**3GPP TSG-RAN WG4 Meeting # 111 R4-24xxxxx**

**Fukuoka, Japan, May 20 – 24, 2024**

**Agenda item:** 7.14.3

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

**Title:** Topic summary for [111] [218] NR\_Mob\_enh2\_part1

**Document for:** Information

# Introduction

This document is the email discussion summary for [111] [216] NR\_Mob\_enh2\_part1 with the following topics covered

* Topic 1: LTM - General aspects and scenarios (AI 7.14.1.1)
	+ Almost all the proposals not related to early TA acquisition and early TCI state activation are captured here.
* Topic 2: LTM - L1-RSRP measurement requirements (AI 7.14.1.1)
	+ The proposals related to L1-RSRP measurement core part requirements are captured here.
* Topic 3: LTM - L1/L2 inter-cell mobility delay requirements (AI 7.14.1.1)
	+ The proposals related Cell switch delay requirements are captured here.
* Topic 4: LTM – UE feature (AI 7.14.1.1)
	+ The proposals related to RAN2 LS are captured here.
* Topic 5: LTM – UE feature (AI 7.14.1.1)
	+ The proposals related to “UE capability” except those related to RAN2 LS are captured here.
* Topic 6: LTM – Performance (AI 7.14.2.1)
	+ The proposals related to LTM test cases and L1-RSRP measurement accuracy requuirements are captured here.

**Online issues**

**Issue 4-2-1: Understanding of per BC and Reporting granularity of RAN4 features 39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6**

**Issue 6-2-2: More test cases for PDCCH-order RACH**

**Issue 6-2-3: Whether to have test with two neighbor cells in FR2 for intra-frequency L1-RSRP measurement**

**Issue 2-1-1: whether to consider L1-RSRP measurement on deactivated SCell**

**Issue 2-1-2: L1-RSRP measurement on intra-f neighbor cell of deactivated SCC**

**Issue 1-2-1: Whether and how to define timing requirements for UE based TA measurement**

**Issue 6-2-4: Whether define test cases for UE-based TA measurement**

**Issue 3-2-1: Extension of known TCI state conditions for cell switch**

**Issue 4-1-1: Observations related to whether L1 measurement is prerequisite of R18 LTM.**

**Issue 4-1-2: How to reply RAN2 on Question 1**

**Issue 6-2-1: More test or sub-test cases for cell switch delay**

**Issue 6-1-1: Definition of L1-RSRP measurement relative accuracy**

**Issue 3-1-2-1: Extra time for PL-RS measurement?**

**Issue 1-3-6: Whether to consider early UL TCI state activation**

**Issue 6-2-5: TCI state configurations**

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

**Issue 1-3-2: The definition of Tfirst-SSB in early candidate cell’s TCI state activation delay for inter-frequency with gap for known TCI state case**

**Issue 1-1-1-1: The value of TSSB is if the condition of TSSB equal to zero is not met in PDCCH ordered RACH delay requirements**

**Issue 1-3-1: Whether to consider early TCI state activation for multiple cells at the same time**

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

**Issue 1-3-4: Conditions to support unknown TCI state in FR1 and FR2 (if RAN4 concludes supporting)**

**Issue 3-1-1-1: T/F fine tracking when TRS as QCL source in cell switch delay command**

**Issue 3-1-3-1: Tinterruption** **of PSCell switch**

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

**Issue 3-1-1-2: Conditions of Tfirst-RS =0 in cell switch delay**

# Topic #1: LTM - General aspects and scenarios

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| **[R4-2407348](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407348.zip)** | Apple | **Proposal 1: In PDCCH ordered RACH delay, TSSB is the time to first SSB transmission overlapped with MGL after PDCCH-order RACH command is decoded by the UE when SSB is outside active BWP. Otherwise, UE may need to perform T/F fine tracking using some autonomous gap, which would result in unexpected interruption.****Proposal 4: in time gap between early TCI state activation command and cell switch command, Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +**$3N\_{slot}^{subframe,µ}$ **for inter-frequency with gap.****Proposal 5: in Time gap between early TCI state activation command and cell switch command, unknown TCI state in FR1 is considered only if target cell is known.** |
| [**R4-2407482**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407482.zip) | CATT | **Proposal 1: In PDCCH ordered RACH delay, TSSB = Tfirst-SSB\_RACH + TSSB-proc,** * **Tfirst-SSB\_RACH is the time to first SSB transmission after PDCCH-order RACH command is decoded by the UE when SSB is within active BWP.**
* **Tfirst-SSB\_RACH is the time to first SSB transmission overlapped with MGL after PDCCH-order RACH command is decoded by the UE when SSB is outside active BWP.**
* **TSSB-proc = 2 ms;**

**Proposal 2: Considering the time for PDCCH-ordered RACH decoding, a little relaxation on Tfirst-SSB\_RACH is also acceptable.** * **The relaxation can be further discussed.**

**Observation 1: The exception case that has no UL timing requirements are not captured in the both clause 7.1.2 and clause 6.2.2C.2, which are separately for UL transmit timing requirements and PDCCH ordered Random Access delay.****Proposal 3: It is suggested to further capture the exception case that has no UL timing requirements in TS 38.133.****Proposal 4: It is suggested to determine which clause to capture the exception case that has no UL timing requirements.*** **Option 1: Clause 7.1.2 for UL transmit timing requirements.**
* **Option 2: Clause 6.2.2C.2 for PDCCH ordered Random Access delay.**
 |
| [**R4-2407769**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407769.zip) | vivo | **Observation 10 Based on the agreed big CR [7], and the requirement applicability rules for L1-RSRP measurements, LTM TCI activation delay requirements are not applicable to the case when activated TCI state(s) of one candidate cell already exist, but gNB activates one more unknown TCI state from another candidate cell on top of activated TCI state(s) from the existing candidate cell.****Proposal 6 RAN4 further discuss whether the scenario described in observation 10 is an important scenario in FR2, and whether RRM requirements need to be specified.****Proposal 7 TSSB-proc = 2 ms should be counted in TSSB****Proposal 8 Capture the following in 6.2.2C of TS 38.133:*** **PDCCH order-based RACH on candidate cell is triggered based on L1-RSRP report or L3-RSRP beam-level report.**

**Proposal 9 Specify RRM requirements for UE-based TA, so that the whole feature is completed.****Proposal 10 Not to consider uplink TCI activation before cell switch, i.e. both uplink TCI activation delay including known state definition, and additional time for PL-RS measurement including known state definition and maintained state definition, are not specified for the time gap of TCI pre-sync before cell switch.****Proposal 11 RRM requirements for early TCI activation of a candidate cell whose QCL source RSs and/or PL-RSs i.e. SSBs and/or CSI-RSs are outside active BWP is not defined in Rel-18.****Proposal 12 RRM requirements for a R18 UE are not applicable if TCI activation of two candidate cells happens at the same time in FR2, e.g. received in one MAC PDU with two MAC CEs.** |
| [**R4-2408172**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408172.zip) | CMCC | ***Observation 1: for UE autonomous TA adjustment for LPHAP, RAN4 agreed that UE autonomously adjusts the TA based on twice of the DL timing difference if the DL timing difference is≥CP/4, and the UL timing requirements for the subsequent SRS transmission after one-shot autonomous TA adjustment is ±Te. The requirements are defined in TS38.133 7.1.2.4.******Observation 2: according to RAN1/2, ltm-ServingCellUE-MeasuredTA-ID and ltm-UE-MeasuredTA-ID are used to help UE to determine whether UE-based TA measurements should be performed towards an LTM candidate cell.*** ***Observation 3: since UE has performed L3 measurement on the target cell, and fine timing tracking (Tfirst-RS) is considered in the LTM delay requirements, UE could get the full timing information for TA transmission to the target cell.*** ***Observation 4: the estimated TA is calculated based on the Rx timing difference between current serving cell and target cell, and the TA value for the current serving cell, which does not take too much time. Even if no estimated TA is available when it is expected to transmit the first UL message on the target cell, UE could*** ***fallback to CBRA.*** ***Proposal 1: it is proposed to define timing requirements for UE based TA measurement for LTM.******Proposal 2: for UE autonomous TA adjustment for LTM, it is proposed that UE autonomously adjusts the TA based on twice of the DL timing difference if the DL timing difference is≥CP/4, and the UL timing requirements after one-shot autonomous TA adjustment is±Te same as existing transmit timing accuracy requirements (similar as the UE transmit timing requirements for LPHAP defined in TS38.133 7.1.2.4).*** |
| [**R4-2408581**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408581.zip) | Huawei, HiSilicon | **Proposal 1: In PDCCH ordered RACH delay:*** **TSSB is the time to first SSB transmission after PDCCH-order RACH command is decoded by the UE when SSB is within active BWP**
* **TSSB is the time to first SSB transmission overlapped with MGL after PDCCH-order RACH command is decoded by the UE when SSB is outside active BWP.**

**Proposal 3: After UE receives early TCI state activation command, if the target TCI associated candidate cell is inter-frequency cell with gap, the measurement gap is supposed to be used rather than introducing interruptions.****Proposal 4: When TCI state is known, if UE receives early TCI state activation command at slot n, UE shall have activated the TCI state in slot n + THARQ +**$3N\_{slot}^{subframe,µ}$ **+ TOk\*(Tfirst-SSB + TSSB-proc) / *NR slot length*, where TOk=0 if the TCI state is already in previous active TCI state list, otherwise TOk=1.*** **for intra-frequency and inter-frequency without gap: Tfirst-SSB is the time to first SSB occasion after slot n + THARQ +**$3N\_{slot}^{subframe,µ}$**.**
* **for inter-frequency with gap: Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +**$3N\_{slot}^{subframe,µ}$**.**
* **No requirements are specified when multiple LTM TCI activation MAC CE are received at the same time**

