**3GPP TSG-RAN WG4 Meeting # 112 R4-2411802**

**Maastricht, Netherlands, 19 – 23, 2024**

**Agenda item:** 5.24.3

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

**Title:** Topic summary for [112] [207] NR\_Mob\_enh2

**Document for:** Information

# Introduction

This document is the email discussion summary for [112] [207] NR\_Mob\_enh2 with the following topics covered.

* Topic 1: LTM – Core part (AI 5.24.1)
	+ The proposals related to LTM core part requirements are captured here.
* Topic 2: Improvement on SCell/SCG setup delay - Core part (AI 5.24.1)
	+ The proposals related to Improvement on SCell/SCG setup delay core part requirements are captured here.
* Topic 3: Performance Part (AI 5.24.2)
	+ The proposals related to performance part are captured here.

**Recommended Online issues:**

**LTM:**

**Issue 1-4-4-1: Applicable conditions of cell switch delay requirements in FR1 without L1 measurement**

**Issue 1-4-4-2: How to capture the applicable conditions of cell switch delay requirements in FR1 without L1 measurement in spec?**

**Issue 1-4-3-1: Which cell(s) TLTM-RRC-processing = 0 apply to when candidate cells configured are more than UE capability?**

**Issue 1-5-1: Capability for supporting RTD>CP**

**Issue 1-5-2: Capability for RACH-less LTM cell switch**

**Issue 1-4-2-1:** **Conditions of no extra time for PL-RS measurement in cell switch delay**

**Issue 1-4-1-1: T/F tracking when TRS as QCL source in cell switch delay**

**Issue 1-2-3: Whether and how to support unknown TCI state in FR2 for early TCI state activation**

**Issue 1-2-1: Whether to consider early TCI state activation for multiple cells at the same time**

**Issue 1-1-1: SFN acquisition**

**Issue 1-4-1-2: Conditions of Tfirst-RS =0 in cell switch delay**

**Issue 1-2-5: Conditions to support unknown TCI state in FR1 for early TCI state activation**

**Issue 3-1-1: Definition of L1-RSRP measurement relative accuracy**

**Issue 3-1-2: TCI state configurations**

**Improvement on SCell/SCG setup delay:**

**Issue 2-1-1: UE behaviour when *measReselectionCarrierListNR* is not configured**

**Issue 3-2-1: More test for Improvement on SCell/SCG setup delay**

# Topic #1: LTM – Core part (AI 5.24.1)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411348**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411348.zip) | CATT | **Proposal 1: Early TCI state activation delay requirements are defined for one or more TCI states for a single candidate cell.****Proposal 2: RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.****Proposal 3: If RAN4 allow cell switch delay requirements applicable to unknown TCI state case with conditions in FR1 and FR2, we also can agree to directly clarify all applicable conditions for cell switch delay requirements in the spec, rather than defining known TCI state conditions.****Proposal 4: For the conditions when SNR of the TCI state≥ -3dB, it is supported that UE has reported L3-RSRP measurements for the SSB associated to the target TCI state in [1280]ms before the cell switch command.****Observation: For the case without SSB based L1-RSRP measurements, there is no capability to indicate whether UE supports RTD>CP case for early T/F tracking and/or PDCCH order RACH.****Proposal 5: The current capability of SSB based L1-RSRP measurements for multiple cells with RTD > CP should be revised.*** **It only needs to describe the capability of handling multiple cells with RTD > CP.**
* **This capability will be supported together with the capabilities of SSB based L1-RSRP measurements and/or early T/F tracking and/or PDCCH order RACH.**
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| [**R4-2411433**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411433.zip) | Apple | **Proposal 1: to decouple L1-RSRP with LTM for target cell in FR1, allow cell switch delay requirements applicable to unknown TCI state case with the following conditions:****Proposal 2: remove the FFS regarding support of inter-frequency L1 measurement with MG in definition of TSSB in PDCCH ordered RACH and early TCI activation requirements.****Proposal 3: No additional PL-RS measurement time is needed, provided L3-RSRP or L1-RSRP on the SSB associated with PL-RS has been measured/reported.****Proposal 4: in RRM requirements applicability of LTM cell switch delay and PDCCH order RACH delay, clarify that SFN between serving and target cell should be the same even for inter-frequency target cell in FR1. Otherwise, additional time for UE to perform SFN acquisition is expected as for minimum requirements.** |
| [**R4-2411480**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411480.zip) | OPPO | **Observation 1: The principle to define the delay requirements of L1 RSRP measurements on Serving cell and intra-frequency neighbour cell should be kept aligned.****Proposal 1:** **RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.****Proposal 2: Consider to revisit the agreements for L1 RSRP measurement on neighbour cell, e.g., either follow the logic of serving cell L1-RSRP measurement or L3 intra-frequency measurement without gap.****Proposal 3: For the applicable condition of FR1and FR2, when SNR of the TCI state≥ -3dB and TCI state has been activated, it is also required that the RS associated to the target TCI state is available at least every 1280ms after TCI state activation command.** |
| [**R4-2411701**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411701.zip) | MediaTek Inc. | **Proposal 1: Not to consider unknown TCI state in FR2 for early TCI state activation.****Proposal 2: Not to handle the collision of multiple MAC CE commands for early TCI state activation. Specifically, not to consider early TCI state activation for multiple cells at the same time.****Proposal 3: In FR1, without L1 measurement, cell switch delay requirements are applicable, provided:*** **SNR of the SSB associated to TCI state ≥ -3dB**
* **Beam-level L3 measurement results have been reported in 1280ms**

**Proposal 4: Capture the applicable conditions for cell switch delay requirements directly in spec instead of defining known TCI state conditions.****Proposal 5: Not to extend cell switch delay requirements to FR2 without L1 report.****Proposal 6: The condition of no additional time for PL-RS measurement in cell switch delay is that the PL-RS is associated with the SSB indicated for T/F tracking in cell switch command.****Proposal 7: When the configured candidate cells are more than number of candidates that UE supports early RRC decoding and validity check, UE will perform early RRC decoding on the last X cells which TCI state activation MAC-CE or PDCCH order command is sent for and*** **NW will not trigger TCI state activation or PDCCH-order RACH on different candidate cells at the same occasion.**
* **If NW deactivates all the TCI states of a candidate, this cell will be removed from the early RRC decoding list until any of its TCI states is added back again.**

**Proposal 8: Revise 39-1 to indicate whether UE supports L1-RSRP measurement and/or early T/F tracking and/or PDCCH order RACH when RTD of cells >CP.**  |
| [**R4-2411986**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411986.zip) | CMCC | ***Proposal 1: it is proposed to consider TRS as QCL source RS for cell switch and early TCI state.*** |
| [**R4-2412209**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412209.zip) | Huawei, HiSilicon | **Proposal 1: No requirements of early TCI state activation delay are specified for the case that multiple LTM TCI activation commands are received at the same time.****Proposal 2: Unknown TCI state in FR1, provided the following conditions are met:****- UE has reported L3 measurement result with the associated SSB index of the TCI state within 1280ms before the LTM TCI state activation command.****- SNR of the associated SSB is above -3dB.****Proposal 3: Early TCI state activation delay is not applicable to FR2 unknown case.****Proposal 4: DIFFRSRP\_15 in Table 10.1.6.1-2 to be used for measurement reporting for unmeasured LTM L1-RSRP resources. To ensure the some understanding between network and UE, some clarification on DIFFRSRP\_15 is required.****Proposal 5: If TRS is configured as a resource RS in TCI state,** **-the current RACH based LTM cell switch delay can keep unchanged with using SSB for T/F tracking.****-for RACH-less based LTM cell switch delay, either using SSB or using TRS for T/F tracking can work.****Proposal 6: RAN4 only consider PL-RS maintained case and no extra time is expected for PL-RS measurement in LTM cell switch delay.****Proposal 7: TLTM\_RRC-processing =0 applies to the cells with early TCI activation or early PDCCH order RACH, provided that the total number of serving cells and the candidate cells in the LTM candidate cell configuration, the cells with early TCI activation, and the cells with early PDCCH order RACH does not exceed the capability [*Fast processing of LTM candidate cell RRC configuration*].****Proposal 8: TLTM\_RRC-processing =0 applies to the latest cell(s) with early TCI activation or early PDCCH order RACH before LTM cell switch command, if the total number of serving cells and the candidate cells in the LTM candidate cell configuration, the cells with early TCI activation, and the cells with early PDCCH order RACH exceed the capability [*Fast processing of LTM candidate cell RRC configuration*].****Proposal 9: The current LTM cell switch switching delay can be applied for FR1 without early L1 measurement, when UE has reported L3 measurement result with the associated SSB index of the TCI state within 1280ms before the LTM TCI state activation command.**  |
| [**R4-2412230**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412230.zip) | China Telecom | **Proposal 1:** **Early TCI state activation delay requirements are defined for one or more TCI states for a single candidate cell.****Proposal 2:** **UE is supposed to decoding RRC of all the cells whose TCI state(s)are activated or early RACH is triggered, provided the number of these cells doesn’t exceed UE capability.****If the number of these cells exceeds UE capability, UE is supposed to decoding RRC of the lasted ones within UE capability whose TCI state(s)are activated or early RACH is triggered.** |
| [**R4-2412384**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412384.zip) | ZTE Corporation, Sanechips | **Proposal 1: Early TCI state activation delay requirements to be defined for one or more TCI states for a single candidate cell, because one MAC-CE activates TCI states only for a single candidate cell.****Proposal 2: In early candidate cell’s TCI state activation delay for known TCI state case: Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +**$3N\_{slot}^{subframe,µ}$ **+ [2ms] if the SSB needs to be measured with MG, which is only applicable to UE supporting inter-frequency L1 measurement with MG.****Proposal 3: Unknown TCI state in FR2 for early TCI state activation is supported with the following conditions:** * + **UE has reported measurement result of the associated SSB of the TCI state within [TBD] before the LTM TCI state activation command.**
	+ **SNR of the associated SSB is above -3dB.**

