**3GPP TSG-RAN WG4 Meeting #109 R4-23xxxxx**

**Chicago, USA, November 13 – 17, 2023**

**Agenda item:** 8.24.4

**Source:** Ad-hoc chair (Apple)

**Title:** Ad-hoc minutes for [109][224] NR\_Mob\_enh2\_part1

**Document for:** Approval

# Introduction

This document is the ad-hoc minutes for [109][224] NR\_Mob\_enh2\_part1 with the following topics covered.

* Topic 1: LTM - General aspects and scenarios (AI 8.24.2.1.1)
* Topic 2: LTM - L1-RSRP measurement requirements (AI 8.24.2.1.2)
* Topic 3: LTM - L1/L2 inter-cell mobility delay requirements (AI 8.24.2.1.3)
* Topic 4: LTM – Others (AI 8.24.2.1.4)
* Topic 5: LTM – UE feature

# Open issues based on R4-2318179

## Topic #1: LTM - General aspects and scenarios (AI 8.24.2.1.1)

### Sub-topic 1-1 DL synchronization before cell switch command

**(Online) Issue 1-1-1: When to acquire SFN of the candidate cell**

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| **RAN4#108bis Agreement**   * + No extra time for SFN acquisition toward target cell is needed, if     - PDCCH-order RACH or cell switch command is triggered after network received the L1-RSRP measurement report or L3 measurement report with SBI, or     - SFN of serving cell from which the PDCCH order/cell switch command is received and target cell are same.   + Otherwise, FFS |

* Proposals
  + Option 1 (Apple, MTK, [QC]): RAN4 doesn’t define requirements for the following cases
    - NW doesn’t configure UE to perform neither L3 measurement with SSB index nor L1 measurement before triggering RACH toward neighbour cell or cell switch, and
    - SFN of serving cell from which the PDCCH order/cell switch command is received and target cell are different.
    - Option 1A (QC)
      * When the above conditions are not fulfilled upon the reception of PDCCH-order or cell switch command, UE assumes SFN is synchronous between the serving cell from which PDCCH order/cell switch command is received and the target cell, i.e. the requirement does not add an extra time for SFN acquisition toward target cell.
  + Option 2 (ZTE, Ericsson): For other cases, UE is supposed to perform additional procedure to acquire SFN of the target cell before cell switch command.
* Recommended WF
  + Further discussion.

**(Online) Issue 1-1-2: Whether and how to define TCI state activation delay requirements for early T/F tracking before cell switch command**

*Existing TCI state activation delay cannot be reused directly considering inter-f case.*

*Please further check whether the compromised solution is acceptable “add a condition on the time gap between TCI state activation command and cell switch command in cell switch delay requirements”.*

* Proposals
  + Option 1 (Apple, MTK, [QC]): No need to define delay requirement for TCI state activation before cell switch.
    - Option 1a (MTK): Not to define TCI state activation delay requirements before cell switch command. A condition on the cell switch delay requirements can be added, i.e., T/F tracking after cell switch command can be skipped only if cell switch command is received at least 3ms+ L1-RSRP measurement period after UE sends ACK for the reception of TCI state activation command.
    - Option 1b (QC): It is clarified that the TCI state pre-activation on the first bullet of the agreement on Issue 3-2-2-1 in RAN4#108bis means that the time gap between the TCI state activation command reception and the LTM cell switch command reception is at least not smaller than the existing TCI state activation delay value
  + Option 2 (vivo, Nokia, Huawei): RAN4 to define TCI state activation delay requirement for early TCI state activation for LTM candidate cell before the cell switch.
    - Option 2a (vivo):
      * The end point is defined as the slot X that:
        + If UE receives cell switch command to the cell with active TCI after slot X, and the TCI to be used after cell switch is activated, then UE may not need additional T\_delta in cell switch delay
      * This TCI activation delay counts the following parts:
        + SFN (system frame number) acquisition delay, if needed.
        + SSB-based rough time-frequency tracking delay
        + the delay for waiting next SSB occasion follows the actual L1-RSRP measurement delay defined for SSB-based L1-RSRP measurement before cell switch
    - Option 2b (Nokia):
      * Define early candidate cell TCI state activation delay requirements for both known and unknown target TCI state.
      * Early DL/UL TCI state activation delay for a known TCI state is defined as n+ THARQ + 3Nslotsubframe,µ+ TOk\* (Tfirst-RS+ TSSB-proc)/ NR slot length after receiving the MAC-CE command.
      * Early DL/UL TCI state activation delay for an unknown TCI state is defined as n+ THARQ + 3Nslotsubframe,µ+ TL1-RSRP + TOuk\* (Tfirst-RS+ TSSB-proc)/ NR slot length after receiving the MAC-CE command.
    - Option 2c (Huawei)
      * The legacy requirements for “active TCI state list update delay” can be reused for early T/F tracking of candidate LTM cells before cell switching command. No need to define additional requirements for LTM.
* Recommended WF
  + Recommend agree on the compromised solution
    - Not define TCI state activation delay before cell switch command.
    - Add a condition on the time gap between TCI state activation command and cell switch command in cell switch delay requirements.

**Issue 1-1-3: Whether UE shall be able to maintain PL-RS associated with or included in the UL or joint TCI states in the LTM candidate cell active TCI state list**

* Proposals
  + Option 1 (Nokia):
    - UE can perform PL-RS estimation based on the same SSB as is used for T/F tracking at TCI state activation. Hence, no additional delay due to PL-RS is needed when TCI state is activated before or at the cell switch.
    - UE shall be able to maintain PL-RS associated with or included in the UL or joint TCI states in the LTM candidate cell active TCI state list.
* Recommended WF
  + Need more discussion.

**Issue 1-1-4: Others**

* Proposals
  + Proposal 1 (QC): Update the agreement

From: For UE not supporting using L3 measurement in L1 report, only if UE is capable of performing LTM L1 measurements for RTD > CP and supports TCI state activation on neighbour cell before cell switch command, then UE supports TCI state activation on neighbour cell before cell switch command when RTD>CP.

To: For UE not supporting using L3 measurement in L1 report, only if UE is capable of performing LTM L1 measurements for RTD > CP and supports TCI state activation on neighbour cell before cell switch command, TCI state pre-activation delay requirement on the neighbour cell, if any explicit requirement is defined, is applicable when RTD>CP.

* Recommended WF
  + Recommend agree on: Update the agreement

From: For UE not supporting using L3 measurement in L1 report, only if UE is capable of performing LTM L1 measurements for RTD > CP and supports TCI state activation on neighbour cell before cell switch command, then UE supports TCI state activation on neighbour cell before cell switch command when RTD>CP.

To: For UE not supporting using L3 measurement in L1 report, only if UE is capable of performing LTM L1 measurements for RTD > CP and supports TCI state activation on neighbour cell before cell switch command, all the requirements defined for TCI state pre-activation before cell switch command if any, are applicable when RTD>CP.

### Sub-topic 1-2 PDCCH-order RACH on neighbor cell

#### Delay requirements

**(Online) Issue 1-2-1-1: Further clarification on the condition when additional time for DL synchronization needed in the delay requirements for PDCCH ordered RACH before cell switch command**

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| --- | --- | --- |
| TCI state#1 of cell#1 is in the active TCI state list  TCI state#2 of cell#1 is not in the active TCI state list | TCI state or SSB index to use | Whether additional time for SSB based T/F tracking is needed? |
| 1st sub-bullet | TCI state#1 | No (agreed) |
| 2nd sub-bullet | TCI state#2 | FFS |

*Recommend follow the majority and agree on Option 1.*

* Proposals
  + Option 1 (CATT, Apple, ZTE, Huawei, OPPO, QC): If SSB index indicated in PDCCH order is not in the active TCI state list that has been activated, one complete SSB burst is needed for fine time tracking.
  + Option 2 (MTK)
    - In FR2, even some of the TCI state of the target cell is activated but SSB index indicated in PDCCH order is not in the active TCI state list, UE still needs additional time for T/F tracking.
    - In FR1, make a down-selection from two alternatives
      * Alt.1: even some of the TCI state of the target cell is activated but SSB index indicated in PDCCH order is not in the active TCI state list, UE still needs additional time for T/F tracking.
      * Alt.2: if some of the TCI state of the target cell is activated but SSB index indicated in PDCCH order is not in the active TCI state list, additional time for T/F tracking is not needed under the conditions
        + the arrival timing of different SSBs from the same cell is within [260ns]
        + SNR if the active TCI state is always above -3dB since it is activated.
  + Option 3 (Ericsson):
    - If SSB index indicated in PDCCH order is not in the active TCI state list that has been activated for the target cell, when the measurement period of L1-RSRP is no longer than 160ms, additional delay is not needed for fine time tracking.
    - This is applicable when RTD between SSB of the cell are within 260ns.
* Recommended WF
  + Recommend agree on Option 1.

**(Online) 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**

* Proposals
  + Option 1 (CATT, Apple, Huawei, OPPO, MTK, Ericsson): TSSB in the additional time for T/F tracking during PDCCH ordered RACH delay is the time waiting for the first SSB for L1-RSRP measurement.
    - Option 1a (CATT, Apple, MTK, [Ericsson]):
      * Target cell of intra-f or inter-f w/o gap: TSSB is SSB periodicity
      * Target cell of inter-f with Type 1 MG: TSSB is max {MGRP, SSB period} after the slot receiving PDCCH order.
    - Option 1b (OPPO): min (160ms, Tfirst-SSB)
  + Option 2 (QC):
    - RAN4 to not add an additional delay component from PDCCH order to the PRACH transmission to a candidate cell for UE to obtain DL synchronization with the candidate cell based on SSB. If the UE has not been able to receive the SSB associated with the PDCCH-order PRACH, as per RAN4 requirements, due to NW configuration, e.g. MGs, # of measurement cells/carriers, etc, UL timing accuracy requirement does not apply to the PRACH transmission irrespective of whether the SSB is associated with an active TCI state of the candidate cell.
* Recommended WF
  + Further discussion

**(Online) Issue 1-2-1-3: The value of additional time for RF/BB preparation and RF re-tuning: when PRACH bandwidth is not within any of the configured UL BWPs of any active serving cell**

* Proposals
  + Option 1 (CATT, Apple, ZTE, MTK): Define a single value
    - Option 1a (CATT, MTK): [10ms].
  + Option 2 (Huawei): same as DCI based BWP switching delay specified in clause 8.6 of TS 38.133.
  + Option 3 (OPPO, QC): introduce UE capability to report the time needed for RF/BB preparation and RF retuning
    - Option 3a (QC): The exact set of value(s) will be decided at RAN4#110, e.g. among [1ms, 3ms, 5ms, 8ms, 10ms, 15ms].
  + Option 4 (Ericsson): same as RRC based BWP switching delay (5ms)

*Moderator: RRC based BWP switching delay = 6ms?*

* Recommended WF
  + Recommend agree on:
    - For the case of PRACH bandwidth not within any of the configured UL BWPs of any active serving cell
      * Introduce UE capability to report the time needed for RF/BB preparation and RF retuning, down-select from [1ms, 3ms, 5ms, 8ms, 10ms, 15ms].

#### Interruption requirements

**(Online) Issue 1-2-2-1: Interruption due to RF/BB retuning to target cell before RACH transmission or retuning back to serving cell after RACH transmission: when PRACH bandwidth is not within any of the configured UL BWPs of any active serving cell**

* Proposals
  + Option 1 (CATT, ZTE, OPPO):
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot or ⌈Y/1slot length⌉ slot + 1 slot.
    - The value of Y is 1ms.
  + Option 2 (CMCC):
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot.
    - The value of Y can be 0.5ms for FR1 and 0.25ms for FR2
  + Option 3 (Huawei):
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot.
    - The value of Y can be 0.5ms
  + Option 4 (Ericsson): 1 slot for FR1 and FR2
  + Option 5 (QC): Introduce new UE capability
* Recommended WF
  + Recommend agree on
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot
    - Y is up to UE capability.

**(Online) Issue 1-2-2-2: Location of interruption due to RF/BB retuning to target cell before RACH transmission or retuning back to serving cell after RACH transmission**

* Proposals
  + Option 1 (MTK, Ericsson, CATT):
    - Location of the interruption due to RF retuning is before and after the RACH transmission
  + Option 2 (QC): Introduce new UE capability
* Recommended WF
  + Need more discussion.

