**3GPP TSG RAN WG1 #116 R1-240XXXX**

**Athens, Greece, February 26th – March 1st, 2024**

**Source: Moderator (Fujitsu)**

**Title: FL summary 1 of Maintenance on Further NR Mobility Enhancements**

**Agenda Item: 8.5**

**Document for: Information**

# Introduction

This contribution is a Feature Lead (FL) summary for A.I. 8.5: Maintenance on Further NR Mobility Enhancements.

# Plan for GTW/Online discussion

Explanation of the tag in the section name:

* **[High]** Handled with highest priority in this meeting, aiming at the resolution in this meeting
* **[Low]** Gather the companies view first. If consensus can be achieved during FL summary-based discussion, FL will try to get agreement. Or, if FL see the need for offline/online discussion, the slot will be allocated. Otherwise, come back in the next meeting.
* **[Closed]** The discussion is closed with/without consensus

##### [Proposals for Monday Online]

##### [Proposals for Tuesday Online]

##### [Proposals for Wednesday Online]

##### [Proposals for Thursday Online]

##### [Proposals for Friday Online]

# void

# List of Contributions

## Contributions under AI 5

According to the Chair’s note, the discussion on the following contributions are not planned as RAN1 is CCed.

R1-2400028 Reply LS on L1 measurements for LTM RAN4, Ericsson

**Relevant tdocs:**

R1-2400029 LS on n-TimingAdvanceOffset for PDCCH order RACH RAN4, Huawei

**Relevant tdocs:**

* R1-2400282 Reply LS to RAN4 on n-TimingAdvanceOffset for PDCCH order RACH ZTE

## Contributions under AI 8.5

|  |  |  |
| --- | --- | --- |
| [**R1-2400038**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400038.zip) | Remaining issues on further NR Mobility Enhancements | Spreadtrum Communications |
| [**R1-2400142**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400142.zip) | Maintenance of L1 enhancements for inter-cell beam management | Huawei, HiSilicon |
| [**R1-2400186**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400186.zip) | FL plan for Maintenance on Further NR Mobility Enhancements at RAN1#116 | Moderator (Fujitsu) |
| [**R1-2400193**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400193.zip) | Mainteness on further NR mobility enhancements | Lenovo |
| [**R1-2400221**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400221.zip) | Maintenance on Further NR Mobility Enhancements | vivo |
| [**R1-2400276**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400276.zip) | Maintenance on Further NR Mobility Enhancements | ZTE |
| [**R1-2400452**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400452.zip) | Maintenance on NR mobility enhancements | CATT |
| [**R1-2400581**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400581.zip) | Text Proposals on Further NR Mobility Enhancement | OPPO |
| [**R1-2400646**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400646.zip) | Remaining Issues for L1/L2-triggered Mobility | Nokia, Nokia Shanghai Bell |
| [**R1-2400680**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400680.zip) | Maintenance on Further NR Mobility Enhancements | Langbo |
| [**R1-2400707**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400707.zip) | Maintenance on Further NR Mobility Enhancements | Samsung |
| [**R1-2400763**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400763.zip) | Remaining issues on further NR mobility enhancements | Fujitsu |
| [**R1-2400880**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400880.zip) | On missing specification on LTM TCI state configuration | Panasonic |
| [**R1-2400911**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400911.zip) | Maintenance on Further NR Mobility Enhancements | Ericsson |
| [**R1-2400991**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2400991.zip) | Maintenance of further NR mobility enhancement | Apple |
| [**R1-2401093**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401093.zip) | Maintenance on Further NR Mobility Enhancements | NTT DOCOMO, INC. |
| [**R1-2401200**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401200.zip) | Discussion on early PRACH | ASUSTeK |
| [**R1-2401255**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401255.zip) | Discussion on maintenance on further NR mobility enhancements | Google |
| [**R1-2401312**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_116/Docs/R1-2401312.zip) | On maintenance for mobility enhancements | MediaTek Inc. |

# Discussion

## [Void] L1 measurement

No issue is identified

## L1 measurement reporting

### [High-MonOff4] Priority rule for LTM CSI report

Prioritization between legacy CSI-report and LTM CSI report was agreed at RAN1#115. An open issue is priority rule within LTM CSI-report, which may reuse the existing rule for legacy CSI report but the necessity of some adjustment is foresee. The related part of the specification is section 5.2.5 of 38.214.