**Proposal 4: RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.****Proposal 5: No additional delay for PL-RS measurement time is needed in cell switch delay for PL-RS measurement provide that the following condition is fulfilled:****L3-RSRP or L1-RSRP on the SSB associated with PL-RS has been measured/reported.Proposal 6: When TCI state activation MAC-CE or PDCCH order is sent for more cells than UE capability for fast processing, the cells for which the UE received TCI state activation MAC-CE or PDCCH order the most recently before cell switch command are the ones that are pre-processed.**Observation 1: both option1 and option2 are fine and can handle the case that the cell switch delay requirement is applicable without L1 measurement and report. And option1 will cause the different definition from legacy which maybe make specification more complex.**Proposal 7: For unknown TCI state in FR1, cell switch delay requirements applicable when SNR of the TCI state≥ -3dB and UE has reported L3-RSRP measurements for the SSB associated to the target TCI state in [1280]ms before the cell switch command****Observation 2: when *measReselectionCarrierListNR* is not configured, there maybe disalignment between RAN2 and RAN4.****Proposal 8: RAN4 should confirm what the UE behavior is if *measReselectionCarrierListNR* is not configured. UE will repoet any measurement results if available or UE will not repoet any measurement results.** |
| [**R4-2412798**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412798.zip) | Nokia | [**Proposal 1: If RAN4 sees a need to clarify what the UE reports in case it is not measuring some LTM candidate cell, clarify this by sending an LS to RAN1**](#_Toc173846484)[**a. Question : From RAN1 point of view, is it acceptable for the UE to report invalid values (from table 10.1.6.1-1 of TS 38.133) or value DIFFRSRP\_15 (from table 10.1.6.1-2 of TS 38.133) for LTM candidate cells that are not measured by the UE? At least the following should be considered:**](#_Toc173846485)[**i. When none of the candidate cells are measured within the given periodicity, UE reports a 7 bit “Not valid” value.**](#_Toc173846486)[**ii. DIFFRSRP\_15 is reported when at least one LTM candidate cell was measured and at least one configured candidate cell was unmeasured.**](#_Toc173846487)[**iii. The reported values for unmeasured cells do not meet any measurement requirements as they are unmeasured.**](#_Toc173846488)[**Proposal 2: Use the following conditions for Tfirst-RS = 0 and TRS-proc= 0**](#_Toc173846489)**Tfirst-RS is the time for fine time tracking and acquiring full timing information of the target cell.** **TRS-proc is the time for SSB processing.** **Tfirst-RS = 0 and TRS-proc= 0 under the following conditions:****- The target TCI state indicated in the LTM cell switch command is in the serving cell active TCI state list, or****- The UE is configured with LTM L1 intra- and/or inter-frequency measurements for the target cell, and****- The target TCI state in the cell switch command is in the LTM candidate cell active TCI state list, and** **- the time gap between receiving the LTM candidate cell TCI state activation MAC-CE and the cell switch command is at least TCI state activation delay stated in section 8.25.3x, and****- the time gap between receiving the LTM candidate cell TCI state activation MAC-CE and the cell switch command is not more than TCI state activation delay stated in section 8.25.3 + 160 ms, or** **- the measurement period of the SSB associated to target TCI state is not larger than 160 ms after the LTM candidate cell TCI state activation MAC-CE is received, or****- The target cell is an FR1 cell, and the UE is not configured with LTM L1 intra- and/or inter-frequency measurements for the target cell, and** **- The target TCI state in the cell switch command is in the LTM candidate cell active TCI state list, and** **- the time gap between receiving the LTM candidate cell TCI state activation MAC-CE and the cell switch command is at least TCI state activation delay stated in section 8.x, and not more than TCI state activation delay stated in section 8.x + [160 ms], or****- The time gap between the latest PDCCH ordered RACH preamble transmission on the target cell and the cell switch command is not more than [160 ms].****Otherwise,** **Tfirst-RS is the time to the first SSB transmission on the target cell [after Tcmd].*****Editor’s note: FFS whether TRS transmission is also considered.*****TRS-proc = 2 ms.**[**Proposal 3: Use the following known TCI state conditions for cell switch:**](#_Toc173846490)**The target joint DL/UL TCI state or separate DL and UL TCI states in the LTM cell switch command are known if the following conditions are met:****- The target TCI state in the cell switch command is activated not more than TBD1280 ms before the reception of the cell switch command and SNR of the SSB associated to TCI state ≥ -3dB; or** **- The target TCI state in the cell switch command is activated before receiving the cell switch command and the SSB associated to target TCI state is available at least once every TBD1280 ms after the TCI state activation command is received and SNR of the SSB associated to TCI state ≥ -3dB; or****- During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target DL/UL TCI state to the completion of LTM cell switch, where the RS resource for L1-RSRP measurement is the RS in target DL/UL TCI state or QCLed to the target DL/UL TCI state****- LTM cell switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement** **- The UE has sent at least 1 L1-RSRP report for the target DL/UL TCI state before the LTM cell switch command****- The target DL/UL TCI state remains detectable during the LTM cell switching period****- The SSB associated with the target DL/UL TCI state remain detectable during the cell switching period****- SNR of the TCI state ≥ -3dB****Otherwise, the target joint DL/UL TCI state or separate DL and UL TCI state is unknown.**[**Proposal 4: Cell switch delay requirements to apply for unknown target TCI state in FR1 if there was a beam level L3-RSRP report within TBD ms before the cell switch command.**](#_Toc173846491)[**Observation 1: After TCI state activation for one LTM candidate cell, the UE is according to RAN4 requirements allowed to deprioritize L1 measurements on other candidate cells. Hence, a following TCI state activation command for any other candidate cell leads to UE potentially not measuring this cell at the time of TCI state activation. Therefore, the target TCI state is unknown.**](#_Toc173846492)[**Observation 2: If unknown TCI state activation is not supported in FR2, RAN4 requirements do not support TCI state activation for more than one candidate cell in FR2.**](#_Toc173846493)[**Observation 3: TCI state activation delay requirements for a cell on which the UE is not performing L1 measurements due to TCI state activation on other candidate cell(s) can be handled through: 1. Requirements not supporting TCI state activation for more than one canddate cell in FR2 in Rel-18, or 2. Handling the case through unknown TCI state activation delay requirements (also in FR2), or 3. Reconsidering the agreement about UE being allowed to prioritize measurements only on cell(s) with active TCI states e.g. by defining some additional conditions or network signalling (potential RAN2 impact).**](#_Toc173846494)[**Proposal 5: RAN4 to discuss whether to cover TCI state activation delay requirement for a cell on which the UE is not performing L1 measurements due to earlier TCI state activation on other candidate cell(s) through: 1. Handling the case through unknown TCI state activation delay requirements (also in FR2), or 2. Reconsidering the agreement about UE being allowed to prioritize measurements only on cell(s) with active TCI states e.g. through some additional conditions. 3. Requirements not supporting TCI state activation for more than one candidate cell in FR2 in Rel-18.**](#_Toc173846495)[**Observation 4: Early TCI activation can be configured either by using TRS or SSB association, not both, therefore the UE should always know which one to follow.**](#_Toc173846496)[**Proposal 6: Add TRS as a possible QCL source for T/F tracking in RAN4 TCI state activation and cell switch delay requirements.**](#_Toc173846497)[**Proposal 7: Target PL-RS is maintained in the scenarios where Tfirst-RS = 0. When Tfirst-RS > 0, the UE can use the first SSB for PL-RS measurement, if needed. Hence, no additional delay due to PL-RS measurement is needed in cell switch delay requirement.**](#_Toc173846498)[**Proposal 8: When TCI state activation MAC-CE or PDCCH order is sent for more cells than UE capability for fast processing, the cells for which the UE received TCI state activation MAC-CE or PDCCH order the most recently before cell switch command are the ones that are pre-processed.**](#_Toc173846499) |
| [**R4-2413005**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413005.zip) | Ericsson, Qualcomm Incorporated | 1. When one or more of TCI state activation commands are received at slot n, UE shall be able to finish the TCI state activation within slot n+ THARQ +$3N\_{slot}^{subframe,µ}+$TTF + TSSB-proc. where TTF  is mentioned in the below table.

