**3GPP TSG-RAN WG1 Meeting #102-eR1-200xxxx**

**e-Meeting, August 17th – 28th, 2020**

**Agenda item:** **7.2.5.3**

**Source: Moderator (Apple Inc.)**

**Title: Summary of Email Discussion [102-e-NR-L1enh-URLLC-PUSCH\_Enh-01]**

**Document for: Discussion and Decision**

# 1 Introduction

The following has been agreed for email discussion based on the issues raised in the contributions submitted under AI 7.2.5.3 [11]:

[102-e-NR-L1enh-URLLC-PUSCH\_Enh-01] Remaining issues on URLLC PUSCH – Sigen (Apple)

* Issue #1: Optimization regarding numberInvallidSymbolsForDL-UL-Switching
* Issue #2: Peak rate restriction
* Issue #3: Number of MIMO layers
* Discussions/Agreements by 8/21, TPs by 8/28

This contribution provides the summary for the email discussion.

# 2 Issues #1: Optimization regarding *numberInvallidSymbolsForDL-UL-Switching*

There was some discussion in RAN1#101-e regarding whether *numberInvallidSymbolsForDL-UL-Switching* should also apply to the symbols after SSB or CORESET#0. This was further considered by some companies in this meeting:

* Apply *numberInvallidSymbolsForDL-UL-Switching* to indicate the number of symbols after the last symbol that is indicated by *ssb-PositionsInBurst* in SIB1 or *ssb-PositionsInBurst* in *ServingCellConfigCommon* for reception of SS/PBCH block are invalid symbols for PUSCH repetition Type B transmission.
  + Yes: ZTE[2], CATT[4], WILUS[10]
  + No: Samsung[7]
    - Samsung[7]: A UE that is not required to receive an SSB can transmit a PUSCH Type B repetition starting from a first UL or flexible symbol after the SSB.
* Apply *numberInvallidSymbolsForDL-UL-Switching* to indicate the number of symbols after the last symbol that is indicated by *pdcch-ConfigSIB1* in *MIB* for a CORESET for Type0-PDCCH CSS set are invalid symbols for PUSCH repetition Type B transmission.
  + Yes: ZTE[2], CATT[4], WILUS[10]
  + No: Samsung[7]

## **Proposal 1-1:**

**If *numberInvallidSymbolsForDL-UL-Switching* is configured, *numberInvallidSymbolsForDL-UL-Switching* symbols after the last symbol that is indicated by *ssb-PositionsInBurst* in SIB1 or *ssb-PositionsInBurst* in *ServingCellConfigCommon* for reception of SS/PBCH block are invalid symbols for PUSCH repetition Type B transmission.**

**Companies please indicate if you support the proposal.**

|  |  |
| --- | --- |
| **Yes** |  |
| **No** |  |

Companies please provide detailed comments if any.

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |
|  |  |
|  |  |

## **Proposal 1-2:**

**If *numberInvallidSymbolsForDL-UL-Switching* is configured, *numberInvallidSymbolsForDL-UL-Switching* symbols after the last symbol that is indicated by *pdcch-ConfigSIB1* in *MIB* for a CORESET for Type0-PDCCH CSS set are invalid symbols for PUSCH repetition Type B transmission.**

**Companies please indicate if you support the proposal.**

|  |  |
| --- | --- |
| **Yes** |  |
| **No** |  |

Companies please provide detailed comments if any.

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |
|  |  |
|  |  |

# 3 Issues #2: Peak rate restriction

Huawei/HiSi[5] and Apple[8] discussed the issues on the peak rate restrictions related to PUSCH repetition Type B. There are two aspects, one is the per-cell peak rate restriction, the other one is the aggregated data rate restriction. The corresponding TPs have been proposed.

Huawei/HiSi[5]:

