**3GPP TSG RAN WG1 #110bis-e R1-22xxxxx**

**e-Meeting, October 10th – 19th, 2022**

**Source: Moderator (MediaTek)**

**Title: [110bis-e-NR-R15-05] Discussion on** **PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP**

**Agenda item: 7.1**

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

Introduction

In RAN1#110bis-e meeting, three CRs [1, 2, 3, MTK] are submitted to clarify the PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP in 38.213 for Rel-15/Rel-16/Rel-17 spec.

As guided by the Chairman, this contribution provides summary of the submitted contributions (Section 4), discussion points (Section 2), and possible RAN1 consensus during this meeting (Section 3, TBD).

[110bis-e-NR-R15-05] Discussion on PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP by Oct 14 – TBD (MediaTek)

[R1-2209512](file:///D:\\3GPP_meeting_related\\RAN1_110b-e_2022Oct\\Docs\\R1-2209512.zip) [R15] Draft CR on PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP MediaTek

[R1-2209513](file:///D:\3GPP_meeting_related\RAN1_110b-e_2022Oct\Docs\R1-2209513.zip) [R16] Draft CR on PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP MediaTek

[R1-2209514](file:///D:\3GPP_meeting_related\RAN1_110b-e_2022Oct\Docs\R1-2209514.zip) [R17] Draft CR on PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP MediaTek

Discussion points (phase 1 until 11-Oct)

The three submitted CRs [1, 2, 3, MTK] intend to clarify the PDCCH monitoring of Type1-PDCCH CSS set in a DL BWP for the **following paragraph in 38.213 10.1** [4]

* "If the UE has not been provided a Type3-PDCCH CSS set or a USS set and the UE has received a C-RNTI and has been provided a Type1-PDCCH CSS set, the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set."

The spec paragraph quoted above basically says that:

* Under the green highlighted scenario:
  + “UE has received a C-RNTI and has been provided a Type1-PDCCH CSS set”
* UE performs the blue highlighted behavior:
  + “UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set”
* when the yellow highlighted condition holds:
  + “If the UE has not been provided a Type3-PDCCH CSS set or a USS set”

At the same time, if the yellow highlighted condition does not hold, UE can choose NOT to perform the blue highlighted behavior for power saving.

It is mentioned in the submitted CRs [1, 2, 3, MTK] that there may be two revisions needed for the yellow highlighted condition: “If the UE has not been provided a Type3-PDCCH CSS set or a USS set”

1. The underlined “USS set” above should be only for DCI 0\_0/1\_0, since USS for DCI 0\_1/1\_1 would always be configured under BWP framework; otherwise, NW does not have the tool (DCI 0\_1/1\_1) to do BWP switch.
2. “If the UE has not been provided A or B” here seems intending to express “If the UE has not been provided A and not been provided B”. It is better to revise it to avoid the confusion of “or” versus “and”.

**Note**: In Rel-17 38.213 [5] 10.1 spec, the yellow highlighted condition becomes

* “If the UE has not been provided a Type3-PDCCH CSS set, or a **Type1A-PDCCH CSS set**, or a USS set”
  + - where “**Type1A-PDCCH CSS set**” (serving for small data transmission) is added to the text, but the sentence structure is the same as Rel-15/Rel-16

The following discussions points are devised for these two potential revisions.

**Discussion point 1:**

**For the yellow highlighted condition in 38.213 spec mentioned in the beginning of this section:**

* **“If the UE has not been provided a Type3-PDCCH CSS set or a USS set”**

**Contributions** **[1, 2, 3, MTK] mention that**

* **The** **underlined “USS set” above should be only for** **DCI 0\_0/1\_0, since USS for DCI 0\_1/1\_1 would always be configured under BWP framework; otherwise, NW does not have the tool (DCI 0\_1/1\_1) to do BWP switch.**