|  |  |  |
| --- | --- | --- |
|  | TTF | Comments  |
| FR1 intra-frequency cell, known and unknown TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn)  | Tfirst-SSB\_TCIn is the time for first SSB associated to TCI state n.  |
| FR1 inter-frequency cell without MG, known and unknown TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn) + (M-1)\*TSSB | Tfirst-SSB\_TCIn is the time for first SSB reception associated to TCI state n. M is the number of cells to activate the TCI statesTSSB is the SSB burst periodicity. |
| FR1 inter-frequency cell with MG, known and unknown TCI state | TFirstMG + (M-1) \*MGRP+MGL | TFirstMG is the time to start of first MG after slot n+THARQ+3ms, MGL is measurement gap lengthM is the number of cells to activate the TCI statesMGRP is the MG repetition periodicity  |
| FR2 intra-frequency cell, known TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn) + (M-1)\*TSSB | Tfirst-SSB\_TCIn is the time for first SSB reception associated to TCI state n. M is the number of cells to activate the TCI statesTSSB is the SSB burst periodicity |
| FR2 inter-frequency cell without MG, known TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn) + (M-1)\*TSSB | Tfirst-SSB\_TCIn is the time for first SSB reception associated to TCI state n. M is the number of cells to activate the TCI statesTSSB is the SSB burst periodicity |
| FR2 inter-frequency cell with MG, known TCI state | TFirstMG + (M-1) \*MGRP+MGL | TFirstMG is the time to start of first MG after slot n+THARQ+3ms, MGL is measurement gap lengthM is the number of cells to activate the TCI statesMGRP is the MG repetition periodicity |

1. FR2 unknown TCI state activation requirements are not specified in Rel-18.
2. Unknown TCI state activation requirements are applicable if the TCI state activated is based on the measurement report (e.g., L3-RSRP or L1-RSRP) within last 5 seconds and the SNR of the associated SSB is above -3dB.
3. In FR1, for UE not supporting/configured with L1 measurement, one SSB occasion is needed from RAN4 requirement point of view for T/F fine tracking, if
	* + the time gap between completion of TCI activation and cell switch command is larger than 480ms and the L3 measurement interval is larger than 160 ms, or
		+ the time gap between early RACH transmission and cell switch command is larger than 480ms and the L3 measurement interval is larger than 160 ms.
4. Interruption to both DL and UL duration before/after PDCCH-order LTM PRACH is extended by 1ms for the following case:
* The PDCCH-order PRACH is not fully contained in any of UE’s configured UL BWP(s) of active serving cells, and
* the number of RRC-configured LTM cells whose PRACH resources are not fully overlapping in the frequency domain is more than 2, and
* UE is configured with SRS carrier.
1. RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.
2. In L1-RSRP measurement report, for unmeasured candidate cells, UE reports DIFFRSRP\_15 in Table 10.1.6.1-2.
3. For the cell switch delay, no additional delay or conditions are needed for PL-RS measurement provided that the following condition are fulfilled:
* UE has reported L3-RSRP on the SSB associated with PL-RS before reception of LTM configuration and UE is configured to perform L3 or L1 measurements after LTM configuration.
1. RAN4 to allow the LTM cell switch requirements to be applicable for unknown TCI state.
2. We suggest modifying the TCI known condition to following

