**3GPP TSG RAN WG1 #110 R1-** **210xxxx**

**August 22nd – 26th, 2022**

**Agenda item:** 7.2.5

**Source:** Moderator (Qualcomm)

**Title:** Summary of Additional Patterns for Span-Based PDCCH

**Document for:** Discussion and Decision

# 1 Introduction

This document summarizes companies views on introducing new patterns for span-based PDCCH as proposed in [1].

In R16, three different patterns for span-based PDCCH were introduced: (2,2), (4,3) and (7,3). In [1], it is mentioned that supporting the (2,2) pattern, where the UE has to monitor PDCCH effectively on every DL symbol, is challenging. Further, supporting (4,3) or (7,3), where the UE has monitor PDCCH over multiple groups of 3 consecutive symbols, is challenging. To facilitate the implementation of this feature for URLLC applications, it is therefore proposed to adopt additional, less demanding, patterns; these patterns are (2,1), (4,1) and (7,1).

If introduced, the following changes to TS 38.213 are necessary:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **10       UE procedure for receiving control information****…**A UE can indicate a capability to monitor PDCCH according to one or more of the combinations  = (2,1), (2, 2), (4,1), (4, 3), (7,1) and (7, 3) per SCS configuration of  and . A span is a number of consecutive symbols in a slot where the UE is configured to monitor PDCCH. Each PDCCH monitoring occasion is within one span. If a UE monitors PDCCH on a cell according to combination , the UE supports PDCCH monitoring occasions in any symbol of a slot with minimum time separation of  symbols between the first symbol of two consecutive spans, including across slots. A span starts at a first symbol where a PDCCH monitoring occasion starts and ends at a last symbol where a PDCCH monitoring occasion ends, where the number of symbols of the span is up to .**…****10.1   UE procedure for determining physical downlink control channel assignment****…**A PDCCH candidate with index  for a search space set  using a set of CCEs in a CORESET  on the active DL BWP for serving cell  is not counted for monitoring if there is a PDCCH candidate with index  for a search space set , or if there is a PDCCH candidate with index  and , in the CORESET  on the active DL BWP for serving cell  using a same set of CCEs, the PDCCH candidates have identical scrambling, and the corresponding DCI formats for the PDCCH candidates have a same size; otherwise, the PDCCH candidate with index  is counted for monitoring.Table 10.1-2 provides the maximum number of monitored PDCCH candidates, , per slot for a UE in a DL BWP with SCS configuration  for operation with a single serving cell.**Table 10.1-2: Maximum number  of monitored PDCCH candidates per slot for a DL BWP with SCS configuration  for a single serving cell**

|  |  |
| --- | --- |
|  | **Maximum number of monitored PDCCH candidates per slot and per serving cell** |
| 0 | 44 |
| 1 | 36 |
| 2 | 22 |
| 3 | 20 |

 Table 10.1-2A provides the maximum number of monitored PDCCH candidates, , per span for a UE in a DL BWP with SCS configuration  for operation with a single serving cell.**Table 10.1-2A: Maximum number  of monitored PDCCH candidates in a span for combination (X, Y) for a DL BWP with SCS configuration  for a single serving cell**

|  |  |
| --- | --- |
|  | **Maximum number  of monitored PDCCH candidates per span for combination  and per serving cell** |
|  | (2,1), (2, 2) | (4,1), (4, 3) | (7,1), (7, 3) |
| 0 | 14 | 28 | 44 |
| 1 | 12 | 24 | 36 |

Table 10.1-3 provides the maximum number of non-overlapped CCEs, , for a DL BWP with SCS configuration  that a UE is expected to monitor corresponding PDCCH candidates per slot for operation with a single serving cell.CCEs for PDCCH candidates are non-overlapped if they correspond to-     different CORESET indexes, or-     different first symbols for the reception of the respective PDCCH candidates.**Table 10.1-3: Maximum number  of non-overlapped CCEs per slot for a DL BWP with SCS configuration  for a single serving cell**

|  |  |
| --- | --- |
|  | **Maximum number of non-overlapped CCEs per slot and per serving cell** |
| 0 | 56 |
| 1 | 56 |
| 2 | 48 |
| 3 | 32 |

 Table 10.1-3A provides the maximum number of non-overlapped CCEs, , for a DL BWP with SCS configuration  that a UE is expected to monitor corresponding PDCCH candidates per span for operation with a single serving cell.**Table 10.1-3A: Maximum number  of non-overlapped CCEs in a span for combination (X, Y) for a DL BWP with SCS configuration  for a single serving cell**

|  |  |
| --- | --- |
|  | **Maximum number  of non-overlapped CCEs per span for combination  and per serving cell** |
|  | (2,1), (2, 2) | (4,1), (4, 3) | (7,1), (7, 3) |
| 0 | 18 | 36 | 56 |
| 1 | 18 | 36 | 56 |

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Also, it is proposed to introduce a new FG, FG 11-2x, to include the new patterns. FG 11-2x is identical to FG 11-2 except that the old patterns are replaced by the new patterns. Further, it is proposed to add identical FGs as those that have FG 11-2 as prerequisite and replace FG 11-2 by FG 11-2x. These FGs are FG 11-2a, 11-2b, 11-2c, 11-2d, 11-2e, 11-2f and 11-2g. If any new pattern is introduced, the related capabilities can be discussed under the UE feature AI.

# 2 Proposals and Summary of Views

**Question #1:** Do you support the addition of new span patterns (2,1), (4,1) and (7,1) for R16 eURLLC PDCCH? If you support only a subset of these patterns or would like to support others instead, please add your preference in the comment section below.

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
|  |  |  |
|  |  |  |

# 3 Summary

TBD

# 4 References

**[1] R1-2207172, “*Maintenance for R16 eURLLC*,” Qualcomm**