**Do you agree that the** **underlined “USS set” should be only for DCI 0\_0/1\_0?**

**If your answer is “No”, please assist to elaborate on how to address the concern from [1, 2, 3, MTK] about BWP switch in the comment.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| MTK | Yes |  |
| vivo | No | Firstly, we don’t know the relevance of BWP switching for UE monitoring type-1 CSS – in our view the UE monitors the CSS regardless of whether/how the BWP switching happens.  Secondly, DCI is not the only way for BWP switching – BWP switching can be done also by RRC.  Finally, the current spec is intended to define the UE behaviour during random access process, i.e., when a C-RNTI is provided (after contention resolution) but the RRC setup has not completed (no type-3 CSS or USS provided). Thus, unfortunately the changes/CRs seem to make it incorrect. |
| ZTE | Yes | We think the intention of the existing spec refers to DCI 0\_0/1\_0 since it clearly mentions DCI 0\_0/1\_0 in the last sentence as highlighted below.   * "If the UE has not been provided a Type3-PDCCH CSS set or a USS set and the UE has received a C-RNTI and has been provided a Type1-PDCCH CSS set, the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set."   However, we are not sure whether this is really related to BWP switching or not. We prefer to have separate discussion for this issue and for BWP switching. If the “USS set” refers for both DCI 0\_0/1\_0 and non-fallback DCI (e.g., DCI 1-1/0-1), then it basically means network has to configure a separate USS for C-RNTI with 0-0/1-0 instead of reusing type1 CSS since non-fallback DCI will typically be configured. |
| Huawei, HiSilicon | No | We share a similar view with vivo that the relevant specification text is to address the case during random access process, i.e., when a C-RNTI is provided but the RRC connection has not completed as discussed in section 2.5 of R1-1811820.  We are not sure why this is related to BWP switching. |
| Qualcomm |  | We understood MTK’s intention, but this is not the meaning of the current spec text which has been stable for very long. |
| Apple | No | This sentence was added in RAN1 95 meeting for initial access procedure as pointed out by vivo and Huawei. More importantly, the sentence was included since 2018 and followed by implementation. The bar to change spec should be super high. |
| Ericsson |  | We are OK with this. |
| Samsung | No | We do not think dynamic BWP switching is relevant here. |
| CATT | No | We share the views from other companies that dynamic BWP switching is not relevant here. |
| Spreadtrum | No | We echo the comments of vivo and Huawei. This part is only for the specific period that after the C-RNTI allocation but before the complete of RRC setup. So the USS not only for DCI 0\_0/1\_0, but also for DCI1\_1/0\_1, it is for all type of DCI formats. We do not see any problem for the text. |
| DOCOMO | No | We share the views from other companies that dynamic BWP switching is not relevant here. |
| Intel | No | Same view as vivo and others that dynamic BWP switching is not relevant here. More importantly, it is not clear why it should matter to the quoted spec text what the USS may carry, if configured. |
| Nokia, NSB |  | We understand the situation to be transitory and not relevant to BWP switching |
| MTK (moderator) | Summary for Discussion point 1 | A quick summary for companies’ stands below:   * Interpretation 1: The underlined “USS set” is only for DCI 0\_0/1\_0   + MTK, ZTE, Ericsson (3) * Interpretation 2: The underlined “USS set” is NOT only for DCI 0\_0/1\_0   + vivo, Huawei, HiSilicon, Qualcomm, Apple, Samsung, CATT, Spreadtrum, DOCOMO, Intel, Nokia, NSB (12)   It seems the majority view is Interpretation 2.  With interpretation 2, we would invite companies to take a look at ZTE’s comment copied below in brown:   * If the “USS set” refers for both DCI 0\_0/1\_0 and non-fallback DCI (e.g., DCI 1-1/0-1), then it basically means network has to configure a separate USS for C-RNTI with 0-0/1-0 instead of reusing type1 CSS since non-fallback DCI will typically be configured.   and check whether you have the same understanding as ZTE in Discussion point 1-2. |

**Discussion point 1-2:**

**Do you share the same understanding as ZTE in Discussion point 1 as quoted below?**

* **[ZTE] If the “USS set” refers for both DCI 0\_0/1\_0 and non-fallback DCI (e.g., DCI 1-1/0-1), then it basically means network has to configure a separate USS for C-RNTI with 0-0/1-0 instead of reusing type1 CSS since non-fallback DCI will typically be configured.**

**If your answer is No, please describe your understanding in the comment.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| MTK | Yes | That’s the reason we proposed the corresponding spec change in [1]~[3]. |
|  |  |  |
|  |  |  |

