**3GPP TSG RAN WG1 #106bis-e R1-21xxxxx**

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

**Agenda Item: 8.8**

**Source: Moderator (China Telecom, Sharp, Nokia, Qualcomm, ZTE)**

**Title: [106bis-e-R17-RRC-CovEnh] Email discussion on Rel-17 RRC parameters for Coverage Enhancement**

**Document for: Discussion**

1. Introduction

There was an initial email discussion on RRC parameters for NR coverage enhancements [1]. This contribution is a summary of the following email discussion:

[106bis-e-R17-RRC-CovEnh] Email discussion on Rel-17 RRC parameters for Coverage Enhancement

* 1st check point: October 14
* Final check point: October 19

1. Discussion on RRC parameters for AI 8.8.1.1
2. Discussion on RRC parameters for AI 8.8.1.2

Table 3.1 RRC parameters for AI 8.8.1.2 from [1]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| NR\_cov\_enh-Core | TB processing over multi-slot PUSCH | *numberOfSlotsTBoMS-r17* | new | Indicates the number of slots allocated for a single TB over multi-slot PUSCH | FFS |  | [UE-specific] | 38.331 | Agreement Number of slots allocated for TBoMS is determined by using a row index of a TDRA list, configured via RRC. • FFS: details. Note: numberOfRepetitions \* numberOfSlotsTBoMS-r17 is no larger than 32 |
| ~~NR\_cov\_enh-Core~~ | ~~TB processing over multi-slot PUSCH~~ | *~~numberOfRepetitionsTBoMS-r17~~* | ~~new~~ | ~~Indicates the number of repetitions of a single TB over multi-slot PUSCH~~ | ~~FFS~~ |  | ~~[UE-specific]~~ | ~~38.331~~ | ~~Agreement Repetitions of a single TBoMS are supported, where: • The number of configured repetitions is denoted by M, i.e., the total number of allocated slots for TBoMS repetition is M\*N. o Note: M\*N is no more than the max number of repetitions agreed for repetition Type A enhancement in agenda 8.8.1.1 • Available slot determination is according to existing agreements. • The number and location of allocated symbols within an allocated slot for TBoMS transmission are the same among all repeated single TBoMS. • FFS other aspects of TBoMS repetitions, e.g.: o Details of time domain resource indication. o Supported values for the number of TBoMS repetitions. o How to indicate the number of TBoMS repetitions. o Interactions with frequency hopping and precoder cycling across the M groups of N allocated slots for each single TBoMS repetition. o Whether RV indices should be cycled across the M groups of N allocated slots for each single TBoMS repetition. o Details of TBoMS retransmissions. o Potential MAC layer impact, but should be decided by RAN2 Note: No additional dropping rule optimization will be introduced other than dropping rules for single TBoMS transmission.~~ |

**FL comments on October 11**

Table 3.1 shows the outcome of the post-RAN1#106-e meeting email discussions on RRC parameters [1]. The column “RAN2 parent IE” has been removed in Table 3.1 as per guideline in [2]. As highlighted in Table 3.2, the following open issues need to be further discussed:

* Issue#3-1: Whether numberOfSlotsTBoMS-r17 is UE-specific or Cell-specific parameter?
* Issue#3-2: Value ranges for numberOfSlotsTBoMS-r17 (i.e., candidate values for N)
* Issue#3-3: Whether to introduce a separate RRC parameter for indicating the number of repetitions (M)?

In addition, other aspects discussed in the contributions submitted to RAN1#106bis-e meeting that may have impact on RRC parameters and signaling are:

* Issue#3-4: Whether to introduce a separate RRC parameter to enable/disable TBoMS transmission?
* Issue#3-5: Whether/how the scaling factor (K) for TBS determination is supported?

FL’s views on the above is the following:

* Discussions on Issue#3-1 can start, given that sufficient agreements already exist in this regard to be able to take decisions on this issue.
* Issues #3-2 to #3-5 need further agreements on the feature design before being able to discuss them here. For this reason, it has been decided to discuss about them in [8].

## **First round discussions**

### Issue #3-1

The parameter *numberOfSlotsTBoMS-r17* is related to the discussion in Section 2.1.1.2 in [8]. However, no matter which values will be eventually agreed on by the group, FL understanding is that this parameter is going to be configured per UE (as a column of the TDRA table configured via *PUSCH-TimeDomainAllocationList*).

**FL’s Observation 1**

The parameter *numberOfSlotsTBoMS-r17* is UE-specific.