**Proposal 5: For unknown TCI state in FR1, UE shall have sent a valid L3 measurement report of the TCI associated target cell within [TBD] before the LTM TCI state activation command.****Proposal 6: No requirements of SSB based TCI state activation delay are defined for FR2 unknown TCI state case.** |
| [**R4-2408611**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408611.zip) | China Telecom | **Proposal 1: In PDCCH ordered RACH delay, TSSB is:*** **TSSB is the time to first SSB transmission after PDCCH-order RACH command is decoded by the UE when SSB is within active BWP**
* **TSSB is the time to first SSB transmission overlapped with MGL after PDCCH-order RACH command is decoded by the UE when SSB is outside active BWP.**
 |
| [**R4-2408684**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408684.zip) | Nokia | Proposal 1: In PDCCH ordered RACH delay, TSSB is the time to first SSB overlapping or not overlapping with MG after PDCCH-order RACH command is decoded by the UE both when SSB is within or outside the active BWP.Proposal 2: Use “scheduling restriction on symbols overlapping with the SSB symbols to measure”**Proposal 11: Extend the condition for TSSB= 0 in PDCCH ordered RACH delay requirement “The time between receiving the MAC-CE activating the target TCI state and PDCCH order is not larger than 160ms” at least to [TCI state activation delay + 160 ms].****Proposal 14: 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 15: When UE is performing and reporting L1 measurements for LTM candidate cells, unknown TCI state activation delay may follow the legacy requirement.****Proposal 16: When UE is not performing L1 measurements and LTM decision is based on L3 measurements (if supported), L1-RSRP measurement period in legacy unknown TCI state activation delay can be replaced with L3-RSRP measurement period.****Proposal 17: Extend the agreement “When the target cell is a current serving cell (role switch) and the target TCI state in LTM cell switch command or SSB index indicated in PDCCH order is already on the active TCI state list for that serving cell or on the LTM candidate cell active TCI state list, consider the target TCI state activated.” to cover also the time gap between TCI state activation MAC-CE and LTM cell switch command****Observation 8: 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.****Proposal 18: Add TRS as a possible QCL source for T/F tracking in RAN4 TCI state activation and cell switch delay requirements.****Proposal 27: Not to define requirements for UE based TA estimation in Rel-18 but leave it for future releases.** |
| [**R4-2409031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409031.zip) | ZTE Corporation, Sanechips | **Proposal 1: In PDCCH ordered RACH delay, TSSB is:*** **TSSB is the time to first SSB transmission after PDCCH-order RACH command is decoded by the UE when SSB is within active BWP**
* **TSSB is the time to first SSB transmission overlapped with MGL after PDCCH-order RACH command is decoded by the UE when SSB is outside active BWP.**

**Proposal 2: TSSB-proc = 2 ms should be counted in TSSB.****Observation 1: Existing requirement could not be reused for UE based TA measurement for LTM and core part of this work item has been closed.****Observation 2: TCI state activation would be finished before UE receives cell switch command, the gap configuration from old serving cell maybe can used.** |
| [**R4-2409385**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409385.zip) | MediaTek Inc. | **Proposal 1: In PDCCH ordered RACH delay, if TSSB is needed, the value is：** * **the time to first SSB transmission after slot n+1 or n+ ⌈** NT,2**⌉, where slot n is the slot that UE receives PDCCH-order RACH command when SSB is within active BWP**
* **the time to first SSB transmission overlapped with MGL after slot n+1 or n+ ⌈** NT,2**⌉, where slot n is the slot that UE receives PDCCH-order RACH command when SSB is outside active BWP.**

**Proposal 2: Not to define requirements for UE based TA measurement in R18.****Proposal 3: Support the case that candidate cell’s SSB or PL-RS is outside active BWP in FR2, i.e., inter-f with MG, for early TCI state activation.****Proposal 4: When TCI state is known, Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +**$3N\_{slot}^{subframe,µ}$ **in early TCI state activation delay.****Proposal 5: The following conditions shall be met to support unknown TCI state case for early TCI state activation in FR1:** * **UE has reported beam-level L3 measurement result of the associated SSB of the TCI state within 1280ms**
* **SNR of the associated SSB is above -3dB.**

**Proposal 6: Not to consider unknown TCI state in FR2 for early TCI state activation.****Proposal 7: 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.** |
| [**R4-2409714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409714.zip) | Ericsson, Qualcomm Incorporated | 1. In PDCCH ordered RACH delay, TSSB is as follows if the condition of TSSB equal to zero is not met:
	1. TSSB is the time to first SSB transmission after the end of the slot of PDCCH + [2]ms when SSB is within active BWP
	2. TSSB is the time to first SSB transmission overlapped with MG after the end of the slot of PDCCH + [2]ms when SSB is outside active BWP.
2. RAN4 to agree the following as requirements for LTM candidate TCI state activation delay before receiving the cell switch command.
* If all the target LTM TCI states in the active TCI state list are known, if the UE receives TCI state activation command at slot n, UE shall have completed the LTM TCI state list update in slot n + THARQ +$3N\_{slot}^{subframe,µ}$ + TOk\*(Tfirst-SSB\_List + TSSB-proc) / *NR slot length*.
* If any of the target TCI states in the active TCI state list are unknown, if the UE receives TCI state activation command at slot n, UE shall have completed the LTM TCI state list update in slot n+ THARQ +$3N\_{slot}^{subframe,µ}$ + (TL1-RSRP\_list +TOuk\*(Tfirst-SSB\_List+ TSSB-proc)) / *NR slot length*.
1. In the TCI state activation requirements for LTM candidate cells, T L1-RSRP = 0 for FR1
2. In the TCI state activation requirements for LTM candidate cells, for FR2, T L1-RSRP is the time for Rx beam refinement in FR2, defined as
	* TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.14 and 9.15,
	* with the assumption of M=1
	* with TReport = 0
	* NNeighbor\_Cell is the number of neighbour cells that are to be activated with TCI states
3. In the TCI state activation requirements for LTM candidate cells, Tfirst-SSB\_List is given by
	* For FR1, Tfirst-SSB\_List = max (Tfirst-SSB\_LTM1, Tfirst-SSB\_LTM2, .. , Tfirst-SSB\_LTMn).
	* For FR2,
		+ Tfirst-SSB\_List = Tfirst-SSB\_LTM1 + Tfirst-SSB\_LTM2 + ... +Tfirst-SSB\_LTMn, if the time to first SSB associated to LTM candidate TCI states are overlapped in FR2.
		+ Tfirst-SSB\_List = max (Tfirst-SSB\_LTM1, Tfirst-SSB\_LTM2, .. , Tfirst-SSB\_LTMn.) if the time to first SSB associated to LTM candidate TCI states are not overlapped.
	* Where, the Tfirst-SSB\_LTMn is the SSB periodicity of LTM candidate cell n.
4. 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
	* when to be activated unknown TCI states are from one FR1 frequency layer, or when to be activated unknown TCI states are from one FR2 candidate cell.
 |

## 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: The value of TSSB is if the condition of TSSB equal to zero is not met in PDCCH ordered RACH delay requirements**

* Proposals
	+ Option 1 (Apple, CATT, Huawei, CTC, ZTE, MTK):
		- TSSB is the time to first SSB transmission after PDCCH-order RACH command is decoded by the UE when SSB is within active BWP
		- TSSB is the time to first SSB transmission overlapped with MGL after PDCCH-order RACH command is decoded by the UE when SSB is outside active BWP.
			* Option 1a (CATT): Considering the time for PDCCH-ordered RACH decoding, a little relaxation on Tfirst-SSB\_RACH is also acceptable.
			* Option 2b (MTK): in the definition of TSSB, the PDCCH-order decoding time is assumed as 1 slot or ⌈NT,2⌉.
				+ the time to first SSB transmission after slot n+1 or n+ ⌈ NT,2⌉, where slot n is the slot that UE receives PDCCH-order RACH command when SSB is within active BWP
				+ the time to first SSB transmission overlapped with MGL after slot n+1 or n+ ⌈ NT,2⌉, where slot n is the slot that UE receives PDCCH-order RACH command when SSB is outside active BWP.
	+ Option 2 (vivo, ZTE): TSSB-proc = 2 ms should be counted in TSSB
		- Option 2a (Ericsson, QC): In PDCCH ordered RACH delay, TSSB is as follows if the condition of TSSB equal to zero is not met:
			* TSSB is the time to first SSB transmission after the end of the slot of PDCCH + [2]ms when SSB is within active BWP
			* TSSB is the time to first SSB transmission overlapped with MG after the end of the slot of PDCCH + [2]ms when SSB is outside active BWP.
	+ Option 3 (Nokia):
		- In PDCCH ordered RACH delay, TSSB is the time to first SSB overlapping or not overlapping with MG after PDCCH-order RACH command is decoded by the UE both when SSB is within or outside the active BWP.
* Recommended WF
	+ Recommend agree on:
		- In PDCCH ordered RACH delay, when additional time for T/F tracking is needed, TSSB is:
			* TSSB is the time to first SSB transmission after PDCCH-order RACH command is decoded by the UE when SSB is within active BWP + 2ms
			* TSSB is the time to first SSB transmission overlapped with MGL after PDCCH-order RACH command is decoded by the UE when SSB is outside active BWP +2ms.
			* FFS: Define PDCCH-order decoding time.

*Moderator: Generally, following the majority view, and 2ms is added for TSSB-proc*

**Issue 1-1-2: Conditions for TSSB= 0 in PDCCH ordered RACH delay requirement**

*Similar proposal as proposal 1 in Issue 3-1-1-2, suggest* *following the agreement on proposal 1 in Issue 3-1-1-2.*

* Proposals
	+ Option 1 (Nokia):
		- Extend the condition for TSSB= 0 in PDCCH ordered RACH delay requirement “The time between receiving the MAC-CE activating the target TCI state and PDCCH order is not larger than 160ms” at least to [TCI state activation delay + 160 ms].
* Recommended WF
	+ No more discussion
	+ Follow the agreement on proposal 1 in Issue 3-1-1-2.

**Issue 1-1-3: How to capture the case with no UL Tx timing accuracy requirements in spec**

*For information*

|  |
| --- |
| ***RAN4#109*****Issue 1-2-1-2: The value of additional time for DL synchronization when needed in the delay requirements for PDCCH ordered RACH before cell switch command****<Agreement>:** * For FR2, one Tssb delay is always assumed before UE transmit PDCCH-ordered RACH.
* For FR1, when TCI state associated the PDCCH-order RACH has not been activated,
	+ one Tssb delay is always assumed before UE transmit PDCCH-ordered RACH.
* For FR1, when TCI state associated the PDCCH-order RACH is activated,
	+ If L1-RSRP measurement delay is less than or equal to 160ms, Tssb is not needed. UE is required to meet the UL Tx timing accuracy requirements
	+ If L1-RSRP measurement delay is more than 160ms, UE is allowed to transmit PDCCH-ordered RACH with or without one Tssb delay. No UE UL Tx timing accuracyrequirement will be defined.
 |

* Proposals
	+ Option 1 (CATT):
		- suggested to determine which clause to capture the exception case that has no UL timing requirements.
		- Option A: Clause 7.1.2 for UL transmit timing requirements.
		- Option B: Clause 6.2.2C.2 for PDCCH ordered Random Access delay.
* Recommended WF
	+ Discuss in the corresponding CR directly.

