**3GPP TSG-RAN WG4 Meeting # 104-e R4-22xxxxx**

**Electronic Meeting, 15 ‒ 26 August 2022**

**Title: WF on HST FR2 RRM Core Requirement Maintenance**

**Agenda Item:** 9.7.5?

**Source:** Nokia, Nokia Shanghai Bell

**Document for:** Approval

# UL timing

## Large one-step UL timing adjustment

**[Issue 1-1-1] <Way forward/Agreement> on Large one-step UL timing adjustment**

Open issue needs further discussion:

* Option 1[Nokia, Samsung, ZTE]: Clarify the requirement if target TCI state is not in the active TCI state list and the DL timing difference is larger than [CP/4]
  + Option 1a [Nokia]: If target TCI state is not in the active TCI state list and the DL timing difference is larger than [CP/4], limit the time needed for the UE to follow again clause 7.1.2.1 requirements and to adjust its UL timing within ±Te. It should happen not later than Trs + 2ms after the TCI state switch.
  + Option 1b [Ericsson]: Same as above, but Tssb is used instead of Trs
  + Option 1c [QC]: Tq requirement in 7.1.2.1 applicable to UL slots except the first after TCI state switch.
  + Option 1d [GtW]: The gradual timing adjustment step of Tq shall be applied after the one shot uplink timing adjustment after TCI state switch.
  + Other options are not precluded
* Option 2 [QC, OPPO, Huawei]: Keep current specification as it is.

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| *Background:*  The current formulation of UL timing adjustment requirements for HST FR2 scenario:   |  | | --- | | **7.1.2.3 One shot large UL timing adjustment for FR2 Power Class 6 UE**  When *highSpeedMeasFlagFR2-r17* is configured and *highSpeedLargeOneStepUL-TimingFR2-r17* is enabled for UE supporting FR2 power class 6 and [*largeOneStepUL-timingFR2-r17*] capability, the following requirements apply to the UE:  - If the absolute value , the requirement in clause 7.1.2.1 apply to the first UL transmission after a TCI state switch.  - Otherwise, the UE transmit timing immediately after TCI state switch shall be and clause 7.1.2.1 requirements don’t apply.  - The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to ±Te as specified in clause 7.1.2 if the new target TCI state is within active TCI state list, otherwise ±[7Ts], and the reference point is .  Above,  - (in units) is the DL timing defined as the time when UE receives downlink frame with new target TCI state.  - (in units) is the DL timing defined as the time when UE receives downlink frame with old source TCI state. |   One group of companies thinks that it could be possible to keep the requirements in Clause 7.1.2.3 without changes to give more implementation flexibility and because it is not easy specify when UE can follow again the requirements in 7.1.2.1 again after the TCI state switch.  Still, many of the companies acknowledge that there is an ambiguity in the formulation of transmit timing requirement after the TCI state switch, especially in the case when target TCI state is not in the active TCI state list and the DL timing difference is larger than [CP/4]. In this case, a relaxation of transmit timing accuracy is allowed and it is not clear how and when the requirement in 7.1.2.1 is applicable again. It is mentioned that a clarification or an additional requirement would help to close the loop.  One additional identified issue is that immediately after the TCI state switch the reference point for UL transmit timing is . Wherease for gradual timing adjustment in 7.1.2.1, the reference timing shall be before the downlink timing of the reference cell.  *Recommendation for the second round:*  Continue the discussion of the options and resolution of newly raised issues. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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**[Issue 1-1-2] <Way forward/Agreement> on the value of relaxed UL transmit timing accuracy**

Open issue needs further discussion:

* Option 1 [QC, ZTE, OPPO, Samsung]: Remove square brackets and use ±7Ts as relaxed UL transmit timing accuracy in the current requirement.
* Option 1a [Ericsson]: Remove square brackets and use ±7\*64\*Tc as relaxed UL transmit timing accuracy in the current requirement.
* Option 2 [Huawei]: Do not distinguish the case “new target TCI state is not in the active TCI state list” and “in the active TCI state” and use ±7Ts accuracy for both.