Companies are invited to input their views on FL’s observation 1 in the table below (for instance, you may write “agree” or “disagree” and then add an explanation if you disagree.

**Views on FL’s observation 1**

|  |  |
| --- | --- |
| **Company name** | **Comment** |
| QC | Agree. Suffices to specify the new table within pusch-Config. |
| Sharp | Agree. |
| Intel | Agree |
| Xiaomi | Agree. |
| TCL | Agree. |
| CATT | Agree. |
| Lenovo, Motorola Mobility | Agree |
| vivo | Agree. |
| ZTE | Agree |
| Apple | Agree |
| Samsung | Agree |
| NTT DOCOMO | Agree |

Furthermore, concerning the description of this parameter, and regardless of the supported value range, the following observation is made.

**FL’s Observation 2**

The parameter *numberOfSlotsTBoMS-r17* could be described as follows.

|  |
| --- |
| ***numberOfSlotsTBoMS-r17***  Number of slots allocated for TB processing over multi-slot PUSCH for DCI format 0\_1/0\_2 (see TS 38.214 [X], clause XX) |

Companies are invited to input their views on FL’s observation 2 in the table below (for instance, you may write “agree” or “disagree” and then add a suggestion for modification if you disagree.

**Views on FL’s observation 2**

|  |  |
| --- | --- |
| **Company name** | **Comment** |
| Sharp | Agree. Couldn’t it be also used for CG-PUSCH? |
| Intel | Agree and share similar view as Sharp. |
| Xiaomi | Share the same view as Sharp. |
| TCL | Agree. Similar view as Sharp. |
| CATT | Agree, and it shall be able to apply to CG case. |
| Lenovo, Motorola Mobility | Agree and similar view to apply for CG-PUSCH as well |
| vivo | Agree, and Similar view as Sharp. |
| ZTE | Agree. Similar view as Sharp. |
| Apple | Agree. Similar view as Sharp. |
| Samsung | Agree and similar view to apply for CG-PUSCH as well |
| Ericsson | Agree. TDRA configured in DCI 0\_1/0\_2 allows TBoMS to be used for DG-PUSCH and Type-2 CG-PUSCH. The TDRA list for Type-1 CG-PUSCH is configured by DCI0\_0 and based on Rel-15, without a column indicating the number of repetitions. In 8.8.1.1, there is no agreement to add such a column (with increased number of repetitions) to TDRA list for Type-1 CG-PUSCH. |
| Nokia/NSB | We share similar view as Ericsson that currently Type-1 CG uses the same TDRA table as the one used for DCI 0\_0, which is Rel-15 TDRA table. In Rel-15 TDRA table, the column for numberOfRepetitions does not exist. Given that there is no consensus on adding two new columns for N and M in TDRA table in AI 8.8.1.2, which is the only way to support Type-1 CG-PUSCH for TBoMS we prefer that the above text from the FL’s observation is extended for Type-2 CG only. |

### 3.1.2. RRC parameters other than the ones already considered

This section is for companies to provide further input on possible other RRC parameters that you may have identified based on current progress, or that you will identify during RAN1 #106bis-e. **Please do not comment on RRC parameters which may stem from discussions related to Issues #3-2 to #3-5**. Corresponding discussions will be opened by FL, if and when applicable.

|  |  |
| --- | --- |
| **Company name** | **Comment** |
|  |  |
|  |  |
|  |  |

### 3.1.3. Supported values of N and impact on the RRC parameter description

The following agreements have been made during #106b-e on how to indicate the number of TBoMS repetitions in Rel-17:

|  |
| --- |
| **Agreement**  The number N of allocated slots for TBoMS is indicated via a new column added to the TDRA table configured via PUSCH-TimeDomainAllocationList. The ~~existing~~column for configuring the number of repetitions in the TDRA for Rel-17 PUSCH repetition Type A, i.e., numberOfRepetitions, is used for indicating the number of repetitions M of a single TBoMS, when TBoMS transmission is enabled.  FFS: supported values of N and M.  FFS: how to enable the TBoMS transmission  FFS: details of retransmission of TBoMS  **Agreement**  At least the following values are supported in Rel-17 for the number*N* of allocated slots for the single TBoMS:      FFS: whether *N*=1 is also supported depends on how TBoMS transmission feature is enabled (or disabled)  FFS: other values, if any.  FFS: further constraints on N\*M |