**Issue 1-1-4: Applicability rule of PDCCH-order RACH delay**

* Proposals
	+ Option 1 (vivo):
		- Capture the following in 6.2.2C of TS 38.133:
			* PDCCH order-based RACH on candidate cell is triggered based on L1-RSRP report or L3-RSRP beam-level report.
* Recommended WF
	+ Discuss in the corresponding CR directly.

### Sub-topic 1-2 UE based TA measurement

**Issue 1-2-1: Whether and how to define timing requirements for UE based TA measurement**

* Proposals
	+ Option 1 (vivo, CMCC): Define timing requirements for UE based TA measurement for LTM.
		- Option 1a (CMCC): for UE autonomous TA adjustment for LTM, it is proposed that UE autonomously adjusts the TA based on twice of the DL timing difference if the DL timing difference is≥CP/4, and the UL timing requirements after one-shot autonomous TA adjustment is ±Te (similar as the UE transmit timing requirements for LPHAP defined in TS38.133 7.1.2.4).
	+ Option 2 (Nokia, MTK, ZTE): Not to define requirements for UE based TA measurement in R18.
* Recommended WF
	+ Need more discussion

### 1.2.3 Sub-topic 1-3 Early Candidate cell’s TCI state activation

**Issue 1-3-1: Whether to consider early TCI state activation for multiple cells at the same time**

* Proposals
	+ Option 1 (Huawei, vivo, Nokia, MTK):
		- 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.
	+ Option 2 (Ericsson, QC):
		- If all the target LTM TCI states in the active TCI state list are known, if the UE receives TCI state activation command at slot n, UE shall have completed the LTM TCI state list update in slot n + THARQ +$3N\_{slot}^{subframe,µ}$ + TOk\*(Tfirst-SSB\_List + TSSB-proc) / *NR slot length*.
		- If any of the target TCI states in the active TCI state list are unknown, if the UE receives TCI state activation command at slot n, UE shall have completed the LTM TCI state list update in slot n+ THARQ +$3N\_{slot}^{subframe,µ}$ + (TL1-RSRP\_list +TOuk\*(Tfirst-SSB\_List+ TSSB-proc)) / *NR slot length*.
		- In the TCI state activation requirements for LTM candidate cells, T L1-RSRP = 0 for FR1
		- In the TCI state activation requirements for LTM candidate cells, Tfirst-SSB\_List is given by
			* For FR1, Tfirst-SSB\_List = max (Tfirst-SSB\_LTM1, Tfirst-SSB\_LTM2, .. , Tfirst-SSB\_LTMn).
			* For FR2,
				+ Tfirst-SSB\_List = Tfirst-SSB\_LTM1 + Tfirst-SSB\_LTM2 + ... +Tfirst-SSB\_LTMn, if the time to first SSB associated to LTM candidate TCI states are overlapped in FR2.
				+ Tfirst-SSB\_List = max (Tfirst-SSB\_LTM1, Tfirst-SSB\_LTM2, .. , Tfirst-SSB\_LTMn.) if the time to first SSB associated to LTM candidate TCI states are not overlapped.
			* Where, the Tfirst-SSB\_LTMn is the SSB periodicity of LTM candidate cell n.
* Recommended WF
	+ Need more discussion

**Issue 1-3-2: The definition of Tfirst-SSB in early candidate cell’s TCI state activation delay for inter-frequency with gap for known TCI state case**

* Proposals
	+ Option 1 (Apple, Huawei, MTK):
		- Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +$3N\_{slot}^{subframe,µ}$ for inter-frequency with gap.
	+ Option 2 (vivo):
		- RRM requirements for early TCI activation of a candidate cell whose QCL source RSs and/or PL-RSs i.e. SSBs and/or CSI-RSs are outside active BWP is not defined in Rel-18.
* Recommended WF
	+ Recommend following the majority and agree on Option 1:
		- 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 +$3N\_{slot}^{subframe,µ}$ for inter-frequency with gap.

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

* Proposals
	+ Option 1 (vivo):
		- RAN4 further discuss whether the scenario below is an important scenario in FR2, and whether RRM requirements need to be specified.
			* Based on the agreed big CR, and the requirement applicability rules for L1-RSRP measurements, LTM TCI activation delay requirements are not applicable to the case when activated TCI state(s) of one candidate cell already exist, but gNB activates one more unknown TCI state from another candidate cell on top of activated TCI state(s) from the existing candidate cell.
	+ Option 2 (Huawei, MTK):
		- Not to define requirements of SSB based TCI state activation delay for FR2 unknown TCI state case.
	+ Option 3 (Nokia):
		- When UE is performing and reporting L1 measurements for LTM candidate cells, unknown TCI state activation delay may follow the legacy requirement.
		- When UE is not performing L1 measurements and LTM decision is based on L3 measurements (if supported), L1-RSRP measurement period in legacy unknown TCI state activation delay can be replaced with L3-RSRP measurement period.
	+ Option 4 (Ericsson, QC): In the TCI state activation requirements for LTM candidate cells, for FR2, T L1-RSRP is the time for Rx beam refinement in FR2, defined as
		- TL1-RSPR\_Measurement\_Period\_SSB for SSB as specified in clause 9.14 and 9.15,
		- with the assumption of M=1
		- with TReport = 0
		- NNeighbor\_Cell is the number of neighbour cells that are to be activated with TCI states
* Recommended WF
	+ Need more discussion

**Issue 1-3-4: Conditions to support unknown TCI state in FR1**

* Proposals
	+ Option 1 (Apple, Huawei, MTK): For unknown TCI state in FR1, UE shall have sent a valid L3 measurement report of the TCI associated target cell within [TBD] before the LTM TCI state activation command.
		- Option 1a (Apple):
			* unknown TCI state in FR1 is considered only if target cell is known.
		- Option 1b (MTK):
			* UE has reported beam-level L3 measurement result of the associated SSB of the TCI state within 1280ms
			* 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
		- when to be activated unknown TCI states are from one FR1 frequency layer, or when to be activated unknown TCI states are from one FR2 candidate cell.
* Recommended WF
	+ Recommend agree on:
		- 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.

**Issue 1-3-5: Whether to consider early UL TCI state activation**

* Proposals
	+ Option 1 (vivo):
		- Not to consider uplink TCI activation before cell switch, i.e. both uplink TCI activation delay including known state definition, and additional time for PL-RS measurement including known state definition and maintained state definition, are not specified for the time gap of TCI pre-sync before cell switch.
* Recommended WF
	+ Need more discussion

**Issue 1-3-6: UE behaviour of early DL TCI state activation without L1 measurement**

* Proposals
	+ Option 1 (MTK):
		- When L1 measurement is not configured, after receiving TCI state activation command, UE only performs one shot T/F tracking without any periodic T/F tracking afterward.
* Recommended WF
	+ Need more discussion

**Issue 1-3-7: 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.*

* Proposals
	+ Option 1 (Nokia):
		- Add TRS as a possible QCL source for T/F tracking in RAN4 TCI state activation requirements.
* Recommended WF
	+ Need more discussion

**Issue 1-3-8: Others**

* Proposals
	+ Proposal 1 (Nokia):
		- Extend the agreement “When the target cell is a current serving cell (role switch) and the target TCI state in LTM cell switch command or SSB index indicated in PDCCH order is already on the active TCI state list for that serving cell or on the LTM candidate cell active TCI state list, consider the target TCI state activated.” to cover also the time gap between TCI state activation MAC-CE and LTM cell switch command.
* Recommended WF
	+ Discuss in the CR directly

# Topic #2: LTM - L1-RSRP measurement requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2407348**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407348.zip) | Apple | **Observation 1: applying existing LTM L1-RSRP measurement period to deactivated SCC would result in misalignment between L1 and L3 measurement, which is unexpected at least in FR1. Thereby, power saving of legacy L3 measurement (following measCycleSCell) would be significantly jeopardized.****Proposal 2: for L1-RSRP measurement on intra-frequency neighbor cell of deactivated SCC:*** **Option 1: not define requirements in R18**
* **Option 2: allow similar measurement relaxation as L3 measurement (e.g. following measCycleSCell)**