The target joint DL/UL TCI state or separate DL and UL TCI states in the LTM cell switch command are known if the following conditions are met:[- The TCI state is activated not more than TBD ms before the reception of the cell switch command and SNR of the SSB associated to TCI state is ≥ -3dB; where the TCI state is considered activated if the activated TCI state and target TCI state in the cell switch command are same or the SSB associated to target TCI state in cell switch command and the SSB associated to activated TCI state are same; or] [- The TCI state is activated before the reception of the cell switch command (where the TCI state is considered activated if the activated TCI state and target TCI state in the cell switch command are same or the SSB associated to target TCI state in cell switch command and the SSB associated to activated TCI state are same) and the SSB associated to target TCI state is available at least once every TBD ms after the TCI state activation command is received and SNR of the SSB associated to TCI state ≥ -3dB; or]1. RAN4 to clarify, if TCI state in LTM Cell Switch command is “unknown”/not activated, UE should perform the cell switch with additional time for T/F tracking in the cell switch delay.
2. For ‘fast processing of an LTM candidate cell RRC configuration,’ RAN4 to adopt the following additional UE capabilities and applicable conditions:
* Add the following components:
	+ maxLTMCandidateConfig (2nd component of 39-6)
	+ maxServingAndCandidteCells (1st component of 39-6)
* Fast RRC processing is applicable to the following candidate cells (ltm-CandidateConfig):
	+ The ltm-CandidateConfig IEs associated with at least one active TCI state
	+ The ltm-CandidateConfig IEs associated with previously performed PDCCH-order PRACH.
	+ If the number of the ltm-CandidateConfig IEs associated with active TCI state and PDCCH-order PRACH transmission is larger than maxLTMCandidateConfig, the ltm-CandidateConfig IEs for fast RRC processing are chosen in reverse chronological order of Candidate Cell TCI States Activation MAC CE and PDCCH-order PRACH, i.e. maxLTMCandidateConfig ltm-CandidateConfig IEs with the most recently activated TCI states and PDCCH-order PRACH transmission. And in case a tie-break rule is needed, the ltm-CandidateConfig associated with the most recent PDCCH-order PRACH transmission will be chosen.
	+ The above applies only if each of the following conditions are fulfilled
		- The current serving cells and the cells inside the ltm-CandidateConfig, chosen by the above condition, across cell groups (i.e. MCG and SCG) is not larger than maxServingAndCandidteCells
		- The time gap from the slot where the UE received the candidate cell TCI state activation MAC CE to the slot where the UE received the LTM cell switch MAC CE is larger than THARQ+13ms, if the condition of ‘fast RRC processing’ is met by the candidate cell TCI state activation.
		- The time gap from the slot where the UE received the PDCCH triggering the PDCCH-order PRACH transmission to the slot where the UE received the LTM cell switch MAC CE is larger than NT,2+10ms, if the condition of ‘fast RRC processing’ is met by the PDCCH-order PRACH transmission.
1. RAN4 to define the following UE capability:
* RACH-less LTM cell switch can be conducted to one of ‘N’ cells to which the UE most recently transmitted the ‘PDCCH-order PRACH’ except for the cell configured as SCell.
	+ N = {[1], 2, …, 7}, if not reported, N=8.
	+ Granularity: Per UE
 |
| R4-2412517 | vivo | **Observation 1 RRC configurations of LTM L1 measurement and reporting are separate from legacy L1 measurement and reporting.** **Observation 2 RAN1 has agreed that LTM CSI reports have higher priority than all legacy CSI Reports configured under *CSI-ReportConfig* in case of collision. Hence, it is nature that gNBs will prevent collisions in CSI-reporting occasions as far as possible so as to ensure performance of legacy CSI reporting.****Observation 3 For legacy serving cell L1 measurement, the CSI measurement occasion is restricted to the most recent occasion according to TS 38.214. However, such restriction does not apply to LTM L1 measurement.** **Observation 4 L1 measurement configured by *LTM-CSI-ResourceConfig* are performed for the RTD>CP scenario only if UE supports RAN4 FG39-1. However, requirements specified in 9.5.4.1 are applicable for the RTD>CP scenario if UE support *rxTimingDiff-r18* defined in R18 MIMO WI. Actually *rxTimingDiff-18* is only applicable to the L1 measurement configured by *CSI-ResourceConfig*.****Observation 5 L1 measurement configured by *CSI-ResourceConfig* are performed in case the total number of resource to measure does not exceed *beamManagementSSB-CSI-RS*. If UE is configured with LTM L1 measurement and the total number of cells or resources exceed the number indicated by UE FG 39-3-1/2/3/4/5/6, it shall not impact the L1 measurement configured by *CSI-ResourceConfig*.****Observation 6 RRM requirements for L1 measurement configured by *CSI-ResourceConfig* shall be applicable to FR1 HST and FR2 HST no matter whether LTM L1 measurement is configured or not.****Observation 7 For FR1 and FR2, there is no technical issue if LTM L1 measurement and legacy L1 measurement are performed simultaneously on serving cell SSBs.****Observation 8 For FR2, RAN4 has agreed to define sharing factor between all serving cell L1 measurements (including LTM L1 and legacy L1) and neighbour cell(s) LTM L1 measurement, considering different UE Rx beams could be used. It shall be understood as measurement relaxation to legacy L1 measurements if LTM L1 measurements on neighbour cell(s) are configured, and PL1\_sharing would be enough to capture this impact.** **Observation 9 It is not always necessary to assume UE are performing legacy L1 measurement and LTM L1 measurement simultaneously with exactly the same UE behaviour.****Proposal 1 Capture all intra-frequency LTM L1 measurement requirements, including serving cell L1 measurement requirements, in 9.14.** **Proposal 2 The impact to serving cell L1 measurement, which is configured by *CSI-ResourceConfig*, due to Rx beam sharing with neighbour cell LTM L1 measurement is captured by PL1\_sharing in 9.5.4.1****Observation 10 Based on the SSB detectable condition defined in TS 38.133, it is possible for LTM L1 measurement that, the number of SSBs identified by UE in the configured list of candidate SSBs in *LTM-CSI-ResourceConfig-r18*, is less than the number of SSBs configured to report, i.e. *nrOfReportedCells-r18* \* *nrOfReportedRS-PerCell-r18*.****Proposal 3 In L1-RSRP measurement report, for unmeasured candidate cells, UE sends invalid L1-RSRP in PUCCH if needed, i.e. the reported value corresponds to one of the invalid codepoints for L1-RSRP in Table 10.1.6.1-1 or DIFFRSRP\_15 in Table 10.1.6.1-2.** * **In this case, the SSB or the cell it reflects remains unknown to the UE.**

**Proposal 4 Confirm the FFS bullet:*** **In early candidate cell’s TCI state activation delay for known TCI state case: For UE supporting inter-frequency L1 measurement with gap, Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +**$3N\_{slot}^{subframe,µ}$ **+ [2ms] if the SSB needs to be measured with MG.**
* **In PDCCH ordered RACH delay, when additional time for T/F tracking is needed: For UE supporting inter-frequency L1 measurement with gap, TSSB is the time to the first SSB occasion overlapped with MGL after [2]ms and [1slot from] the end of the slot of the PDCCH, plus 2ms (SSB processing time), if the SSB needs to be measured with MG.**
 |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1 PDCCH-order RACH on neighbor cell

**Issue 1-1-1: SFN acquisition**

**38.133:**

|  |
| --- |
| The requirements for inter-frequency cell switch to an FR2 target cell in this clause are only applicable, when - network has configured UE to perform L3 measurement with SSB index or L1 measurement for the target cell before the cell switch command, or - the SFN of the serving cell from which cell switch command is received and the SFN of the target cell are the same. |

**38.211:**

|  |
| --- |
| For handover purposes to a target cell in paired or unpaired spectrum where the target cell uses $L\_{max}=4$, the UE may assume the absolute value of the time difference between radio frame $i$ in the current cell and radio frame $i$ in the target cell is less than $153600T\_{s}$ if the association pattern period in clause 8.1 of [5, TS 38.213] is not equal to 10 ms.For inter frequency handover purposes where the source cell is either in paired or unpaired spectrum and the target cell is in unpaired spectrum and uses $L\_{max}=8$, the UE may assume the absolute value of the time difference between radio frame $i$ in the current cell and radio frame $i$ in the target cell is less than $76800T\_{s}.$ |

As a very soft tone is used in RAN1 spec “UE may assume”, proponent pointed out that NW may not strictly follow this especially for RACH-less scenario.

* Proposals
	+ Option 1 (Apple):
		- in RRM requirements applicability of LTM cell switch delay and PDCCH order RACH delay, clarify that SFN between serving and target cell should be the same even for inter-frequency target cell in FR1. Otherwise, additional time for UE to perform SFN acquisition is expected as for minimum requirements.
* Recommended WF
	+ Need more discussion.

**Issue 1-1-2: Interruption when PRACH is not fully contained in any of UE’s configured UL BWP(s) of active serving cells**

***RAN4#110bis***

|  |
| --- |
| **<Agreement >*** + Interruption to both DL and UL duration before/after PDCCH-order LTM PRACH is extended by [1ms] for the following case:
		- The PDCCH-order PRACH is not fully contained in any of UE’s configured UL BWP(s) of active serving cells, and
		- the number of RRC-configured LTM cells whose PRACH resources are not fully contained in any of UE’s configured UL BWP(s) of serving cell(s) is more than [2], and
		- UE is configured with SRS carrier switching.
 |

* Proposals
	+ Option 1 (Ericsson, QC): Remove the brackets.
		- Interruption to both DL and UL duration before/after PDCCH-order LTM PRACH is extended by ~~[~~1ms~~]~~ for the following case:
			* The PDCCH-order PRACH is not fully contained in any of UE’s configured UL BWP(s) of active serving cells, and
			* the number of RRC-configured LTM cells whose PRACH resources are not fully contained in any of UE’s configured UL BWP(s) of serving cell(s) is more than ~~[~~2~~]~~, and
			* UE is configured with SRS carrier switching.
* Recommended WF
	+ Recommend agree on Option 1.