##### [Summary of contributions]

* + SpreadTrum
		- The current formula is applied to LTM CSI report, adopting the following TP.
		- The serving cell index indicates the serving cell in which the LTM-CSI-ReportConfig is configured.
		- can be a fixed value
		-  is replaced with maxNrofLTMCSI-ReportConfigurations
	+ Huawei
		- An LTM report for a candidate cell is prioritized over all CSI report for serving cell. Among the LTM reports, legacy priority rule of CSI report for serving cell can be adopted. An offset could be added in the priority of CSI report for serving cell. Adopt TP#7 in clause 5.2.5 of TS38.214.
	+ Lenovo
		- Adopt the following TP to determine CSI priority of CSI report configured with LTM-CSI-ReportConfig
	+ Vivo
		- Introduce a separate priority formula for LTM reports, which takes time-domain reporting characteristic, serving cell index and report configuration index into account, and the serving cell index indicates a cell in which the report configuration is configured.
	+ ZTE
		- Proposal 5: Priority value of a LTM CSI report can be calculated by reusing the formula of legacy CSI report with clarifying some input parameters for candidate cell, such as “c”, “N\_cells”, “s” and “Ms”.
			* c is the serving cell index or candidate cell index and N\_cells is the value of the higher layer parameter maxNrofServingCells or maxNrofLTM-Configs-r18;
			* s is the reportConfigID or ltm-CSI-ReportConfigId-r18 and is the value of the higher layer parameter maxNrofCSI-ReportConfigurations or maxNrofLTM-CSI-ReportConfigurations-r18.
	+ Nokia
		- For the legacy CSI reporting, the serving cell index (the value of “c” in the formula) is the cell where CSI-RS is configured. This would not work properly for a LTM CSI report since there may be RSs from the multiple cells reported in the same reporting instance thus the value needs to be defined so that there is no ambiguity.
		- In order to determine the priority of a LTM CSI report when two or more LTM CSI reports are collided,
			* the value of s and M\_s should refer to the LTM-CSI-ReportConfigID, maxNrofLTM-CSI-ReportConfigurations, respectively, of the LTM CSI report,
			* c is the serving cell index value where the LTM CSI report configuration is configured or index value that carries the PUCCH/PUSCH for CSI report, and N\_cells is the value of the higher layer parameter maxNrofServingCells.
			* Adopt the text proposal from Appendix A.6 clause 5.2.5 of TS38.214 [4].
				+ *c* is the serving cell index and is the value of the higher layer parameter *maxNrofServingCells*;

for a CSI report configured with *LTM-CSI-ReportConfig, c* is the serving cell index value where the report configuration is configured.

* + - * + *s* is the *reportConfigID* andis the value of the higher layer parameter *maxNrofCSI-ReportConfigurations.*

for a CSI report configured with *LTM-CSI-ReportConfig, s is the LTM-CSI-ReportConfigID and* and *Ms* the value of the higher layer parameter *maxNrofLTM-CSI-ReportConfigurations*

* + Fujitsu
		- To determine the priority rules for the LTM CSI reports, the priority value of a LTM CSI report can be defined as

, or

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* + - for aperiodic LTM CSI reports to be carried on PUSCH, for semi-persistent LTM CSI reports to be carried on PUSCH, for semi-persistent LTM CSI reports to be carried on PUCCH and for periodic LTM CSI reports to be carried on PUCCH;
		- c is the serving cell index and is the value of the higher layer parameter maxNrofServingCells; More specifically, c is the serving cell where LTM-CSI-ReportConfig is configured;
		- is the ltm-CSI-ReportConfigId-r18 and is the value of the higher layer parameter maxNrofLTM-CSI-ReportConfigurations-r18.
	+ Apple
		- The legacy priority rules of serving cell CSI reports are reused for LTM CSI reports.
	+ DCM
		- Legacy CSI priority formular is applied to LTM CSI reports and legacy CSI reports when the calculated priority values are different. For a LTM CSI report and a legacy CSI report with the same calculated priority value, LTM CSI report is prioritized.
		- Adopt following TP for TS 38.214.
	+ Google
		- When calculating CSI priority value, adopt the following principles:
			* Step 0: Compare whether it is LTM CSI report or legacy CSI report: LTM CSI report > legacy CSI report
			* Step 1: CSI priority is firstly determined by its time domain behaviour: Aperiodic CSI report > SP CSI report on PUSCH > SP CSI report on PUCCH > periodic CSI report
			* Step 2: CSI priority is then determined by its report quantity: CSI report with L1-RSRP/SINR > CSI report without L1-RSRP/SINR
			* Step 3: CSI priority is then determined by serving cell ID: CSI report for a serving cell with lower cell ID > CSI report for a serving cell with larger cell ID, where for LTM CSI reports, the candidate cell with lowest candidate cell ID included in the LTM CSI report is used to compare
			* Step 4: CSI priority is then determined by its report configuration ID: CSI report with lower report configuration ID > CSI report with larger report configuration ID, where for LTM CSI reports, LTM-CSI-ReportConfigId is used to compare

##### [FL observation]

The discussion points are summarized as follwows:

* Point 1) Reuse the existing paragraph, or introduce a separate paragraph for LTM CSI report from legacy one
	+ Approach 1): Reusing existing paragraph: the spec change would be minimum
	+ Approach 2): Additional paragraph: description to the legacy behaviour can be kept as much as possible
	+ FL view is that both approach works. However, Approach 2 would be easier because the modified part can be kept small.
* Handling of c, i.e. serving cell index, and N\_cells
	+ This would be necessary to clarify that this is the serving cell index where LTM-CSI-ReportConfig is configured. With this, N\_cells can be kept unchanged
* Handling of s and Ms
	+ LTM-CSI-ReportConfigID and maxNrofLTM-CSI-ReportConfigurations-r18 should be used for LTM CSI report

FL suggestion is to take Nokia’s version for the baseline proposal because it is the simplest but covers all the necessary aspects

##### [FL Proposal 5.2.1-v1]

**Reason of change:**

* The priority rules for LTM CSI reports is not defined when two or more LTM CSI reports are collided.

**Summary of change:**

* Add the priority rules for LTM CSI reports when two or more LTM CSI reports are collided.

**Consequence if not approved:**

* The priority rules for LTM CSI reports when two or more LTM CSI reports are ambiguous.
* The procedure for the collision handling of LTM CSI reports is undefined.