**Observation 2: for UE supporting RTD>CP, UE can perform L1-RSRP measurement on serving cell and neighbour cell simultaneously. Thereby, same measurement period requirements are excepted.****Observation 3: there is a scaling factor NLayer in neighbour L1-RSRP measurement requirement but not in serving cell measurement requirement for UE capable of RTD>CP.**Proposal 3: introduce NLayer in serving cell L1 RSRP measurement requirement and clarify that it is for UE capable of RTD>CP configured with L1 RSRP measurement on neighbour cell. |
| [**R4-2407482**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407482.zip) | CATT | **Proposal 5: Capture all LTM L1 measurement requirements, including serving cell L1 measurement requirements in 9.14.** |
| [**R4-2407769**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407769.zip) | vivo | **Observation 1 RRC configurations of LTM L1 measurement and reporting are separate from legacy L1 measurement and reporting. In contrast, for R17 ICBM L1 measurement on the additional cell, RRC configuration framework shares the legacy CSI configuration framework.****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 The existing requirements in 9.5.4.1 shows that, if a UE is configured with LTM L1 measurements on neighbour cell, enhanced serving cell L1 measurement requirements for FR1 HST are no longer applicable even if UE supports and is configured with *highSpeedMeasFlag-r16* and/or *highSpeedMeasCA-Scell-r17*.****Observation 4 The existing requirements in 9.5 shows that, RRM requirements specified in 9.5 are applicable if the total number of resources to be measured does not exceed R15 UE capability ‘*beamManagementSSB-CSI-RS*’. However, for LTM, new methods in restricting total number of cells/layers/resources are agreed in RAN4 #110bis.****Observation 5 The existing requirements in 9.5 shows that, RRM requirements specified in 9.5 are applicable when CP < RTD < MRTD as specified in 7.6.8 of TS 38.133 if UE supports R18 MIMO capability *rxTimingDiff-r18*, no matter Multi-TRP transmission is configured or not. However, when LTM neighbour cell L1 measurement is configured, it is difficult to understand which requirement UE shall follow if UE supports R18 MIMO capability *rxTimingDiff-r18*, but does not support R18 LTM capability in FG 39-1.****Observation 6 For FR1, there is no technical issue if LTM L1 measurement and legacy L1 measurement are performed simultaneously on serving cell SSBs.****Observation 7 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. 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 LTM L1 measurement requirements, including serving cell L1 measurement requirements in 9.14.** **Proposal 2 The impact to legacy serving cell L1 measurement due to Rx beam sharing with neighbour cell LTM L1 measurement is captured by PL1\_sharing in 9.5.4.1****Proposal 3 RAN4 further consider the impact of LTM L1 measurements to legacy RLM/BFD/CBD requirements in FR2, since different Rx beams could be assumed in some of SSB measurement occasions.****Observation 8 According to current TS 38.331, LTM candidate config is a configuration which may or may not include current SpCell as one of the candidate cell. Hence, for LTM L1 measurement, it is not always necessary to perform L1 measurements on serving cell SSBs.****Proposal 4 Clarify the RTD for LTM L1 measurement as the Rx timing difference between cells configured by LTM-*CSI-ResourceConfig-r18* on which UE is required to perform L1 measurements also for the intra-frequency L1 measurements.****Observation 9 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 5 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. |
| [**R4-2407864**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407864.zip) | OPPO | **Proposal 1: Prefer option 2 to take deactivated SCell equally to other candidate LTM cell and measure using LTM L1-RSRP measurement period in R18.****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 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.** |
| [**R4-2408172**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408172.zip) | CMCC | ***Proposal 3: it is proposed to consider L1-RSRP measurement on deactivated SCell.*** |
| [**R4-2408581**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408581.zip) | Huawei, HiSilicon | **Proposal 2: If network configures cell on deactivate SCell frequency as a LTM candidate cell, the L1-RSRP measurement requirement on candidate neighbour cells can be reused.** |
| [**R4-2408611**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408611.zip) | China Telecom | **Proposal 3: In L1-RSRP measurement report, for unmeasured candidate cells, UE reports measured quantity value corresponding to any of the invalid codepoints in Table 10.1.6.1-1.** |
| [**R4-2408684**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408684.zip) | Nokia | Proposal 3: RAN4 to send LS to RAN1a. 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:i. When none of the candidate cells are measured within the given periodicity, UE reports a 7 bit “Not valid” value.ii. DIFFRSRP\_15 is reported when at least one LTM candidate cell was measured and at least one configured candidate cell was unmeasured.iii. The reported values for unmeasured cells do not meet any measurement requirements as they are unmeasured.**Proposal 28: In Rel-18, do not define LTM measurement requirements for deactivated SCells.** |
| [**R4-2409031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409031.zip) | ZTE Corporation, Sanechips | **Observation 3: L1-RSRP measurement on de-activated SCell is already supported by RAN1/2.****Prpposal 5: RAN4 not to consider L1-RSRP measurement on deactivated SCell in R18 unless there is no impact on RAN2.****Prpposal 6: If network configures a deactivated SCell as a LTM candidate cell, UE should measure that cell using LTM L1-RSRP measurement period.**  |
| [**R4-2409385**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409385.zip) | MediaTek Inc. | **Proposal 8: LTM intra-frequency L1-RSRP requirements defined in R18 are not applicable to deactivated SCC and neighbor cell on deactivated SCC.**Proposal 9: Not to define intra-frequency L1-RSRP requirements for deactivated SCC. |
| [**R4-2409714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409714.zip) | Ericsson, Qualcomm Incorporated | 1. RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.
2. RAN4 to use “measurement and scheduling restriction on symbols overlapping with the SSB symbols to measure” instead of “measurement and scheduling restriction on the same or adjacent OFDM symbol as SSB”.
3. In L1-RSRP measurement report, for unmeasured candidate cells, UE reports DIFFRSRP\_15 in Table 10.1.6.1-2.
 |

## 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 2-1 Scenarios

**Issue 2-1-1: whether to consider** **L1-RSRP measurement on deactivated SCell**

*Related RAN2 agreement and spec*

|  |
| --- |
| **RAN2#123bis*** Confirm that deactivated SCell as LTM candidate cell is supported

38.3211>  if the SCell is deactivated:2> not transmit SRS on the SCell;2> not report CSI for the SCell;2> not transmit on UL-SCH on the SCell;2> not transmit on RACH on the SCell;2> not monitor the PDCCH on the SCell;2> not monitor the PDCCH for the SCell;2>  not transmit PUCCH on the SCell. |

**RAN4#110bis**

|  |
| --- |
| **Issue 2-1-2: whether to consider L1-RSRP measurement on deactivated SCell***Online agreement*< **Agreement**>: Conclude this issue in the next meeting. |

* Proposals
	+ Option 1 (CMCC): Consider L1-RSRP measurement on deactivated SCell.
		- Option 1a (ZTE): If network configures a deactivated SCell as a LTM candidate cell, UE should measure that cell using LTM L1-RSRP measurement period.
	+ Option 2 (Nokia, MTK): RAN4 not to consider L1-RSRP measurement on deactivated SCell in R18.
		- Option 2a (MTK): Intra-frequency L1-RSRP requirements defined in R18 are not applicable to deactivated SCC.
* Recommended WF
	+ Recommend discuss
		- whether intra-frequency L1-RSRP requirements defined in R18 are applicable to deactivated SCC.
		- Whether to define L1-RSRP measurement requirements on deactivated SCell in R18.

**Issue 2-1-2: L1-RSRP measurement on intra-f neighbor cell of deactivated SCC**

* Proposals
	+ Option 1 (Apple, MTK): LTM intra-frequency L1-RSRP requirements defined in R18 are not applicable to neighbor cell on deactivated SCC.
		- Option 1a (Apple): not define requirements in R18
		- Option 1b (Apple): allow similar measurement relaxation as L3 measurement (e.g. following measCycleSCell)
	+ Option 2 (OPPO, Huawei): If network configures cell on deactivate SCell frequency as a LTM candidate cell, UE should measure that cell using LTM L1-RSRP measurement period.
* Recommended WF
	+ Need more discussion.

### Sub-topic 2-2 Measurement period

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

* Proposals
	+ Option 1 (Apple):
		- introduce NLayer in serving cell L1 RSRP measurement requirement and clarify that it is for UE capable of RTD>CP configured with L1 RSRP measurement on neighbour cell.
	+ Option 2 (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.
	+ Option 3 (Ericsson, QC):
		- RAN4 not to modify the serving cell measurement period by scaling it with NLayer for UE supporting RTD > CP.
* Recommended WF
	+ Need more discussion.

### Sub-topic 2-3 Measurement and Scheduling restriction

**Issue 2-3-1: Measurement and scheduling restriction of intra-frequency L1-RSRP measurement**

*Proposal 1 and 2 are aligned with current spec or big CR endorsed last meeting.*

* Proposals
	+ Proposal 1 (Nokia): Use “scheduling restriction on symbols overlapping with the SSB symbols to measure”
	+ Proposal 2 (Ericsson, QC): RAN4 to use “measurement and scheduling restriction on symbols overlapping with the SSB symbols to measure” instead of “measurement and scheduling restriction on the same or adjacent OFDM symbol as SSB”.
* Recommended WF
	+ No more discussion.

### Sub-topic 2-4 Others

**Issue 2-4-1: L1 report for unmeasured candidate cells**

* Proposals
	+ Option 1 (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.
	+ Option 2 (CTC):
		- In L1-RSRP measurement report, for unmeasured candidate cells, UE reports measured quantity value corresponding to any of the invalid codepoints in Table 10.1.6.1-1.
	+ Option 3 (Nokia): RAN4 to send LS to RAN1
		- 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:
			* 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 4 (Ericsson, QC):
		- In L1-RSRP measurement report, for unmeasured candidate cells, UE reports DIFFRSRP\_15 in Table 10.1.6.1-2.
* Recommended WF
	+ Need more discussion.

**Issue 2-4-2: Spec organization**

* Proposals
	+ Option 1 (CATT, vivo):
		- Capture all LTM L1 measurement requirements, including serving cell L1 measurement requirements in 9.14.
		- vivo: The impact to legacy serving cell L1 measurement 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.

**Issue 2-4-3: Impact on legacy RLM/BFD/CBD**

*The impact of L1 measurement on neighbor cell on legacy RLM/BFD/CBD, L1-SINR, CSI-RS based L1 measurement are all captured by measurement restriction in each related section.*

* Proposals
	+ Proposal 1 (vivo):
		- RAN4 further consider the impact of LTM L1 measurements to legacy RLM/BFD/CBD requirements in FR2, since different Rx beams could be assumed in some of SSB measurement occasions.
* Recommended WF
	+ No more discussion.

**Issue 2-4-4: Clarifications**

* Proposals
	+ Proposal 1 (vivo):
		- Clarify the RTD for LTM L1 measurement as the Rx timing difference between cells configured by LTM-CSI-ResourceConfig-r18 on which UE is required to perform L1 measurements also for the intra-frequency L1 measurements.
* Recommended WF
	+ Need more discussion