### 1.2.2 Sub-topic 1-2 Early Candidate cell’s TCI state activation

**Issue 1-2-1: Whether to consider early TCI state activation for multiple cells at the same time**

* Proposals
	+ Option 1 (CATT, MTK, Huawei, CTC, ZTE):
		- No requirements of early TCI state activation delay are specified for the case that multiple LTM TCI activation commands are received at the same time.
	+ Option 2 (Ericsson, QC):
		- When one or more of TCI state activation commands are received at slot n, UE shall be able to finish the TCI state activation within slot n+ THARQ +$3N\_{slot}^{subframe,µ}+$TTF + TSSB-proc. where TTF  is mentioned in the below table.

|  |  |  |
| --- | --- | --- |
|  | TTF | Comments  |
| FR1 intra-frequency cell, known and unknown TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn)  | Tfirst-SSB\_TCIn is the time for first SSB associated to TCI state n.  |
| FR1 inter-frequency cell without MG, known and unknown TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn) + (M-1)\*TSSB | Tfirst-SSB\_TCIn is the time for first SSB reception associated to TCI state n. M is the number of cells to activate the TCI statesTSSB is the SSB burst periodicity. |
| FR1 inter-frequency cell with MG, known and unknown TCI state | TFirstMG + (M-1) \*MGRP+MGL | TFirstMG is the time to start of first MG after slot n+THARQ+3ms, MGL is measurement gap lengthM is the number of cells to activate the TCI statesMGRP is the MG repetition periodicity  |
| FR2 intra-frequency cell, known TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn) + (M-1)\*TSSB | Tfirst-SSB\_TCIn is the time for first SSB reception associated to TCI state n. M is the number of cells to activate the TCI statesTSSB is the SSB burst periodicity |
| FR2 inter-frequency cell without MG, known TCI state | max (Tfirst-SSB\_TCI1, Tfirst-SSB\_TCI2 .., Tfirst-SSB\_TCIn) + (M-1)\*TSSB | Tfirst-SSB\_TCIn is the time for first SSB reception associated to TCI state n. M is the number of cells to activate the TCI statesTSSB is the SSB burst periodicity |
| FR2 inter-frequency cell with MG, known TCI state | TFirstMG + (M-1) \*MGRP+MGL | TFirstMG is the time to start of first MG after slot n+THARQ+3ms, MGL is measurement gap lengthM is the number of cells to activate the TCI statesMGRP is the MG repetition periodicity |

* Recommended WF
	+ Recommend following the majority view and agree on Option 1
		- No requirements of early TCI state activation delay are specified for the case that multiple LTM TCI activation commands are received at the same time.

**Issue 1-2-2: The definition of Tfirst-SSB in early candidate cell’s TCI state activation delay for inter-frequency with gap for known TCI state case**

|  |
| --- |
| **RAN4#111**< **Agreement**>: * + In early candidate cell’s TCI state activation delay for known TCI state case: Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +$3N\_{slot}^{subframe,µ}$ + [2ms] if the SSB needs to be measured with MG.
		- FFS: this is only applicable to UE supporting inter-frequency L1 measurement with MG.
	+ Same agreement applies to the definition of Tfirst-SSB in PDCCH order RACH delay requirement.
 |

* Proposals
	+ Option 1 (Apple, MTK):
		- remove the FFS regarding support of inter-frequency L1 measurement with MG in definition of TSSB in PDCCH ordered RACH and early TCI activation requirements.
	+ Option 2 (ZTE, vivo):
		- Confirm the FFS.
* Recommended WF
	+ Need more discussion.

**Issue 1-2-3: Whether and how to support unknown TCI state in FR2 for early TCI state activation**

* Proposals
	+ Option 1 (MTK, Huawei, Ericsson, QC):
		- Not to define requirements of SSB based early TCI state activation delay for FR2 unknown TCI state case.
	+ Option 2 (ZTE):
		- Unknown TCI state in FR2 for early TCI state activation is supported with the following conditions:
			* UE has reported measurement result of the associated SSB of the TCI state within [TBD] before the LTM TCI state activation command.
			* SNR of the associated SSB is above -3dB.
	+ Option 3 (Nokia):
		- RAN4 to discuss whether to cover TCI state activation delay requirement for a cell on which the UE is not performing L1 measurements due to earlier TCI state activation on other candidate cell(s) through:
			* Handling the case through unknown TCI state activation delay requirements (also in FR2), or
			* Reconsidering the agreement about UE being allowed to prioritize measurements only on cell(s) with active TCI states e.g. through some additional conditions.
			* Requirements not supporting TCI state activation for more than one candidate cell in FR2 in Rel-18.
* Recommended WF
	+ Recommend following the majority view and agree on Option 1.
		- Not to define requirements of SSB based early TCI state activation delay for FR2 unknown TCI state case.

**Issue 1-2-4: Whether to consider TRS as QCL source in early candidate cell’s TCI state activation**

*As far as moderator know, supporting TRS as QCL source for early TCI state activation was a late conclusion in RAN1. RAN4 didn’t discuss the requirements for TRS as QCL source for early TCI state activation in R18. This is a R19 issue as R19 mobility is discussing early CSI-RS measurement.*

* Proposals
	+ Option 1 (CMCC):
		- it is proposed to consider TRS as QCL source RS for early TCI state.
	+ Option 2 (Nokia):
		- Add TRS as a possible QCL source for T/F tracking in RAN4 TCI state activation requirements.
* Recommended WF
	+ No more discussion.

**Issue 1-2-5: Conditions to support unknown TCI state in FR1 for early TCI state activation**

*RAN4#111*

|  |
| --- |
| < **Agreement**>: Unknown TCI state in FR1 for early TCI state activation is supported with the following conditions: * + UE has reported beam-level L3 measurement result of the associated SSB of the TCI state within [1280ms or 5 seconds] before the LTM TCI state activation command.
	+ SNR of the associated SSB is above -3dB.
 |

* Proposals
	+ Option 1 (Huawei):
		- Unknown TCI state in FR1, provided the following conditions are met:
			* UE has reported L3 measurement result with the associated SSB index of the TCI state within 1280ms before the LTM TCI state activation command.
			* SNR of the associated SSB is above -3dB.
	+ Option 2 (Ericsson, QC)
		- Unknown TCI state activation requirements are applicable if the TCI state activated is based on the measurement report (e.g., L3-RSRP or L1-RSRP) within last 5 seconds and the SNR of the associated SSB is above -3dB.
* Recommended WF
	+ Need more discussion.

### Sub-topic 1-3 L1-RSRP Measurement

**Issue 1-3-1: Measurement period of serving cell L1-RSRP measurement**

* Proposals
	+ Option 1 (CATT, OPPO, ZTE, Ericsson, QC):
		- RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.
* Recommended WF
	+ Recommend agree on Option 1:
		- RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.

**Issue 1-3-2: Measurement period of neighbor cell L1-RSRP measurement**

* Proposals
	+ Option 1 (OPPO):
		- Consider to revisit the agreements for L1 RSRP measurement on neighbour cell, e.g., either follow the logic of serving cell L1-RSRP measurement or L3 intra-frequency measurement.
* Recommended WF
	+ Need more discussion.

**Issue 1-3-3: L1 report for unmeasured candidate cells**

* Proposals
	+ Option 1 (Huawei, Ericsson, QC):
		- DIFFRSRP\_15 in Table 10.1.6.1-2 to be used for measurement reporting for unmeasured LTM L1-RSRP resources.
		- Huawei: To ensure the some understanding between network and UE, some clarification on DIFFRSRP\_15 is required.
	+ Option 2 (Nokia): If RAN4 sees a need to clarify what the UE reports in case it is not measuring some LTM candidate cell, clarify this by sending an LS to RAN1
		- From RAN1 point of view, is it acceptable for the UE to report invalid values (from table 10.1.6.1-1 of TS 38.133) or value DIFFRSRP\_15 (from table 10.1.6.1-2 of TS 38.133) for LTM candidate cells that are not measured by the UE? At least the following should be considered:
			* When none of the candidate cells are measured within the given periodicity, UE reports a 7 bit “Not valid” value.
			* DIFFRSRP\_15 is reported when at least one LTM candidate cell was measured and at least one configured candidate cell was unmeasured.
			* The reported values for unmeasured cells do not meet any measurement requirements as they are unmeasured.
	+ Option 3 (vivo):
		- In L1-RSRP measurement report, for unmeasured candidate cells, UE sends invalid L1-RSRP in PUCCH if needed, i.e. the reported value corresponds to one of the invalid codepoints for L1-RSRP in Table 10.1.6.1-1 or DIFFRSRP\_15 in Table 10.1.6.1-2.
			* In this case, the SSB or the cell it reflects remains unknown to the UE.
* Recommended WF

It seems there is common understanding that DIFFRSRP\_15 in Table 10.1.6.1-2 to be used for measurement reporting of differential values for unmeasured LTM L1-RSRP resources.

* + Recommend agree on:
		- Use DIFFRSRP\_15 in Table 10.1.6.1-2 for measurement reporting of differential values for unmeasured LTM L1-RSRP resources.

**Issue 1-3-4: Spec organization**

* Proposals
	+ Option 1 (vivo):
		- Capture all intra-frequency LTM L1 measurement requirements, including serving cell L1 measurement requirements, in 9.14.
		- The impact to serving cell L1 measurement, which is configured by CSI-ResourceConfig, due to Rx beam sharing with neighbour cell LTM L1 measurement is captured by PL1\_sharing in 9.5.4.1
* Recommended WF
	+ Collect more views from other companies.