**5.2.5 Priority rules for CSI reports**

For two overlapping PUSCHs, the priority rules in this clause are applied for physical channels with same priority index according to clause 9 in [6, TS 38.213] if a UE is not configured with *enableSTx2PofmDCI* or a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and the UE is configured with *enableSTx2PofmDCI* and the two overlapping PUSCHs are associated with same value of *coresetPoolIndex*.

CSI reports are associated with a priority value where

-  for aperiodic CSI reports to be carried on PUSCH  for semi-persistent CSI reports to be carried on PUSCH,  for semi-persistent CSI reports to be carried on PUCCH and  for periodic CSI reports to be carried on PUCCH;

-  for CSI reports carrying L1-RSRP or L1-SINR and  for CSI reports not carrying L1-RSRP or L1-SINR;

- *c* is the serving cell index and is the value of the higher layer parameter *maxNrofServingCells*;

 - for a CSI report configured with *LTM-CSI-ReportConfig, c* is the serving cell index value where the report configuration is configured.

- *s* is the *reportConfigID* andis the value of the higher layer parameter *maxNrofCSI-ReportConfiguration* for a CSI report configured with *CSI-ReportConfig.*

 *-* for a CSI report configured with *LTM-CSI-ReportConfig, s* is the *LTM-CSI-ReportConfigID* and *Ms* is the value of the higher layer parameter *maxNrofLTM-CSI-ReportConfigurations*

A first CSI report is said to have priority over second CSI report if the associated  value is lower for the first report than for the second report.

Two CSI reports are said to collide if the time occupancy of the physical channels scheduled to carry the CSI reports overlap in at least one OFDM symbol and are transmitted on the same carrier. When a UE is configured to transmit two colliding CSI reports,

- if *y* values are different between the two CSI reports, the following rules apply except for the case when one of the *y* value is 2 and the other *y* value is 3 (for CSI reports transmitted on PUSCH, as described in Clause 5.2.3; for CSI reports transmitted on PUCCH, as described in Clause 5.2.4):

- The CSI report with higher  value shall not be sent by the UE.

- otherwise, the two CSI reports are multiplexed or either is dropped based on the priority values, as described in Clause 9.2.5.2 in [6, TS 38.213].

A CSI report configured with *LTM-CSI-ReportConfig* has a higher priority in case of collision with CSI report(s) configured with *CSI-ReportConfig.*

##### [Comments to FL Proposal 5.2.1-v1]

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | For some reason, our proposal was not included: base the prio only on the ltm-CSI-ReportConfigId. This is clearly the simplest option, and we ask companies to consider that. The prio for the time domain reporting can be included. Since the UE only supports up to 4 report configs, it would seem to be overkill to do something else.  |
| CATT | Agree in principle. |
|  |  |

### [High-MonOn3] Condition to identify SpCell when SpCellInclusion is configured

The condition to identify SpCell when SpCellInclusion is configured was discussed at RAN1#115, but no consensus how to update the specification was not achieved. The discussion point are

* Which one to use, SSB frequency or ARFCN, where majority view was SSB frequency at the previous meeting
* How to express the SSB frequency for the current SpCell, i.e. may not be not easy to refer to the exact IE name for current SpCell.

##### [Summary of the contributions]

* Huawei
	+ When a UE is configured with SpCellInclusion, the SpCell measurements are the entries in the LTM-CSI-SSB-ResourceSet where the PCI and ssbFrequency-r18 of the candidate cell is equal to the PCI and center frequency of SSB of SpCell where UE performs initial cell selection or handover procedure. Adopt TP#8 in clause 5.2.1.4.2 of TS38.214.
		- if *spCellInclusion* is configured, SSB resources in *ltm-CSI-SSB-ResourceList* associated with the current SpCell are the entries where PCI given by *ltm-CandidatePCI* and frequency information given by *ssbFrequency-r18*  of the associated candidate cell (given in *ltm-CandidateIdList*) is equal to the PCI and center frequency of SSB of the current SpCell where UE performs initial cell selection or handover procedure.
* ZTE
	+ If spCellInclusion is configured, SSB resources in [ltm-CSI-SSB-ResourceList] associated with the current SpCell are the entries where PCI [given by ltm-CandidatePCI] and frequency information [given by ssbFrequency-r18] of the associated candidate cell (given in [ltm-CandidateIdList]) is equal to the PCI and frequency information [given by absoluteFrequencySSB] of the current SpCell.
		- RP for section 5.2.1.4.2 of TS 38.214-i10.
		- if *spCellInclusion* is configured, SSB resources in [*ltm-CSI-SSB-ResourceList*] associated with the current SpCell are the entries where PCI [given by *ltm-CandidatePCI*] and frequency information [given by *ssbFrequency-r18* ] of the associated candidate cell (given in [*ltm-CandidateIdList*]) is equal to the PCI and frequency information [given by *absoluteFrequencySSB* ] of the current SpCell.
* Nokia
	+ SSB frequency using ARFCN-ValueNR provides sufficient frequency information to derive the frequency information of an SSB
	+ Consider the following agreement of RAN1 #114bis with SSB frequency to provide the frequency information of an SSB:
	+ For the LTM L1 measurement report,
		- When a UE is configured is configured with SpCellInclusion, the SpCell measurements are the entries in the LTM-CSI-SSB-ResourceSet where the PCI and frequency information [~~SSB frequency/ARFCN~~ given by *ssbFrequency-r18*] of the candidate cell is equal to the PCI and frequency information [~~SSB frequency/ARFCN~~ given by *absoluteFrequencySSB*] of the current SpCell.
* Ericsson
	+ The SpCell measurements are the entries in the LTM-CSI-SSB-ResourceSet where the PCI of the candidate cell, provided by ltm-CandidatePCI, is equal to the PCI of the SpCell, and the frequency information of the candidate cell, provided by ssbFrequency in LTM-SSB-Config, is equal to the SSB frequency of the SpCell.
* Apple
	+ When SpCellInclusion is configured for LTM measurement, the ‘ssbFrequency-r18’ IE in ‘LTM-SSB-Config-r18’ is used to map a candidate cell to the SpCell in addition to PCI.
	+ Capturing the SpCell identification rule into TS 38.214.
* NTT DOCOMO
	+ When a UE is configured is configured with SpCellInclusion, the SpCell measurements are the entries in the LTM-CSI-SSB-ResourceSet where the PCI and frequency information ssbFrequency-r18 of the candidate cell is equal to the PCI and frequency information absoluteFrequencySSB of the current SpCell.
	+ Adopt following TP for TS 38.214.