**Discussion point 2:**

**If your answer to Discussion point 1 is “yes”, is the following spec change fine to you**

* **Change “USS set” to “USS set for DCI format 0\_0 and DCI format 1\_0”**

**and** **from which release should this change apply?**

**If your answer to Discussion point 1 is “yes” but your answer to this question is “No”, please assist to elaborate on your preferred wording to clarify/change this spec sentence in the comment.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes/No** | **From Release** | **Comment** |
| MTK | Yes | R15 or R16 | This paragraph is originated from R15, so applying the change from R15 seems natural. However, considering R15 spec has been there for a long time, we can also accept to apply the change from R16. |
| ZTE | Yes | R15 or R16 | Similar view as MTK. |
| Qualcomm | No |  | We understood the intention. But the proposed CR is non-backward compatible. In the meanwhile, this can be properly handled by network if network wants to send UE specific data to the UE not by using Type1 CSS, e.g., by configuring DCI formats 0\_0/1\_0 scrambled by C-RNTI in USS or Type 3 CSS. |
| Ericsson |  |  | OK to consider Rel-16 change. |
| Samsung |  |  | The clarification “DCI format 0\_0 and DCI format 1\_0” is not needed. No other DCI formats with CRC scrambled by C-RNTI can be associated with the Type1-PDCCH CSS set. |
| Intel | No |  | The clarification is not necessary for the quoted spec text. |
| Nokia |  |  | The clarification is not necessary and doesn’t appear to change anything in the UE-gNB interface |
| MTK (moderator) | Summary for Discussion point 2 |  | A quick summary for companies’ stands below:   * Ok with the spec change:   + MTK, ZTE, Ericsson (3) * Not ok with the spec change:   + Qualcomm, Samsung, Nokia (3)   It seems the proposed spec change may not be agreeable.  At the same time, we would invite companies to take a look at Samsung’s comment copied below in brown:   * The clarification “DCI format 0\_0 and DCI format 1\_0” is not needed. No other DCI formats with CRC scrambled by C-RNTI can be associated with the Type1-PDCCH CSS set.   and check whether you have the same understanding as Samsung in Discussion point 2-2. |

**Discussion point 2-2:**

**Do you share the same understanding as Samsung in Discussion point 2 that the “USS set” in current spec mentioned in discussion point 1/2 refers to “DCI format 0\_0 and DCI format 1\_0” only as quoted below?**

* **[Samsung] The clarification** **“DCI format 0\_0 and DCI format 1\_0” is not needed. No other DCI formats with CRC scrambled by C-RNTI can be associated with the Type1-PDCCH CSS set.**

**If your answer is No, please describe your understanding in the comment.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| MTK | No | Current spec says:   * “If the UE has not been provided a Type3-PDCCH CSS set or a USS set …”   We do not see how the underlined “USS set” can be interpreted as only “DCI format 0\_0 and DCI format 1\_0” from current spec wording. “USS set” can be DCI formats 0\_0/1\_0, 0\_1/1\_1, or other DCI formats that can exist in a USS set. |
| ZTE | No | Similar view as MTK. |
|  |  |  |

**Discussion point 3:**

**For the yellow highlighted condition in 38.213 spec mentioned in the beginning of this section**

* **“****If the UE has not been provided a** **Type3-PDCCH CSS set or a** **USS set”**

**What’s your interpretation for this sentence?**

* **Interpretation 1:** **If** **the UE has not been provided a Type3-PDCCH CSS set and the UE has not been provided a USS set**
* **Interpretation 2: If the UE has not been provided a Type3-PDCCH CSS set or the UE has not been provided a USS set**

|  |  |  |
| --- | --- | --- |
| **Company** | **Interpretation 1 or 2** | **Comment** |
| MTK | 1 | Logically speaking, we tend to think the intention of this sentence is to regulate that UE must do the additional PDCCH monitoring of   * “DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set”   only when neither “Type3-PDCCH CSS set” nor “USS set” is provided. If any one of “Type3-PDCCH CSS set” or “USS set” is provided, NW can just use it to send PDCCH, and UE can choose not to do the additional PDCCH monitoring. Hence, our interpretation tends to be the first one. |
| Vivo | 1 | Our understanding is that “Not (A or B)” means “Not A and Not B”. |
| ZTE | 1 | similar view as vivo. |
| Huawei, HiSilicon | 1 |  |
| Qualcomm | 1 |  |
| Apple | 1 |  |
| Ericsson |  | We do not see need to discuss this. |
| Samsung | 1 |  |
| CATT | 1 |  |
| Spreadtrum | 1 |  |
| DOCOMO | 1 |  |
| Intel | 1 |  |
| Nokia, NSB | 1 | This should be obvious |
| MTK (moderator) | Summary for Discussion point 3 | A quick summary below:   * Interpretation 1:   + MTK, vivo, ZTE, Huawei, HiSilicon, Qualcomm, Apple, Samsung, CATT, Spreadtrum, DOCOMO, Intel, Nokia, NSB (14) * No opinion:   + Ericsson   It seems Interpretation 1 is common understanding. |

**Discussion point 4:**

**Continuing from Discussion point 3, regardless your interpretation is 1 or 2, is it fine for you to change the current spec sentence**

* + - **“If the UE has not been provided a Type3-PDCCH CSS set or a USS set”**

**into the corresponding interpretation sentence below**

* **Interpretation 1: If the UE has not been provided a Type3-PDCCH CSS set and the UE has not been provided a USS set**
* **Interpretation 2: If the UE has not been provided a Type3-PDCCH CSS set or the UE has not been provided a USS set**