### Sub-topic 1-4 Cell switch delay requirements for Pcell/PSCell

#### T/F tracking: Tfirst-RS and Tmargin

**Issue 1-4-1-1: T/F tracking when TRS as QCL source in cell switch delay**

* Proposals
	+ Option 1 (CMCC):
		- It is proposed to consider TRS as QCL source RS for cell switch and early TCI state.
	+ Option 2 (Huawei):
		- If TRS is configured as a resource RS in TCI state,
			* the current RACH based LTM cell switch delay can keep unchanged with using SSB for T/F tracking.
			* for RACH-less based LTM cell switch delay, either using SSB or using TRS for T/F tracking can work.
	+ Option 3 (Nokia)
		- Add TRS as a possible QCL source for T/F tracking in RAN4 cell switch delay requirements.
	+ Option 4 (Ericsson, QC):
		- modify the TCI known condition to following

The target joint DL/UL TCI state or separate DL and UL TCI states in the LTM cell switch command are known if the following conditions are met:

[- The TCI state is activated not more than TBD ms before the reception of the cell switch command and SNR of the SSB associated to TCI state is ≥ -3dB; where the TCI state is considered activated if the activated TCI state and target TCI state in the cell switch command are same or the SSB associated to target TCI state in cell switch command and the SSB associated to activated TCI state are same; or]

[- The TCI state is activated before the reception of the cell switch command (where the TCI state is considered activated if the activated TCI state and target TCI state in the cell switch command are same or the SSB associated to target TCI state in cell switch command and the SSB associated to activated TCI state are same) and the SSB associated to target TCI state is available at least once every TBD ms after the TCI state activation command is received and SNR of the SSB associated to TCI state ≥ -3dB; or]

* + - RAN4 to clarify, if TCI state in LTM Cell Switch command is “unknown”/not activated, UE should perform the cell switch with additional time for T/F tracking in the cell switch delay.
* Recommended WF

The proposals are discussing T/F tracking time needed in the following case:

|  |  |  |
| --- | --- | --- |
|  | Early TCI state activation | TCI state indication in cell switch command |
| Source RS | SSB | TRS |

In moderator understanding, whether to skip T/F tracking during cell switch delay is agnostic to the Type A source is SSB or TRS for early T/F tracking as long as they are on the same QCL chain.

* + Recommend agree on
		- Confirm current cell switch delay requirements are applicable to the case that TRS is configured as a QCL source in the indicated TCI state in cell switch command.

**Issue 1-4-1-2: Conditions of Tfirst-RS =0 in cell switch delay**

* Proposals
	+ Proposal 1 (Nokia): For cell switch with L1 measurement: Extend the condition for Tfirst-RS = 0 “the time gap between receiving the LTM candidate cell TCI state activation MAC-CE and the cell switch command is not more than [160 ms]” as much as feasible from the agreed 160 ms, to TCI state activation delay stated in section 8.25.3 + 160 ms.
	+ Proposal 2 (Nokia): For cell switch with L1 measurement: Tfirst-RS and TRS-proc = 0 in cell switch delay if UE successfully completed PDCCH ordered RACH preamble transmission within 160 ms before the cell switch command, and if the SSB in the PDCCH order is associated to the target TCI state.
	+ Proposal 3 (Nokia): For cell switch without L1 measurement in FR1: Tfirst-RS and TRS-proc = 0 in cell switch delay if the measurement period of the SSB associated to target TCI state is not larger than 160 ms.
	+ Proposal 4 (Ericsson, QC): In FR1, for UE not supporting/configured with L1 measurement, one SSB occasion is needed from RAN4 requirement point of view for T/F fine tracking, if
		- the time gap between completion of TCI activation and cell switch command is larger than 480ms and the L3 measurement interval is larger than 160 ms, or
		- the time gap between early RACH transmission and cell switch command is larger than 480ms and the L3 measurement interval is larger than 160 ms.
* Recommended WF
	+ Need more discussion.

#### Conditions of no extra time for PL-RS measurement in cell switch delay

**Issue 1-4-2-1:** **Conditions of no extra time for PL-RS measurement in cell switch delay**

* Proposals
	+ Option 1 (Apple, ZTE, Ericsson, QC):
		- No additional PL-RS measurement time is needed, provided L3-RSRP or L1-RSRP on the SSB associated with PL-RS has been measured/reported.
	+ Option 2 (MTK):
		- The condition of no additional time for PL-RS measurement in cell switch delay is that the PL-RS is associated with the SSB indicated for T/F tracking in cell switch command.
	+ Option 3 (Huawei):
		- RAN4 only consider PL-RS maintained case and no extra time is expected for PL-RS measurement in LTM cell switch delay.
	+ Option 4 (Nokia):
		- Target PL-RS is maintained in the scenarios where Tfirst-RS = 0. When Tfirst-RS > 0, the UE can use the first SSB for PL-RS measurement, if needed. Hence, no additional delay due to PL-RS measurement is needed in cell switch delay requirement.
* Recommended WF
	+ Recommend following the majority view and agree on Option 1
		- No additional PL-RS measurement time is needed, provided L3-RSRP or L1-RSRP on the SSB associated with PL-RS has been measured/reported.

#### Conditions of Early ASN.1 decoding and validity/compliance check

**Issue 1-4-3-1: Which cell(s) TLTM-RRC-processing = 0 apply to when candidate cells configured are more than UE capability?**

* Proposals
	+ Proposal 1 (Huawei, CTC):
		- TLTM\_RRC-processing =0 applies to the cells with early TCI activation or early PDCCH order RACH, provided that the number of these cells doesn’t exceed UE capability [*Fast processing of LTM candidate cell RRC configuration*].
		- Otherwise TLTM\_RRC-processing =0 applies to the latest cell(s) with early TCI activation or early PDCCH order RACH before LTM cell switch command.
	+ Proposal 2 (MTK):
		- When the configured candidate cells are more than number of candidates that UE supports early RRC decoding and validity check, UE will perform early RRC decoding on the last X cells which TCI state activation MAC-CE or PDCCH order command is sent for and
			* NW will not trigger TCI state activation or PDCCH-order RACH on different candidate cells at the same occasion.
			* If NW deactivates all the TCI states of a candidate, this cell will be removed from the early RRC decoding list until any of its TCI states is added back again.
	+ Proposal 3 (ZTE, Nokia): When TCI state activation MAC-CE or PDCCH order is sent for more cells than UE capability for fast processing, the cells for which the UE received TCI state activation MAC-CE or PDCCH order the most recently before cell switch command are the ones that are pre-processed.
	+ Proposal 4 (Ericsson, QC)
		- Fast RRC processing is applicable to the following candidate cells (ltm-CandidateConfig):
			* The ltm-CandidateConfig IEs associated with at least one active TCI state
			* The ltm-CandidateConfig IEs associated with previously performed PDCCH-order PRACH.
			* The current serving cells and the cells inside the ltm-CandidateConfig, chosen by the above condition, across cell groups (i.e. MCG and SCG) is not larger than maxServingAndCandidteCells
			* If the number of the ltm-CandidateConfig IEs associated with active TCI state and PDCCH-order PRACH transmission is larger than maxLTMCandidateConfig, the ltm-CandidateConfig IEs for fast RRC processing are chosen in reverse chronological order of Candidate Cell TCI States Activation MAC CE and PDCCH-order PRACH, i.e. maxLTMCandidateConfig ltm-CandidateConfig IEs with the most recently activated TCI states and PDCCH-order PRACH transmission. And in case a tie-break rule is needed, the ltm-CandidateConfig associated with the most recent PDCCH-order PRACH transmission will be chosen.
* Recommended WF

*The common part of the proposals are:*

* + - *If the total number of stored cells does not exceed UE capability maxNumberStoredConfigCells-r18 and the number of LTMCandidateConfigs fast decoded does not exceed maxNumberConfigs-r18, TLTM\_RRC-processing =0 applies to the LTM candidates with early TCI activation or early PDCCH order RACH,*
		- *Otherwise, TLTM\_RRC-processing =0 applies to the LTM candidates with the most recently activated TCI states and PDCCH-order PRACH transmission within UE capability maxNumberStoredConfigCells-r18 and maxNumberConfigs-r18.*

