do you agree that the intention of the RAN#94 agreement is to limit the number of DCIs instead of the number of DCI formats for each of the RNTIs per slot for a given UE? If not, why?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree or not** | **Comment** |
| Ericsson | Yes |  |
| Qualcomm | Yes |  |
| ZTE | Agree |  |
| DOCOMO | Yes |  |
| Intel | Yes |  |
| Samsung | Agree |  |

**Q2: Do you think that the RAN#94 agreement has been captured by the current specification? If yes, why?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree or not** | **Comment** |
| Ericsson | Yes | “UE does not expect to process information from more than one DCI format with CRC scrambled with the RNTI”  With current wording, it is clear that UE stop processing PDCCH information after it has detected one DCI format with the RNTI. So here the “one DCI format” is having the same effect with “one DCI” that explain clearly the UE behavior.  Another reason is in 38.213 the “DCI format” is used in many places which eventually means “DCI”, with that understanding, the wording for the case in this CR is fine and consistent with the other parts in 38.213. |
| Qualcomm | Not exactly | We agree with Ericsson that in 38.213, “DCI” and “DCI format” can be interchangeable depending on the context. For this case, this should be the only reasonable understanding. Otherwise, the spec text is redundant. But “DCI format” can be confusing to certain readers of the spec as strictly speaking “DCI format” means how data structure of the control information fields is defined instead of individual transmission of instance of the data structure. |
| ZTE | Yes | Although the current specification says “the UE does not expect to process information from more than one DCI format with CRC scrambled with the RNTI per slot”, as analyzed by the moderator and other companies, the current wording is correct since each RNTI can only be associated with one DCI format in this case. |
| DOCOMO | Yes | We agree with Ericsson that “one DCI format” here is having the same effect with “one DCI” with the current captured sentence. |
| Intel | Yes | Share the same views and reasons as explained by Ericsson.  A particular example of use of “DCI format” that refers to “DCI in a PDCCH” from 213 that was formulated after extensive discussions during Rel-15:  “*If a UE detects a DCI format with inconsistent information, the UE discards all the information in the DCI for*.” |
| Samsung | Yes | We think that the agreement has been correctly captured by the current specification for the following reasons.  First, “DCI” is not used in 38.213. Instead, all L1 DCI in NR is provided by DCI formats in 38.213. Also, “DCI formats” is used in order to identify the DCI format when needed.  Second, the text is according to the agreement – “for a RNTI … UE does not expect to process information for more than one DCI format with the RNTI”. The fact that the system operation will not result to having more than one DCI format with those RNTIs per slot is not relevant. If that was to be addressed, the whole statement could be removed as unnecessary. |

**Q3: Do you agree with the changes as proposed in [1]? If not, why?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree or not** | **Comment** |
| Ericsson | Disagree | As explained in Q2. |
| QC |  | We do not have a strong opinion whether the spec should be changed or not. |
| ZTE |  | We would prefer not to change the spec if most of companies agree that the agreements has been corrected captured in the current spec.  Somehow, we tend to agree with the previous comments “DCI format” is used to imply a single instance of DCI carried in a PDCCH in many other places in 38.213”, but maybe it is better if editor can clarify this from his perspective. |
| DOCOMO |  | We do not have a strong opinion whether proposed change is needed or not. Slightly we prefer to keep the current description. |
| Intel | Disagree | As explained in response to Q2. |
| Samsung | Disagree | As explained in Q2. |

**Q4: Have you identified similar changes required in other parts of TS 38.213?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or no** | **Comment** |
|  |  |  |
|  |  |  |
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|  |  |  |

# Conclusions

To be updated based on the discussion

# References

1. R1-2112404, Correction on PDCCH detection for common search space set in TS38.213, Huawei, HiSilicon

# Appendix: Proposed CR in R1-2110870

6.2.7 Data and control multiplexing

< Unchanged part is omitted >

If frequency hopping is configured for the PUSCH,

- denote as the OFDM symbol index of the first OFDM symbol after the first set of consecutive OFDM symbol(s) carrying DMRS in the first hop;

- denote  as the OFDM symbol index of the first OFDM symbol after the first set of consecutive OFDM symbol(s) carrying DMRS in the second hop.

- denote  as the OFDM symbol index of the first OFDM symbol that does not carry DMRS in the first hop;

- denote  as the OFDM symbol index of the first OFDM symbol that does not carry DMRS in the second hop;

- if HARQ-ACK is present for transmission on the PUSCH with UL-SCH, let

-  and ;

- if CSI is present for transmission on the PUSCH with UL-SCH, let

- ;

- ;

- ; and

- ;

- if only HARQ-ACK and CSI part 1 are present for transmission on the PUSCH without UL-SCH, let

- ;

- ;

- if the number of HARQ-ACK information bits is more than 2, ; otherwise,

- ;

- if HARQ-ACK, CSI part 1 and CSI part 2 are present for transmission on the PUSCH without UL-SCH, let

- ;

- ;

- if the number of HARQ-ACK information bits is more than 2, ; otherwise, 

- ;

-  if the number of HARQ-ACK information bits is no more than 2, and  otherwise; and

-  if the number of HARQ-ACK information bits is no more than 2, and  otherwise;

- if only CSI part 1 and CSI part 2 are present for transmission on the PUSCH without UL-SCH, let

- ;

- ;

- ; and

- ;

- let , and denote ,  as the number of OFDM symbols of the PUSCH in the first and second hop, respectively;

-  is the number of transmission layers of the PUSCH;

-  is the modulation order of the PUSCH;

- ;

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- .

< Unchanged part is omitted >