# Topic #3: LTM – Cell switch delay requirements

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

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2407348**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407348.zip) | Apple | **Proposal 4: in time gap between early TCI state activation command and cell switch command, Tfirst-SSB is the time to the first SSB occasion overlapped with MGL after slot n + THARQ +**$3N\_{slot}^{subframe,µ}$ **for inter-frequency with gap.****Proposal 5: in Time gap between early TCI state activation command and cell switch command, unknown TCI state in FR1 is considered only if target cell is known.****Observation 4: NW is not expected to trigger TCI activation or RACH toward candidate cell unless cell switch is likely to happen soon.****Proposal 6: TLTM\_RRC-processing in TS38.133 is zero only applicable to the cells with early TCI activation or early TA acquisition, provided the number of these cells doesn’t exceed UE capability regarding number of cells for early ASN.1 decoding.** |
| [**R4-2407769**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407769.zip) | vivo | **Proposal 13 The UL TCI activation delay is added into cell switch delay as follows.****TLTM-interrupt = TLTM-RRC-processing + TLTM-processing + max(Tfirst-RS + TRS-proc, Tfirst\_target-PL-RS + [2]\*Ttarget\_PL-RS + 2ms)+ TLTM-IU****Proposal 14 In R18, if target SpCell is current SCell, TLTM-processing is 10 ms for intra-FR and 20ms for inter-FR.** |
| [**R4-2408581**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408581.zip) | Huawei, HiSilicon | **Proposal 7: No need to have extra time for PL-RS measurement in cell switch delay.**Proposal 8: TLTM-RRC-processing = 0, if the UE supports [*earlyDecodingAndValidityCheck*] capability, and the maximum number of serving cell(s) and candidate cell(s) and the maximum number of *LTMCandidateConfigs* does not exceed [*number of candidate cells for early ASN.1 decoding and validity check*]. Early TCI state activation or PDCCH order RACH does not necessarily trigger early decoding and validity check. |
| [**R4-2408611**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408611.zip) | China Telecom | **Proposal 2: The interruption on MCG due to PSCell switch is the same as PSCell addition.** |
| [**R4-2408684**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408684.zip) | Nokia | Proposal 4: In cell switch delay requirements, the target TCI state is known if the UE has reported L3-RSRP measurements for the SSB associated to the target TCI state before the cell switch command.Observation 3: According to RAN4 agreements, a TCI state in LTM candidate cell active TCI state list becomes deactivated from UE point of view after 160 ms if the SSB associated to the TCI state is not available at least every 160 ms.Observation 4: In LTM, when the TCI state is unknown, cell switch delay requirements do not apply.Observation 5: If TCI state is not active, it is enough that the associated SSB is available and reported every 1280 ms for the TCI state to be known.Proposal 9: The target TCI state in the LTM cell switch command is known if the TCI state activation command was received not more than 1280 ms before the cell switch command, or if the RS associated to the target TCI state is available at least every 1280 ms after TCI state activation command.Observation 6: When SSB associated to active TCI state is available with periodicity larger than 160 ms, TCI state activation delay, PDCCH ordered RACH and cell switch command need to happen within a 160 ms time window for early TCI state activation to make sense, according to current agreements.Proposal 10: 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, at least to [TCI state activation delay + 160 ms].**Proposal 12: Due to having or acquiring DL timing during PDCCH ordered RACH procedure, Tfirst-RS and TRS-proc = 0 in cell switch delay if UE successfully completed PDCCH ordered RACH preamble transmission within [TCI state activation delay + 160 ms] before the cell switch command, and if the SSB in the PDCCH order is associated to the target TCI state.****Proposal 13: Target TCI state in cell switch command is known, if UE successfully completed PDCCH ordered RACH preamble transmission within 1280 ms before the cell switch command, and if the SSB in the PDCCH order is associated to the target TCI state.****Observation 8: 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.****Proposal 18: Add TRS as a possible QCL source for T/F tracking in RAN4 TCI state activation and cell switch delay requirements.****Observation 9: It is reasonable to assume that PL-RS of the TCI state is the SSB that is configured for L1-RSRP measurement for the candidate cell in question.****Proposal 19: If TCI state is activated before cell switch, the UE shall do PL-RS estimation during the early TCI state activation. After TCI state activation, UE shall maintain the PL-RS for the active TCI state(s).****Proposal 20: UE can perform PL-RS estimation based on the same SSB (Tfirst-SSB/Tfirst-RS) as is used for T/F tracking at TCI state activation.****Proposal 21: No additional delay due to PL-RS is needed at early TCI state activation or in the cell switch delay.****Proposal 22: The number of PL-RS the UE shall be able to maintain for LTM candidate cells should be added on top of the number of the 4 PL-RS the UE is expected to be able to keep track of for serving cells. RAN4 to discuss the exact number of LTM candidate cell PL-RS that the UE shall be able to maintain.****Proposal 23: RAN4 to discuss how long interruption would be needed due to LTM PSCell switch on serving cells in MCG, and at which point during cell switch is the interruption expected to happen.****Proposal 24: TLTM-RRC-processing = 0, if UE has received PDCCH order for the target cell at least 10 ms before the LTM cell switch command.****Proposal 25: 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 26: In R18, if target SpCell is current SCell, TLTM-processing is 10 ms for intra-FR and 20ms for inter-FR**. |
| [**R4-2409031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409031.zip) | ZTE Corporation, Sanechips | Proposal 3: No additional delay for PL-RS tracking or conditions are needed in cell switch delay for PL-RS measurement.Proposal 4: 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. |
| [**R4-2409385**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409385.zip) | MediaTek Inc. | **Proposal 10: UE is supposed to perform T/F tracking (if needed) based on SSB during cell switch delay in R18 LTM.****Proposal 11: For CBRA cell switch, no additional PL-RS measurement time is needed.****Proposal 12: For CFRA and RACH-less cell switch, both in FR1 and FR2, the cell switch requirements are only applicable to the case when target PL-RS is maintained, and UE does not need extra time to measure the PL-RS.** **Proposal 13: During cell switch, PL-RS is maintained provided:****- the target PL-RS is associated with or included in the UL or joint TCI states in the active TCI list for PUSCH/PUCCH/SRS transmissions****- Number of active UL TCI states (UL or joint TCI state) for PUSCH/PUCCH/SRS transmissions does not exceed UE capability ltm-MAC-CE-JointTCI-r18 or ltm-MAC-CE-SeparateTCI-r18****- The target pathloss reference signal remains detectable during cell switch delay****- SNR of the target pathloss reference signal≥-3dB****- The associated SSBs with the target pathloss reference signal remain detectable during cell switch delay****- SNR of the associated SSB ≥-3dB****Proposal 14: TLTM\_RRC-processing in TS38.133 is zero only applicable to the cells whose TCI state(s) are activated, if early TCI state activation on any candidate cell is triggered and the number of cells to perform early RRC decoding and validity check does not exceed UE capability.****Proposal 15: TLTM\_RRC-processing in TS38.133 is zero only applicable to the latest cell on which PDCCH-order RACH is triggered if NW doesn’t active TCI state of any candidate cell and UE has received the PDCCH-order RACH command more than NT,2+10ms ago.****Proposal 16: The interruption on MCG due to PSCell change is the same as PSCell addition.****Proposal 17: In cell switch delay requirements, activated TCI state can be known if the following conditions can be met:*** **SNR of the SSB associated to TCI state ≥ -3dB**
* **Beam-level L3 measurement results have been reported in 1280ms**
* **L1-RSRP measurement period is no larger than 1280ms in FR2**
 |
| [**R4-2409714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409714.zip) | Ericsson, Qualcomm Incorporated | 1. For the cell switch delay, no additional delay or conditions are needed for PL-RS measurement provided that the following condition are fulfilled:
	1. 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.
2. 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 X1 ms before the reception of the cell switch command and SNR of the SSB associated to TCI state ≥ -3dB; where X1 is 1280ms for FR1 and 160ms for FR2; or**- The target TCI state in 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 160 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 ≥ -3dBOtherwise, the target joint DL/UL TCI state or separate DL and UL TCI state is unknown.1. In order to clarify the agreed two components for ‘fast processing of an LTM candidate cell RRC configuration,’ RAN4 to adopt the following applicable conditions:
* 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.
	+ 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.
* Note:
	+ maxServingAndCandidateCells: max number of serving and candidate cells
	+ maxLTMCandidateConfig: the maximum number of LTMCandidateConfigs that UE can support fast processing
 |

## Open issues summary

### Sub-topic 3-1 Detail of cell switch delay requirements for Pcell/PSCell

#### T/F fine tracking: TΔ and Tmargin

**Issue 3-1-1-1: T/F fine tracking when TRS as QCL source in cell switch delay**

* Proposals
	+ Option 1 (MTK): UE is supposed to perform T/F tracking (if needed) based on SSB during cell switch delay in R18 LTM.
	+ Option 2 (Nokia): Add TRS as a possible QCL source for T/F tracking in RAN4 cell switch delay requirements.
* Recommended WF
	+ Need more discussion

**Issue 3-1-1-2: Conditions of Tfirst-RS =0 in cell switch delay**

****

* Proposals
	+ Proposal 1 (Nokia): 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, at least to [TCI state activation delay + 160 ms].
	+ Proposal 2 (Nokia): Due to having or acquiring DL timing during PDCCH ordered RACH procedure, Tfirst-RS and TRS-proc = 0 in cell switch delay if UE successfully completed PDCCH ordered RACH preamble transmission within [TCI state activation delay + 160 ms] before the cell switch command, and if the SSB in the PDCCH order is associated to the target TCI state.
* Recommended WF
	+ Need more discussion.

#### Extra time for PL-RS measurement?

**Issue 3-1-2-1: Extra time for PL-RS measurement?**

* Proposals
	+ Option 1 (vivo): The UL TCI activation delay is added into cell switch delay as follows.
		- TLTM-interrupt = TLTM-RRC-processing + TLTM-processing + max(Tfirst-RS + TRS-proc, Tfirst\_target-PL-RS + [2]\*Ttarget\_PL-RS + 2ms)+ TLTM-IU
	+ Option 2 (MTK):
		- For CBRA cell switch, no additional PL-RS measurement time is needed.
		- For CFRA and RACH-less cell switch, both in FR1 and FR2, the cell switch requirements are only applicable to the case when target PL-RS is maintained, and UE does not need extra time to measure the PL-RS.
		- During cell switch, PL-RS is maintained provided:

|  |
| --- |
| - the target PL-RS is associated with or included in the UL or joint TCI states in the active TCI list for PUSCH/PUCCH/SRS transmissions- Number of active UL TCI states (UL or joint TCI state) for PUSCH/PUCCH/SRS transmissions does not exceed UE capability ltm-MAC-CE-JointTCI-r18 or ltm-MAC-CE-SeparateTCI-r18- The target pathloss reference signal remains detectable during cell switch delay- SNR of the target pathloss reference signal≥-3dB- The associated SSBs with the target pathloss reference signal remain detectable during cell switch delay- SNR of the associated SSB ≥-3dB |

* + Option 3 (Huawei, Nokia, ZTE): No additional delay or conditions are needed for PL-RS measurement.
		- Option 3a (Nokia):
			* If TCI state is activated before cell switch, the UE shall do PL-RS estimation during the early TCI state activation. After TCI state activation, UE shall maintain the PL-RS for the active TCI state(s).
			* UE can perform PL-RS estimation based on the same SSB (Tfirst-SSB/Tfirst-RS) as is used for T/F tracking at TCI state activation.
			* The number of PL-RS the UE shall be able to maintain for LTM candidate cells should be added on top of the number of the 4 PL-RS the UE is expected to be able to keep track of for serving cells. RAN4 to discuss the exact number of LTM candidate cell PL-RS that the UE shall be able to maintain.
	+ Option 4 (Ericsson, QC): 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.
* Recommended WF
	+ Recommend following the majority view and agree on
		- No additional PL-RS measurement time is needed
		- Further discuss whether some conditions are needed:
			* Option A: No additional condition
			* Option B: L3-RSRP or L1-RSRP on the SSB associated with PL-RS has been reported
			* Option C: Target PL-RS is maintained.