#### UL timing

**(Signalling) Issue 1-2-3-1: n-TimingAdvanceOffset**

*For information:*

Table 7.1.2-2: The Value of 

|  |  |
| --- | --- |
| Frequency range and band of cell used for uplink transmission | (Unit: TC) |
| FR1 FDD or TDD band with neither E-UTRA–NR nor NB-IoT–NR coexistence case | 25600 (Note 1) |
| FR1 FDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case | 0 (Note 1) |
| FR1 TDD band with E-UTRA–NR and/or NB-IoT–NR coexistence case | 39936 (Note 1) |
| FR2 | 13792 |
| Note 1: The UE identifies  based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of  is set as 25600 for FR1 band. In case of multiple UL carriers in the same TAG, UE expects that the same value of n-TimingAdvanceOffset is provided for all the UL carriers according to clause 4.2 in TS 38.213 [3] and the value 39936 of  can also be provided for a FDD serving cell.  Note 2: Void | |

* Proposals
  + Option 1 (Apple, MTK):
    - n-TimingAdvanceOffset from serving cell cannot always be reused for neighbor cell on different band.
    - In the derivation of UL timing of PDCCH-ordered RACH on target cell, DL timing of the target cell which to transmit UL on should be used as a reference
      * Apple: ask RAN1/2 if n-TimingAdvanceOffset can be added in TA Management Related RRC parameters (e.g., LTM-EarlyUlSyncConfig-r18).
      * MTK: When “*n-TimingAdvanceOffset*” is not configured by NW for PDCCH-ordered RACH on target cell, reuse the default value in 38.133 Table 7.1.2-2.
  + Option 2 (vivo):
    - For PDCCH-ordered RACH to neighbour cell, UE always assumes the serving cell n-TimingAdvanceOffset also applies for the cell where PRACH transmitted.
    - Re-use the UL timing adjustment requirements defined for R17 FR2 HST as the baseline for PDCCH-ordered RACH to neighbour cell before cell switch command.
* Recommended WF
  + Recommend agree on
    - Ask RAN1/2 to add *n-TimingAdvanceOffset* in TA Management Related RRC parameters (e.g. LTM-EarlyUlSyncConfig-r18)
    - When “*n-TimingAdvanceOffset*” is not configured by NW for PDCCH-ordered RACH on target cell, reuse the default value in 38.133 Table 7.1.2-2.
    - In the derivation of UL timing of PDCCH-ordered RACH on target cell, DL timing of the target cell which to transmit UL on should be used as a reference.

**Issue 1-2-3-2: Whether to define UL timing requirements for the first UL on target cell before cell switch command, i.e. PDCCH ordered RACH**

* + Option 1 (vivo):
    - Re-use the UL timing adjustment requirements defined for R17 FR2 HST as the baseline for PDCCH-ordered RACH to neighbour cell before cell switch command.
* Recommended WF
  + Collect views from companies.

### Sub-topic 1-3 UE based TA measurement

**Issue 1-3-1: Whether and how to define timing requirements for UE based TA measurement**

*In moderator’s understanding, it is not enough to only define UL timing requirements for the use of UE based TA measurement. For completeness, the requirements on the synchronization between serving cell and target cell (usually captured in 38.104) should be defined too. Considering this is the last meeting, suggest not to define requirements for UE based TA measurement in R18.*

* Proposals
  + Option 1 (CMCC): define timing requirements for UE-based TA measurement, and the timing requirements introduced for FR2 Power Class 6 UE (FR2 HST UE) can be reused.
  + Option 2 (vivo): UE-based TA during cell switch command can be applicable to both with-early-RACH scenario and without-early-RACH scenario. RAN4 to clarify in the spec that for the case of UE-based TA, UE shall also follow existing requirements in TS 38.133. Similar to previous issue, if RTD between cells is larger than CP/4, existing requirements defined for FR2 HST can be re-used.
  + Option 3 (MTK): Not to define requirements for UE based TA measurement in R18.
* Recommended WF
  + Recommend agree on
    - Not to define requirements for UE based TA measurement in R18.

## Topic #2: LTM - L1-RSRP (Baseline) measurement requirements (AI 8.24.2.1.2)

### Sub-topic 2-1 Applicability rule for L1-RSRP measurement

**(Online) Issue 2-1-1: Whether L1 measurement layer is configured on the same frequency as one of current L3 MO**

* Proposals
  + Option 1 (Apple, vivo, ZTE, MTK, Nokia, CATT):
    - For LTM L1 measurement, RRM requirements are applicable only if L1 measurement layer is configured on the same frequency as one of current L3 MO
  + Option 2 (CMCC):
    - it is not necessary to have the limitation that RRM requirements for LTM are applicable only if L1 measurement layer is configured on the same frequency as one of current L3 MO.
* Recommended WF
  + Recommend agree on Option 1.

**Issue 2-1-2: Updating on agreement of L1 measurements on unknown cell**

* Proposals
  + Proposal 1 (QC):
    - Update the following agreement:

From: UE is not required to perform L1 measurements on unknown cell.

To: L1 measurement requirements are NOT applied to unknown candidate cells.

* Recommended WF
  + Recommend agree on Proposal 1.

**(Online) Issue 2-1-3:** **known cell condition for L1-RSRP measurement***.*

*For information:*

*RAN4#108bis*

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| **Issue 2-1-3: known cell condition for L1-RSRP measurement***.*  **< Agreement>**   * + In L1-RSRP measurement for neighbour cell, target cell is considered as known if the following conditions are met in this requirement:     - The UE has performed L3 measurement on the target cell, and       * FFS whether to add time constraint e.g. during the last [5] seconds     - The SSB from the target cell configured for L1 measurementremains detectable according to the cell identification requirements specified in clause 9.2 and 9.3.   + Otherwise, it is unknown |

* Proposals
  + Option 1 (CATT, Apple, ZTE ):
    - Add the time constraint “The UE has performed L3 measurement on the target cell during the last [5] seconds” in known cell condition for L1-RSRP measurement.
  + Option 2 (Nokia): Not to have “during the last [5] seconds” as part of known condition
* Recommended WF
  + Recommend agree on Option 1.

**Issue 2-1-4:** **Whether additional time for SSB index reading is needed at L1-RSRP measurement?**

***For information***

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| **RAN4#108**  **Common understanding:** If *deriveSSB-IndexFromCell* or *deriveSSB-IndexFromCellInter* is enabled, UE can derive SSB index according to serving cell timing. |

* Proposals
  + Option 1 (Apple, CATT, ZTE, Huawei, MTK, Ericsson, Nokia):
    - If deriveSSB-IndexFromCell and deriveSSB-IndexFromCellInter-r17 are not enabled, but UE performed L3 measurement with SSB index reading on the candidate cell, no additional time is needed when defining requirements for L1-RSRP for neighbour cell
    - If deriveSSB-IndexFromCell and deriveSSB-IndexFromCellInter-r17 are not enabled, and UE performed L3 measurement without SSB index reading on the candidate cell, additional time for time index detection is needed when defining requirements for L1-RSRP for neighbour cell.
* Recommended WF
  + Recommend agree on
    - If *deriveSSB-IndexFromCell* and *deriveSSB-IndexFromCellInter-r17* are not enabled, but UE has performedL3 measurement with SSB index on the candidate cell, no additional time is needed when defining requirements for L1-RSRP for neighbour cell
    - If *deriveSSB-IndexFromCell* and *deriveSSB-IndexFromCellInter-r17* are not enabled, and UE has not performed L3 measurement without SSB index reading on the candidate cell, additional time for time index detection is needed when defining requirements for L1-RSRP for neighbour cell.

### Sub-topic 2-2 Measurement capability

**Issue 2-2-1: Intra-frequency layers to measure**

* Proposals
  + Proposal 1 (Apple): For L1-RSRP measurement on neighbour cell, UE measures only one intra-frequency layer on each FR2 band in CA scenario.
    - Selection of the single layer for intra-frequency measurement on a FR2 band shall follow existing L3 measurement, i.e, this single intra-frequency layer shall be:
      * PCC when UE is configured with SA NR operation mode with PCC in the band; or
      * PSCC when UE is configured with EN-DC with PSCC in the band; or
      * PSCC when UE is configured with NR-DC with PSCC in the band; or
      * One of the SCCs on which UE is configured to report SSB based measurements when neither PCC nor PSCC is in the same band, so that the selected SCC shall be an SCC where the UE is configured with SS-RSRP measurement reporting if such SCC exists, otherwise the selected SCC is determined by UE implementation.
* Recommended WF
  + Recommend agree on Proposal 1.

**Issue 2-2-2: How to handle the case that the number of cells NW configured/activated to measure exceeds the configuration to exceed UE capability (# of cells/SSBs UE supported per frequency layer)**

*Background:*

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| **Conclusion (RAN1#113)**   * For the beam selection for SSB based L1-RSRP measurement report, except SpCell is configured to be included,   + the selection of cells for the L1 measurement report is up to UE implementation.   the selection of beams per cell for the L1 measurement report is the same as legacy behaviour. |

*To address Nokia’s question on “configured/activated”: There are periodic report, semi-persistent report and aperiodic report for L1-RSRS measurement. For periodic report, there is only RRC configuration. For semi-persistent and aperiodic report, except RRC configuration, there is also related mechanism to active part of the measurement. Here “the number of cells NW configured/activated to measure” is referring to the cells that NW is asking UE to measure, including periodic report, semi-persistent report and aperiodic report.*

* Proposals
  + Option 1 (Apple, MTK, Nokia): It is up to UE implementation on how to choose cells/SSB to measure if the number of cells/SSB NW configured/activated to measure exceeds UE capability.
    - Nokia: In rel-18 if network configuration to measure exceeds the UE capability to perform L1-RSRP measurements, no requirements are defined.
  + Option 2 (ZTE): When number of LTM candidate cells configured exceeds the UE capability of number of cells UE can measure, down selection of cells for LTM measurement is based on indication from the NW.
  + Option 3 (Ericsson): It is up to UE implementation till the TCI state activation is received. After TCI state activation, UE should at least measure cells which are activated for TCI state and additional cells to measure is up to UE implementation.
* Recommended WF
  + Recommend agree on
    - If the number of cells/SSB NW configured/activated to measure exceeds UE capability (# of cells/SSBs UE supported per frequency layer), it is up to UE implementation on how to choose cells/SSB to measure per frequency layer.

### Sub-topic 2-3 Intra-frequency L1-RSRP Measurement delay

#### Scenario and basic assumption

**(Online) Issue 2-3-1-1: whether to support the case that SSB periodicity of FR2 intra-frequency neighbour cell equals to SMTC periodicity in R18 LTM.**

*Background: In RAN4#107, a CR (R4-2310139) was agreed to support this case in R17 ICBM.*

* Proposals
  + Option 1(Apple, vivo, ZTE, MTK, QC): When the SSB periodicity of FR2 intra-frequency cell is fully overlapped with SMTC periodicity of inter-frequency neighbour cell, the existing sharing factor P used for L1/L3 measurements can be reused, i.e., P =3 for L1 measurement and P=1.5 for L3 measurement.
  + Option 2 (Ericsson): Yes, support the case.
    - In FR2, L1-RSRP measurement period of less than 160ms is only possible under following conditions. RAN4 to discuss the feasibility of it and methods to achieve 160ms L1-RSRP measurement period.
      * L3 measurements are suspended after TCI state activation
      * N is 1 or reduced to some other value smaller than 8 (i.e., beam sweeping or reduced after TCI state activation for certain time)
    - RAN4 to find a method to achieve less than 160ms measurement period or a method to skip fine time tracking (e.g., by performing fine time tracking in parallel to UE processing). If RAN4 did not find a method to achieve less than 160ms L1-RSRP periodicity or a method to remove fine time tracking from the cell switch delay, for at least one configuration, RAN4 to send LS to RAN1 and RAN2 to convey pre-sync or pre-TCI state activation is not suitable/applicable for FR2.
* Recommended WF
  + Recommend agree on Option 1.

**Issue 2-3-1-2: whether to consider** **L1-RSRP measurement on deactivated SCell**

*For information:*

*38.321*

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| 1> 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. |

*Before R18, L1 measurement on deactivated SCC is not supported. In R18 LTM, there is no related discussion or agreement on whether L1 measurement on deactivated SCC is supported in RAN1/2. According to RAN2 running CR on 38.321, Moderator suggests RAN4 not considering L1-RSRP measurement on deactivated SCell in R18.*

* Proposals
  + Option 1A(vivo): If the SSB for L1 measurement in LTM is an intra-frequency L1 measurement on de-activated SCC, RAN4 confirms to specify RRM requirements for this case
    - The measurement cycle is the same as MeasCycleSCell configured in L3 MO.
    - The interruption specified for L3 measurement on de-activated SCC can be re-used.
  + Option 1B (vivo, QC): If the SSB for L1 measurement in LTM is an intra-frequency L1 measurement on de-activated SCC, the measurement period is still based on MeasCycleSCell of the cell at least for L3 measurements.
  + Option 2 (Apple): more justification is expected to consider L1-RSRP measurement on deactivated SCell.
* Recommended WF
  + Recommend agree on
    - RAN4 not to consider L1-RSRP measurement on deactivated SCell in R18.