|  |
| --- |
| **Proposal 1: Apply per-cell peak rate restriction for PUSCH repetition type B.**  The text proposal for 38.214 could be found in the following:  --------------------------------------------Start of text proposal-------------------------------------------------------- 6.1.4 Modulation order, redundancy version and transport block size determination \*\*\* Unchanged text is omitted \*\*\*  For a *j*-th serving cell, if higher layer parameter *processingType2Enabled* of *PUSCH-ServingCellConfig* is configured for the serving cell and set to *enable,* or if at least one *IMCS > W* for a PUSCH, where *W* = 28 for MCS tables 5.1.3.1-1 and 5.1.3.1-3, and *W* = 27 for MCS tables 5.1.3.1-2, 6.1.4.1-1, and 6.1.4.1-2, or if *PUSCHRepTypeIndicator-ForDCIFormat0\_1* is set to '*pusch-RepTypeB*' for PUSCH scheduled by DCI format 0\_1, or if *PUSCHRepTypeIndicator-ForDCIFormat0\_2* is set to '*pusch-RepTypeB*' for PUSCH scheduled by DCI format 0\_2, the UE is not required to handle PUSCH transmissions, if the following condition is not satisfied:  where  - is the number of symbols assigned to the PUSCH  - *M* is the number of TB in the PUSCH  - where μ is the numerology of the PUSCH  - for the *m*-th TB,  - *A* is the number of bits in the transport block as defined in Clause 6.2.1 [5, TS 38.212]  - *C* is the total number of code blocks for the transport block defined in Clause 5.2.2 [5, TS 38.212]  - is the number of scheduled code blocks for the transport block as defined in Clause 5.4.2.1 [5, TS 38.212]  - [Mbps] is computed as the maximum data rate for a carrier in the frequency band of the serving cell for any signaled band combination and feature set consistent with the serving cell, where the data rate value is given by the formula in Clause 4.1.2 in [13, TS 38.306], including the scaling factor *f(i).*  - each actual repetition for PUSCH repetition type B is treated as one PUSCH.  ---------------------------------------------End of text proposal-------------------------------------------------------- |

Apple[8]:

TP for TS 38.214 Clause 6.1.4:

|  |
| --- |
| Within a cell group, a UE is not required to handle PUSCH(s) transmissions in slot *sj* in serving cell-*j*, and for *j* = 0,1,2.. *J-1*, slot *sj* overlapping with any given point in time, if the following condition is not satisfied at that point in time:  ,  where  *- J* is the number of configured serving cells belong to a frequency range  - for the *j-th* serving cell,  *- M* is the number of TB(s) transmitted in slot-*sj*. For PUSCH repetition Type B, each actual repetition is counted separately.  *- Tslotμ(j)* =10-3/2*μ(j*), where *μ(j)* is the numerology for PUSCH(s) in slot *sj* of the *j*-th serving cell.  - for the *m*-th TB,  *- A* is the number of bits in the transport block as defined in Clause 6.2.1 [5, TS 38.212]  *- C* is the total number of code blocks for the transport block defined in Clause 5.2.2 [5, TS 38.212].  - is the number of scheduled code blocks for the transport block as defined in Clause 5.4.2.1 [5,38.212]  - [Mbps] is computed as the maximum data rate summed over all the carriers in the frequency range for any signaled band combination and feature set consistent with the configured servings cells, where the data rate value is given by the formula in Clause 4.1.2 in [13, TS 38.306], including the scaling factor *f(i).*  For a *j*-th serving cell, if higher layer parameter *processingType2Enabled* of *PUSCH-ServingCellConfig* is configured for the serving cell and set to *enable,* or if at least one *IMCS > W* for a PUSCH, where *W* = 28 for MCS tables 5.1.3.1-1 and 5.1.3.1-3, and *W* = 27 for MCS tables 5.1.3.1-2, 6.1.4.1-1, and 6.1.4.1-2, or if it is an actual repetition for PUSCH repetition Type B, the UE is not required to handle PUSCH transmissions, if the following condition is not satisfied:  where  - is the number of symbols assigned to the PUSCH  - *M* is the number of TB in the PUSCH  - where μ is the numerology of the PUSCH  - for the *m*-th TB,  - *A* is the number of bits in the transport block as defined in Clause 6.2.1 [5, TS 38.212]  - *C* is the total number of code blocks for the transport block defined in Clause 5.2.2 [5, TS 38.212]  - is the number of scheduled code blocks for the transport block as defined in Clause 5.4.2.1 [5, TS 38.212]  - [Mbps] is computed as the maximum data rate for a carrier in the frequency band of the serving cell for any signaled band combination and feature set consistent with the serving cell, where the data rate value is given by the formula in Clause 4.1.2 in [13, TS 38.306], including the scaling factor *f(i).* |