**and from which release should this change apply?**

**If your answer is “No”, please assist to elaborate on your reasons.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes/No** | **From Release** | **Comment** |
| MTK | Yes | R15 or R16 | It is better to revise the sentence to avoid the confusion of “or” versus “and”. This paragraph is originated from R15, so applying the change from R15 seems natural. However, considering R15 spec has been there for a long time, we can also accept to apply the change from R16. |
| Vivo | No |  | In our view the current spec text is clear, and such kind of text “not … or …” is used in other places in 38.213. If this clarification is needed, other parts of the spec should be updated as well. |
| ZTE | No |  | Similar view as vivo. |
| Huawei, HiSilicon | No |  | We don’t see the need to make any changes to the current spec. In the same section, the following description mandates UE to monitor DCI format 0\_0 and 1\_0 scrambled by C-RNTI (when provided) in *raSeachSpace* regardless of whether Type-3 CSS or USS is provided or not. Hence, the UE behaviour seems clear even without the change  …  If a UE is provided  - one or more search space sets by corresponding one or more of *searchSpaceZero, searchSpaceSIB1*, *searchSpaceOtherSystemInformation*, *pagingSearchSpace*, *ra-SearchSpace*, and  - a C-RNTI, an MCS-C-RNTI, or a CS-RNTI  the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI, the MCS-C-RNTI, or the CS-RNTI in the one or more search space sets in a slot where the UE monitors PDCCH candidates for at least a DCI format 0\_0 or a DCI format 1\_0 with CRC scrambled by SI-RNTI, RA-RNTI, MsgB-RNTI, or P-RNTI. |
| Qualcomm | No |  | We share the same view as vivo’s |
| Apple | No |  |  |
| Ericsson |  |  | We do not see need for CR/conclusion for this part. |
| Samsung |  |  | OK as there is no NBC change – only capturing a common understanding that ‘and’ instead of ‘or’ is applicable.  Although “A or B” is used in 38.213, it is used to mean ‘A’ or ‘B’ or ‘A and B’ – here, only be ‘A and B’ is applicable; so OK to change ‘or’ to ‘and’. |
| CATT | No |  | We share the same view as vivo. |
| DOCOMO | No |  | We share the same view as vivo. |
| Intel | No |  | Same view as vivo. |
| Nokia, NSB | No |  | The wording optimization might have been useful back in 2018 before the specification was frozen. There is no disagreement or chance to mis-interpret the spec as it now stands, so even if a better wording may exist, that is not a justification to take the change. We had similar discussion on a somewhat more complicated sentence related to UE power control in RAN1#110 in R1-2206429 where the CR was rejected and the conclusion was that “The specification is already clear, and the CR is not needed.”. Same should apply here. |
| MTK (moderator) | Summary for Discussion point 4 |  | A quick summary below:   * Ok with the spec change:   + MTK, Samsung (2) * Not ok with the spec change:   + vivo, ZTE, Huawei, HiSilicon, Qualcomm, Apple, Ericsson, CATT, DOCOMO, Intel, Nokia, NSB (12)   It seems the spec change is not agreeable. Since companies have common understanding with interpretation 1 in Discussion point 3, moderator also sees no need to pursue the CR mentioned in Discussion point 4.  At the same time, we would invite companies to take a look at Huawei’s comment copied in Discussion point 4-2 for further discussion on interpretation for this spec paragraph. |

**Discussion point 4-2:**

**Do you share the same understanding as Huawei in Discussion point 4 that the following spec paragraph in 38.213 10.1**

* **"If the UE has not been provided a Type3-PDCCH CSS set or a USS set and the UE has received a C-RNTI and has been provided a Type1-PDCCH CSS set, the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set."**

**does not have impact on UE behavior since the following spec description in 38.213 10.1 mandates UE to monitor DCI format 0\_0 and 1\_0 scrambled by C-RNTI (when provided) in *raSeachSpace* regardless of whether Type-3 CSS or USS is provided or not**

* **“If a UE is provided**

**- one or more search space sets by corresponding one or more of *searchSpaceZero, searchSpaceSIB1*, *searchSpaceOtherSystemInformation*, *pagingSearchSpace*, *ra-SearchSpace*, and**

**- a C-RNTI, an MCS-C-RNTI, or a CS-RNTI**

**the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI, the MCS-C-RNTI, or the CS-RNTI in the one or more search space sets in a slot** **where the UE monitors PDCCH candidates for at least a DCI format 0\_0 or a DCI format 1\_0 with CRC scrambled by SI-RNTI, RA-RNTI, MsgB-RNTI, or P-RNTI.”**