#### UE incapable of RTD>CP or UE incapable of measuring multiple cells on the same OFDM symbol when actual RTD>CP

**(Online) Issue 2-3-2-1: Measurement period for UE incapable of RTD>CP or UE incapable of measuring multiple cells on the same OFDM symbol when actual RTD>CP**

* Proposals
  + Option 1 (CATT, CMCC, ZTE, Huawei, MTK, [Nokia], Ericsson)
    - when the actual RTD of serving cell and neighbour cell is no larger than CP, the legacy measurement period, measurement restriction and scheduling restriction defined for non-serving cell in R17 apply for intra-frequency L1-RSRP measurement on neighbour cell.
    - when actual RTD>CP, **no requirements**
      * Nokia:
        + Discuss how does UE know “actual RTD” when UE does not support RTD > CP?
        + Discuss how the network knows RTD conditions.
        + Requirements for RTD <= CP and RTD > CP shall be clearly separated in order not to penalize UEs not supporting RTD > CP with extra symbols.
  + Option 2 (Apple, QC): RAN4 to define requirements for both RTD > CP and RTD <= CP
    - In FR1:‘the existing L1-RSRP measurement period (Table 9.5.4.1-1)’ x ‘the number of L1 measurement cells (including non-LTM L1-RSRP measurement cells) having SSBs colliding in the time domain’
    - In FR2: same as the measurement period when UE supports RTD>CP
    - Define scheduling restriction based on SSB + 1 symbol before/after the SSB to measure
  + Option 3 (xiaomi):
    - For UE incapable of RTD>CP, it is assumed that no spare FFT module used for intra-frequency L1-RSRP measurement on neighbour cells.
    - RAN4 to define the measurement delay requirement for UE incapable of RTD>CP when actual RTD>CP in FR1, and the neighbour cell whose TCI state is activated and the serving cell are prioritized.
    - When TCI state of neighbor cell is activated, UE performs L1-RSRP measurement on the neighbor cell whose TCI state is activated and the serving cell. UE may measure any other cell(s) based on UE implementation.
* The measurement period of serving cell is R15/R16 SSB based L1-RSRP measurement period is scaled by 3.
* The measurement period of the neighbor cell whose TCI state is activated is R15/R16 SSB based L1-RSRP measurement period is scaled by 3.
  + Assuming the NW activate TCI state(s) from only one neighbor cell.
* For the other neighbor cells: no measurement delay requirements
  + - When TCI state of neighbor cell is not activated, UE performs L1-RSRP measurement on the neighbor cells and the serving cell.
* The measurement period of serving cell is R15/R16 SSB based L1-RSRP measurement period is scaled by 3.
  + - The measurement period of the neighbor cell is R15/R16 SSB based L1-RSRP measurement period is scaled by 3\*(number of neighbor cells).
* Recommended WF
  + Further discussion.

#### UE capable of RTD>CP

**Issue 2-3-3-1: Measurement period of intra-frequency L1-RSRP measurement for UE capable of RTD>CP in FR1 if UE performs L1-RSRP measurement on multiple intra-frequency layer**

* Proposals
  + Option 1 (CATT, Apple, CMCC, ZTE, MTK, Ericsson): For multiple intra-frequency layers, additional scaling factor (i.e., number of intra-frequency layers) is to be scaled on top of measurement period specified for single frequency layer.
    - Option 1a (QC): For multiple intra-frequency layers, additional scaling factor (i.e., number of intra- and inter-frequency layers) is to be scaled on top of measurement period specified for single frequency layer.
  + Option 2 (Huawei): In FR1 for UE capable of RTD>CP, the FFT engine number is limited. If supported cell numbers on each layers is introduced as UE capability, no need to consider additional scaling factor. If no such capability, if the configured number of to-be-measured cells exceeds the number of FFT engine, additional scaling factor of serving CC number can be scaled.
  + Option 3 (xiaomi):
    - For intra-frequency L1-RSRP measurement period requirement for UE capable of RTD>CP in FR1, the neighbour cell whose TCI state is activated and the serving cell are prioritized.
      * When TCI state of neighbor cell is activated, UE performs L1-RSRP measurement on the neighbor cell whose TCI state is activated and the serving cell. UE may measure any other cell(s) based on UE implementation.
        + The measurement period of serving cell is not scaled, and R15/R16 SSB based L1-RSRP measurement period is applied.
        + The R15/R16 SSB based L1-RSRP measurement period is applied to the measurement period of the neighbor cell whose TCI state is activated.

Assuming the NW activate TCI state(s) from only one neighbor cell.

* + - * + For the other neighbor cells: no measurement delay requirements
      * When TCI state of neighbor cell is not activated, UE performs L1-RSRP measurement on the neighbor cells and the serving cell.
        + The measurement period of serving cell is not scaled, and R15/R16 SSB based L1-RSRP measurement period is applied.
        + The measurement period of the neighbor cell is R15/R16 SSB based L1-RSRP measurement period is scaled by ceil().
      * If the neighbor cell whose TCI state is activated and other neighbor cells are measured with the same spare FFT module, The measurement period of the neighbor cell whose TCI state is activated is R15/R16 SSB based L1-RSRP measurement period is scaled by 2.
* Recommended WF
  + Recommend agree on
    - For multiple intra-frequency layers, additional scaling factor (i.e., **number of frequency layers including intra-frequency and inter-frequency without gap if supported and configured**) is to be scaled on top of measurement period specified for single frequency layer.

**Issue 2-3-3-2: Measurement period of intra-frequency L1-RSRP measurement in FR2 if UE performs L1-RSRP measurement on multiple intra-frequency layer**

*Option 2 covers option 1.*

* Proposals
  + Option 1 (Huawei):
    - The principle agreed for FR2 intra-frequency measurement for LTM cells can also be applied for multiple serving cells scenario.
    - When TCI states are activated on neighbor cells in multiple bands, band number is to be scaled additionally on the measurement period of neighbor cell.
  + Option 2 (MTK):
    - For UE capable of RTD>CP, when TCI states of multiple intra-frequency neighbour cells are activated, the measurement delay of the neighbour cells whose TCI state(s) are activated is R15/R16 SSB based L1-RSRP measurement period scaled by 3 x number of intra-frequency neighbour cells whose TCI state(s) are activated.
* Recommended WF
  + Further discussion.

**Issue 2-3-3-3: Scheduling restriction of intra-frequency L1-RSRP measurement for UE capable of RTD>CP**

* Proposals
  + Option 1 (MTK):
    - For UE capable of RTD>CP, scheduling restriction should be extended by one more symbol before and after SSB symbols when deriveSSB-IndexFromCell is enabled. No L1 measurement requirements if mixed numerology is used and deriveSSB-IndexFromCell is not enabled in FR1 FDD
  + Option 2 (QC):
    - In FR2, for scheduling restriction for L1-RSRP measurement on a candidate cell, on top of the legacy scheduling restriction defined for non-serving cell in R17, additional 1 symbol is added before and after those OFDM symbols corresponding to the configured LTM L1-RSRP measurement SSBs
* Recommended WF
  + Recommend agree on
    - For UE capable of RTD>CP, scheduling restriction should be extended by one more symbol before and after SSB symbols when *deriveSSB-IndexFromCell* is enabled.
    - Need more discussion on the case that when *deriveSSB-IndexFromCell* is not enabled.

### Sub-topic 2-4 Inter-frequency L1-RSRP measurement delay

#### L1 inter-frequency with Type 1 MG

**Issue 2-4-1-1: The principles in defining inter-frequency L1-RSRP measurement period with MG in FR1**

A screenshot of a graph

Description automatically generated

* Proposals
  + Option 1 (CATT, Apple, ZTE, Huawei, MTK, Ericsson):
    - within one gap occasion, if there is L1 measurement but no L3 MO on the same frequency layer, the L1-RSRP measurement is regarded as one independent candidate to be measured in a gap when calculating CSSF for other overlapped inter-frequency layers.
* Recommended WF
  + Recommend agree on Option 1.

**Issue 2-4-1-2: Number of SSB periods needed in inter-frequency L1-RSRP measurement period with Type 1 MG**

* Proposals
  + Option1 (CMCC, MTK): For inter-frequency L1-RSRP measurement with MG, the number of samples is [2] if higher layer parameter timeRestrictionForChannelMeasurement is configured, and [4] otherwise.
  + Option 2 (Apple): assuming RRM requirements are applicable only if L1 measurement layer is configured on the same frequency as one of current L3 MO, existing number of samples in intra-frequency L1-RSRP measurement requirements can be reused in inter-frequency L1-RSRP measurement period with Type 1 MG.
  + Option 3 (vivo): For inter-frequency L1 measurement within type 1 measurement gap, enough SSB measurement samples on the corresponding frequency layer needs to be considered to ensure that UE is allowed to perform additional L3 measurement, i.e., cell search and rough synchronization to deal with time-domain deep channel fading.
  + Option 4 (Huawei): The existing sample number indicated in timeRestrictionForChannelMeasurement can be reused for inter-frequency L1-RSRP with type 1 MG.
  + Option 5 (Ericsson): For inter-frequency measurement requirements, M is 1 if the L1-RSRP periodicity is lesser than or equal to 160ms. If not M=2.
* Recommended WF
  + Recommend agree on
    - For inter-frequency L1-RSRP measurement with MG, the number of samples
      * M = [1 or 2] if higher layer parameter timeRestrictionForChannelMeasurement is configured,
      * Otherwise M= [3 or 4].

**Issue 2-4-1-3: inter-frequency L1-RSRP measurement period with MG in FR1**

* Proposals
  + Option 1 (CATT, MTK): Define inter-frequency L1-RSRP measurement period with MG in FR1 as:

|  |  |
| --- | --- |
| **Condition** | **T L1-RSRP\_SSB\_measurement\_period\_inter** |
| No DRX | Max(Treport, Ceil(M \* Kgap) × Max(MGRP, SSB period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(Treport, Ceil(M × 1.5 \* Kgap) × Max(MGRP, SSB period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(M \* Kgap) × DRX cycle × CSSFinter |
| The definition of Kgap is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern.  M = [2] when timeRestrictionForChannelMeasurement is configured. Otherwise M = [4]. | |

* Recommended WF
  + Recommend agree on
    - Define inter-frequency L1-RSRP measurement period with MG in FR1 as:

|  |  |
| --- | --- |
| **Condition** | **T L1-RSRP\_SSB\_measurement\_period\_inter** |
| No DRX | Max(Treport, Ceil(M \* Kgap) × Max(MGRP, SSB period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(Treport, Ceil(M × 1.5 \* Kgap) × Max(MGRP, SSB period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(M \* Kgap) × DRX cycle × CSSFinter |
| The definition of Kgap is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern.  M = **[1 or 2]** when timeRestrictionForChannelMeasurement is configured. Otherwise M = [**3 or 4**]. | |

**Issue 2-4-1-4: inter-frequency L1-RSRP measurement period with MG in FR2**

* Proposals
  + Option 1 (CATT, MTK): Define inter-frequency L1-RSRP measurement period with MG in FR2 as:

|  |  |
| --- | --- |
| **Condition** | **T L1-RSRP\_SSB\_measurement\_period\_inter** |
| No DRX | Max(Treport, Ceil(Kgap × M\*N)× Max(MGRP, SSB period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(Treport, Ceil(1.5 \* Kgap × M\*N) × Max(MGRP, SSB period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × M\*N) × DRX cycle × CSSFinter |
| The definition of Kgap is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern.  M = [2] when timeRestrictionForChannelMeasurement is configured. Otherwise M = [4]. | |

* Recommended WF
  + Recommend agree on
    - Define inter-frequency L1-RSRP measurement period with MG in FR2 as:

|  |  |
| --- | --- |
| **Condition** | **T L1-RSRP\_SSB\_measurement\_period\_inter** |
| No DRX | Max(Treport, Ceil(Kgap × M\*N)× Max(MGRP, SSB period)) × CSSFinter |
| DRX cycle ≤ 320ms | Max(Treport, Ceil(1.5 \* Kgap × M\*N) × Max(MGRP, SSB period, DRX cycle)) × CSSFinter |
| DRX cycle > 320ms | Ceil(Kgap × M\*N) × DRX cycle × CSSFinter |
| The definition of Kgap is the same as L3 measurement which is a scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern.  M = [**1 or 2**] when timeRestrictionForChannelMeasurement is configured. Otherwise M = [**3 or 4**]. | |

### Sub-topic 2-5 L1-RSRP measurement accuracy

**Issue 2-5-1: side condition of intra-frequency L1-RSRP measurement accuracy requirements**

* Proposals
  + Option 1 (Apple, Huawei, Nokia): Reuse legacy value SNR= -3dB
  + Option 2 (Ericsson): RAN4 to consider same side condition of L3 measurement as for L1 measurements at least for FR1
  + Option 3 (QC): The SNR side condition of L1-RSRP measurement accuracy requirements on candidate cells is the same as that of L3-RSRP, and the L1-RSRP measurement accuracy requirements are relaxed, compared to the existing L1-RSRP measurement requirements, by, e.g. 0.5 – 1dB. The exact value of the accuracy requirements will be defined during performance requirement definition phase
* Recommended WF
  + To be discussed in performance part.

### Sub-topic 2-6 Others

**Issue 2-6-1: L1 report for unmeasured candidate cells**

* Proposals
  + Proposal 1 (QC):
    - In L1-RSRP measurement report, for unmeasured candidate cells, UE reports measured quantity value corresponding to one of the invalid codepoints in Table 10.1.6.1-1, preferably RSRP\_0.
* Recommended WF
  + Need more discussion.

**Issue 2-6-2: Additional conditions to perform L1 measurement for LTM**

* Proposals
  + Proposal 1 (Nokia):
    - UE is not required to perform LTM measurements when UE is not in active data transmission.
* Recommended WF
  + Need more discussion.

**Issue 2-6-3: Impact on L3 measurement**

* Proposals
  + Proposal 1 (vivo):
    - For intra-frequency LTM L1 measurement, if configured, the corresponding L3 measurement is performed by sharing the PCC searcher, and the CSSF calculation for L3 measurement is updated based on whether intra-frequency L1 measurement is configured on this L3 frequency layer.
* Recommended WF
  + Need more discussion.

## Topic #3: LTM – Cell switch delay requirements (AI 8.24.2.1.3)

### Sub-topic 3-1 Scenarios and General Procedures

**Issue 3-1-1: How to** **specify cell switch delay requirements for PSCell switch**

* Proposals
  + Option 1 (Nokia):
    - Reuse LTM PCell switch delay for PSCell.
    - Define LTM PSCell switch delay requirements in section 8.
* Recommended WF
  + Recommend agree on Option 1.