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| *Background:*  The current requirement in 7.1.2.3 states that  The UE UL transmission timing error after the TCI state switching procedure shall be less than or equal to ±Te as specified in clause 7.1.2 if the new target TCI state is within active TCI state list, otherwise ±[7Ts], and the reference point is .  In general, the specification text above is based on the agreement at RAN4#103-e [WF, R4-2210608]:   |  | | --- | | Sub-topic 1-2: UL transmit timing accuracy **GtW Agreement**:  If new TCI state within active TCI state list: Adopt ±Te immediately after TCI state switch as the accuracy otherwise ±[7Ts] adopted. |   *Recommendation for the second round:*  In Moderator’s view Option 1a is better aligned with existing accuracy requirements in table 7.1.2-1 and can be considered for agreement.  Option 2 is a new option that requires revision of the previous agreement. Companies are encouraged to comment whether such a revision is needed. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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## Other remaining UL transmit timing issues

**[Issues 1-2-1 & 1-2-2 & 1-2-3] <Way forward/Agreement> on UL timing requirement when large one-step mechanism is disabled**:

Open issue needs further discussion:

* Option 2 [Ericsson, QC, Samsung, OPPO]: No impact on UE behavior (no additional requirements)
* Option 4 [CATT, ZTE, Nokia]: After the TCI state switch, the UE shall not transmit except for RACH preamble in the new target TCI before one of the following conditions is fulfilled:
  + the new timing advance is acquired and applied in the target TCI state according to the requirements in clause 7.3;
  + the UL transmission is scheduled by the gNB.  
    In this case, the requirements in clause 7.1.2.1 apply.
* Option 6 [Nokia]: Power Class 6 UE initial transmission timing error after the TCI state switch shall be less than or equal to ±Te. Enhance the requirement in 7.1.2.
* Option 7 [Ericsson, Nokia, ZTE]: Introduce a DL timing difference threshold when highSpeedLargeOneStepUL-TimingFR2 is disabled.
* Other options are not precluded

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| *Background:*  This second-round discussion combines Issues 1-2-1, 1-2-2, 1-2-3 because the main goal of all of them is related to the definition of requirements on UL transmit timing when large one-step timing adjustment is disabled.  In general, one group of companies thinks that there is no need to introduce any additional requirement (Option 2).  Then, there are several alternative ways to introduce the requirement:   * Specifically for the case when large one short timing adjustment is disabled (Option 4) * As a general requirement for all PC 6 UEs, and then consider Clause 7.1.2.3 as a special case (Option 6) * Introduce a DL timing difference threshold when highSpeedLargeOneStepUL-TimingFR2 is disabled (Option 7) to give a UE a possibility to distinguish intra-RRH TCI state switch (DL timing difference below the threshold, and PRACH is not needed) from inter-RRH TCI state switch (DL timing difference is above the threshold, PRACH is needed, and UE should not transmit before timing adjustment).   *Recommendation for the second round*:  Companies are encouraged to discuss further the candidate options and indicate compromises, if any. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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# Other remaining issues in RRM CORE maintenance

**[Issue 2-1] <Way forward/Agreement> on L1-SINR reporting with CSI-RS based CMR and no dedicated IMR configured**:

Open issue needs further discussion:

* Option 1 [CATT, ZTE, Nokia]: For L1-SINR measurements with SSB-based CMR and dedicated IMR configured for FR2 HST, the same enhancements as SSB-based L1-RSRP measurements should be applied.
* Option 2 [QC, Samsung, Ericsson]: Do not define enhancement for L1-SINR measurements with SSB-based CMR and dedicated IMR
* Option 2a [Samsung]: For FR2 PC6 UE which support Rel-16 L1-SINR measurement, it can rely on legacy Rel-16 test cases to verify the performance.