## **Proposal 2-1:**

**Adopt the following TP for TS 38.214:**

|  |
| --- |
| TP for TS 38.214 Clause 6.1.4  6.1.4 Modulation order, redundancy version and transport block size determination  < Unchanged parts are omitted >  Within a cell group, a UE is not required to handle PUSCH(s) transmissions in slot *sj* in serving cell-*j*, and for *j* = 0,1,2.. *J-1*, slot *sj* overlapping with any given point in time, if the following condition is not satisfied at that point in time:  ,  where  *- J* is the number of configured serving cells belong to a frequency range  - for the *j-th* serving cell,  *- M* is the number of TB(s) transmitted in slot-*sj*. For PUSCH repetition Type B, each actual repetition is counted separately.  *- Tslotμ(j)* =10-3/2*μ(j*), where *μ(j)* is the numerology for PUSCH(s) in slot *sj* of the *j*-th serving cell.  - for the *m*-th TB,  *- A* is the number of bits in the transport block as defined in Clause 6.2.1 [5, TS 38.212]  *- C* is the total number of code blocks for the transport block defined in Clause 5.2.2 [5, TS 38.212].  - is the number of scheduled code blocks for the transport block as defined in Clause 5.4.2.1 [5,38.212]  - [Mbps] is computed as the maximum data rate summed over all the carriers in the frequency range for any signaled band combination and feature set consistent with the configured servings cells, where the data rate value is given by the formula in Clause 4.1.2 in [13, TS 38.306], including the scaling factor *f(i).*  For a *j*-th serving cell, if higher layer parameter *processingType2Enabled* of *PUSCH-ServingCellConfig* is configured for the serving cell and set to *enable,* or if at least one *IMCS > W* for a PUSCH, where *W* = 28 for MCS tables 5.1.3.1-1 and 5.1.3.1-3, and *W* = 27 for MCS tables 5.1.3.1-2, 6.1.4.1-1, and 6.1.4.1-2, or if it is an actual repetition for PUSCH repetition Type B, the UE is not required to handle PUSCH transmissions, if the following condition is not satisfied:  where  - is the number of symbols assigned to the PUSCH  - *M* is the number of TB in the PUSCH  - where μ is the numerology of the PUSCH  - for the *m*-th TB,  - *A* is the number of bits in the transport block as defined in Clause 6.2.1 [5, TS 38.212]  - *C* is the total number of code blocks for the transport block defined in Clause 5.2.2 [5, TS 38.212]  - is the number of scheduled code blocks for the transport block as defined in Clause 5.4.2.1 [5, TS 38.212]  - [Mbps] is computed as the maximum data rate for a carrier in the frequency band of the serving cell for any signaled band combination and feature set consistent with the serving cell, where the data rate value is given by the formula in Clause 4.1.2 in [13, TS 38.306], including the scaling factor *f(i).*  - each actual repetition for PUSCH repetition type B is treated as one PUSCH.  < Unchanged parts are omitted > |

**Companies please indicate if you support the intention of the TP.**

|  |  |
| --- | --- |
| **Yes** |  |
| **No** |  |

Companies please provide detailed comments if any.

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |
|  |  |
|  |  |

# 4 Issues #3: Number of MIMO layers

vivo[1] discussed whether to introduce the restriction on the number of MIMO layers for PUSCH repetition Type B, and proposed:

* If *numberofrepetitions* is configured, in case the number of nominal repetitions >1, PUSCH is limited to a single transmission layer.

## **Proposal 3-1:**

**For PUSCH repetition Type B, if the number of nominal repetitions is larger than 1, the PUSCH is limited to a single transmission layer.**

**Companies please indicate if you support the proposal.**

|  |  |
| --- | --- |
| **Yes** |  |
| **No** |  |

Companies please provide detailed comments if any.

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |
|  |  |
|  |  |

# 5 Agreements

# References

1. R1-2005349 PUSCH enhancements for URLLC vivo
2. R1-2005415 Remaining issues on PUSCH enhancements for NR URLLC ZTE
3. R1-2005508 Remaining Issue of PUSCH Enhancements for NR URLLC Ericsson
4. R1-2005674 Remaining issues on PUSCH enhancements CATT
5. R1-2005793 Corrections on PUSCH enhancement Huawei, HiSilicon
6. R1-2006053 PUSCH enhancements for URLLC OPPO
7. R1-2006111 Remaining issues for PUSCH enhancement Samsung
8. R1-2006489 Remaining Issues on PUSCH enhancements for eURLLC Apple
9. R1-2006776 Remaining issues on PUSCH enhancements for URLLC Qualcomm Incorporated
10. R1-2006883 Remaining issues on PUSCH enhancement for NR URLLC WILUS Inc.
11. R1-2006992 Feature lead summary #2 on PUSCH enhancements for NR eURLLC (AI 7.2.5.3) Moderator (Apple Inc.)