- If a UE is configured with a ~~[~~*LTM-CSI-ReportConfig-r18*~~]~~,

- if the UE is configured with *spCellInclusion*, the UE shall report in a single reporting instance ~~[~~*noOfReportedRS-PerCell-r18~~]~~ different SSBRI* for the current SpCell and each of the ~~[~~*noOfReportedCells-r18*~~]~~-1 candidate cells.Otherwise, the UE shall report in a single reporting instance *~~[~~noOfReportedRS-PerCell-r18~~]~~* different SSBRI for each of the *~~[~~noOfReportedCell-r18~~]~~* candidate cells.

* where SSBRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of the associated ~~[~~*ltm-CSI-SSB-ResourceList-r18*~~]~~ in the corresponding~~[~~*LTM-CSI-SSB-ResourceSet-r18*~~]~~*.*
* if spCellInclusion is configured, SSB resources in ~~[~~*ltm-CSI-SSB-ResourceList-r18*~~]~~ associated with the current SpCell are the entries where PCI ~~[~~given by *ltm-CandidatePCI-r18*~~]~~ and frequency information ~~[~~given by ***ssbFrequency-r18****~~SSB frequency/ ARFCN-ValueNR~~*~~]~~ of the associated candidate cell (given in ~~[~~*ltm-CandidateIdList-r18*~~]~~) is equal to the PCI and frequency information ~~[~~given by ***absoluteFrequencySSB****~~SSB frequency/ ARFCN-ValueNR~~*~~]~~ of the current SpCell

##### [FL observation]

There are two discussion points

* Which one to use, SSB frequency or ARFCN 🡪 Everyone proposed to use SSB, i.e. *ssbFrequency-r18*
* How to express the SSB frequency for the current SpCell:
	+ Approach 1) keep general expression without IE name
	+ Approach 2) use specific IE name, i.e. absoluteFrequencySSB

It was observed that the companies’ view hasn’t been unchanged.

##### [FL proposal 5.2.2-v1]

FL intention is to discuss online which approach (Approach 1) vs (Approach 2) to take during RAN1#116.

**Reason of change:**

* For LTM L1 measurement report with *SpCellInclusion* configured, how to identify a SSB in a *ltm-CSI-SSB-ResourceSet-r18* belonging to SpCell is not defined

**Summary of change:**

* Clarify that SpCell measurements are the entries in the *LTM-CSI-SSB-ResourceSet* where the PCI and *ssbFrequency-r18* of the candidate cell is equal to the PCI and (Approach 1) center frequency of SSB (Approach 2) *absoluteFrequencySSB* of the current SpCell.

**Consequence if not approved:**

* The UE cannot identify which LTM

**5.2.1.4.2 Report quantity configurations**

<omit unchanged part>

If a UE is configured with a *LTM-CSI-ReportConfig*,

- if the UE is configured with *spCellInclusion*, the UE shall report in a single reporting instance *nrOfReportedRS-PerCell* different SSBRIfor the current SpCell and each of the [*nrOfReportedCells] -1* candidate cells.Otherwise, the UE shall report in a single reporting instance *[nrOfReportedRS-PerCell]* different SSBRI for each of the *[nrOfReportedCell]* candidate cells,

- where SSBRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of the associated *ltm-CSI-SSB-ResourceList*in the corresponding *ltm-CSI-SSB-ResourceSet*,

- if *spCellInclusion* is configured, SSB resources in *ltm-CSI-SSB-ResourceList* associated with the current SpCell are the entries where PCI given by *ltm-CandidatePCI* and frequency information given by *ssbFrequency-r18* of the associated candidate cell (given in *ltm-CandidateIdList*) is equal to the PCI and (Approach 1) center frequency of SSB of the current SpCell where UE performs initial cell selection or handover procedure. (Approach 2) frequency information given by *absoluteFrequencySSB* of the current SpCell

<omit unchanged part>

##### [Comments to FL proposal 5.2.2-v1]

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | This was discussed last time. We checked this with the RRC editor, and the UE is only provided absoluteFrequencySSB in RRC configuration with sync, i.e., after a handover. So, referring to absoluteFrequencySSB is not generally applicable.  |
| CATT | Approach 2 is preferred. |

