**3GPP TSG-RAN WG4 Meeting #100-e R4-2114991**

**Electronic Meeting, Aug, 2021**

**Title:** Reply LS on PUCCH and PUSCH transmissions

**Response to:** LS on joint channel estimation for PUSCH and PUCCH (R1-2106212, R4-2111706)

**Release:** Release 17

**Work Item:** NR\_cov\_enh

**Source:** TSG RAN WG4

**To:** TSG RAN WG1

**Cc:**

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**Attachments:**

**1. Overall Description:**

**RAN1 question:** For joint channel estimation, is there a maximum duration during which UE is able to maintain power consistency and phase continuity under certain tolerance level? If any, how long is it?

**RAN4 answer:** (*Based on GTW agreement*) Yes, there is a maximum duration but RAN4 has not agreed how many slots it is.

* **RAN1 question:** What factors determine the maximum duration?
  + **RAN4 answer *(Editors note:*** *agreement from GTW):* RAN4 has agreed that network commanded TA adjustment should be avoided across the PUSCH/PUCCH transmissions (i.e., from starting the first transmission until the end of repetition) for joint channel estimation. Having long bundle may result in to large timing error without TA adjustement.
* ***For further discussion if this can be agreed as a response to ran1***
  + **RAN4 answer:** Factors determining could include UE ability to defer frequency error corrections, timing corrections, etc. If a certain level of performance relative to ideal DMRS bundling is to be ensured, then maximum duration also depends on the phase jitter observed across slots.
* **RAN1 question:** Whether the maximum duration should be the same for different cases for both PUSCH and PUCCH?
  + **RAN4 answer:** Yes
* **RAN1 question:** Whether the maximum duration is dependent on the modulation order of transmission, e.g., QPSK, 16QAM, 64QAM?
  + **RAN4 answer:** If a certain level of performance relative to ideal DMRS bundling is to be ensured, then maximum duration depends on modulation order.
* **RAN1 question:** Whether the maximum duration is dependent on UL waveform (DFT-s-OFDM vs. OFDM)?
  + **RAN4 answer:** No
* **RAN1 question:** Whether the maximum duration is band specific?
  + **RAN4 answer:** It is FR dependent, maybe band dependent as well.
* **RAN1 question:** Besides the factors listed above, whether or not the maximum duration is further dependent on UE capabilities (e.g., multiple possible values for a given set of factor(s)), and if so, whether the UE should report such a duration
  + **RAN4 answer:** Yes

*Agreements from GTW not related to max duration:*

RAN4 has further agreed that for the gap between repetitions, that the 13-symbol is the maximum length for the gap and that the 14-symbol or 1ms will not be discussed in RAN4 anymore for un-scheduled gap in Rel-17.

Ran4 has agreed that for the other channels in the gap between repetitions, it is not feasible for UE to transmit other channels with different settings.

For the other UL channels in between repetitions with same settings, as communicated R4-2105417, RAN4 has further refined the conditions when phase continuity can be met as follows:

* Signals/channels with repetitions and other signals/channels in the gap have the same PAPR and AVG power, e.g., PUSCH/PUCCH part of repetitions and SRS has same PAPR and AVG power.
* The same RPB location and RPB size for signals/channels with repetitions and other signals/channels in the gap
* Signals/channels with repetitions and other signals/channels in the gap have the same settings in antenna port, occupied PRBs and UL power than the repeated transmission signals/channels

Ran4 has not agreed detailed requirement for phase continuity and therefore will need to revisit the above agreement on other UL channels in the gap once the requirement is defined. Therefore, RAN4 would like to ask RAN1 what are the consequences if phase continuity can not be maintained in the case of any UL transmissions in the gap.

**2. Actions:**

**To RAN2 group.**

**ACTION:**  RAN4 would like to ask RAN1 what are the consequences if phase continuity can not be maintained in the case of any UL transmissions in the gap?

**3. Date of Next TSG-RAN WG4 Meetings:**

TSG-RAN4 Meeting#101-e Nov 2021 Electronic Meeting

TSG-RAN4 Meeting#101-Bis-e Jan 2022 Electronic Meeting