3GPP TSG-RAN WG4 Meeting # 109  R4-23XXXXX

Chicago, US, November 13 – 17, 2023

**Title:** Reply LS on PDCCH order RACH on neighbour cell

**Response to:** R1-2304276

**Release:** Rel-18

**Work Item:** NR\_mob\_enh2-Core

**Source:** RAN WG 4

**To:** RAN WG 1

**Cc:** RAN WG 2

**Contact person:**

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**Attachments: None**

# 1 Overall description

RAN4 thanks RAN1 for the LS sent in R1-2304276 asking about the time gap between a PDCCH order and the corresponding PRACH transmission and the impact/interruption on UL Tx and/or DL Rx of serving cell due to the PRACH Tx on a candidate cell.

In RAN4 #108 meeting, RAN4 replied to RAN1 in R4-2314454 and RAN4’s feedback is copied below:

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| For the need for any update is required to ΔBWPSwitching, ΔDelay,   * For ΔDelay: RAN4 has agreed to not change the component. * For ∆BWPSwitching: It is not needed.   For the need for additional latency, RAN4 agreed to introduce new additional delay components at least for SSB based T/F tracking (TSSB) and RF and/or BB preparation and retuning (∆RF/BB\_preparation). The additional delay components introduced are clarified as follows:  **TSSB:**   * If TCI state of target cell has been activated before PDCCH ordered RACH, and if SSB index indicated in PDCCH order is in the active TCI state list, and measurement period of L1-RSRP is no longer than 160ms, UE doesn’t need additional time for SSB based T/F tracking to meet UL transmission timing requirements, that is, TSSB = 0. * If SSB index indicated in PDCCH order is not in the active TCI state list that has been activated for the target cell, and when the measurement period of L1-RSRP is no longer than 160ms, additional delay is needed for fine time tracking, TSSB is FFS. * Otherwise, TSSB is needed, and the value is FFS.   **∆RF/BB\_preparation:**   * For the case of PRACH bandwidth of neighbor cell is within active UL BWP, ∆RF/BB\_preparation is FFS. * For the case of PRACH bandwidth outside active UL BWP but within one of configured UL BWPs of any active serving cell, ∆RF/BB\_preparation is DCI based BWP switching delay specified in clause 8.6 of TS 38.133 (in TS 38.133, DCI based BWP switch delay value is dependent on UE capability). * For the case of PRACH bandwidth is not within any of the configured UL BWPs of any active serving cell, ∆RF/BB\_preparation is FFS     For any impact/interruption on UL Tx and/or DL Rx of serving cell due to the PRACH Tx on a candidate cell that is not a current serving cell with PUCCH/PUSCH, RAN4 is still discussing. |

For FFS, RAN4 has further discussed delay requirements and interruption requirements for PDCCH ordered RACH on neighbour cell in RAN4 #108-bis and #109 meeting. RAN4 sincerely asks RAN1 to consider potential spec update based on RAN4’s following feedback.

**RAN4 feedback:**

From RAN4 requirement point of view, UE is required to meet the UL Tx timing requirement as specified in Section 7.1.2 in TS 38.133. To guarantee that the requirement can be met, the need of additional latency was discussed in RAN4 as following. Note that since this is minimum requirement, UE is still allowed to transmit RACH earlier as long as the Tx timing accuracy is fulfilled.

**TSSB:**

In RAN4 #109 meeting, RAN4 reached the agreement on TCI state activation for early T/F tracking before cell switch command, which is as follows:

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| **Agreement:**  RAN4 to define a time gap between TCI state activation and PDCCH order RACH or cell switch. If PDCCH order or cell switch cmd is received before the time gap, additional time for T/F tracking in PDCCH order RACH delay or cell switch delay requirement is needed. |

Based on the above agreement, the condition of additional delay for SSB based T/F tracking is further clarified as follows:

* If TCI state of target cell has been activated before PDCCH ordered RACH, and if the SSB index indicated in PDCCH order is in the active TCI state list, and the corresponding measurement period of L1-RSRP is no longer than 160ms, and if PDCCH order or cell switch command is received after the time gap between TCI state activation and PDCCH order RACH, UE doesn’t need additional time for SSB based T/F tracking to meet UL transmission timing requirements, that is, TSSB = 0.
* If SSB index indicated in PDCCH order is not in the active TCI state list, but another SSB index of the same target cell has been activated, and when the measurement period of L1-RSRP is no longer than 160ms, TSSB is FFS.
* Otherwise, TSSB is needed, which is one complete SSB burst for fine time tracking.

**∆RF/BB\_preparation:**

* For the case of PRACH bandwidth of neighbor cell is within active UL BWP, ∆RF/BB\_preparation = 0.
* For the case of PRACH bandwidth is not within any of the configured UL BWPs of any active serving cell, RAN4 will introduce theUE capability to report ∆RF/BB\_preparation.

For any impact/interruption on UL Tx and/or DL Rx of serving cell due to the PRACH Tx on a candidate cell that is not a current serving cell with PUCCH/PUSCH,

* There will be interruption on UL Tx and DL Rx of all the serving cells during PRACH transmission.
* RAN4 understands that RAN1 is already discussing the interruption on UL during PDCCH order RACH transmission.
* RAN4 will introduce the UE capability to indicate whether there will be interruption on DL during PDCCH order RACH transmission to target cell.
* There will be interruption on UL Tx and DL Rx of all the serving cells due to RF/BB retuning to target cell before RACH transmission or retuning back to serving cell after RACH transmission.
* When RACH bandwidth is in the UL active BWP, reuse legacy N symbols defined in TS 38.213.
* For the case of PRACH bandwidth outside active UL BWP but within one of configured UL BWPs of any active serving cell, reuse interruption requirements of BWP switching on other serving cells in NR-DC for asynchronous scenarios which are defined in TS 38.133 cl. 8.2.4.2.5.
* For the case of PRACH bandwidth not within any of the configured UL BWPs of any active serving cell, the interruption on both UL and DL is Y, which is up to UE capability. The candidate values for Y are 0.25ms, 0.5ms, 1ms and 2ms.
* The scheduling restriction or interruption due to additional DL synchronization after reception of PDCCH order RACH on neighbor cell if needed can be covered by scheduling restriction due to L1/L3 measurement or MG.

In RAN4 understanding, the interruption requirements of PDCCH ordered RACH will be captured in RAN4 spec and the delay requirements of PDCCH ordered RACH will be captured in RAN1 spec as legacy. RAN4 spec will not capture any definition of TSSB and ∆RF/BB\_preparation for PDCCH ordered RACH. RAN4 sincerely asks RAN1 to capture the definition for TSSB and ∆RF/BB\_preparation in RAN1 spec.

# 2 Actions

**To RAN WG1 group**

**ACTION:** RAN4 sincerely asks RAN1 to take into account the above feedback into consideration and consider to capture the definition for TSSB and ∆RF/BB\_preparation in RAN1 spec, and provide feedback if any.

# 3 Dates of Next TSG RAN WG4 Meetings

TSG-RAN WG4 Meeting #110 26 Feb – 01 Mar 2024 Athens, GR

TSG-RAN WG4 Meeting #110-bis 15 Apr – 19 Apr 2024 China (TBC), CN