### [Low] CSI-AperiodicTriggerStateList for LTM-CSI-ReportConfig Reporting Settings

##### [Summary of the contributions]

* CATT in R1-2400452
	+ In TS38.331, each trigger state in CSI-AperiodicTriggerStateList is only associated with one LTM-CSI-ReportConfig Reporting Setting. However, in Section 5.2.1 of TS 38.214, multiple LTM-CSI-ReportConfig Reporting Settings could be associated with one trigger state. The description in these two specifications should be aligned.
		- For CQI, PMI, CRI, SSBRI, LI, RI, L1-RSRP, L1-SINR, CapabilityIndex, TDCP a UE is configured by higher layers with N≥1 *CSI-ReportConfig* Reporting Settings and/or [X≥1 *LTM-CSI-ReportConfig* Reporting Settings], M≥1 *CSI-ResourceConfig* Resource Settings and/or [Y≥1 *LTM-CSI-ResourceConfig* Resource Settings], and one or two list(s) of trigger states (given by the higher layer parameters *CSI-AperiodicTriggerStateList* and *CSI-SemiPersistentOnPUSCH-TriggerStateList*). Each trigger state in *CSI-AperiodicTriggerStateList* contains a list of associated *CSI-ReportConfigs* and, optionally, one associated *LTM-CSI-ReportConfig* indicating the Resource Set IDs for channel and optionally for interference where a Resource Set for interference can only be present for a Report Setting given by a *CSI-ReportConfig* and a trigger state additionally contains one or more [*csi-ReportSubConfigID*] if the associated *CSI-ReportConfig* configured with a list of sub-configurations, as described in Clause 5.2.1.1. Each trigger state in *CSI-SemiPersistentOnPUSCH-TriggerStateList* contains one associated *CSI-ReportConfig* [or *LTM-CSI-ReportConfig*], and a trigger state additionally contain one or more [csi-ReportSubConfigID] if the associated CSI-ReportConfig is configured with a list of sub-configurations, as described in Clause 5.2.1.1.

##### [FL observation]

FL thinks the current description in 5.2.1 of 38.214 is correct and aligned with the description in 38.331 below:

* *ltm-AssociatedReportConfigInfo*
	+ This field configures the aperiodic CSI reports of LTM candidate cells. If ltm-associatedReportConfigInfo is configured the UE shall ignore the field associatedReportConfigInfoList.

##### [Comments]

Companies are encouraged to provide their view on the proposal by CATT above, if any

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | Agree with FL assessment |
| CATT | Yes | In 38.331, ltm-associatedReportConfigInfo corresponds to a single *LTM-CSI-ReportConfig* not a list of multiple *LTM-CSI-ReportConfig*s.  |

### [Low] Typo correction

##### [Summary of the contributions]

* CATT
	+ - Typo correction: Change the italic type of different SSBRI in section 5.2.1.4.2 of 38.214 to the normal type.
			* if the UE is configured with [*spCellInclusion*], the UE shall report in a single reporting instance [*noOfReportedRS-PerCell]* different SSBRI for the current SpCell and each of the [*nOfReportedCells] -1* candidate cells.Otherwise, the UE shall report in a single reporting instance *[noOfReportedRS-PerCell]* different SSBRI for each of the *[noOfReportedCell]* candidate cells,

##### [FL observation]

FL thinks this typo can be corrected by the editor without any formal agreement.

##### [Comments]

Companies are encouraged to provide their view on the proposal by CATT above, if any

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Agree with FL assessment |
|  |  |

## Beam indication

### [High-MonOff3] Beam application time

Beam application time is an open issue for a couple of meetings. This issue has also discussed at RAN1#115, but not consensus was achieved due to the lack of clarity of the definition of cell switch time defined in RAN4. The conclusion at RAN1#115 is to comeback this issue after RAN4 finishes their work, even though the bar to introduce additional RRC parameter(s) will be high.

RAN4 definition of cell switch delay described in Huawei and ZTE contribution.

* From: the end of the last TTI containing the MAC-CE of cell switch command
* To: the time the UE transmits the first UL message on the target cell
	+ equals to + 3ms : MAC CE processing time and HARQ-ACK feedback delay
	+ TLTM-interrupt = TLTM-RRC-processing + TLTM-processing + Tfirst-RS + TRS-proc + TLTM-IU (ms)
		- is the time between the end of the last TTI containing the MAC-CE command for LTM cell switch until the time the UE transmits the first UL message on the target cell
		- TLTM-RRC-processing is the processing time for ASN.1 decoding and validity/compliance check for the RCC configuration,
		- TLTM-processing is the delay for UE to apply target cell parameters,
		- Tfirst-RS + TRS-proc is the delay for RS measurement to get fine time tracking
		- TLTM-IU is the interruption uncertainty on transmitting the first uplink transmission on the target cell, considering the allocated UL resource