#### Tinterruption

**Issue 3-1-3-1: Tinterruption** **of PSCell switch**

*Interruption on MCG is caused by RF/BB retuning. The interruption on MCG due to PSCell addition is also caused by RF retuning. So the interruption length of PSCell addition can be reused.*

* Proposals
	+ Option 1 (CTC, MTK):
		- The interruption on MCG due to PSCell change is the same as PSCell addition.
	+ Option 2 (Nokia):
		- RAN4 to discuss how long interruption would be needed due to LTM PSCell switch on serving cells in MCG, and at which point during cell switch is the interruption expected to happen.
* Recommended WF
	+ Recommend agree on Option 1.

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

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

*For information:*

|  |
| --- |
| 38.321Figure 6.1.3.76-1: Candidate Cell TCI state activation/deactivation MAC CE |

* Proposals
	+ Option 1 (Apple):
		- NW is not expected to trigger TCI activation or RACH toward candidate cell unless cell switch is likely to happen soon.
		- TLTM\_RRC-processing in TS38.133 is zero only applicable to the cells with early TCI activation or early TA acquisition, provided the number of these cells doesn’t exceed UE capability regarding number of cells for early ASN.1 decoding.
	+ Option 2 (Huawei):
		- TLTM-RRC-processing = 0, if the UE supports [*earlyDecodingAndValidityCheck*] capability, and the maximum number of serving cell(s) and candidate cell(s) and the maximum number of *LTMCandidateConfigs* does not exceed [*number of candidate cells for early ASN.1 decoding and validity check*]. Early TCI state activation or PDCCH order RACH does not necessarily trigger early decoding and validity check.
	+ Option 3 (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
	+ Option 4 (MTK):
		- TLTM\_RRC-processing in TS38.133 is zero only applicable to the cells whose TCI state(s) are activated, if early TCI state activation on any candidate cell is triggered, and the number of cells to perform early RRC decoding and validity check does not exceed UE capability.
		- TLTM\_RRC-processing in TS38.133 is zero only applicable to the latest cell on which PDCCH-order RACH is triggered if NW doesn’t active TCI state of any candidate cell
	+ Option 5 (Ericsson, QC)
		- 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.
		- 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
* Recommended WF
	+ Need more discussion.

**Issue 3-1-4-2: Condition on time gap between PDCCH-order and cell switch command for TLTM\_RRC-processing =0**

* Proposals
	+ Option 1 (Nokia):
		- TLTM-RRC-processing = 0, if UE supports [Early processing of an LTM candidate cell RRC configuration] and has received PDCCH order for the target cell at least 10 ms before the LTM cell switch command.
	+ Option 2 (ZTE, MTK, Ericsson, QC)
		- 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.

*Moderator: NT,2 is the time given for PDCCH-order decoding in moderator’s understanding*

* Recommended WF
	+ Recommend agree on Option 2.

#### TLTM-processing

**Issue 3-1-5-1: Value of TLTM-processing**

* Proposals
	+ Proposal 1 (vivo, Nokia):
		- In R18, if target SpCell is current SCell, TLTM-processing is 10 ms for intra-FR and 20ms for inter-FR.
* Recommended WF
	+ Need more discussion

### Sub-topic 3-2 Known conditions

**Issue 3-2-1: Extension of known TCI state conditions for cell switch**

* Proposals
	+ Proposal 1 (Nokia):
		- The target TCI state in the LTM cell switch command is known if the TCI state activation command was received not more than 1280 ms before the cell switch command, or if the RS associated to the target TCI state is available at least every 1280 ms after TCI state activation command.
		- Target TCI state in cell switch command is known, if UE successfully completed PDCCH ordered RACH preamble transmission within 1280 ms before the cell switch command, and if the SSB in the PDCCH order is associated to the target TCI state
		- In cell switch delay requirements, the target TCI state is known if the UE has reported L3-RSRP measurements for the SSB associated to the target TCI state before the cell switch command.
	+ Proposal 2 (MTK): In cell switch delay requirements, activated TCI state can be known if the following conditions can be met:
		- SNR of the SSB associated to TCI state ≥ -3dB
		- Beam-level L3 measurement results have been reported in 1280ms
		- L1-RSRP measurement period is no larger than 1280ms in FR2
	+ Proposal 3 (Ericsson, QC): update the known TCI state conditions for LTM cell switch:

|  |
| --- |
| 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 X1 ms before the reception of the cell switch command and SNR of the SSB associated to TCI state ≥ -3dB; where X1 is 1280ms for FR1 and 160ms for FR2; or**- The target TCI state in 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 160 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 ≥ -3dBOtherwise, the target joint DL/UL TCI state or separate DL and UL TCI state is unknown. |

* Recommended WF
	+ Recommend to discuss whether TCI state can be viewed as known if the following conditions are met when SNR of the TCI state≥ -3dB
		- In FR1
			* Condition 1: TCI state has been activated and
				+ Condition 1A: the TCI state activation command was received not more than 1280 ms before the cell switch command
				+ Condition 1B: Beam-level L3 measurement results have been reported in 1280 ms
				+ Condition 1C: The RS associated to the target TCI state is available at least every 1280 ms after TCI state activation command
			* Condition 2: UE has reported L3-RSRP measurements for the SSB associated to the target TCI state in [1280]ms before the cell switch command
		- In FR2
			* Condition 3: TCI state has been activated and
				+ Condition 3A: the TCI state activation command was received not more than 1280 ms before the cell switch command
				+ Condition 3B: the TCI state activation command was received not more than 160 ms before the cell switch command
				+ Condition 3C: The RS associated to the target TCI state is available at least every 1280 ms after TCI state activation command
				+ Condition 3D:

Beam-level L3 measurement results have been reported in 1280ms

L1-RSRP measurement period is no larger than 1280ms in FR2

* + - * Condition 4: UE has reported L3-RSRP measurements for the SSB associated to the target TCI state in [1280]ms before the cell switch command

# 4. Topic #4: LTM – RAN2 LS

## 4.1 Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2407348**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407348.zip) | Apple | **Observation 5: LTM cell switch requirements only cover known cell and known TCI scenario.****Observation 6: L1-RSRP measurement is one of the components in TCI state activation requirements. If L1-RSRP on neighbour cell is not supported, target TCI is always unknown according to current spec. Thereby, LTM cell switch requirements do not apply.****Proposal 7: answer to question 1: current RAN4 LTM cell switch delay requirements are applicable only to UE supporting L1-RSRP measurement.****Proposal 8: answer to question 2: RAN4 features (39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6) are defined per BC of serving cells.** |
| [**R4-2407482**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407482.zip) | CATT | **Observation 2: It is inconsistent with the definition of LTM if L3 measurements can also be used to trigger LTM.****Proposal 6: Reply RAN2 that RAN4 only consider intra-frequency and inter-frequency LTM triggered by intra-frequency and inter-frequency L1 measurement and reporting.** |
| [**R4-2407769**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407769.zip) | vivo | **Proposal 15 In RAN4’s understanding, the per-BC capability shall be based on the band combo of CA in which UE support LTM L1 measurements if current serving cell(s) is within the band combo.**Proposal 19 From RAN4 perspective, LTM L1 measurements are not pre-requisite for LTM cell switch.Proposal 20 If an LTM cell switch is triggered, and the target LTM cell is known based on UE’s L3 reporting, and a TCI state is activated in the LTM cell switch command, and if the TCI state activated is based on the reported SSB index in L3 reports from the UE, LTM cell switch delay requirements are also applicable. |
| [**R4-2408581**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408581.zip) | Huawei, HiSilicon | **Proposal 9: FG45-1 should be the prerequisite to support intra-frequency LTM. FG45-1a should be the prerequisite to support inter-frequency LTM.****Proposal 10: The BC granularity is BC including current serving cells and cell to be measured.****Proposal 11: For intra frequency/intra-band inter-frequency LTM measurement, the current serving cell and candidate cell to be measured are on the same band in a band combination. For inter-band inter-frequency measurement, the current serving cell and candidate cell to be measured can be on any band in the band combination.** |
| [**R4-2408684**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408684.zip) | Nokia | Observation 1: Based on the current RAN4 agreements, LTM cell switch decision does not need to be based on L1-RSRP report, if the target TCI state in the cell switch command is known based on TCI state activation.Observation 2: Based on current agreements, when TCI state is not activated before cell switch command, L1-RSRP report is needed for the target TCI state to be considered known.Proposal 4: In cell switch delay requirements, the target TCI state is known if the UE has reported L3-RSRP measurements for the SSB associated to the target TCI state before the cell switch command.Proposal 5: In early TCI state activation delay requirements, the target TCI state is known if the UE has reported L3-RSRP measurements for the SSB associated to the target TCI state before TCI state activation command.Proposal 6: RAN4 to respond RAN2 that L1 measurements and reporting is not a prerequisite for LTM from RAN4 requirement point of view.Proposal 7: Due to implementation and signalling overhead, the LTM measurements capabilities are defined per UE instead of per BC agreed in RAN4#110bis.Proposal 8: RAN4 to inform RAN2 about changes in UE capabilities from per BC to per UE. |
| [**R4-2409031**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409031.zip) | ZTE Corporation, Sanechips | **Observation 4: There is no restriction that intra-frequency and inter-frequency LTM shall based on intra-frequency and inter-frequency L1 measurement and reporting.****Proposal 7: For RAN4 features (39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6) are defined per BC for both intra-frequency and inter-frequency measurements, RAN4 understands that per BC is band combination of current serving cells.** |
| [**R4-2409385**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409385.zip) | MediaTek Inc. | **Observation 1:** **L1 measurement is necessary to support early TCI state activation in FR2.****Observation 2: L1 measurement is not necessary to support early TCI state activation in FR1.****Proposal 18: When L1 measurement is configured, after receiving TCI state activation command, UE only performs one shot T/F tracking without any periodic T/F tracking afterward.****Observation 3: L1 measurement is not necessary to support PDCCH-order RACH in FR1, if the triggering is based L3 measurement report.****Observation 4: L1 measurement is necessary to support PDCCH-order RACH in FR2.****Observation 5: L1 measurement is not necessary for cell switch in FR1, if it is based L3 measurement report.****Observation 6: L1 measurement is necessary for cell switch in FR2.****Conclusion 1: L1 measurement is not necessary in FR1 but necessary in FR2 for R18 LTM.****Conclusion 2: similar benefits can be obtained in FR1 without L1 measurement compared to with L1 measurement for R18 LTM.****Proposal 19: Reply RAN2 that from the point of RAN4 requirements*** **In FR1: L1 measurement is not necessary and similar benefits can be obtained in FR1 without L1 measurement compared to with L1 measurement**
* **In FR2: there are not related requirements if L1 measurement is not supported or configured.**
* **Decouple R18 LTM and L1-RSRP measurement.**