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| *Background:*  The moderator’s understanding is that the Issue is related only to requirements in Clause 9.8.4.2 L1-SINR reporting with SSB based CMR and dedicated IMR configured and introduced in R4-2213892.  Note, that the Table 9.8.4.2-3 was already implemented in the TS by mistake.  *Recommendation for the second round*:  Discuss further the candidate options in the second round. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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**[Issue 2-2] <Way forward/Agreement> on SMTC length in HST FR2 enhanced requirements**:

For UE supporting power class 6 with highSpeedMeasFlagFR2-r17 configured, if SMTC <= 40ms, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-11; otherwise, TPSS/SSS\_sync\_intra is given in Table 9.2.5.1-2.

For UE supporting power class 6 with highSpeedMeasFlagFR2-r17 configured, if SMTC <= 40ms, TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-7; otherwise, TSSB\_measurement\_period\_intra is given in Table 9.2.5.2-2.

The addition of the clarification note needs further discussion:

* Option 2 [Nokia, Samsung]: Add Notes in the TS:  
  Note: Operation with TPSS/SSS\_sync\_intra in Table 9.2.5.1-2 may not be guaranteed for the maximum speed under high-speed deployment scenarios.

Note: Operation with TSSB\_measurement\_period\_intra in Table 9.2.5.2-2 may not be guaranteed for the maximum speed under high-speed deployment scenarios.

* Option 3 [QC, CATT]: Add Notes from Option 2 in the WF.
* Option 4 [Ericsson, ZTE, CATT]: Do not add any notes.

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| *Background:*  Seems that the companies do not object removal of square brackets in the requirement applicability rule:  [otherwise, TPSS/SSS\_sync\_intra (T SSB\_measurement\_period\_intra) is given in Table 9.2.5.2-1(2).]  However, further discussion whether and how to define the clarification notes is still needed.  *Recommendation for the second round:*  Agree on the removal of square brackets in the requirements.  Discuss further the addition of clarification notes. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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**[Issue 2-3] Agreement on Mpss/sss\_sync\_w/o\_gaps and Mmeas\_period\_w/o\_gaps for power class 6 UEs**:

Define Mpss/sss\_sync\_w/o\_gaps = 24 and Mmeas\_period\_w/o\_gaps = 24 for PC 6 UEs in Clause 9.2.5.

NOTE 3 from tables Table 9.2.5.1-11 and Table 9.2.5.2-7 can be removed.

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| *Background:*  In Moderator’s understanding the core of the proposal is to add the definition of Mpss/sss\_sync\_w/o\_gaps and Mmeas\_period\_w/o\_gaps as follows:  Mpss/sss\_sync\_w/o\_gaps : For a UE supporting FR2 power class 1 or 5, Mpss/sss\_sync\_w/o\_gaps =40. For a UE supporting power class 2, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 3, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 4, Mpss/sss\_sync\_w/o\_gaps =24. For a UE supporting FR2 power class 6, Mpss/sss\_sync\_w/o\_gaps =24.  Mmeas\_period\_w/o\_gaps : For a UE supporting power class 1 or 5, Mmeas\_period\_w/o\_gaps =40. For a UE supporting FR2 power class 2, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 3, Mmeas\_period\_w/o\_gaps =24. For a UE supporting power class 4, Mmeas\_period\_w/o\_gaps =24. For a UE supporting FR2 power class 6, Mmeas\_period\_w/o\_gap=24.  *Recommendation for the second round*:  Check whether tentative agreement is agreeable. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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**[Issue 2-4] Agreement on requirement for intra-frequency measurement with measurement gaps**:

Apply two agreements above for intra-frequency measurement without measurement gaps to the requirements with measurement gaps.

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| *Background:*  The Issue is the extension of the agreements in the two pervious Issues, applied to the measurements without gaps.  The issue is pending on the agreements is the corresponding issues.  *Recommendation for the second round*:  Agree on the agreement taking into account that the agreement in Issue 2-2 and 2-3 are achived. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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**[Issue 2-5] Agreement on applicability of enhanced requirements for other PCs**:

When HST FR2 flags are configured for other power classes other than PC6, the legacy requirements should be used.

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| *Recommendation for the second round*:  Companies are encouraged to describe what are the expected specification impacts and to agree on the tentative agreement. | |
| *Company A* |  |
| *Company B* |  |
| *Company C* |  |
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