Given existing endorsed Observations, the following row of the RRC parameter table can be provided to RAN2.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| NR\_cov\_enh-Core | TB processing over multi-slot PUSCH | *numberOfSlotsTBoMS-r17* | new | Number of slots allocated for TB processing over multi-slot PUSCH for DCI format 0\_1/0\_2 (see TS 38.214 [X], clause XX) | [1], 2,4,8 | Per UE, Parent IE: PUSCH-TimeDomainResourceAllocationList | UE-specific | 38.331 | Agreement  The number N of allocated slots for TBoMS is indicated via a new column added to the TDRA table configured via PUSCH-TimeDomainAllocationList. The existing column for configuring the number of repetitions in the TDRA for Rel-17 PUSCH repetition Type A, i.e., numberOfRepetitions, is used for indicating the number of repetitions M of a single TBoMS, when TBoMS transmission is enabled.  FFS: supported values of N and M.  FFS: how to enable the TBoMS transmission  FFS: details of retransmission of TBoMS  **Agreement**  At least the following values are supported in Rel-17 for the number*N* of allocated slots for the single TBoMS:      FFS: whether *N*=1 is also supported depends on how TBoMS transmission feature is enabled (or disabled)  FFS: other values, if any.  FFS: further constraints on N\*M |

The above will be sent via email for endorsement.

### 3.1.4 Supported values of M and impact on RRC parameter discussion

The following agreement have also been made during #106b-e on the supported values for the number of TBoMS repetitions in Rel-17:

|  |
| --- |
| **FL’s proposal 13**  The following values are supported in Rel-17 for the number*M*of repetitions of the single TBoMS:      FFS: further constraints on N\*M, e.g., N\*M is a valid value according to agreements in AI 8.8.1.1 |

From FL’s perspective, this implies that RAN1 can simply inform RAN2 that the indication of the number of TBoMS repetitions in Rel-17 is performed via the existing Rel-16 IE numberOfRepetitions, whose supported range does not change.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **Specification** | **Comment** |
| NR\_cov\_enh-Core | TB processing over multi-slot PUSCH | *numberOfRepetitions* | Existing | Number of repetitions of a single TB over multi-slot PUSCH (see TS 38.214 [X], clause XX) | 1,2,3,4,7,8, 12, 16 | Per UE, Parent IE: PUSCH-TimeDomainResourceAllocationList | UE-specific | 38.331 | Agreement  The number N of allocated slots for TBoMS is indicated via a new column added to the TDRA table configured via PUSCH-TimeDomainAllocationList. The existing column for configuring the number of repetitions in the TDRA for Rel-17 PUSCH repetition Type A, i.e., numberOfRepetitions, is used for indicating the number of repetitions M of a single TBoMS, when TBoMS transmission is enabled.  FFS: supported values of N and M.  FFS: how to enable the TBoMS transmission  FFS: details of retransmission of TBoMS  **Agreement**  The following values are supported in Rel-17 for the number*M*of repetitions of the single TBoMS:      FFS: further constraints on N\*M, e.g., N\*M is a valid value according to agreements in AI 8.8.1.1 |

1. Discussion on RRC parameters for AI 8.8.1.3
2. Discussion on RRC parameters for AI 8.8.2
3. Discussion on RRC parameters for AI 8.8.3
4. References
5. R1-2108673, [Post-106-e-Rel17-RRC-08] NR coverage enhancement, Moderator (China Telecom), RAN1#106-e, August 16th – 27th, 2021.
6. R1-2110415, Recommendations for RAN1 RRC Parameter Preparation, Moderator (Ericsson), RAN1#106-e, August 16th – 27th, 2021.
7. R1-2108847, Discussion on joint channel estimation for PUSCH, ZTE, RAN1#106-e, August 16th – 27th, 2021.
8. R1-2108991, Discussion on Joint channel estimation for PUSCH, vivo, RAN1#106-e, August 16th – 27th, 2021.
9. R1-2109509, Considerations on Rel-17 RRC parameters for Coverage Enhancement, Samsung, RAN1#106-e, August 16th – 27th, 2021.
10. R1-2110002, Joint channel estimation for multiple PUSCH transmission, Sharp, RAN1#106-e, August 16th – 27th, 2021.
11. R1-2110124, Joint Channel Estimation for PUSCH, Ericsson, RAN1#106-e, August 16th – 27th, 2021.
12. R1-2110248, FL summary of TB processing over multi-slot PUSCH (AI 8.8.1.2), Moderator (Nokia/NSB), RAN1#106bis-e, October 11th -19th, 2021.