**If your answer is No, please describe your understanding in the comment.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| MTK | No | The spec contents mentioned by Huawei holds under the condition (last sentence in the quoted spec above) that   * “where the UE monitors PDCCH candidates for at least a DCI format 0\_0 or a DCI format 1\_0 with CRC scrambled by SI-RNTI, RA-RNTI, MsgB-RNTI, or P-RNTI”   Hence, to our understanding, the following spec paragraph in 38.213 10.1 still impacts UE behavior   * "If the UE has not been provided a Type3-PDCCH CSS set or a USS set and the UE has received a C-RNTI and has been provided a Type1-PDCCH CSS set, the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set." |
| ZTE |  | If companies have the same understanding on the spec cited above, then it seems that companies have the same understanding on the UE behaviour, i.e., UE can receive DCI format 0-0/1-0 with C-RNTI in type-1 SS as long as both type-1 SS and C-RNTI are configured for the UE. If companies don’t think any spec change is needed, a conclusion to clarify this may be beneficial. |
|  |  |  |

Resulted RAN1 conclusion/agreement (phase 2)

TBD based on outcome/situation of phase 1 discussion.

Summary of contribution inputs

**Summary for [1, 2, 3, MTK]:**

In [1, 2, MTK], the proposed CR towards 38.213 10.1 is the same for Rel-15/Rel-16 as copied below:

##### 10.1 UE procedure for determining physical downlink control channel assignment

<Unchanged Text Omitted>

For a DL BWP, if a UE is not provided *ra-SearchSpace* for Type1-PDCCH CSS set, the UE does not monitor PDCCH for Type1-PDCCH CSS set on the DL BWP. If the UE has not been provided a Type3-PDCCH CSS set and the UE has not been provided a USS set for DCI format 0\_0 and DCI format 1\_0 and the UE has received a C-RNTI and has been provided a Type1-PDCCH CSS set, the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set.

<Unchanged Text Omitted>

where the reason for change is:

* In 38.213 V15.15.0/V16.11.0 Clause 10.1, it is mentioned that
  + “For a DL BWP, … If the UE has not been provided a Type3-PDCCH CSS set or a USS set … UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 … in the Type1-PDCCH CSS set.”

We think there are two revisions needed for this paragraph:

1. The underlined “USS set” above should be only for DCI 0\_0/1\_0, since USS for DCI 0\_1/1\_1 would always be configured under BWP framework; otherwise, NW does not have the tool (DCI 0\_1/1\_1) to do BWP switch.
2. “If the UE has not been provided A or B” here intends to express “If the UE has not been provided A and not been provided B”. It is better to revise it to avoid the confusion of “or” versus “and”.

and the summary for change is:

1. Change “USS set” to “USS set for DCI format 0\_0 and DCI format 1\_0”.
2. Change “If the UE has not been provided A or B” to “If the UE has not been provided A and not been provided B”.

In [3, MTK], the proposed CR towards 38.213 10.1 for Rel-17 [5] is basically the same as Rel-15/Rel-16, with a small difference that an additional Type1A-PDCCH CSS set (which serves for small data transmission) exists in the text:

##### 10.1 UE procedure for determining physical downlink control channel assignment

<Unchanged Text Omitted>

For a DL BWP, if a UE is not provided *ra-SearchSpace* for Type1-PDCCH CSS set, the UE does not monitor PDCCH for Type1-PDCCH CSS set on the DL BWP. If the UE has not been provided a Type3-PDCCH CSS set, and the UE has not been provided a Type1A-PDCCH CSS set, and the UE has not been provided a USS set for DCI format 0\_0 and DCI format 1\_0 and the UE has received a C-RNTI and has been provided a Type1-PDCCH CSS set, the UE monitors PDCCH candidates for DCI format 0\_0 and DCI format 1\_0 with CRC scrambled by the C-RNTI in the Type1-PDCCH CSS set.

<Unchanged Text Omitted>

References

[1] R1-2209512, “[R15] Draft CR on PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP”, MediaTek, RAN1 #110bis-e

[2] R1-2209513, “[R16] Draft CR on PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP”, MediaTek, RAN1 #110bis-e

[3] R1-2209514, “[R17] Draft CR on PDCCH monitoring of Type1-PDCCH CSS set for a DL BWP”, MediaTek, RAN1 #110bis-e

[4] 3GPP TS 38.213 V16.11.0, “NR; Physical layer procedures for control”

[5] 3GPP TS 38.213 V17.3.0, “NR; Physical layer procedures for control”