**3GPP TSG RAN WG1 Meeting #108-e R1-22xxxxx**

**E-meeting, February 21st – March 3rd, 2022**

**Source: Moderator (Qualcomm Incorporated)**

**Title:** **Summary of [108-e-NR-CRs-13]: Clarification on PDCCH monitoring for Case 1-2**

**Agenda Item:** **7.1**

**Document for:** **Discussion and Decision**

# **Introduction**

This document is the summary of email discussion regarding the proposal in [1].

[108-e-NR-CRs-13] Issue#15 Clarification on PDCCH monitoring for Case 1-2 – Fred (Qualcomm)

* Relevant tdoc: R1-2202113
* Check point on February 23

# **Background**

At the RAN1#91 meeting, following agreements have been made:

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| **Agreements:*** For information, the following cases are clarified:
	+ Case 1: PDCCH monitoring periodicity of 14 or more symbols
		- Case 1-1: PDCCH monitoring on up to three OFDM symbols at the beginning of a slot
		- Case 1-2: PDCCH monitoring on any span of up to 3 consecutive OFDM symbols of a slot
			* For a given UE, all search space configurations are within the same span of 3 consecutive OFDM symbols in the slot
	+ Case 2: PDCCH monitoring periodicity of less than 14 symbols
		- Note: this includes the PDCCH monitoring of up to three OFDM symbols at the beginning of a slot
 |

The Case 1-2 was intended to support DSS operations. In DSS, LTE-CRS is mapped on some symbols and these symbols are not available for NR-PDCCH monitoring. Therefore, Case 1-2 enables a UE to monitor PDCCH on a single span of three contiguous OFDM symbols that is not limited to the first three consecutive OFDM symbols in a slot. The corresponding UE capability, *pdcch-MonitoringSingleOccasion*, has been specified for SCS 15kHz in TS 38.306 as follows [1].

| ***pdcch-MonitoringSingleOccasion***Indicates whether the UE supports receiving PDCCH in a search space configured to be monitored within a single span of any three contiguous OFDM symbols in a slot with the capability of supporting at least 44 blind decodes in a slot for 15 kHz subcarrier spacing. | UE | No | No | FR1 only |
| --- | --- | --- | --- | --- |

# **Problem description**

[1] pointed out that *pdcch-MonitoringSingleOccasion* is beyond what is necessary.

* According to TS 38.213 Table 13-11, the first symbol index of a PDCCH monitoring occasion for Type-0 CSS set in FR1 is {0, 1, 2, or $N\_{symb}^{CORESET}$}, where $N\_{symb}^{CORESET}$ is the number of symbols for CORESET #0. Therefore, as long as the UE monitors Type-0 CSS set in this cell (i.e., PCell), there is no case where the UE is configured with PDCCH monitoring other than the first 6 OFDM symbols of a slot.
* In DSS scenarios, LTE-CRS is present on some OFDM symbols and these symbols are not available for NR-PDCCH.

Considering the above two aspects, desired feature for Case 1-2 in DSS scenario is, in reality, limited to the followings – up to the 4th OFDM symbol of a slot.

 

(a) LTE-CRS 2 ports (b) LTE-CRS 4 ports

Fig.1 Symbols available for NR-PDCCH monitoring on a DSS carrier

In order to meet the market demand for NR-PDCCH monitoring other than the first 3 OFDM symbols in a slot in DSS operation in Rel-16, [1] proposes to update the description of *pdcch-MonitoringSingleOccasion* in Rel-16 spec as follows. With the change, a UE can declare support of the feature if the UE implements, and is tested with, PDCCH monitoring occasion within the first four OFDM symbols in a slot.

| ***pdcch-MonitoringSingleOccasion***Indicates whether the UE supports receiving PDCCH in a search space configured to be monitored within a single span of any three contiguous OFDM symbols that are within the first four OFDM symbols in a slot with the capability of supporting at least 44 blind decodes in a slot for 15 kHz subcarrier spacing. | UE | No | No | FR1 only |
| --- | --- | --- | --- | --- |

# **Comments received during preparation phase**

During the preparation phase, following comments have been received for the proposal in [1]:

* The proposed change is NBC (ZTE)
* Spec is not broken and the change is not essential (Nokia, Intel)
* Case 1-2 is not limited to DSS use-case (Intel)
* Scheduling flexibility is restricted (Samsung)
* Case 1-2 can be configured on SCell, in which case Type-0 CSS set is not relevant (Huawei)

# **1st round discussion**

Q1: Do you agree that there is a need to support PDCCH monitoring with a single span of three contiguous OFDM symbols that is within the first four OFDM symbols in a slot for DSS on PCell in Rel-16?

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| --- | --- | --- |
| Company | Yes/No | Comment |
| DOCOMO | Yes |  |
| Intel | Yes | It is a valid use-case and is currently possible to be supported via more than one means. |
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Q2: Do you agree that the current description of *pdcch-MonitoringSingleOccasion* “single span of any three consecutive OFDM symbols in a slot” requires UE to support, and be tested with, various PDCCH monitoring occasions that are not within the first four OFDM symbols in a slot?