**Proposal 20: Reply RAN2 that per BC refers to BC of current serving cells for the RAN4 features (39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6) defined per BC for both intra-frequency and inter-frequency measurements.** |
| [**R4-2409714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409714.zip) | Ericsson, Qualcomm Incorporated | 1. For Question 1 in the LS R4-2407116 (R2-2404014), RAN4 to await confirmation from RAN1. If necessary, RAN4 to confirm that RRM requirements are defined to accommodate scenarios where L3 measurement and report are conducted, even if L1 measurement and report were unavailable.
2. The RAN4 features (39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6) are defined per BC, assuming that candidate cells are considered as if they are serving cells when reporting the UE features in the form of per BC.
 |

## 4.2 Open issues summary

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

### 4.2.1 Sub-topic 4-1 Question 1

LS from RAN2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| RAN2 discussed RAN1 and RAN4 feature lists associated with Rel-18 NR\_Mob\_enh2. RAN2 discussed wither the following L1 measurement and reporting features are mandatory to support LTM or whether L3 measurement could be used.

|  |  |
| --- | --- |
| 45-1 | Intra-frequency L1 measurement and reports for L1-L2 Triggered Mobility (LTM) procedure |
| 45-1a | Inter-frequency L1 measurement and reports for L1-L2 Triggered Mobility (LTM) procedure |

RAN2 made the following agreement:RAN2 makes no further assumptions whether L3 measurements can be used or not to trigger LTM. RAN2 would like to check the following with RAN1 and RAN4:**Question 1 :** Are the above intra-frequency and inter-frequency L1 measurement and reporting features (45-1 and 45-1a) prerequisites to support intra-frequency and inter-frequency LTM, respectively? |

**Issue 4-1-1: Observations related to whether L1 measurement is prerequisite of R18 LTM.**

*Moderator suggests to discuss the controversial observations to align understanding.*

* Proposals
	+ Observation 1 (Apple):
		- LTM cell switch requirements only cover known cell and known TCI scenario.
		- L1-RSRP measurement is one of the components in TCI state activation requirements. If L1-RSRP on neighbour cell is not supported, target TCI is always unknown according to current spec. Thereby, LTM cell switch requirements do not apply.
	+ Observation 2 (CATT): It is inconsistent with the definition of LTM if L3 measurements can also be used to trigger LTM.
	+ Observation 3 (vivo):
		- If an LTM cell switch is triggered, and the target LTM cell is known based on UE’s L3 reporting, and a TCI state is activated in the LTM cell switch command, and if the TCI state activated is based on the reported SSB index in L3 reports from the UE, LTM cell switch delay requirements are also applicable.
	+ Observation 4 (Nokia):
		- Based on the current RAN4 agreements, LTM cell switch decision does not need to be based on L1-RSRP report, if the target TCI state in the cell switch command is known based on TCI state activation.
		- Based on current agreements, when TCI state is not activated before cell switch command, L1-RSRP report is needed for the target TCI state to be considered known.
	+ Observation 5 (ZTE): There is no restriction that intra-frequency and inter-frequency LTM shall based on intra-frequency and inter-frequency L1 measurement and reporting.
	+ Observation 6 (MTK):
		- L1 measurement is not necessary for cell switch in FR1, if it is based L3 measurement report.
		- L1 measurement is necessary for cell switch in FR2.
		- L1 measurement is necessary to support early TCI state activation in FR2.
		- L1 measurement is not necessary to support early TCI state activation in FR1.
		- L1 measurement is not necessary to support PDCCH-order RACH in FR1, if the triggering is based L3 measurement report.
		- L1 measurement is necessary to support PDCCH-order RACH in FR2.
* Recommended WF
	+ Discuss on the controversial observations:
		- Observation A:
			* LTM cell switch requirements only cover known cell and known TCI scenario.
			* L1-RSRP measurement is one of the components in TCI state activation requirements. If L1-RSRP on neighbour cell is not supported, target TCI is always unknown according to current spec. Thereby, LTM cell switch requirements do not apply.
		- Observation B:
			* Based on the current RAN4 agreements, LTM cell switch decision does not need to be based on L1-RSRP report, if the target TCI state in the cell switch command is known based on TCI state activation.
			* Based on current agreements, when TCI state is not activated before cell switch command, L1-RSRP report is needed for the target TCI state to be considered known.
		- Observation C:
			* L1 measurement is not necessary for cell switch in FR1, if it is based L3 measurement report.
			* L1 measurement is necessary for cell switch in FR2.

**Issue 4-1-2: How to reply RAN2 on Question 1**

* Proposals
	+ Option 1 (Apple, CATT, Huawei): L1-RSRP measurements and reporting are the prerequisite to support R18 LTM
		- Option 1a (Apple): answer to question 1: current RAN4 LTM cell switch delay requirements are applicable only to UE supporting L1-RSRP measurement.
		- Option 1b (CATT): Reply RAN2 that RAN4 only consider intra-frequency and inter-frequency LTM triggered by intra-frequency and inter-frequency L1 measurement and reporting.
		- Option 1c (Huawei): FG45-1 should be the prerequisite to support intra-frequency LTM. FG45-1a should be the prerequisite to support inter-frequency LTM.
	+ Option 2 (Nokia, vivo, ZTE, MTK, Ericsson, QC): L1-RSRP measurements and reporting are not the prerequisite to support R18 LTM
		- Option 2a (MTK): From the point of RAN4 requirements
			* In FR1: L1 measurement is not necessary and similar benefits can be obtained in FR1 without L1 measurement compared to with L1 measurement
			* In FR2: there are not related requirements if L1 measurement is not supported or configured.
			* Decouple R18 LTM and L1-RSRP measurement.
		- Option 2b (Ericsson, QC)
			* RAN4 to await confirmation from RAN1. If necessary, RAN4 to confirm that RRM requirements are defined to accommodate scenarios where L3 measurement and report are conducted, even if L1 measurement and report were unavailable.
* Recommended WF
	+ Need more discussion.

### 4.2.2 Sub-topic 4-2 Question 2

**Issue** **4-2-1: Understanding of per BC and Reporting granularity of RAN4 features 39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6**

|  |
| --- |
| **Question 2:** The above features, 45-1 and 45-1a, from RAN1 and related RAN4 features (39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6) are defined per BC for both intra-frequency and inter-frequency measurements. RAN2 would like check with RAN1/4 for which BC (e.g. BC of current serving cells, BC including current serving cells and cell to be measured or something else) these capabilities are to be considered for L1 intra-frequency and inter-frequency LTM measurements? |

|  |
| --- |
| **From 38.306**UE capability parameters have hierarchical structure. In the table of UE capability parameter in subsequent clauses, "Per" indicates the level the associated parameter is included. "UE" in the column indicates the associated parameter is signalled per UE, "Band" indicates it is signalled per band, "BC" indicates it is signalled per band combination, "FS" indicates it is signalled per feature set (per band per band combination), "FSPC" indicates it is signalled per feature set per component carrier (per CC per band per band combination), and "FD" in the column indicates to refer the associated field description |

|  |  |  |
| --- | --- | --- |
| 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. |
| 39-2 | SSB based inter-frequency L1-RSRP measurements without measurement gaps | Capability of SSB based inter-frequency L1-RSRP measurements on SSBs within active DL BWP without measurement gaps (without interruption on serving cell(s)) for LTM |
| 39-3-1 | Number of frequency layers for L1-RSRP measurement | 1. The max number of frequency layers UE can measure for intra- and inter-frequency without measurement gaps L1-RSRP measurement

2. The max number of frequency layers UE can measure for inter-frequency L1-RSRP measurement with measurement gaps  |
| 39-3-2 | Number of neighbour cells to be measured per frequency layer | 1. The max number of neighbour cells UE can measure for L1-RSRP per frequency layer for intra-frequency or inter-frequency without measurement gaps

2. The max number of neighbour cells UE can measure for L1-RSRP per frequency layer for inter-frequency with measurement gaps |
| 39-3-3 | Number of total cells to be measured | The max number of total cells of serving cells and neighboring cells across all frequency layers of intra-frequency and inter-frequency without measurement gaps for L1 measurement. |
| 39-3-4 | Number of SSB resources for L1-RSRP measurement within a slot | The max number of SSB resources for L1-RSRP measurement that UE can measure within a slot across candidate cells for intra- and inter-frequency without gap L1-RSRP measurement |
| 39-3-5 | Number of SSB resources for L1-RSRP measurement per frequency layer | 1. The max number of SSB resources UE can measure for L1-RSRP per frequency layer for intra-frequency or inter-frequency without measurement gaps

2. The max number of SSB resources UE can measure for L1-RSRP per frequency layer for inter-frequency with measurement gaps |
| 39-3-6 | Number of total SSB resources to be measured | The max number of total SSB resources of serving cells and neighboring cells across all frequency layers of intra-frequency and inter-frequency without measurement gaps for L1 measurement. |

* Proposals
	+ Option 1 (Apple, vivo, MTK, ZTE):
		- RAN4 features (39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6) are defined per BC of serving cells.
	+ Option 2 (Huawei, Ericsson, QC): The BC granularity is BC including current serving cells and cell to be measured.
		- Option 2a (Huawei): For intra frequency/intra-band inter-frequency LTM measurement, the current serving cell and candidate cell to be measured are on the same band in a band combination. For inter-band inter-frequency measurement, the current serving cell and candidate cell to be measured can be on any band in the band combination.
		- Option 2b (Ericsson, QC):
			* The RAN4 features (39-1, 39-2, 39-3-1, 39-3-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6) are defined per BC, assuming that candidate cells are considered as if they are serving cells when reporting the UE features in the form of per BC.
	+ Option 3 (Nokia):
		- Due to implementation and signalling overhead, the LTM measurements capabilities are defined per UE instead of per BC agreed in RAN4#110bis.
		- RAN4 to inform RAN2 about changes in UE capabilities from per BC to per UE.
* Recommended WF

*Generally, suggest not to revert previous agreements.*

*For intra-f and inter-f without gap L1 measurement, the SSB to measure will be within serving band(s). There is no difference between option 1 and option 2.*

*For the capabilities for intra-f and inter-f without gap L1 measurement (39-1,* *39-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6, component 1 of 39-3-1, component 1 of 39-3-2, and component 1 of 39-3-5), suggest not to revert previous agreement, they are per BC of serving cells.*

*For capabilities for inter-f with MG L1 measurement (component 2 of 39-3-1, component 2 of 39-3-2, and component 2 of 39-3-5), different understanding of per BC may lead to different reporting mechanism. Suggest to discuss the report granularity.*