**Issue 3-1-2: Procedure of cell switch**

* Proposals
  + Option 1 (CATT, Apple, ZTE, MTK): If T/F fine tracking (TΔ) is needed after receiving cell switch command, UE is not required to perform it before L1/L2/L3 processing (Tprocessing,2)
  + Option 2 (Ericsson): RAN4 to agree that UE performs fine time tracking while performing UE processing (Texecution\_time and Tprocessing,2)
  + Option 3 (MTK): Due to limited time, further discuss the optimization on cell switch procedure in later releases.
  + Option 4 (vivo): If downlink pre-synchronization, i.e. TCI state activation before cell switch, is not indicated by gNB before cell switch, UE needs to perform PBCH decoding and SSB-based T/F tracking according to the activated TCI during cell switch. In this case, they are performed before Tprocessing,2 so that the interruption to serving cell and target cell can be shortened**.**
* Recommended WF
  + Recommend agree on Option 3.

### Sub-topic 3-2 Detail of cell switch delay requirements for Pcell/PSCell

#### Processing time: Tprocessing,2 /T LTM\_processing

**Issue 3-2-1-1: Shorter Processing time?**

* Proposals
  + Option 1 (CATT, Nokia, ZTE, Huawei): Tprocessing,2/ TLTM-processing can be reduced when target Pcell/SCell is current SCell/PCell.
    - Option 1a (CATT)
      * RAN4 to discuss whether and how to differently define the requirements depending on whether the SCell is for DL-only or both DL/UL.
  + Option 2 (ZTE, MTK, Ericsson): introduce a UE capability for shorter Tprocessing,2/ TLTM-processing.
    - Option 2a (ZTE): Introduce UE capability with up to 2 candidate values, one value is 20ms, and FFS the other one.
    - Option 2b (MTK): The candidate reduced values can be [10ms, 15ms].
    - Option 2c (Ericsson): potential values of 10ms, 20ms.
* Recommended WF
  + Need more discussion.

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

**(Online) Issue 3-2-2-1: T/F fine tracking: TΔ and Tmargin**

* Proposals
  + Option 1 (Apple, ZTE, QC): If TCI state of target cell is not in the active TCI state list, additional time for SSB based T/F tracking is needed.
    - Option 1b (QC):
      * If TCI state indicated in cell switch command is not in the active TCI state list that has been activated for the target cell, when the measurement period of L1-RSRP is no longer than 160ms, TΔ=1 Tfirst-RS, Tmargin = 2ms.
      * It is clarified that the TCI state pre-activation on the first bullet of the agreement on Issue 3-2-2-1 in RAN4#108bis means that the time gap between the TCI state activation command reception and the LTM cell switch command reception is at least not smaller than the existing TCI state activation delay value.
  + Option 2 (MTK)
    - In FR2, even some of the TCI state of the target cell is activated but TCI state indicated in cell switch command is not in the active TCI state list, UE still needs additional time for T/F tracking.
    - In FR1, make a down-selection from two alternatives
      * Alt.1: even some of the TCI state of the target cell is activated but TCI state indicated in cell switch command is not in the active TCI state list, UE still needs additional time for T/F tracking.
      * Alt.2: if some of the TCI state of the target cell is activated but TCI state indicated in cell switch command is not in the active TCI state list, additional time for T/F tracking is not needed under the conditions
        + the arrival timing of different SSBs from the same cell is within [260ns].
        + SNR if the active TCI state is always above -3dB since it is activated.
* Recommended WF
  + Recommend agree on Option 1.

#### Extra time for PL-RS measurement

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

* Proposals
  + Option 1 (Nokia):
    - When TCI state has been activated before the cell switch, PL-RS estimation is not part of the cell switch delay.
    - When TCI state activation is done at the cell switch, UE uses the same SSB for PL-RS and fine T/F tracking (Tfirst-RS). No additional delay due to PL-RS is needed in the cell switch delay.
  + Option 2 (MTK):
    - For PCell/PSCell switch delay, the PL-RS to use should be one of the SSBs UE performs L1-RSRP measurement on and UE does not need extra time to measure the PL-RS.
  + Option 3 (vivo): The PL-RS of the TCI activated/indicated in cell switch command is not maintained at the endpoint of the cell switch delay.
    - For CBRA RACH-based cell switch, UE uses the SSB for PRACH transmission as the default PL-RS, before the PL-RS in the target TCI is maintained.
    - For CFRA RACH-based cell switch, early-RACH-based RACH-less cell switch, if the SSB for PRACH transmission is the same as QCL source of the indicated TCI, UE uses the SSB for PRACH transmission as the default PL-RS, before the PL-RS in the target TCI is maintained.
    - For UE-based TA derivation after cell switch, UE uses the SSB indicated in the TCI in cell switch command as the default PL-RS, before the PL-RS in the target TCI is maintained.
    - For all other RACH-less cell switch, UE is assumed to follow the same behaviour as R17 ICBM.
    - No additional interruption is assumed.
  + Option 4 (Ericsson): No additional delay or conditions are needed for PL-RS measurement.
  + Option 5 (QC): UE is not required to measure/maintain PL-RS more than X, e.g. 4, SSBs across all candidate cells. If the configured PL-RSs is more than X, which one’s pathloss measurement to maintain is up to UE implementation, and the latency and accuracy requirements are left undefined. No additional delay component for pathloss measurement is not added to LTM cell switch execution delay.
* Recommended WF
  + Recommend agree on
    - No additional delay is needed for PL-RS measurement in cell switch delay.
    - FFS: Any applicable conditions.

#### Tinterruption

**Issue 3-2-4-1: Tinterruption**  **of PCell switch**

* Proposals
  + Option 1 (CATT, Apple, CMCC, ZTE): The components of L1/L2 cell switch interruption Tinterruption are the components of L1/L2 inter-cell mobility delay except Tcmd
  + Option 2 (Nokia): Tinterrupt = TLTM-processing + TIU.
    - TLTM-RRC-processing/Texecution is not part of the interruption.
    - Tfirst-RS (TΔ) and TRS-proc (Tmargin) are not part of the interruption.
  + Option 3 (Huawei): Tinterruption = Tprocessing,2+ TΔ +Tmargin + Tuncertainity/TIU
  + Option 4 (Ericsson):
    - For RACH-based cell switch, Tinterruption include the time of Tprocessing,2 and TIU.
    - For RACH-less cell switch, Tinterruption include Tprocessing,2 only.
* Recommended WF
  + Discuss whether TLTM-RRC-processing/Texecution is not part of the interruption.
  + Down-selection between Option 1 and Option 3.

### Sub-topic 3-3 Known conditions

**(Online) Issue 3-3-1: known cell conditions**

* Proposals
  + Option 1 (MTK, Apple, Ericsson):
    - The target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the ~~handover~~ cell switch command:

- the UE has sent a valid L1 [or L3] measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell,

- One of the SSBs measured from the target cell also remains detectable during the ~~handover~~ cell switch delay according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell.

* + - otherwise it is unknown.
  + Option 2 (CMCC):
    - For FR1, a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown (6.1.1.2, TS38.133).
  + Option 3 (Nokia):
    - For Rel-18 LTM, remove “during the last 5 seconds” from the known cell conditions.
    - Cells detected more than 5s ago but are still detectable, are considered as known cells for LTM.
* Recommended WF
  + Need more discussion.

**Issue 3-3-2: known TCI state conditions**

*Option 1 and Option 2 are almost the same.*

* Proposals
  + Option 1 (MTK): use legacy known TCI state conditions with a bit modification:

|  |
| --- |
| The TCI state is known if the following conditions are met:  - During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target TCI state to the completion of ~~active TCI state~~cell switch, where the RS resource for L1-RSRP measurement is the RS in target TCI state or QCLed to the target TCI state  - ~~TCI state~~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 TCI state before the ~~TCI state~~cell switch command  - The TCI state remains detectable during the ~~TCI state~~cell switching period  - The SSB associated with the TCI state remain detectable during the ~~TCI~~cell switching period  - SNR of the TCI state ≥ -3dB  Otherwise, the TCI state is unknown. |

* + Option 2 (Nokia):
    - 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 DL/UL TCI state in the LTM cell switch command is known if the following conditions are met:
        + During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target DL/UL TCI state to the completion of LTM cell switch, where the RS resource for L1-RSRP measurement is the RS in target DL/UL TCI state or QCLed to the target DL/UL TCI state

LTM cell switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement

The UE has sent at least 1 L1-RSRP report for the target DL/UL TCI state before the LTM cell switch command

The target DL/UL TCI state remains detectable during the LTM cell switching period

The SSB associated with the target DL/UL TCI state remain detectable during the cell switching period

SNR of the TCI state ≥ -3dB

* + - * Otherwise, the target joint DL/UL TCI state or separate DL and UL TCI state is unknown.
* Recommended WF
  + Recommend agree on Option 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 DL/UL TCI state in the LTM cell switch command is known if the following conditions are met:
        + During the period from the last transmission of the RS resource used for the L1-RSRP measurement reporting for the target DL/UL TCI state to the completion of LTM cell switch, where the RS resource for L1-RSRP measurement is the RS in target DL/UL TCI state or QCLed to the target DL/UL TCI state

LTM cell switch command is received within 1280 ms upon the last transmission of the RS resource for beam reporting or measurement

The UE has sent at least 1 L1-RSRP report for the target DL/UL TCI state before the LTM cell switch command

The target DL/UL TCI state remains detectable during the LTM cell switching period

The SSB associated with the target DL/UL TCI state remain detectable during the cell switching period

SNR of the TCI state ≥ -3dB

* + - * Otherwise, the target joint DL/UL TCI state or separate DL and UL TCI state is unknown.

## Topic #4: LTM – Others (AI 8.24.2.1.4)

### Sub-topic 4-1 RAN2 LS

**(Online) Issue 4-1-1: Whether to include SMTC in the RS configuration for L1-RSRP measurement**

* Proposals
  + Option 1 (Apple, vivo, MTK, Huawei, Ericsson, CATT): additional SMTC configuration dedicated for L1 measurement is unnecessary
  + Option 2 (CMCC): configure SMTC of LTM candidate cells to UE
* Recommended WF
  + Need more discussion.

### Sub-topic 4-2 Using L3 measurement in L1 report

**(Online) Issue 4-2-1: Measurement reporting**

* Proposals
  + Option 1 (ZTE, Nokia):
    - UE reports based on L1 measurement configuration
    - Measurement report mapping: No changes to Table 10.1.6.1-1 are needed due to support of L3 measurements in L1 measurement report.
    - L3 and L1 measurements are not included in the same report, at least in rel-18
  + Option 2 (Ericsson):
    - RAN4 to agree that the L1-RSRP report sent to NW can contain L1-RSRP derived from L1 measurement and L1-RSRP derived from L3 measurement results.
    - One bit field can be introduced in the measurement report to distinguish whether L1-RSRP is measured or L1-RSRP derived. Detailed signalling can be left to RAN1/RAN2.
    - NW to indicate whether UE should report a L1 based report alone or report containing L1 and L3 results.
* Recommended WF
  + Need more discussion.

**(Online) Issue 4-2-2: NW needs to know UE using L3 results in L1 report or not?**

* Proposals
  + Option 1 (vivo): No need for gNB to know whether the L1 reported results is obtained by L3 measurement of the UE, or L1 measurement of the UE.
  + Option 2 (MTK, Ericsson): Yes
* Recommended WF
  + Need more discussion.

**(Online) Issue 4-2-3: The condition to switch to using L3 results in L1 report**

* Proposals
  + Option 1 (vivo, ZTE): UE enters fall-back mode, i.e., reporting L3 measurements in L1 report, if the conditions, under which UE is able to ensure L1 measurement performance based on L1 measurement delay, are not met. UE may return to the normal mode when the conditions are stable for a pre-defined period. It is up to UE to determine the actual threshold/mechanism how to determine the conditions are met or not.
  + Option 2 (Nokia): If the number of cells to measure exceeds the L1 based LTM measurement capability, UE is allowed to perform L3 measurements and report them in L1 reporting format.
* Recommended WF
  + Need more discussion.

**(Online) Issue 4-2-4: Measurement requirements**

* Proposals
  + Option 1 (Nokia):
    - L3 measurement requirements are followed, where applicable
    - RAN4 to discuss accuracy requirements during performance part.
    - UEs capable of reporting L3 measurements in L1 report, number of frequency layers to measure for neighboring cell follows the same requirements as L3 measurements.
    - As a baseline: Intra-frequency in clause 9.2, inter-frequency in clause 9.3
* Recommended WF
  + Need more discussion.

**(Online) Issue 4-2-5: TCI state activation and PDCCH-order RACH before cell switch command**

* Proposals
  + Option 1 (Nokia):
    - TCI state activation based on L3 measurements reported in L1 measurement report follows the same procedure as TCI state activation based on L1 measurement based LTM.
      * TCI state activation is based on the reported L3 measurements in L1 measurement report:
      * In FR1, UE do not need additional SSB to meet transmit timing requirements for PRACH on neighbour cell if the L1-RSRP measurement period is with 160ms.
      * For FR2, UE may need additional SSB to meet the transmit timing requirements for PRACH on neighbour cell.
    - Similar to baseline framework, L1 measurement format derived using L3 measurement results are reported in UCI. Same number of M and L applies. RAN4 will specify RRM requirements for the following cases
  + Option 2 (Ericsson):
    - RAN4 to define requirements when TCI state activation and PDCCH order-based RACH trigger is based on L1-RSRP report or L3-RSRP report..
    - Once the TCI state is activated, UE shall prioritise the measurement and reporting on the cell whose TCI state was activated.
* Recommended WF
  + Need more discussion.