##### [Summary of contributions]

* Huawei
	+ The UE applies the TCI-State and/or TCI-UL-State, if indicated by the MAC CE, from a first slot that is TLTM-RRC-processing + TLTM-processing + Tfirst-RS + TRS-proc +3 (ms) after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE. Adopt TP#4 in clause 21 of TS38.213.
		- A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is TLTM-RRC-processing + TLTM-processing + Tfirst-RS + TRS-proc +3 (ms)after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, where the components of TLTM-RRC-processing, TLTM-processing, Tfirst-RS and TRS-proc are define in clause 6.X.1.3 of [11, 38.133].*.* If the MAC CE triggers a PRACH transmission [11, TS 38.321], the UE applies the *TCI-State* for receptions on the candidate cell, and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell, that are after the completion of the random access procedure associated with the PRACH transmission on the candidate cell and before a new TCI state is indicated for the candidate cell.
* ZTE
	+ TCI state indicated in cell switch command is applied starting from a first slot that X ms after the last symbol of the PUCCH or PUSCH carrying the HARQ-ACK for the PDSCH which carries MAC-CE containing cell switch command with the beam indication for the target cell(s).
		- X is configured by [LTM-beamAppTime-r18] and candidate values of X can refer to LTM cell switch delay DLTM specified in Clause 6.3.1.2 of TS 38.133-i40.
* CATT
	+ The application time of the TCI state/TCI-UL-State in cell switch command can be defined similar to the beam application time specified for unified TCI framework in Section 5.1.5 of TS38.214
		- The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is beamAppTime-r17 after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, and is the SCS configuration for the carrier with the smallest SCS among the carrier(s) applying the beam indication.
* OPPO
	+ The time line of applying TCI state indicated in cell switch command is still TBD in current specification. In the section of 21 of TS 38.213, clarify that the UE applies the indicated TCI state from the first slot where the first DL or UL transmission in the target cell is scheduled
		- A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE where the first DL or UL in the candidate cell is scheduled*.*
* Nokia
	+ RAN1 does not need to introduce and define beam application time for the TCI indication given in the cell switch command. Adopt the text proposal from Appendix A.4 for clause 21 of 38.213 [3].
		- A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is cell switch delay defined in [6.3, 38.133] after ~~the last symbol of a PUCCH or PUSCH with HARQ-ACK information for~~ the PDSCH providing the MAC CE~~, and is the SCS configuration for the TBD~~*.* If the MAC CE triggers a PRACH transmission [11, TS 38.321], the UE applies the *TCI-State* for receptions on the candidate cell, and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell, that are after the completion of the random access procedure associated with the PRACH transmission on the candidate cell and before a new ~~~
* Samsung
	+ When the TCI state has been activated before, the cell switch command the beam application time is . When the TCI state is activated in the cell switch command. The beam activation time is determined by following RAN4 rules.
	+ The beam application time is independent of the sub-carrier spacing of the channel used for the cell switch command and of the channels or signals to which the beam indication is being applied.
* Ericsson
	+ the beam application and the cell switch are parallel procedures.
	+ Observation: RAN1 defines a beam application time.
		- The beam application time for LTM is configured by the NW based on UE capability
	+ The smallest value of the configurable beam application time for LTM that can be configured is .
	+ The TA is updated when the new beam is applied.
* Apple
	+ The beam application time for beam information indicated in CSC command is defined as after UE sends the HARQ-ACK information for the CSC MAC-CE.
* NTT DOCOMO
	+ No need to define beam application time in RAN1.
* Google
	+ Make SPEC change to reflect RAN4’s LS that TCI state indicated in LTM cell switch command is applied from a first slot after the cell switch delay.

##### [FL observation]

The proposals from companies can be categorized as follows from high level point of view:

* Option 1: Beam application time is a part of cell switch delay defined in RAN4:
	+ Option 1-1: Beam application time is not defined, or just refer to RAN4 specification: Nokia, DOCOMO
	+ Option 1-2: Capture PHY relevant parts from cell switch time: Huawei, (Google)
* Option 2: Beam application time is a parallel procedure and should be defined in RAN1
	+ Option 2-1: Fixed to . : Samsung, Apple
	+ Option 2-2: Configured by RRC: Ericsson ZTE

The companies’ views are equally split, so it is not easy find a good way forward. Meanwhile, the current spec includes TBD and hence it is obviously incomplete, and the resolution in this meeting is expected.

FL reading of RAN4 spec is that cell switch delay is mostly defined from UE perspective. Thus, the latency/delay from network side is not well considered. In other word, the assumption would be that the target cell is ready before the UE is ready to transmit UL signal. If so, there will be no need to introduce beam application time on top of cell switch delay. If other cases will happen, introduction of RRC configurability will be safer design. Otherwise, only cell switch delay will be sufficient.

With this analysis, FL sees the necessity of offline discussion for the better mutual understanding.

##### [FL Proposal 5.3.1-v1]

Firstly, discuss offline which option to take considering the benefit/drawback for each option given the RAN4 definition of cell switch delay:

* Option 1: Beam application time is a part of cell switch delay defined in RAN4:
	+ Option 1-1: Just refer to RAN4 specification: Nokia, DOCOMO
	+ Option 1-2: Capture PHY relevant parts from cell switch time: Huawei, (Google)
* Option 2: Beam application time is a parallel procedure and should be defined in RAN1
	+ Option 2-1: Fixed to . : Samsung, Apple
	+ Option 2-2: Configured by RRC: Ericsson ZTE

After the consensus on the option above, the next step discussion how to reflect the agreement into specification will be triggered.

##### [Comments to FL Proposal 5.3.1-v1]

|  |  |
| --- | --- |
| Company | Comments |
| CATT | We support Option 2. |
|  |  |
|  |  |

### [High-MonOn2] TCI states used after cell switch command

RAN2 agreement

* For RRC configured CFRA, UE selects from the RRC configured beams for CFRA (if above the RSRP threshold as in legacy); [No further spec impact]
* For CBRA, UE selects a beam based on RSRP and ignores indicated beam in CBRA. [No further spec impact]

RAN1 Agreement

* After RACH procedure until a new TCI state is indicated by the target cell, a UE follows the indicated TCI-state in the cell switch command at least for CFRA triggered by cell switch command.