* + Recommend agree on
		- The capabilities for intra-f and inter-f without gap L1 measurement (39-1, 39-2, 39-3-3, 39-3-4, 39-3-5, 39-3-6, component 1 of 39-3-1, component 1 of 39-3-2, and component 1 of 39-3-5) are reported per BC of serving cells
		- Discuss the exact reporting granularity for capabilities for inter-f with MG L1 measurement, i.e., component 2 of 39-3-1, component 2 of 39-3-2, and component 2 of 39-3-5

# 5. Topic #5: LTM – UE feature

## 5.1 Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2407769**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407769.zip) | vivo | **Proposal 16 The granularity of RAN4 FG 39-2a ‘inter-frequency with gap’ is changed from ‘per-UE’ to ‘per-BC’.****Proposal 17 Adopt the optimization on consequence of not supporting 39-1 as following:*** **The corresponding RAN4 requirements for intra-frequency and inter-frequency w/wo gaps may not be satisfied when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is larger than CP length of the cell on the frequency layer.**
* **If in one active BWP, there are more than one LTM L1 measurement frequency layers, the corresponding RAN4 requirements for intra-frequency and inter-frequency without gaps may not be satisfied when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement in the same active BWP is larger than CP length of the cell in the same active BWP.**

**Proposal 18 Adopt the optimizations on consequence of not supporting 39-2/3/4/5/6 as following, , as shown in Table 1:*** **There is no additional limitation on ‘xxx’ for L1 measurement, on top of 39-3-1 and any other reported FG(s) in 39-3-2/3/4/5/6.**
 |
| [**R4-2409714**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409714.zip) | Ericsson, Qualcomm Incorporated | 1. For 39-3-2/3/4/5/6, there is no need to add separate behaviour if UE does not report support this capability.
2. Not to change the exiting capability description on Interruption on DL slots due to PDCCH-ordered RACH.
 |

## 5.2 Open issues summary

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

### 5.2.1 Sub-topic 5-1

**Issue 5-1-1: Inter-f L1-RSRP measurement with gap**

* Proposals
	+ Option 1 (vivo):
		- The granularity of RAN4 FG 39-2a ‘inter-frequency with gap’ is changed from ‘per-UE’ to ‘per-BC’.
* Recommended WF
	+ Need more discussion.

**Issue 5-1-2: Optimization on consequence of not supporting some features**

* Proposals
	+ Proposal 1 (vivo): Adopt the optimization on consequence of not supporting 39-1 as following:
		- The corresponding RAN4 requirements for intra-frequency and inter-frequency w/wo gaps may not be satisfied when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement on the same frequency layer is larger than CP length of the cell on the frequency layer.
		- If in one active BWP, there are more than one LTM L1 measurement frequency layers, the corresponding RAN4 requirements for intra-frequency and inter-frequency without gaps may not be satisfied when the max RTD among the cells on which UE is required to perform simultaneous L1-RSRP measurement in the same active BWP is larger than CP length of the cell in the same active BWP.
	+ Proposal 2 (vivo): Adopt the optimizations on consequence of not supporting 39-2/3/4/5/6 as following, , as shown in Table 1:
		- There is no additional limitation on ‘xxx’ for L1 measurement, on top of 39-3-1 and any other reported FG(s) in 39-3-2/3/4/5/6.
	+ Proposal 3 (Ericsson, QC): For 39-3-2/3/4/5/6, there is no need to add separate behaviour if UE does not report support this capability.
* Recommended WF
	+ Need more discussion.

**Issue 5-1-3: Interruption on DL slots due to PDCCH-ordered RACH**

*Proposal 1 is aligned with previous agreement.*

* Proposals
	+ Proposal 1 (Ericsson, QC): Not to change the exiting capability description on Interruption on DL slots due to PDCCH-ordered RACH.
* Recommended WF
	+ No more discussion.

# 6. Topic #6: LTM – Performance (AI 7.14.2.1)

## 6.1 Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2407773**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2407773.zip) | 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 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*.****Proposal 2 Introduce two sub-tests for inter-frequency cell switch test cases so as to cover UEs supporting inter-frequency L1 measurement with gaps and UEs supporting inter-frequency L1 measurement without gaps.****Proposal 3 For L3 measurement configurations in LTM L1 measurement tests and cell switch delay tests, *reportQuantityRS-Indexes* and *maxNrofRS-IndexesToReport* shall be configured.****Proposal 4 For cell switch delay test cases, the RTD condition shall also be set according to UE capability in 39-1, so that UE supporting RTD>CP can be verified.** |
| [**R4-2408174**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408174.zip) | CMCC | ***Proposal 1: it is proposed to define test cases for UE based TA measurement for LTM.*** |
| [**R4-2409033**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409033.zip) | ZTE Corporation, Sanechips | **Proposal 1: Introduce test with two neighbor cells in FR2 for intra-frequency L1-RSRP measurement to verify the UE behavior.** **Proposal 2：RAN4 should define test cases for unknown TCI state activation for the test cases involving early TCI state activation.** |
| [**R4-2409387**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409387.zip) | MediaTek Inc. | **Proposal 1: Change “T3 ends 50ms after the candidate cell TCI state activation MAC CE transmission” to “T3 ends 100ms after the candidate cell TCI state activation MAC CE transmission” for inter-frequency cell switch test cases, i.e., A.6.3.x.2 and A.7.3.x.3.****Proposal 2: In A.6.6.x.1 and A.7.6.Z.1 add a limitation that T2 starts at the beginning of a frame with an odd SFN. In A.6.6.z.1, add a limitation that T2 starts at the beginning of a frame boundary with an even SFN.****Proposal 3: In LTM L1-RSRP test cases, the test requirements should consider measurement delay + report delay considering the worst case.****Proposal 4: 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 L1-RSRP levels 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.****Proposal 5: Intra-f relative accuracy requirements are also applicable to two SSBs from cells on the same frequency but not the same frequency as serving cell. Inter-f relative accuracy requirements are also applicable to the case that one SSB is on serving cell frequency and another is on a different frequency.** |
| [**R4-2409716**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409716.zip) | Ericsson | 1. RAN4 should define test cases for unknown TCI state activation for the test cases involving early TCI state activation.
2. introduce test with two neighbor cells in FR2 for intra-frequency L1-RSRP measurement.
 |

## 6.2 Open issues summary

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

### 6.2.1 Sub-topic 6-1 L1-RSRP measurement accuracy

**Issue 6-1-1: Definition of L1-RSRP measurement relative accuracy**

*Copied from the proponent’s Tdoc for information.*



* 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 L1-RSRP levels 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.
		- Intra-f relative accuracy requirements are also applicable to two SSBs from cells on the same frequency but not the same frequency as serving cell. Inter-f relative accuracy requirements are also applicable to the case that one SSB is on serving cell frequency and another is on a different frequency.
* Recommended WF
	+ Need more discussion.

### 6.2.2 Sub-topic 6-2 Test cases

**Issue 6-2-1: More test or sub-test cases for cell switch delay**

* Proposals
	+ Proposal 1 (vivo):
		- Introduce two sub-tests for inter-frequency cell switch test cases so as to cover UEs supporting inter-frequency L1 measurement with gaps and UEs supporting inter-frequency L1 measurement without gaps.
	+ Proposal 2 (vivo):
		- For cell switch delay test cases, the RTD condition shall also be set according to UE capability in 39-1, so that UE supporting RTD>CP can be verified.
	+ Proposal 3 (ZTE, Ericsson):
		- RAN4 should define test cases for unknown TCI state activation for the test cases involving early TCI state activation.

*Moderator: according to the proposed CR R4-2409717, it is to add a TC for RACH-less Intra-frequency PCell switch from FR1 to FR1 with unknown TCI state activation*

* Recommended WF
	+ Need more discussion

**Issue 6-2-2: More test cases for PDCCH-order RACH**

* Proposals
	+ Proposal 1 (Ericsson):
		- RAN4 should define test cases for unknown TCI state activation for the test cases involving early TCI state activation.

*Moderator: according to the proposed CR R4-2409717, it is to add a TC for PDCCH-order RACH with unknown TCI state activation on neighbor cell in FR1 when RACH BW is within active UL BWP.*

* Recommended WF
	+ Need more discussion.

**Issue 6-2-3: Whether to have test with two neighbor cells in FR2 for intra-frequency L1-RSRP measurement**

* Proposals
	+ Proposal 1 (ZTE, Ericsson):
		- Introduce test with two neighbor cells in FR2 for intra-frequency L1-RSRP measurement to verify the UE behavior.
* Recommended WF
	+ Need more discussion

**Issue 6-2-4: Whether define test cases for UE-based TA measurement**

* Proposals
	+ Option 1 (CMCC): Define test cases for UE based TA measurement for LTM.
* Recommended WF
	+ Need more discussion.

**Issue 6-2-5: 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 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.

**Issue 6-2-6: L3 measurement configurations in the test**

* Proposals
	+ Proposal 1 (vivo):
		- For L3 measurement configurations in LTM L1 measurement tests and cell switch delay tests, reportQuantityRS-Indexes and maxNrofRS-IndexesToReport shall be configured.
* Recommended WF
	+ Recommend agree on proposal 1 and discuss in the CR directly.

*Moderator:*

*- suggest the proponent to revise the CR directly.*

*- If not ok with the recommended WF, please comment on the corresponding CR directly.*

**Issue 6-2-7: Changes on cell switch test cases**

* Proposals
	+ Proposal 1 (MTK):
		- Change “T3 ends 50ms after the candidate cell TCI state activation MAC CE transmission” to “T3 ends 100ms after the candidate cell TCI state activation MAC CE transmission” for inter-frequency cell switch test cases, i.e., A.6.3.x.2 and A.7.3.x.3.
* Recommended WF
	+ Discuss in the CR directly.

*Moderator: If you think more online discussion is needed, please let me know before online or ad hoc.*

**Issue 6-2-8: Changes on L1-RSRP measurement period test cases**

* Proposals
	+ Proposal 1 (MTK):
		- In A.6.6.x.1 and A.7.6.Z.1 add a limitation that T2 starts at the beginning of a frame with an odd SFN. In A.6.6.z.1, add a limitation that T2 starts at the beginning of a frame boundary with an even SFN.
	+ Proposal 2 (MTK):
		- Proposal 3: In LTM L1-RSRP test cases, the test requirements should consider measurement delay + report delay considering the worst case.
* Recommended WF
	+ Discuss in the CR directly.

*Moderator: If you think more online discussion is needed, please let me know before online or ad hoc.*