**Issue 4-2-6: Scenarios supported**

* Proposals
  + Option 1 (Nokia):
    - Scenarios for RTD smaller than and larger than CP between source and candidate cell are supported
    - Known cell is supported for L3 measurements in L1 report.
* Recommended WF
  + Recommend agree on
    - Scenarios for RTD smaller than and larger than CP between source and candidate cell are supported for using L3 measurements in L1 report.

**Issue 4-2-7: Cell switch delay**

* Proposals
  + Option 1 (Nokia):
    - Cell switch delay components follow the LTM baseline.
* Recommended WF
  + Recommend agree on Option 1.

**Issue 4-2-8: side condition of intra-frequency L1-RSRP report**

* Proposals
  + Option 1 (Nokia): -6dB.
* Recommended WF
  + Recommend agree on Option 1.

## Topic #5: LTM – UE feature

### Sub-topic 5-1

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

* Proposals
  + Proposal 1 (MTK):
    - The capability of supporting RTD>CP can be applicable to inter-frequency L1-RSRP measurement. It needs FR1/FR2 differentiation.
  + Proposal 2 (Xiaomi):
    - RAN4 to clarify the meaning of UE capability of supporting RTD>CP
      * For UE capable of RTD>CP, it is assumed that there is at least one spare FFT module used for intra-frequency L1-RSRP measurement on neighbour cells.
    - In the UE capability of RTD>CP, it is necessary to indicate the available number of FFT module used for intra-frequency neighbour cell measurement.
* Recommended WF
  + Need more discussion.

**Issue 5-1-2: Capability for inter-f L1 measurement without gap**

* Proposals
  + Proposal 1 (MTK):
    - Discuss the capability for supporting inter-frequency L1-RSRP measurement without gap in RAN1 to avoid duplicated discussion.
* Recommended WF
  + Need more discussion.

**Issue 5-1-3: Number of cells/resources supported**

* Proposals
  + Proposal 1 (MTK):
    - The capability “number of cells supported to measure per frequency layer” indicates the number of neighbor cells UE supports to perform L1-RSRP measurement on per frequency layer. The minimum value reported is 2. This capability can be reported per band.
    - Discuss the detail of the capability “number of neighbor cells supported to measure per frequency layer” in RAN4 UE feature list.
* Recommended WF
  + Need more discussion.

**Issue 5-1-4: Interruption on DL symbols due to PDCCH-ordered RACH**

* Proposals
  + Proposal 1 (MTK):
    - Regarding the capability for interruption on DL symbols due to PDCCH-ordered RACH, the reported granularity is [per BC per target frequency per victim CC].
* Recommended WF
  + Need more discussion.

**Issue 5-1-5: Early ASN.1 decoding and validity/compliance check**

* Proposals
  + Proposal 1 (Nokia):
    - RAN4 to discuss whether a UE supporting the capability for early ASN.1 decoding and validity/compliance check shall perform early ASN.1 decoding and validity/compliance check for all candidate cells or just for the (most probable) target cell.
  + Proposal 2 (Nokia, Ericsson): The UE supporting capability for early ASN.1 decoding and validity/compliance check can perform these steps before the cell switch command only for the candidate cell for which TCI state is activated and/or early RACH is initiated by PDCCH order.
  + Proposal 3 (MTK): Use TCI state activation to trigger early ASN.1 decoding and validity/compliance check on the candidate cell with the following conditions
    - NW activates TCI state(s) from only one candidate cell
    - Not to consider CA.
* Recommended WF
  + Need more discussion.

**Issue 5-1-6: Reduced processing time**

* Proposals
  + Proposal 1 (MTK): Use TCI state activation to trigger early ASN.1 decoding and validity/compliance check on the candidate cell with the following conditions
    - NW activates TCI state(s) from only one candidate cell
    - Not to consider CA.

**Issue 5-1-7: Using L3 results in L1 report**

* Proposals
  + Option 1 (Nokia):
    - UE capability is introduced to use L3 measurement results for intra-frequency and inter-frequency L1 measurement report
    - If the number of cells to measure exceeds the L1 based LTM measurement capability, UE is allowed to perform L3 measurements and report them in L1 reporting format.
    - UE supporting the L3 measurements in L1 measurement format capability should support also the baseline L1 measurement capability
* Recommended WF
  + Need more discussion.

**Issue 5-1-8: Whether to discuss UE capability about TCI state activation on multiple neighbour cell before cell switch command in RAN4**

* Proposals
  + Option 1 (ZTE):
    - RAN4 to discuss the UE capability aspects of downlink synchronisation to multiple cells so that UE can transmit PRACH to the candidate cell on the first PRACH occasion after the PDCCH order reception.
* Recommended WF
  + No discussion in RAN4 and leave the discussion to RAN1 as this is discussed in RAN1.

# Ad-hoc discussion

**~~(Online) Issue 4-1-1: Whether to include SMTC in the RS configuration for L1-RSRP measurement~~**

* ~~Proposals~~
  + ~~Option 1 (Apple, vivo, MTK, Huawei, Ericsson, CATT): additional SMTC configuration dedicated for L1 measurement is unnecessary~~
  + ~~Option 2 (CMCC): configure SMTC of LTM candidate cells to UE~~
* ~~Option for consideration:~~
  + ~~From RAN4 perspecitve, SMTC configuration (offset) is necessary or not essential for L1-RSRP measurement for the scenarios with RAN4 requirement in Rel-18. Whether to add SMTC configuration in the RS configuration for L1-RSRP measurement is up to RAN2.~~

**~~Discussion:~~**

**~~Agreement:~~**

**(Online) Issue 2-3-2-1: Measurement period for UE incapable of RTD>CP or UE incapable of measuring multiple cells on the same OFDM symbol when actual RTD>CP**

* Proposals
  + Option 1 (CATT, CMCC, ZTE, Huawei, MTK, [Nokia], Ericsson)
    - when the actual RTD of serving cell and neighbour cell is no larger than CP, the legacy measurement period, measurement restriction and scheduling restriction defined for non-serving cell in R17 apply for intra-frequency L1-RSRP measurement on neighbour cell.
    - when actual RTD>CP+M, ~~no requirements~~ UE shall not report unless accuracy requirements can be met.
      * M is FFS.
    - RAN4 assume the same UE implementation for RTD within CP and RTD > CP.
      * Nokia:
        + Discuss how does UE know “actual RTD” when UE does not support RTD > CP?
        + Discuss how the network knows RTD conditions.
        + Requirements for RTD <= CP and RTD > CP shall be clearly separated in order not to penalize UEs not supporting RTD > CP with extra symbols.
  + Option 2 (Apple, QC, Nokia): RAN4 to define requirements for both RTD > CP and RTD <= CP
    - In FR1:‘the existing L1-RSRP measurement period (Table 9.5.4.1-1)’ x ‘the number of L1 measurement cells (including non-LTM L1-RSRP measurement cells) having SSBs colliding in the time domain’
    - In FR2: same as the measurement period when UE supports RTD>CP
    - Define scheduling restriction based on SSB + 1 symbol before/after the SSB to measure
  + Option 3 (xiaomi):
    - For UE incapable of RTD>CP, it is assumed that no spare FFT module used for intra-frequency L1-RSRP measurement on neighbour cells.
    - RAN4 to define the measurement delay requirement for UE incapable of RTD>CP when actual RTD>CP in FR1, and the neighbour cell whose TCI state is activated and the serving cell are prioritized.
    - When TCI state of neighbor cell is activated, UE performs L1-RSRP measurement on the neighbor cell whose TCI state is activated and the serving cell. UE may measure any other cell(s) based on UE implementation.
* The measurement period of serving cell is R15/R16 SSB based L1-RSRP measurement period is scaled by 3.
* The measurement period of the neighbor cell whose TCI state is activated is R15/R16 SSB based L1-RSRP measurement period is scaled by 3.
  + Assuming the NW activate TCI state(s) from only one neighbor cell.
* For the other neighbor cells: no measurement delay requirements
  + - When TCI state of neighbor cell is not activated, UE performs L1-RSRP measurement on the neighbor cells and the serving cell.
* The measurement period of serving cell is R15/R16 SSB based L1-RSRP measurement period is scaled by 3.
  + - The measurement period of the neighbor cell is R15/R16 SSB based L1-RSRP measurement period is scaled by 3\*(number of neighbor cells).
* Recommended WF
  + Further discussion.

**Discussion:**

Nokia: we are also fine with option 2.

E///: support option 1, since option 2 would result in extra scheduling restriction.

CMCC: prefer option 1.

Xiaomi: in option 3 we prioritize the neighbor cell with active TCI.

Vivo: it would be good to have requirements for RTD>CP. We can optimize option 2 a bit. E.g. for cell with RTD<CP, UE can measure them simultaneously. UE can know RTD from L3 measurement.

MTK: UE may need to group cells with RTD> CP and RTD<=CP. Cells in the groups may be updated from time to time.

**Agreement:**

**(Online) Issue 1-1-2: Whether and how to define TCI state activation delay requirements for early T/F tracking before cell switch command**

*Existing TCI state activation delay cannot be reused directly considering inter-f case.*

*Please further check whether the compromised solution is acceptable “add a condition on the time gap between TCI state activation command and cell switch command in cell switch delay requirements”.*

* Proposals
  + Option 1 (Apple, MTK, [QC]): No need to define delay requirement for TCI state activation before cell switch.
    - Option 1a (MTK): Not to define TCI state activation delay requirements before cell switch command. A condition on the cell switch delay requirements can be added, i.e., T/F tracking after cell switch command can be skipped only if cell switch command is received at least 3ms+ L1-RSRP measurement period after UE sends ACK for the reception of TCI state activation command.
    - Option 1b (QC): It is clarified that the TCI state pre-activation on the first bullet of the agreement on Issue 3-2-2-1 in RAN4#108bis means that the time gap between the TCI state activation command reception and the LTM cell switch command reception is at least not smaller than the existing TCI state activation delay value
  + Option 2 (vivo, Nokia, Huawei): RAN4 to define TCI state activation delay requirement for early TCI state activation for LTM candidate cell before the cell switch.
    - Option 2a (vivo):
      * The end point is defined as the slot X that:
        + If UE receives cell switch command to the cell with active TCI after slot X, and the TCI to be used after cell switch is activated, then UE may not need additional T\_delta in cell switch delay
      * This TCI activation delay counts the following parts:
        + SFN (system frame number) acquisition delay, if needed.
        + SSB-based rough time-frequency tracking delay
        + the delay for waiting next SSB occasion follows the actual L1-RSRP measurement delay defined for SSB-based L1-RSRP measurement before cell switch
    - Option 2b (Nokia):
      * Define early candidate cell TCI state activation delay requirements for both known and unknown target TCI state.
      * Early DL/UL TCI state activation delay for a known TCI state is defined as n+ THARQ + 3Nslotsubframe,µ+ TOk\* (Tfirst-RS+ TSSB-proc)/ NR slot length after receiving the MAC-CE command.
      * Early DL/UL TCI state activation delay for an unknown TCI state is defined as n+ THARQ + 3Nslotsubframe,µ+ TL1-RSRP + TOuk\* (Tfirst-RS+ TSSB-proc)/ NR slot length after receiving the MAC-CE command.
    - Option 2c (Huawei)
      * The legacy requirements for “active TCI state list update delay” can be reused for early T/F tracking of candidate LTM cells before cell switching command. No need to define additional requirements for LTM.
* Recommended WF
  + Recommend agree on the compromised solution
    - Not define TCI state activation delay before cell switch command.
    - Add a condition on the time gap between TCI state activation command and cell switch command in cell switch delay requirements.

**Discussion:**

Vivo: if UE finishes cell switch first, we still need to wait until TCI activation delay complete for data scheduling. This can also be used for PDCCH order based RACH.

Nokia/E///: after TCI activation delay, UE shall not need additional time for T/F tracking in cell switch delay.

**Agreement:**

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

**(Online) Issue 1-1-1: When to acquire SFN of the candidate cell**

|  |
| --- |
| **RAN4#108bis Agreement**   * + No extra time for SFN acquisition toward target cell is needed, if     - PDCCH-order RACH or cell switch command is triggered after network received the L1-RSRP measurement report or L3 measurement report with SBI, or     - SFN of serving cell from which the PDCCH order/cell switch command is received and target cell are same.   + Otherwise, FFS |

* Proposals
  + Option 1 (Apple, MTK, [QC]): RAN4 doesn’t define requirements for the following cases
    - NW doesn’t configure UE to perform neither L3 measurement with SSB index nor L1 measurement before triggering RACH toward neighbour cell or cell switch, and
    - SFN of serving cell from which the PDCCH order/cell switch command is received and target cell are different.
    - Option 1A (QC)
      * When the above conditions are not fulfilled upon the reception of PDCCH-order or cell switch command, UE assumes SFN is synchronous between the serving cell from which PDCCH order/cell switch command is received and the target cell, i.e. the requirement does not add an extra time for SFN acquisition toward target cell.
  + Option 2 (ZTE, Ericsson): For other cases, UE is supposed to perform additional procedure to acquire SFN of the target cell before cell switch command.
* Recommended WF
  + Further discussion.

**Discussion:**

HW: support option 1.