The open issue is the TCI state used after RACH procedure.

##### [Summary of contributions]

* Spreadtrum
	+ After CFRA pre-configured in reconfigurationWithSync until a new TCI state is indicated by the target cell, a UE follows the indicated TCI-state in the cell switch command.
	+ After CBRA procedure until a new TCI state is indicated by the target cell, a UE follows the SSB identified during a recent RACH procedure.
* Huawei
	+ For CFRA-based LTM, UE should follow the indicated LTM TCI state to transmit PRACH and received RAR during CFRA procedure. The SSB index indicated in the CSC is only used to determine the RO. Adopt TP#6 in clause 8.1 and 21 of TS38.213.
		- A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, and is the SCS configuration for the TBD*.* If the MAC CE triggers a PRACH transmission [11, TS 38.321], the UE applies the *TCI-State* for receptions on the candidate cell, and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell before a new TCI state is indicated for the candidate cell. If UE performs RACH procedure configured by *ReconfigurationWithSync*, the UE applies the beam determined during the RACH procedure on the candidate cell after the completion of the RACH procedure and before a new TCI state is indicated for the candidate cell.
* Vivo
	+ For CFRA-based handover triggered by the network, to avoid ambiguity, SSB index field should be removed from the cell switch command, and CFRA resource could be determined by the root QCL source RS, i.e., SSB, of the indicated TCI state.
	+ When RRC-configured CFRA or CBRA is performed, after RACH procedure, UE always follows the QCL assumption determined within RACH procedure until a TCI state is configured/activated/indicated by the target cell, i.e. the indicated TCI-State/TCI-UL-State in the cell switch command is ignored.
* ZTE
	+ For the case that CFRA is triggered by cell switch command, both SSB index for CFRA and TCI state can be included in cell switch command, where
		- If SSB is configured as QCL source in indicated TCI state, SSB index for CFRA should be the same as that in indicated TCI state.
		- Otherwise, SSB index for CFRA should be the same as that associated with TRS in indicated TCI state.
* Nokia
	+ After RACH procedure until a new TCI state is indicated by the target cell, a UE follows the indicated TCI-state in the cell switch command also for CBRA triggered by cell switch command.
		- Note: No TP is required as the current text in clause 21 of 38.213 is generic in terms of the type of the RACH procedure triggered by cell switch command.
	+ Send an LS to RAN2 to clarify whether/how CFRA/CBRA is triggered in the scenarios when the TCI state information is not present in the TCI state field(s) of the cell switch command.
	+ Capture the UE procedure on applying the beam indication for RACH-less cell switching in clause 21 of 38.213. Adopt the text proposal from Appendix A.1 in clause 21 of TS 38.213 [3].
		- A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, and is the SCS configuration for the TBD*.* If the MAC CE triggers a RACH-less cell switching, the UE applies the *TCI-State* for receptions on the candidate cell and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell before a new TCI state is indicated for the candidate cell. If the MAC CE triggers a PRACH transmission [11, TS 38.321], the UE applies the *TCI-State* for receptions on the candidate cell, and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell, that are after the completion of the random access procedure associated with the PRACH transmission on the candidate cell and before a new TCI state is indicated for the candidate cell.
* Fujitsu
	+ For CBRA in the RACH-based LTM, after the RACH procedure until a new TCI state is applied,
		- if the SSB identified during the RACH procedure is the same as the SSB which is associated with the TCI state (including SSB which is the source of TRS) indicated in the cell switch command, the UE follows the TCI state indicated in the cell switch command,
		- otherwise, the UE follows the SSB identified during the RACH procedure.
* Ericsson
	+ After RACH procedure until a new TCI state is indicated by the target cell, a UE follows the indicated TCI-state in the LTM cell switch command.
* Apple
	+ After RACH procedure triggered by the cell switch command until a new TCI state is indicated by the target cell, a UE follows the SSB identified during the CBRA procedure.
* NTT DOCOMO
	+ When beam is indicated in cell switch command and UE needs to perform CBRA RACH-based handover after receiving cell switch command,
		- During RACH procedure, UE follows the SSB associated with the indicated TCI state in the cell switch command.
	+ After RACH procedure, UE follows the indicated TCI state in cell switch command until a new TCI state is indicated by the new serving cell.
	+ Adopt following TP for section 21 of TS 38.213.
		- A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, and is the SCS configuration for the TBD*.* If ~~the MAC CE triggers a PRACH transmission [11, TS 38.321]~~PRACH transmission on the candidate cell after the reportion of the MAC CE is performed, the UE applies the *TCI-State* for receptions on the candidate cell, and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell, that are after the completion of the random access procedure associated with the PRACH transmission on the candidate cell and before a new TCI state is indicated for the candidate cell.

##### [FL observation]

[Issue 1] For RACH-based LTM with CBRA, 3 options are proposed for the TCI states used after RACH procedure:

* Option 1: Use SSB identified during the RACH procedure
	+ SpreadTrum, Huawei, vivo, Apple
* Option 2: Use the TCI state indicated in the cell switch command
	+ Nokia, Ericsson, DOCOMO
* Option 3: Use the TCI state indicated in the cell switch command if the SSB identified during the RACH procedure is the same as SSB which is the source RS of the TCI state. Otherwise, use SSB identified during the RACH procedure.
	+ Fujitsu

For this issue, the situation has not been changed for a couple of meetings. FL suggestion is to take Option 1 or 2 on “multiple company support” basis. However, since this issue has been discussed for a couple of meetings, FL doesn’t think further offline discussion helps the progress.