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comment |
| DOCOMO | Yes | “Any” three consecutive symbols in a slot needs to be tested from the current description. |
| Intel | Yes | Certainly, the UE is required to support as the capability is described; exact cases (whether all possible cases, etc.) to be tested is out of RAN1 scope.  |
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Q3: Do you agree that a capability signalling that can indicate support of PDCCH monitoring within a single span of any three contiguous OFDM symbols that is within the first four OFDM symbols in a slot for DSS on PCell is necessary in Rel-16?

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| --- | --- | --- |
| Company | Yes/No | Comment |
| DOCOMO |  | Not necessary from spec point of view as nothing is broken. On the other hand, we understand the monitoring flexibility may complicate the test, which would delay deployments of DSS. Therefore, we could be fine with the proposed change unless there is any real NBC issue. |
| Intel | No | As mentioned in response to Q1, such capabilities are already covered by existing capabilities in current specs. Whether there exists reason to introduce a new one should be a separate discussion, not part of maintenance (see our response to Q8).  |
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Q4: Do you see the need of PDCCH monitoring with single span of any three consecutive OFDM symbols in a slot on SCell? If so, please explain the use-case and benefit.

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| --- | --- | --- |
| Company | Yes/No | Comment |
| Intel | Yes, in general. | Up to gNB implementation and particular use-cases/deployments, e.g., if a UE reports the capability, it is up to the NW to decide to utilize it in appropriate ways. For instance, it is not clear why this use-case may not be feasible. We do not see the relevance of this question as it aims to retroactively impose restrictions on an existing feature on the basis of “lack of use-cases”. If we go this route, there can be lots of discussions to change features that may not have been implemented so far. |
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Q5: Do you see the need of PDCCH monitoring with single span of any three consecutive OFDM symbols in a slot for non-DSS scenarios on PCell? If so, please explain the use-case and benefit.

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| Company | Yes/No | Comment |
| Intel | Yes, in general. | Case 1-2 is more flexible than Case 1-1 and both have been specified since Rel-15. Having a capability that offers more scheduling flexibility than the baseline can be utilized to expand the possible use-cases in general to multiplex PDCCH with other DL/UL channels. For similar reasons, we do not tie use-cases to specifications. More importantly, to repeat our response to Q4, we do not see the relevance of this question as it aims to retroactively impose restrictions on an existing feature on the basis of “lack of use-cases”. If we go this route, there can be lots of discussions to start modifying/removing NR features that may not have been implemented so far.  |
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Q6: Do you agree that the description of *pdcch-MonitoringSingleOccasion* in Rel-16 spec should be updated to “Indicates whether the UE supports receiving PDCCH in a search space configured to be monitored within a single span of any three contiguous OFDM symbols that are within the first four OFDM symbols in a slot with the capability of supporting at least 44 blind decodes in a slot for 15 kHz subcarrier spacing.”?

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| Company | Yes/No | Comment |
| DOCOMO |  | **Could be fine with the proposed change unless there is any real NBC issue.**The original intention of this capability is to support Case 1-2 for DSS scenario and it should be the common understanding among the group. Although the proposed change will lead to scheduling restriction, we don’t think the restriction becomes problematic in actual deployments and contradicts to the original intention of the capability. Therefore, we could be fine with the proposed change unless there is any real NBC issue. If anything valid is brought up by other companies in Q7, we would prefer to have a different new UE capability as in Q8 or no change to the current spec. |
| Intel | No | While we do not deny the possible benefit of introducing a variant of *pdcch-MonitoringSingleOccasion* with additional constraints that can best cater to DSS use-cases, we do not agree to retroactively changing an existing feature since past two releases based on reasoning of use-cases or lack thereof when there is no technical issue with the current feature or specs.In this regard, we would be open to considering a new capability (cf. Q8) that should be discussed in context of DSS as a new feature and not as part of maintenance.  |
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Q7: Do you have a real NBC issue if the description of *pdcch-MonitoringSingleOccasion* is changed as in Q6? If so, please explain examples where the change causes NBC issue.

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| Company | Yes/No | Comment |
| Intel | Possibly  | Technically, it would be NBC if we change existing features at this stage if gNB is implemented for PDCCH case 1-2 following current specs, thus, expecting the UE to support current version. Whether or not it’s a “real NBC issue” cannot be conclusively determined in this forum. |
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Q8: If you see a real NBC issue, do you accept to introduce a new UE capability indicating support of PDCCH monitoring within a single span of any three contiguous OFDM symbols that are within the first four OFDM symbols in a slot in Rel-16?

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| Company | Yes/No | Comment |
| Intel |  | We can be open to introduction of a new UE capability to this effect. However, we do not think introducing new UE capabilities to better cater to certain use-cases is strictly in scope of maintenance since nothing is broken. Whether to introduce a new UE feature for Rel-16 DSS should more appropriately be discussed as part of DSS enhancements. |
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# **2nd round discussion**

# **Summary and conclusion**

# **Reference**

1. R1-2202113, Clarification on PDCCH monitoring for Case 1-2, Qualcomm Incorporated