**Agreement:**

* + Assuming this is no FDD above 3GHz, RAN4 requirements do not apply for the following FR2 inter-frequency cases:
    - NW doesn’t configure UE to perform neither L3 measurement with SSB index nor L1 measurement before triggering RACH toward neighbour cell or cell switch, and
    - SFN of serving cell from which the PDCCH order/cell switch command is received and target cell are different.

**(Online) 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**

* Proposals
  + Option 1 (CATT, Apple, Huawei, OPPO, MTK, Ericsson): TSSB in the additional time for T/F tracking during PDCCH ordered RACH delay is the time waiting for the first SSB for L1-RSRP measurement.
    - Option 1a (CATT, Apple, MTK, [Ericsson]):
      * Target cell of intra-f or inter-f w/o gap: TSSB is SSB periodicity
      * Target cell of inter-f with Type 1 MG: TSSB is max {MGRP, SSB period} after the slot receiving PDCCH order.
    - Option 1b (OPPO): min (160ms, Tfirst-SSB)
  + Option 2 (QC):
    - RAN4 to not add an additional delay component from PDCCH order to the PRACH transmission to a candidate cell for UE to obtain DL synchronization with the candidate cell based on SSB. If the UE has not been able to receive the SSB associated with the PDCCH-order PRACH, as per RAN4 requirements, due to NW configuration, e.g. MGs, # of measurement cells/carriers, etc, UL timing accuracy requirement does not apply to the PRACH transmission irrespective of whether the SSB is associated with an active TCI state of the candidate cell.
* Recommended WF
  + Further discussion

**Discussion:**

**Agreement:**

**(Online) Issue 1-2-2-1: Interruption due to RF/BB retuning to target cell before RACH transmission or retuning back to serving cell after RACH transmission: when PRACH bandwidth is not within any of the configured UL BWPs of any active serving cell**

* Proposals
  + Option 1 (CATT, ZTE, OPPO):
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot or ⌈Y/1slot length⌉ slot + 1 slot.
    - The value of Y is 1ms.
  + Option 2 (CMCC):
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot.
    - The value of Y can be 0.5ms for FR1 and 0.25ms for FR2
  + Option 3 (Huawei):
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot.
    - The value of Y can be 0.5ms
  + Option 4 (Ericsson): ~~1 slot~~ total interruption of 0.5 ms for FR1 and FR2
  + Option 5 (QC): Introduce new UE capability
* Recommended WF
  + Recommend agree on
    - The interruption on both UL and DL is ⌈(Y+1 symbol)/1slot length⌉ slot
    - Y is up to UE capability.

**Discussion:**

MTK/HW/CMCC: support UE capability.

Nokia/ZTE: we don’t see the benefit of such capability. This would make NW implementation more complicated.

ZTE: 1ms for FR1 and FR2.

OPPO: what are the candidate values.

QC: we can consider limiting Y to, e.g. 1ms or 2ms.

CMCC: we don’t think 2ms is reasonable.

**Agreement:**

* The interruption on both UL and DL is Y, which is up to UE capability. Candidate values for Y: 0.25ms, 0.5ms, 1ms and 2ms.

**(Online) Issue 1-2-2-2: Location of interruption due to RF/BB retuning to target cell before RACH transmission or retuning back to serving cell after RACH transmission**

* Proposals
  + Option 1 (MTK, Ericsson, CATT):
    - Location of the interruption due to RF retuning is before and after the RACH transmission
  + Option 2 (QC): Introduce new UE capability
* Recommended WF
  + Need more discussion.

**Discussion:**

**Agreement:**

* Location of the interruption due to RF retuning is before and after the RACH transmission

**(Online) Issue 1-2-1-1: Further clarification on the condition when additional time for DL synchronization needed in the delay requirements for PDCCH ordered RACH before cell switch command**

|  |  |  |
| --- | --- | --- |
| TCI state#1 of cell#1 is in the active TCI state list  TCI state#2 of cell#1 is not in the active TCI state list | TCI state or SSB index to use | Whether additional time for SSB based T/F tracking is needed? |
| 1st sub-bullet | TCI state#1 | No (agreed) |
| 2nd sub-bullet | TCI state#2 | FFS |

*Recommend follow the majority and agree on Option 1.*

* Proposals
  + Option 1 (CATT, Apple, ZTE, Huawei, OPPO, QC): If SSB index indicated in PDCCH order is not in the active TCI state list that has been activated, one complete SSB burst is needed for fine time tracking.
  + Option 2 (MTK)
    - In FR2, even some of the TCI state of the target cell is activated but SSB index indicated in PDCCH order is not in the active TCI state list, UE still needs additional time for T/F tracking.
    - In FR1, make a down-selection from two alternatives
      * Alt.1: even some of the TCI state of the target cell is activated but SSB index indicated in PDCCH order is not in the active TCI state list, UE still needs additional time for T/F tracking.
      * Alt.2: if some of the TCI state of the target cell is activated but SSB index indicated in PDCCH order is not in the active TCI state list, additional time for T/F tracking is not needed under the conditions
        + the arrival timing of different SSBs from the same cell is within [260ns]
        + SNR if the active TCI state is always above -3dB since it is activated.
  + Option 3 (Ericsson):
    - If SSB index indicated in PDCCH order is not in the active TCI state list that has been activated for the target cell, when the measurement period of L1-RSRP is no longer than 160ms, additional delay is not needed for fine time tracking.
    - This is applicable when RTD between SSB of the cell are within 260ns in FR1.
* Recommended WF
  + Recommend agree on Option 1.

**Discussion:**

**Tentative agreement:**

Option a: (Nokia, Apple, MTK, ZTE, HW, vivo, OPPO, Xiaomi)

* If SSB index indicated in PDCCH order is not in the active TCI state list that has been activated, one complete SSB burst is needed for fine time tracking.
* Further optimization in future release.

Option b: (E///, MTK)

* If SSB index indicated in PDCCH order is not in the active TCI state list
  + If some of the TCI state of the target cell is activated additional time for T/F tracking is not needed under the following conditions:
  + the arrival timing of different SSBs from the same cell is within [260ns]
  + SNR if the active TCI state is always above -3dB since it is activated.
  + Target cell is in FR1.
* Otherwise, one complete SSB burst is needed for fine time tracking.

**(Online) 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**

* Proposals
  + Option 1 (CATT, Apple, Huawei, OPPO, MTK, Ericsson): TSSB in the additional time for T/F tracking during PDCCH ordered RACH delay is the time waiting for the first SSB for L1-RSRP measurement.
    - Option 1a (CATT, Apple, MTK, [Ericsson]):
      * Target cell of intra-f or inter-f w/o gap: TSSB is SSB periodicity
      * Target cell of inter-f with Type 1 MG: TSSB is max {MGRP, SSB period} after the slot receiving PDCCH order.
    - Option 1b (OPPO): min (160ms, Tfirst-SSB)
  + Option 2 (QC):
    - RAN4 to not add an additional delay component from PDCCH order to the PRACH transmission to a candidate cell for UE to obtain DL synchronization with the candidate cell based on SSB. If the UE has not been able to receive the SSB associated with the PDCCH-order PRACH, as per RAN4 requirements, due to NW configuration, e.g. MGs, # of measurement cells/carriers, etc, UL timing accuracy requirement does not apply to the PRACH transmission irrespective of whether the SSB is associated with an active TCI state of the candidate cell.
* Recommended WF
  + Further discussion

**(Online) Issue 2-3-1-1: whether to support the case that SSB periodicity of FR2 intra-frequency neighbour cell equals to SMTC periodicity in R18 LTM.**

*Background: In RAN4#107, a CR (R4-2310139) was agreed to support this case in R17 ICBM.*

* Proposals
  + Option 1(Apple, vivo, ZTE, MTK, QC): When the SSB periodicity of FR2 intra-frequency cell is fully overlapped with SMTC periodicity of inter-frequency neighbour cell, the existing sharing factor P used for L1/L3 measurements can be reused, i.e., P =3 for L1 measurement and P=1.5 for L3 measurement.
  + Option 2 (Ericsson): Yes, support the case.
    - In FR2, L1-RSRP measurement period of less than 160ms is only possible under following conditions. RAN4 to discuss the feasibility of it and methods to achieve 160ms L1-RSRP measurement period.
      * L3 measurements are suspended after TCI state activation
      * N is 1 or reduced to some other value smaller than 8 (i.e., beam sweeping or reduced after TCI state activation for certain time)
    - RAN4 to find a method to achieve less than 160ms measurement period or a method to skip fine time tracking (e.g., by performing fine time tracking in parallel to UE processing). If RAN4 did not find a method to achieve less than 160ms L1-RSRP periodicity or a method to remove fine time tracking from the cell switch delay, for at least one configuration, RAN4 to send LS to RAN1 and RAN2 to convey pre-sync or pre-TCI state activation is not suitable/applicable for FR2.
* Recommended WF
  + Recommend agree on Option 1.

**Discussion:**

**Agreement:**

* Scenario of SSB periodicity of FR2 intra-frequency neighbour cell equals to SMTC periodicity in R18 LTM is supported.
* Agree the following as baseline:
  + [When the SSB periodicity of FR2 intra-frequency cell is fully overlapped with SMTC periodicity of inter-frequency neighbour cell, the existing sharing factor P used for L1/L3 measurements can be reused, i.e., P =3 for L1 measurement and P=1.5 for L3 measurement.]
* Further discuss whether to support the following optimization:
* In FR2, L1-RSRP measurement period of less than 160ms is only possible under following conditions. RAN4 to discuss the feasibility of it and methods to achieve 160ms L1-RSRP measurement period.
  + L3 measurements are suspended after TCI state activation
  + N is 1 or reduced to some other value smaller than 8 (i.e., beam sweeping or reduced after TCI state activation for certain time)
* RAN4 to find a method to achieve less than 160ms measurement period or a method to skip fine time tracking (e.g., by performing fine time tracking in parallel to UE processing). If RAN4 did not find a method to achieve less than 160ms L1-RSRP periodicity or a method to remove fine time tracking from the cell switch delay, for at least one configuration, RAN4 to send LS to RAN1 and RAN2 to convey pre-sync or pre-TCI state activation is not suitable/applicable for FR2.

**Issue 3-2-4-1: Tinterruption**  **of PCell switch**

* Proposals
  + Option 1 (CATT, Apple, CMCC, ZTE): The components of L1/L2 cell switch interruption Tinterruption are the components of L1/L2 inter-cell mobility delay except Tcmd
  + Option 2 (Nokia): Tinterrupt = TLTM-processing + TIU.
    - TLTM-RRC-processing/Texecution is not part of the interruption.
    - Tfirst-RS (TΔ) and TRS-proc (Tmargin) are not part of the interruption.
  + Option 3 (Huawei): Tinterruption = Tprocessing,2+ TΔ +Tmargin + Tuncertainity/TIU
  + Option 4 (Ericsson):
    - For RACH-based cell switch, Tinterruption include the time of Tprocessing,2 and TIU.
    - For RACH-less cell switch, Tinterruption include Tprocessing,2 only.
* Recommended WF
  + Discuss whether TLTM-RRC-processing/Texecution is not part of the interruption.
  + Down-selection between Option 1 and Option 3.

**Discussion:**

HW: TLTM-RRC-processing/Texecution is not a fixed value.

**Tentative agreement:**

Option 1: QC, Apple, MTK, vivo

* TLTM-RRC-processing/Texecution is part of the interruption.

Option 2: E///, Nokia, ZTE, HW

* TLTM-RRC-processing/Texecution is not part of the interruption.

Option 3: E///

* Introduce UE capability on (TLTM-RRC-processing/Texecution + Tprocessing,2). TLTM-RRC-processing/Texecution is part of the interruption.

**Issue 1-3-1: Whether and how to define timing requirements for UE based TA measurement**

*In moderator’s understanding, it is not enough to only define UL timing requirements for the use of UE based TA measurement. For completeness, the requirements on the synchronization between serving cell and target cell (usually captured in 38.104) should be defined too. Considering this is the last meeting, suggest not to define requirements for UE based TA measurement in R18.*

* Proposals
  + Option 1 (CMCC): define timing requirements for UE-based TA measurement, and the timing requirements introduced for FR2 Power Class 6 UE (FR2 HST UE) can be reused.
  + Option 2 (vivo): UE-based TA during cell switch command can be applicable to both with-early-RACH scenario and without-early-RACH scenario. RAN4 to clarify in the spec that for the case of UE-based TA, UE shall also follow existing requirements in TS 38.133. Similar to previous issue, if RTD between cells is larger than CP/4, existing requirements defined for FR2 HST can be re-used.
  + Option 3 (MTK): Not to define requirements for UE based TA measurement in R18.
* Recommended WF
  + Recommend agree on

Not to define requirements for UE based TA measurement in R18.

**Discussion:**

CMCC: we do not agree not to define timing requirements for UE based TA measurement. We can follow approach in positioning.

MTK: this scenario is different from positioning. We need to discuss the applicable conditions.

QC: HST is only for serving cell. But here UE needs to estimate sth from neighbor cell.

Nokia: how long NW can know UE has finished TA estimation.

**Tentative agreement:**

Option a: MTK, QC, Apple, ZTE, OPPO, Xiaomi

* Not to define requirements for UE based TA measurement in R18

Option b: CMCC, vivo

* define timing requirements for UE-based TA measurement, and the timing requirements introduced for UE based TA measurement in R18 positioning WI can be reused. NW can enable this feature when cells are well synchronized.