*The divergence is how to avoid misunderstanding of “most recent” candidates in the 2nd bullet.*

* + - *Option 1: add some limitation to avoid mis-understanding*
			* *NW will not trigger TCI state activation or PDCCH-order RACH on different candidate cells at the same occasion.*
		- *Option 2: in case a tie-break rule is needed, the ltm-CandidateConfig associated with the most recent PDCCH-order PRACH transmission will be chosen.*



 *This is also related to Issue 1-2-1: Whether to consider early TCI state activation for multiple cells at the same time.*

* + Recommend agree on:
		- If the total number of stored cells does not exceed UE capability *maxNumberStoredConfigCells-r18* and the number of *LTMCandidateConfigs* fast decoded does not exceed *maxNumberConfigs-r18*, TLTM\_RRC-processing =0 applies to the LTM candidates with early TCI activation or early PDCCH order RACH,
		- Otherwise, TLTM\_RRC-processing =0 applies to the LTM candidates with the most recently activated TCI states or PDCCH-order PRACH transmission within UE capability *maxNumberStoredConfigCells-r18* and *maxNumberConfigs-r18.*
			* This is at least applicable to the case that NW does not trigger TCI state activation or PDCCH-order RACH on different candidate cells at the same occasion.
			* FFS: Whether to support and further optimize the case that NW triggers TCI state activation or PDCCH-order RACH on different candidate cells at the same occasion.

#### Cell Switch without L1 measurement in FR1

**Issue 1-4-4-1: Applicable conditions of cell switch delay requirements in FR1 without L1 measurement**

* Proposals
	+ Option 1 (CATT, ZTE, Huawei, MTK):
		- UE has reported L3-RSRP measurements for the SSB associated to the target TCI state in 1280 ms before the cell switch command.
		- SNR of the SSB associated to TCI state ≥ -3dB
	+ Option 2 (Apple):
		- To decouple L1-RSRP with LTM for target cell in FR1, allow cell switch delay requirements applicable to unknown TCI state case with the following conditions:
			* TCI state has been activated and the TCI state activation was completed not more than 1280 ms before the cell switch command, or
			* UE has reported L3-RSRP measurements for the SSB associated to the target TCI state in 1280 ms before the cell switch command.
	+ Option 3 (OPPO):
		- when SNR of the TCI state≥ -3dB and TCI state has been activated, it is also required that the RS associated to the target TCI state is available at least every 1280ms after TCI state activation command.
	+ Option 4 (Nokia):
		- Cell switch delay requirements to apply for unknown target TCI state in FR1 if there was a beam level L3-RSRP report within TBD ms before the cell switch command.
		- TCI state is also known if
			* The target TCI state in the cell switch command is activated not more than 1280 ms before the reception of the cell switch command and SNR of the SSB associated to TCI state ≥ -3dB; or
			* The target TCI state in the cell switch command is activated before receiving the cell switch command and the SSB associated to target TCI state is available at least once every 1280 ms after the TCI state activation command is received and SNR of the SSB associated to TCI state ≥ -3dB
* Recommended WF

*Recommend agree on the common parts of most of the proposals and further discuss the divergence.*

* + Recommend agree on
		- Cell switch delay requirements apply to FR1 without L1 measurement provided that
			* UE has reported L3-RSRP measurements for the SSB associated to the target TCI state in [1280] ms before the cell switch command.
			* SNR of the SSB associated to TCI state ≥ -3dB
		- FFS other conditions.

**Issue 1-4-4-2: How to capture the applicable conditions of cell switch delay requirements in FR1 without L1 measurement in spec?**

* Proposals
	+ Option 1 (CATT, MTK):
		- directly clarify all applicable conditions for cell switch delay requirements in the spec, rather than defining known TCI state conditions.
	+ Option 2 (Apple, Ericsson, QC, [Nokia]):
		- allow cell switch delay requirements applicable to unknown TCI state case with the agreed conditions.
* Recommended WF
	+ Recommend follow the majority view and agree on Option 2:
		- Allow cell switch delay requirements applicable to unknown TCI state case with the agreed conditions in Issue 1-4-4-1.

#### Cell Switch without L1 measurement report in FR2?

**Issue 1-4-5-1: Whether are cell switch delay requirements applicable to FR2 without L1 measurement report?**

* Proposals
	+ Option 1 (OPPO):
		- Yes when SNR of the TCI state≥ -3dB and TCI state has been activated, it is also required that the RS associated to the target TCI state is available at least every 1280ms after TCI state activation command.
	+ Option 2 (Nokia): Yes with the following conditions:
		- The target TCI state in the cell switch command is activated not more than 1280 ms before the reception of the cell switch command and SNR of the SSB associated to TCI state ≥ -3dB; or
		- The target TCI state in the cell switch command is activated before receiving the cell switch command and the SSB associated to target TCI state is available at least once every 1280 ms after the TCI state activation command is received and SNR of the SSB associated to TCI state ≥ -3dB
	+ Option 3 (Ericsson, QC): Yes with the following conditions:
		- [- The TCI state is activated not more than TBD ms before the reception of the cell switch command and SNR of the SSB associated to TCI state is ≥ -3dB; where the TCI state is considered activated if the activated TCI state and target TCI state in the cell switch command are same or the SSB associated to target TCI state in cell switch command and the SSB associated to activated TCI state are same; or]
		- [- The TCI state is activated before the reception of the cell switch command (where the TCI state is considered activated if the activated TCI state and target TCI state in the cell switch command are same or the SSB associated to target TCI state in cell switch command and the SSB associated to activated TCI state are same) and the SSB associated to target TCI state is available at least once every TBD ms after the TCI state activation command is received and SNR of the SSB associated to TCI state ≥ -3dB; or]
	+ Option 4 (MTK):
		- Not to extend cell switch delay requirements to FR2 without L1 measurement report
* Recommended WF
	+ Need more discussion.

### 1.2.5 Sub-topic 1-5 UE feature

**Issue 1-5-1: Capability for supporting RTD>CP**

|  |  |  |  |
| --- | --- | --- | --- |
| **Index** | **Feature group** | **Components** | **Prerequisite feature groups** |
| 39-1 | SSB based L1-RSRP measurements for multiple cells with RTD > CP  | Capability of simultaneous L1-RSRP measurements for more than one cell when the max RTD among the cells on the same frequency layer or in the same active BWP is larger than CP length of the cell on the frequency layer or in the same active BWP. | 45-1 from RAN1 Rel-18 feature list or 39-2 or 39-2a |
| 45-3a | MAC-CE activated joint LTM TCI states | 1. Supported QCL source RS for MAC-CE activated joint LTM TCI states2. Maximum number of MAC-CE activated joint LTM TCI states per candidate cell3. Maximum number of MAC-CE activated joint LTM TCI states across candidate cells and serving cells | 45-3 |
| 45-4a | MAC-CE activated DL/UL LTM TCI states | 1. Supported QCL source RS for MAC-CE activated DL/UL LTM TCI states2. Maximum number K1 of MAC-CE activated DL TCI states per candidate cell3. Maximum number K2 of MAC-CE activated UL TCI states per candidate cell4. Maximum number of MAC-CE activated DL TCI states across all candidate cells and serving cells5. Maximum number of MAC-CE activated UL TCI states across all candidate cells and serving cells | 45-4 |
| 45-5 | RACH-based early TA acquisition | 1. Maximum number of candidate cells for TA acquisition based on PDCCH ordered CFRA procedure before receiving cell switch command MAC-CE2. Power ramping for PRACH retransmission based on PDCCH order indication3. Support of dropping the serving cell UL to handle the overlap between UL transmission on serving cell(s) and PRACH on candidate cell(s) | 45-7, RAN2 FG for LTM  |

* Proposals
	+ Option 1 (CATT, MTK):
		- The current capability of SSB based L1-RSRP measurements for multiple cells with RTD > CP (39-2) should be revised.
			* It only needs to describe the capability of handling multiple cells with RTD > CP.
			* This capability will be supported together with the capabilities of SSB based L1-RSRP measurements and/or early T/F tracking and/or PDCCH order RACH.
* Recommended WF
	+ Need more discussion.