**(Online) Issue 2-1-3: known cell condition for L1-RSRP measurement***.*

*For information:*

*RAN4#108bis*

|  |
| --- |
| **Issue 2-1-3: known cell condition for L1-RSRP measurement***.*  **< Agreement>**   * + In L1-RSRP measurement for neighbour cell, target cell is considered as known if the following conditions are met in this requirement:     - The UE has performed L3 measurement on the target cell, and       * FFS whether to add time constraint e.g. during the last [5] seconds     - The SSB from the target cell configured for L1 measurementremains detectable according to the cell identification requirements specified in clause 9.2 and 9.3.   + Otherwise, it is unknown |

* Proposals
  + Option 1 (CATT, Apple, ZTE, MTK):
    - Add the time constraint “The UE has performed L3 measurement on the target cell during the last [5] seconds” in known cell condition for L1-RSRP measurement.
  + Option 2 (Nokia): Not to have “during the last [5] seconds” as part of known condition
* Recommended WF
  + Recommend agree on Option 1.

**Discussion:**

**Tentative agreement:**

* Add the time constraint “The UE has performed L3 measurement on the target cell during the last [X] seconds” in known cell condition for L1-RSRP measurement.

**(Online) Issue 3-3-1: known cell conditions**

* Proposals
  + Option 1 (MTK, Apple, Ericsson):
    - The target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover cell switch command:

- the UE has sent a valid L1 [or L3] measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell,

- One of the SSBs measured from the target cell also remains detectable during the handover cell switch delay according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell.

* + - otherwise it is unknown.
  + Option 2 (CMCC):
    - For FR1, a cell is known if it has been meeting the relevant cell identification requirement during the last 5 seconds otherwise it is unknown (6.1.1.2, TS38.133).
  + Option 3 (Nokia):
    - For Rel-18 LTM, remove “during the last 5 seconds” from the known cell conditions.
    - Cells detected more than 5s ago but are still detectable, are considered as known cells for LTM.
* Recommended WF
  + Need more discussion.

**Discussion:**

**Agreement:**

* + - The target cell is known if it has been meeting the following conditions:

- During the last 5 seconds before the reception of the handover cell switch command:

- the UE has sent a valid L1 or L3 measurement report for the target cell and

- One of the SSBs measured from the NR target cell being configured remains detectable according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell,

- One of the SSBs measured from the target cell also remains detectable during the handover cell switch delay according to the cell identification conditions specified in clause 9.2 for intra-frequency cell and in clause 9.3 for inter-frequency cell.

* + - otherwise it is unknown.
    - FFS whether and how to address the mismatch on definition of known between existing HO requirement and cell switch delay requirements.

**Issue 2-3-3-3: Scheduling restriction of intra-frequency L1-RSRP measurement for UE capable of RTD>CP**

* Proposals
  + Option 1 (MTK):
    - For UE capable of RTD>CP, scheduling restriction should be extended by one more symbol before and after SSB symbols when deriveSSB-IndexFromCell is enabled. No L1 measurement requirements if mixed numerology is used and deriveSSB-IndexFromCell is not enabled in FR1 FDD
  + Option 2 (QC):
    - In FR2, for scheduling restriction for L1-RSRP measurement on a candidate cell, on top of the legacy scheduling restriction defined for non-serving cell in R17, additional 1 symbol is added before and after those OFDM symbols corresponding to the configured LTM L1-RSRP measurement SSBs
* Recommended WF
  + Recommend agree on
    - For UE capable of RTD>CP, scheduling restriction should be extended by one more symbol before and after SSB symbols when *deriveSSB-IndexFromCell* is enabled.
    - Need more discussion on the case that when *deriveSSB-IndexFromCell* is not enabled.

**Discussion:**

**Agreement:**

* Scheduling restriction of intra-frequency L1-RSRP measurement for UE capable of RTD>CP
  + For FR2:
    - For UE capable of RTD>CP, scheduling restriction should be extended by one more symbol before and after SSB symbols.
  + For FR1:
    - FFS. Discuss scheduling restriction case by case.

**~~Issue 2-3-3-1: Measurement period of intra-frequency L1-RSRP measurement for UE capable of RTD>CP in FR1 if UE performs L1-RSRP measurement on multiple intra-frequency layer~~**

* ~~Proposals~~
  + ~~Option 1 (CATT, Apple, CMCC, ZTE, MTK, Ericsson): For multiple intra-frequency layers, additional scaling factor (i.e., number of intra-frequency layers) is to be scaled on top of measurement period specified for single frequency layer.~~
    - ~~Option 1a (QC): For multiple intra-frequency layers, additional scaling factor (i.e., number of intra- and inter-frequency layers) is to be scaled on top of measurement period specified for single frequency layer.~~
  + ~~Option 2 (Huawei): In FR1 for UE capable of RTD>CP, the FFT engine number is limited. If supported cell numbers on each layers is introduced as UE capability, no need to consider additional scaling factor. If no such capability, if the configured number of to-be-measured cells exceeds the number of FFT engine, additional scaling factor of serving CC number can be scaled.~~
  + ~~Option 3 (xiaomi):~~
    - ~~For intra-frequency L1-RSRP measurement period requirement for UE capable of RTD>CP in FR1, the neighbour cell whose TCI state is activated and the serving cell are prioritized.~~
      * ~~When TCI state of neighbor cell is activated, UE performs L1-RSRP measurement on the neighbor cell whose TCI state is activated and the serving cell. UE may measure any other cell(s) based on UE implementation.~~
        + ~~The measurement period of serving cell is not scaled, and R15/R16 SSB based L1-RSRP measurement period is applied.~~
        + ~~The R15/R16 SSB based L1-RSRP measurement period is applied to the measurement period of the neighbor cell whose TCI state is activated.~~

~~Assuming the NW activate TCI state(s) from only one neighbor cell.~~

* + - * + ~~For the other neighbor cells: no measurement delay requirements~~
      * ~~When TCI state of neighbor cell is not activated, UE performs L1-RSRP measurement on the neighbor cells and the serving cell.~~
        + ~~The measurement period of serving cell is not scaled, and R15/R16 SSB based L1-RSRP measurement period is applied.~~
        + ~~The measurement period of the neighbor cell is R15/R16 SSB based L1-RSRP measurement period is scaled by ceil().~~
      * ~~If the neighbor cell whose TCI state is activated and other neighbor cells are measured with the same spare FFT module, The measurement period of the neighbor cell whose TCI state is activated is R15/R16 SSB based L1-RSRP measurement period is scaled by 2.~~
* ~~Recommended WF~~
  + ~~Recommend agree on~~
    - ~~For multiple intra-frequency layers, additional scaling factor (i.e.,~~ **~~number of frequency layers including intra-frequency and inter-frequency without gap if supported and configured~~**~~) is to be scaled on top of measurement period specified for single frequency layer.~~

**~~Discussion:~~**

**~~Agreement:~~**

**~~Issue 2-3-3-2: Measurement period of intra-frequency L1-RSRP measurement in FR2 if UE performs L1-RSRP measurement on multiple intra-frequency layer~~**

*~~Option 2 covers option 1.~~*

* ~~Proposals~~
  + ~~Option 1 (Huawei):~~
    - ~~The principle agreed for FR2 intra-frequency measurement for LTM cells can also be applied for multiple serving cells scenario.~~
    - ~~When TCI states are activated on neighbor cells in multiple bands, band number is to be scaled additionally on the measurement period of neighbor cell.~~
  + ~~Option 2 (MTK):~~
    - ~~For UE capable of RTD>CP, when TCI states of multiple intra-frequency neighbour cells are activated, the measurement delay of the neighbour cells whose TCI state(s) are activated is R15/R16 SSB based L1-RSRP measurement period scaled by 3 x number of intra-frequency neighbour cells whose TCI state(s) are activated.~~
* ~~Recommended WF~~
  + ~~Further discussion.~~

**~~Discussion:~~**

**~~Agreement:~~**

**~~Issue 2-4-1-2: Number of SSB periods needed in inter-frequency L1-RSRP measurement period with Type 1 MG~~**

* ~~Proposals~~
  + ~~Option1 (CMCC, MTK): For inter-frequency L1-RSRP measurement with MG, the number of samples is [2] if higher layer parameter timeRestrictionForChannelMeasurement is configured, and [4] otherwise.~~
  + ~~Option 2 (Apple): assuming RRM requirements are applicable only if L1 measurement layer is configured on the same frequency as one of current L3 MO, existing number of samples in intra-frequency L1-RSRP measurement requirements can be reused in inter-frequency L1-RSRP measurement period with Type 1 MG.~~
  + ~~Option 3 (vivo): For inter-frequency L1 measurement within type 1 measurement gap, enough SSB measurement samples on the corresponding frequency layer needs to be considered to ensure that UE is allowed to perform additional L3 measurement, i.e., cell search and rough synchronization to deal with time-domain deep channel fading.~~
  + ~~Option 4 (Huawei): The existing sample number indicated in timeRestrictionForChannelMeasurement can be reused for inter-frequency L1-RSRP with type 1 MG.~~
  + ~~Option 5 (Ericsson): For inter-frequency measurement requirements, M is 1 if the L1-RSRP periodicity is lesser than or equal to 160ms. If not M=2.~~
* ~~Recommended WF~~
  + ~~Recommend agree on~~
    - ~~For inter-frequency L1-RSRP measurement with MG, the number of samples~~
      * ~~M = [1 or 2] if higher layer parameter timeRestrictionForChannelMeasurement is configured,~~
      * ~~Otherwise M= [3 or 4].~~

**~~Discussion:~~**

**~~Agreement:~~**

**~~Issue 2-2-2: How to handle the case that the number of cells NW configured/activated to measure exceeds the configuration to exceed UE capability (# of cells/SSBs UE supported per frequency layer)~~**

*~~Background:~~*

|  |
| --- |
| **~~Conclusion (RAN1#113)~~**   * ~~For the beam selection for SSB based L1-RSRP measurement report, except SpCell is configured to be included,~~    + ~~the selection of cells for the L1 measurement report is up to UE implementation.~~   ~~the selection of beams per cell for the L1 measurement report is the same as legacy behaviour.~~ |

*~~To address Nokia’s question on “configured/activated”: There are periodic report, semi-persistent report and aperiodic report for L1-RSRS measurement. For periodic report, there is only RRC configuration. For semi-persistent and aperiodic report, except RRC configuration, there is also related mechanism to active part of the measurement. Here “the number of cells NW configured/activated to measure” is referring to the cells that NW is asking UE to measure, including periodic report, semi-persistent report and aperiodic report.~~*

* ~~Proposals~~
  + ~~Option 1 (Apple, MTK, Nokia): It is up to UE implementation on how to choose cells/SSB to measure if the number of cells/SSB NW configured/activated to measure exceeds UE capability.~~
    - ~~Nokia: In rel-18 if network configuration to measure exceeds the UE capability to perform L1-RSRP measurements, no requirements are defined.~~
  + ~~Option 2 (ZTE): When number of LTM candidate cells configured exceeds the UE capability of number of cells UE can measure, down selection of cells for LTM measurement is based on indication from the NW.~~
  + ~~Option 3 (Ericsson): It is up to UE implementation till the TCI state activation is received. After TCI state activation, UE should at least measure cells which are activated for TCI state and additional cells to measure is up to UE implementation.~~
* ~~Recommended WF~~
  + ~~Recommend agree on~~
    - ~~If the number of cells/SSB NW configured/activated to measure exceeds UE capability (# of cells/SSBs UE supported per frequency layer), it is up to UE implementation on how to choose cells/SSB to measure per frequency layer.~~

**~~Discussion:~~**

**~~Agreement:~~**

**~~Issue 3-1-2: Procedure of cell switch~~**

* ~~Proposals~~
  + ~~Option 1 (CATT, Apple, ZTE, MTK): If T/F fine tracking (T~~~~Δ~~~~) is needed after receiving cell switch command, UE is not required to perform it before L1/L2/L3 processing (T~~~~processing,2~~~~)~~
  + ~~Option 2 (Ericsson): RAN4 to agree that UE performs fine time tracking while performing UE processing (T~~~~execution\_time~~ ~~and T~~~~processing,2~~~~)~~
  + ~~Option 3 (MTK): Due to limited time, further discuss the optimization on cell switch procedure in later releases.~~
  + ~~Option 4 (vivo): If downlink pre-synchronization, i.e. TCI state activation before cell switch, is not indicated by gNB before cell switch, UE needs to perform PBCH decoding and SSB-based T/F tracking according to the activated TCI during cell switch. In this case, they are performed before T~~~~processing,2~~ ~~so that the interruption to serving cell and target cell can be shortened~~**~~.~~**
* ~~Recommended WF~~
  + ~~Recommend agree on Option 3.~~

**~~Discussion:~~**

**~~Agreement:~~**

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

* ~~Proposals~~
  + ~~Option 1 (Nokia):~~ 
    - ~~When TCI state has been activated before the cell switch, PL-RS estimation is not part of the cell switch delay.~~
    - ~~When TCI state activation is done at the cell switch, UE uses the same SSB for PL-RS and fine T/F tracking (T~~~~first-RS~~~~). No additional delay due to PL-RS is needed in the cell switch delay.~~
  + ~~Option 2 (MTK):~~ 
    - ~~For PCell/PSCell switch delay, the PL-RS to use should be one of the SSBs UE performs L1-RSRP measurement on and UE does not need extra time to measure the PL-RS.~~
  + ~~Option 3 (vivo): The PL-RS of the TCI activated/indicated in cell switch command is not maintained at the endpoint of the cell switch delay.~~
    - ~~For CBRA RACH-based cell switch, UE uses the SSB for PRACH transmission as the default PL-RS, before the PL-RS in the target TCI is maintained.~~
    - ~~For CFRA RACH-based cell switch, early-RACH-based RACH-less cell switch, if the SSB for PRACH transmission is the same as QCL source of the indicated TCI, UE uses the SSB for PRACH transmission as the default PL-RS, before the PL-RS in the target TCI is maintained.~~
    - ~~For UE-based TA derivation after cell switch, UE uses the SSB indicated in the TCI in cell switch command as the default PL-RS, before the PL-RS in the target TCI is maintained.~~
    - ~~For all other RACH-less cell switch, UE is assumed to follow the same behaviour as R17 ICBM.~~
    - ~~No additional interruption is assumed.~~
  + ~~Option 4 (Ericsson): No additional delay or conditions are needed for PL-RS measurement.~~
  + ~~Option 5 (QC): UE is not required to measure/maintain PL-RS more than X, e.g. 4, SSBs across all candidate cells. If the configured PL-RSs is more than X, which one’s pathloss measurement to maintain is up to UE implementation, and the latency and accuracy requirements are left undefined. No additional delay component for pathloss measurement is not added to LTM cell switch execution delay.~~
* ~~Recommended WF~~
  + ~~Recommend agree on~~
    - ~~No additional delay is needed for PL-RS measurement in cell switch delay.~~
    - ~~FFS: Any applicable conditions.~~

**~~Discussion:~~**

**~~Agreement:~~**

### Sub-topic 4-2 Using L3 measurement in L1 report

**(Online) Issue 4-2-1: Measurement reporting**

* Proposals
  + Option 1 (ZTE, Nokia):
    - UE reports based on L1 measurement configuration
    - Measurement report mapping: No changes to Table 10.1.6.1-1 are needed due to support of L3 measurements in L1 measurement report.
    - L3 and L1 measurements are not included in the same report, at least in rel-18
  + Option 2 (Ericsson):
    - RAN4 to agree that the L1-RSRP report sent to NW can contain L1-RSRP derived from L1 measurement and L1-RSRP derived from L3 measurement results.
    - One bit field can be introduced in the measurement report to distinguish whether L1-RSRP is measured or L1-RSRP derived. Detailed signalling can be left to RAN1/RAN2.
    - NW to indicate whether UE should report a L1 based report alone or report containing L1 and L3 results.
* Recommended WF
  + Need more discussion.

**Discussion:**

Nokia: can be agreed since there is no RAN1/2 impact.

HW: does it mean in measurement report some cells are based on L3 while some cells are based on L1. How can network compare the results?

Apple: does network need to know whether the results are based on L1 or L3 when comparing results from different cells.

HW/MTK/CMCC: beam assumption is different. NW needs to know.

**Agreement:**

**~~(Online) Issue 4-2-2: NW needs to know UE using L3 results in L1 report or not?~~**

* ~~Proposals~~
  + ~~Option 1 (vivo): No need for gNB to know whether the L1 reported results is obtained by L3 measurement of the UE, or L1 measurement of the UE.~~
  + ~~Option 2 (MTK, Ericsson): Yes~~
* ~~Recommended WF~~
  + ~~Need more discussion.~~

**~~Discussion:~~**

**~~Agreement:~~**

**~~(Online) Issue 4-2-3: The condition to switch to using L3 results in L1 report~~**

* ~~Proposals~~
  + ~~Option 1 (vivo, ZTE): UE enters fall-back mode, i.e., reporting L3 measurements in L1 report, if the conditions, under which UE is able to ensure L1 measurement performance based on L1 measurement delay, are not met. UE may return to the normal mode when the conditions are stable for a pre-defined period. It is up to UE to determine the actual threshold/mechanism how to determine the conditions are met or not.~~
  + ~~Option 2 (Nokia): If the number of cells to measure exceeds the L1 based LTM measurement capability, UE is allowed to perform L3 measurements and report them in L1 reporting format.~~
* ~~Recommended WF~~
  + ~~Need more discussion.~~

**~~Discussion:~~**

**~~Agreement:~~**

# Tdoc recommendations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TDoc** | **Title** | **Source** | **Type** | **For** | **Recommendations** |
| [**R4-2318320**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318320.zip) | Draft CR on measurement restrictions for SSB and CSI-RS based BFD for LTM | CATT | draftCR | Endorsement |  |
| [**R4-2319627**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319627.zip) | Draft CR for intra-frequency L1-RSRP measurement on 38.133 R18 LTM | MediaTek Inc., Ericsson | draftCR | Endorsement |  |
| [**R4-2319628**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319628.zip) | Draft CR for R18 LTM on 38.133 | MediaTek Inc. | draftCR | Endorsement |  |
| [**R4-2319629**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319629.zip) | Discussion on UE feature list for R18 LTM | MediaTek Inc. | discussion | Discussion |  |
| [**R4-2318321**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318321.zip) | Discussion on PDCCH-order RACH on neighbor cell for L1L2 based inter-cell mobility | CATT | discussion | Discussion |  |
| [**R4-2318599**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318599.zip) | Discussion on general aspects and scenarios of L1/L2 based inter-cell mobility | Apple | discussion | Discussion |  |
| [**R4-2319051**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319051.zip) | Discussion on general aspects in R18 LTM | vivo | discussion | Discussion |  |
| [**R4-2319079**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319079.zip) | Discussion on general aspects for L1/L2 based inter-cell mobility | CMCC | discussion | Discussion |  |
| [**R4-2319281**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319281.zip) | On general aspects of LTM | Nokia, Nokia Shanghai Bell | discussion | Discussion |  |
| [**R4-2319282**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319282.zip) | Draft CR on LTM candidate cell TCI state activation delay | Nokia, Nokia Shanghai Bell | draftCR | Endorsement |  |
| [**R4-2319298**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319298.zip) | Discussion on general aspects and scenarios of L1/L2 triggered inter-cell mobility | ZTE Corporation | other | Approval |  |
| [**R4-2319368**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319368.zip) | Discussion on general requirements for L1/L2-based inter-cell mobility | Huawei, HiSilicon | discussion | Discussion |  |
| [**R4-2319486**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319486.zip) | On general and scenarios of LTM | OPPO | other | Approval |  |
| [**R4-2319624**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319624.zip) | Discussion on general aspects and scenarios of LTM | MediaTek Inc. | discussion | Discussion |  |
| [**R4-2320773**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320773.zip) | On LTM general aspects and scenarios | Ericsson | discussion | Discussion |  |
| [**R4-2318322**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318322.zip) | Discussion on L1-RSRP measurement requirements for L1/L2 based inter-cell mobility | CATT | discussion | Discussion |  |
| [**R4-2318600**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318600.zip) | Draft CR for requirements of inter-f L1-RSRP measurement with MG | Apple | draftCR | Endorsement |  |
| [**R4-2318601**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318601.zip) | Discussion on L1-RSRP measurement requirements of L1/L2 based inter-cell mobility | Apple | discussion | Discussion |  |
| [**R4-2318842**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318842.zip) | Discussion on L1-RSRP measurement requirements for LTM | Xiaomi | discussion | Discussion |  |
| [**R4-2318843**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318843.zip) | DraftCR on CSSF for Inter-frequency L1-RSRP measurement within gap | Xiaomi | draftCR | Endorsement |  |
| [**R4-2318844**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318844.zip) | DraftCR on the Impact of CSSF for L3 measurement within gaps | Xiaomi | draftCR | Endorsement |  |
| [**R4-2319052**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319052.zip) | Discussion on L1 measurements in R18 LTM | vivo | discussion | Discussion |  |
| [**R4-2319080**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319080.zip) | Discussion on L1-RSRP measurement requirements for L1/L2 based inter-cell mobility | CMCC | discussion | Discussion |  |
| [**R4-2319084**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319084.zip) | DraftCR on inter-f L1-RSRP measurement without gap | CMCC | draftCR | Endorsement |  |
| [**R4-2319299**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319299.zip) | Discussion on L1-RSRP measurement requirements | ZTE Corporation | other | Approval |  |
| [**R4-2319300**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319300.zip) | draftCR on measurement restrictions for SSB and CSI-RS based candidate beam detection for LTM requirements | ZTE Corporation | draftCR | Endorsement |  |
| [**R4-2319369**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319369.zip) | Discussion on L1-RSRP measurement requirements | Huawei, HiSilicon | discussion | Discussion |  |
| [**R4-2319370**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319370.zip) | CR on measurement restriction for RLM due to intra-f L1-RSRP measurement on neighbor cell and Inter-f L1-RSRP measurement without gap | Huawei, HiSilicon | draftCR | Endorsement |  |
| [**R4-2319487**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319487.zip) | Draft CR for measurement restriction on BFD and CBD due to LTM L1-RSRP measurement | OPPO | draftCR | Endorsement |  |
| [**R4-2319625**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319625.zip) | Discussion on L1-RSRP measurement requirements for LTM | MediaTek Inc. | discussion | Discussion |  |
| [**R4-2319789**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319789.zip) | Discussion on LTM Measurements | Nokia, Nokia Shanghai Bell | discussion | Discussion |  |
| [**R4-2320774**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320774.zip) | On L1-RSRP measurement requirements | Ericsson | discussion | Discussion |  |
| [**R4-2320960**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320960.zip) | L1-RSRP measurement requirements | Qualcomm Incorporated | other | Approval |  |
| [**R4-2318323**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318323.zip) | Discussion on cell switch delay requirements for LTM | CATT | discussion | Discussion |  |
| [**R4-2318602**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318602.zip) | Discussion on L1/L2 based inter-cell mobility delay requirements | Apple | discussion | Discussion |  |
| [**R4-2319053**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319053.zip) | Discussion on cell switch delay requirements in R18 LTM | vivo | discussion | Discussion |  |
| [**R4-2319078**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319078.zip) | Discussion on L1/L2 inter-cell mobility delay requirements | CMCC | discussion | Discussion |  |
| [**R4-2319283**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319283.zip) | On LTM cell switch delay | Nokia, Nokia Shanghai Bell | discussion | Discussion |  |
| [**R4-2319284**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319284.zip) | Draft CR on LTM cell switch delay requirements | Nokia, Nokia Shanghai Bell | draftCR | Endorsement |  |
| [**R4-2319301**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319301.zip) | Discussion on L1/L2 inter-cell mobility delay requirements | ZTE Corporation | other | Approval |  |
| [**R4-2319371**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319371.zip) | Discussion on L1/L2 inter-cell mobility delay requirements | Huawei, HiSilicon | discussion | Discussion |  |
| [**R4-2319626**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319626.zip) | Discussion on LTM delay requirements | MediaTek Inc. | discussion | Discussion |  |
| [**R4-2320775**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320775.zip) | On LTM delay requirements | Ericsson | discussion | Discussion |  |
| [**R4-2320961**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320961.zip) | LTM cell switch execution requirements | Qualcomm Incorporated | other | Approval |  |
| [**R4-2318324**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318324.zip) | Draft Reply LS on PDCCH order RACH on neighbour cell | CATT | LS out | Approval |  |
| [**R4-2318325**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318325.zip) | Draft Reply LS on beam application time for LTM | CATT | LS out | Approval |  |
| [**R4-2318326**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318326.zip) | Draft Reply LS on SMTC of LTM candidate cells for L1 measurements | CATT | LS out | Approval |  |
| [**R4-2318603**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318603.zip) | Discussion on RAN2 LS on L1 measurements for LTM | Apple | discussion | Discussion |  |
| [**R4-2318604**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318604.zip) | Reply LS on L1 measurements for LTM | Apple | LS out | Approval |  |
| [**R4-2319054**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319054.zip) | draftCR on UL transmit timing requirements for R18 LTM | vivo | draftCR | Endorsement |  |
| [**R4-2319055**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319055.zip) | draftCR on RRM requirements for TCI activation before cell switch in R18 LTM | vivo | draftCR | Endorsement |  |
| [**R4-2319081**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319081.zip) | Discussion on LS on LTM | CMCC | discussion | Discussion |  |
| [**R4-2319302**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319302.zip) | Discussion on using L3 measurement in L1 report | ZTE Corporation | other | Approval |  |
| [**R4-2319372**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319372.zip) | Reply LS on L1 measurements for LTM | Huawei, HiSilicon | LS out | Approval |  |
| [**R4-2319790**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319790.zip) | draftCR for 38.133 on LTM L3 measurements in L1 measurement report | Nokia, Nokia Shanghai Bell | draftCR | Endorsement |  |
| [**R4-2319791**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319791.zip) | Discussion on LTM L3 measurements in L1 report | Nokia, Nokia Shanghai Bell | discussion | Discussion |  |
| [**R4-2320776**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320776.zip) | On other aspects of LTM | Ericsson | discussion | Discussion |  |
| **R4-2320777** | Intra-frequency measurments for LTM | Ericsson | discussion | Discussion |  |
| [**R4-2320778**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320778.zip) | Reply LS to RAN2 on L1 measurements for LTM | Ericsson | LS out | Approval |  |
| [**R4-2320962**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320962.zip) | Early DL and UL synchronizations | Qualcomm Incorporated | other | Approval |  |

**New tdocs**

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| **Title** | **Source** |
| WF on R18 Further NR mobility enhancement – part 1 | MTK |