**Issue 1-5-2: Capability for RACH-less LTM cell switch**

* Proposals
	+ Proposal 1 (Ericsson, QC): RAN4 to define the following UE capability:
		- RACH-less LTM cell switch can be conducted to one of ‘N’ cells to which the UE most recently transmitted the ‘PDCCH-order PRACH’ except for the cell configured as SCell.
			* N = {[1], 2, …, 7}, if not reported, N=8.
			* Granularity: Per UE
* Recommended WF
	+ Need more clarification and discussion.

**Issue 1-5-3:** **UE feature for** **Early ASN.1 decoding and validity/compliance check**

* Proposals
	+ Proposal 1 (Ericsson, QC): For ‘fast processing of an LTM candidate cell RRC configuration,’ RAN4 to adopt the following additional UE capabilities and applicable conditions:
		- Add the following components:
			* maxLTMCandidateConfig (2nd component of 39-6)
			* maxServingAndCandidteCells (1st component of 39-6)
		- Fast RRC processing is applicable only if each of the following conditions are fulfilled
			* The time gap from the slot where the UE received the candidate cell TCI state activation MAC CE to the slot where the UE received the LTM cell switch MAC CE is larger than THARQ+13ms, if the condition of ‘fast RRC processing’ is met by the candidate cell TCI state activation.
			* The time gap from the slot where the UE received the PDCCH triggering the PDCCH-order PRACH transmission to the slot where the UE received the LTM cell switch MAC CE is larger than NT,2+10ms, if the condition of ‘fast RRC processing’ is met by the PDCCH-order PRACH transmission.
* Recommended WF

*The proposal is aligned with previous agreement.*

* + No more discussion.

# 2. Topic #2: Improvement on SCell/SCG setup delay - Core part (AI 5.24.1)

## 2.1 Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2412384**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412384.zip) | ZTE Corporation, Sanechips | **Observation 2: when *measReselectionCarrierListNR* is not configured, there maybe disalignment between RAN2 and RAN4.****Proposal 8: RAN4 should confirm what the UE behavior is if *measReselectionCarrierListNR* is not configured. UE will repoet any measurement results if available or UE will not repoet any measurement results.** |

## 2.2 Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### 2.2.1 Sub-topic 2-1

**Issue 2-1-1: Mis-alignment between RAN2 and RAN4 spec when *measReselectionCarrierListNR* is not configured**

|  |
| --- |
| **TS 38.331 clause 5.7.10.3**1> if the *reselectionMeasurementReq* is included in the *UEInformationRequest*:2> if *validatedMeasurementsReq* is included in the *UEInformationRequest* and *measReselectionValidityDuration* is included in *VarMeasReselectionConfig*;3> if *measReselectionCarrierListNR* is present in *VarMeasReselectionConfig*:4> set the *measResultReselectionNR* in the *UEInformationResponse* message the valid NR measurement results, if available for any frequency listed in *measReselectionCarrierListNR* in *VarMeasReselectionConfig* and set *validityStatus* to the value of *measIdleValidityDuration* in *VarMeasReselectionConfig* for each reported measurement;3> else:4> set the *measResultReselectionNR* in the *UEInformationResponse* message to any valid NR measurement results, if available, and set validityStatus to the value of *measIdleValidityDuration* in *VarMeasReselectionConfig*;2> else:3> if *measReselectionCarrierListNR* is present in *VarMeasReselectionConfig*:4> set the *measResultReselectionNR* in the *UEInformationResponse* message the NR measurement results, if available for any frequency listed in *measReselectionCarrierListNR* in *VarMeasReselectionConfig*;3> else:4> set the *measResultReselectionNR* in the *UEInformationResponse* message to any NR measurement results, if available;**38.133 clause 4.3**The measurement results are considered valid if the following conditions are met for the validity check:- the measurements are performed before msg1 transmission for RRC resume/setup request within the last:- measIdleValidityDuration-r18 seconds for carriers configured in measIdleCarrierListNR-r16 or measIdleCarrierListEUTRA-r16, and/or - *measReselectionValidityDuration-r18* seconds for carriers configured in *measReselectionCarrierListNR-r18*,- the measurement results satisfy measurement accuracy requirement at the measurement instance.Otherwise, the measurement results are considered invalid. The UE shall not report invalid measurement results when *measIdleValidityDuration-r18* and/or *measReselectionValidityDuration-r18* is configured. If the *measIdleValidityDuration-r18* is not configured, the UE is not required to perform validity check for carriers in *measIdleCarrierListNR-r16* and *measIdleCarrierListEUTRA-r16,* and the UE may report measurement results given the measurement results satisfy measurement accuracy requirement at the measurement instance.If the *measReselectionValidityDuration-r18* is not configured, the UE is not required to perform validity check for carriers configured in *measReselectionCarrierListNR-r18,* and the UE may report measurement results given the measurement results satisfy measurement accuracy requirement at the measurement instance. |

* Proposals
	+ Option 1 (ZTE):
		- RAN4 should confirm what the UE behavior is if *measReselectionCarrierListNR* is not configured. UE will report any measurement results if available or UE will not report any measurement results.
* Recommended WF
	+ Need more discussion.

# 3. Topic #3: Performance Part (AI 5.24.2)

## 3.1 Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411703**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411703.zip) | MediaTek Inc. | **Proposal 1: The intra-frequency relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the value of L1-RSRP measured from another SSB of the cell(s) on the same frequency, or between any two SSBs measured on the same cell.****The inter-frequency relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the value of L1-RSRP measured from another SSB of the cell(s) on a different frequency.** |
| [**R4-2412489**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412489.zip) | Nokia | 1. Introduce test cases with valid reporting for FR1 and FR2 also for the case when the UE is configured with EMR measurements.
 |
| [**R4-2412519**](https://urldefense.com/v3/__https%3A/www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412519.zip__;!!CTRNKA9wMg0ARbw!i80k5bBdEf34lngZbc2vK89B4WaomjZhmZt_2fAP2Inc2ngQ4CILALFRMWxlA4QR7OY8bn5d_g_OzqPjK0M0Kw$) | vivo | **Observation 1 Since R17, supporting joint TCI configuration is the pre-requisite for supporting separate TCI.****Observation 2 According to RAN1 spec, the meaning of configuring ‘QCL-D’ and UL TCI to UE would be ambiguous in FR1.** **Proposal 1 In RRM test case design for LTM, RAN4 avoid TCI configuration with ‘QCL-D’ or ‘UL TCI’ to UE in FR1, which means only DL or Joint TCI with QCL-A/C configuration, and pathloss RS configuration if necessary, shall be provided to UE in FR1, even if UE supports *ltm-MAC-CE-SeparateTCI-r18*.** |

## 3.2 Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### 3.2.1 Sub-topic 3-1 LTM

**Issue 3-1-1: Definition of L1-RSRP measurement relative accuracy**

* Proposals
	+ Proposal 1 (MTK):
		- The intra-frequency relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the value of L1-RSRP measured from another SSB of the cell(s) on the same frequency, or between any two SSBs measured on the same cell.
		- The inter-frequency relative accuracy of SSB based L1-RSRP is defined as the L1-RSRP measured from one SSB compared to the value of L1-RSRP measured from another SSB of the cell(s) on a different frequency.
* Recommended WF
	+ Need more discussion.

**Issue 3-1-2: TCI state configurations**

* Proposals
	+ Proposal 1 (vivo): In RRM test case design for LTM, RAN4 avoid TCI configuration with ‘QCL-D’ or ‘UL TCI’ to UE in FR1, which means only DL or Joint TCI with QCL-A/C configuration, and pathloss RS configuration if necessary, shall be provided to UE in FR1, even if UE supports *ltm-MAC-CE-SeparateTCI-r18*.
* Recommended WF
	+ Need more discussion.

### 6.2.2 Sub-topic 3-2 Improvement on SCell/SCG setup delay

**Issue 3-2-1: More test for Improvement on SCell/SCG setup delay**

* Proposals
	+ Proposal 1 (Nokia):
		- Introduce test cases with valid reporting for FR1 and FR2 also for the case when the UE is configured with EMR measurements.
* Recommended WF
	+ Need more discussion.