[Issue 2] It is also pointed out by Nokia that TCI state used after cell switch command for RACH less LTM has not been captured in the specification. FL thinks the TP by Nokia is technically correct. This aspect can be resolved together when the TP is discussed.

[Issue 3] It is pointed out by Nokia, vivo, ZTE that the consistency between SSB index field and TCI state (i.e. QCL source) and their necessity. FL think they are error cases, and such cases can be avoided by a carefully handling by gNB. FL recommendation is to directly go to RAN2 for further discussion or take some offline discussion.

##### [FL Proposal 5.3.2-v1]

Choose Option 1 or 2 based on the majority view:

* After RACH procedure until a new TCI state is indicated by the target cell,
	+ Option 1: a UE follows the SSB identified during the CBRA procedure.
		- SpreadTrum, Huawei, vivo, Apple
	+ Option 2: a UE follows the indicated TCI-state in the LTM cell switch command.
		- Nokia, Ericsson, DOCOMO

TP (including the clarification for RACH-less case) will be prepared after the decision on the option to take.

##### [Comments to FL Proposal 5.3.2-v1]

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Note that the CFRA case is already agreed. It would be nice to have a unified solution.  |
| CATT | Support Option 2 |
|  |  |

### [High-MonOn1] Capturing the agreement on the relationship between LTM TCI states and serving cell TCI states

The following agreement was made at RAN1#115, but some companies pointed out that it has not been captured in the specification:

Agreement

* UE may expect that:
	+ For a candidate cell, the configuration of an LTM TCI state in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 is same as its counterpart in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the first active BWP in ServingCellConfig, at least in terms of TCI state ID, the corresponding qcl-Type1 and qcl-Type2 for the DL or joint TCI state or referenceSignal for the UL TCI state.
	+ The LTM TCI state(s) in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 of a candidate cell is a subset of serving cell TCI state(s) in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the same cell.

##### [Summary of contributions]

* SpreadTrum
	+ Send LS to RAN2 and request to capture the previous agreement of LTM TCI in the description of the parameters in 38.331.
* Panasonic
	+ RAN1 to inform RAN2 to capture the previous RAN1 agreement related to LTM TCI state configuration. If the action is not agreeable by RAN1, consider the following TP to 38.214.

##### [FL observation]

FL thinks it would be good to ask RAN2 to capture this agreement somewhere in their specification, e.g. 38.331. Thus, FL would like to suggest sending an LS to RAN2. Note that the discussion with RAN2 rapporteur has been finished (It is OK to capture this in 38.331, but trigger from RAN1 is necessary).

##### [FL Proposal 5.3.3-v1]

Send and LS to RAN2 with the following contents:

* RAN1 has made the following agreement at RAN1#115, but this agreement has not been captured in the RAN1 specifications:
* Agreement
	+ UE may expect that:
		- For a candidate cell, the configuration of an LTM TCI state in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 is same as its counterpart in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the first active BWP in ServingCellConfig, at least in terms of TCI state ID, the corresponding qcl-Type1 and qcl-Type2 for the DL or joint TCI state or referenceSignal for the UL TCI state.
		- The LTM TCI state(s) in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 of a candidate cell is a subset of serving cell TCI state(s) in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the same cell.
* RAN1 believes RAN2 specifications (i.e. TS38.331) is more appropriate to capture this agreement.
* RAN2 is respectfully asked to capture this agreement in their specifications.

##### [Comments to FL Proposal 5.3.3-v1]

Companies are encouraged to provide their views on the LS above.

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Not essential – there is no impact on RAN1 specs |
| CATT | Okay |
|  |  |

### [Low] Beam indication for multiple cells for CA

The RAN2 agreements are quoted below:

In RAN2#119e

|  |
| --- |
| * R2 assumption: Rel-18 L1/L2 mobility includes both non-CA (PCell only) and CA scenarios (PCell and SCell). This includes the following cases

a) the target PCell/target SCell(s) is not a current serving cell (CA 🡪 CA scenario with PCell change)b) FFS the target PCell is a current SCellc) FFS the target SCell is the current PCell. |

In RAN2#123

|  |
| --- |
| * Scell activation state is not in the LTM cell switch MAC CE, but only based on the RRC configuration
 |

Also in RAN1#115, the following conclusion was made:

No consensus to include simultaneousU-TCI-UpdateList under LTM-Candidate-r18 to activate and indicate TCI states for SCell(s) after cell switch command.

The intention of this conclusion is to solve the potential issues without RRC impact.

##### [Summary of contributions]

* Huawei
	+ If more than one CCs are configured in the same simultaneousU-TCI-UpdateList of CellGroupConfig for the target cell, UE activates and applies the indicated LTM TCI state on the SCells in the simultaneousU-TCI-UpdateList AFTER CSC without additional signalling. Adopt TP#2 in clause 21 of TS38.213.
* Samsung
	+ For multi-cell operation in LTM consider the following:
		- The list(s) of cells (same index) that follow the indicated TCI state for the serving cell also applies to the candidate cell.
		- The cell switch command can include a flag indicating whether to apply the indicated TCI state(s) in the cell switch command to the candidate Pcell only or to additional cells as determined by the configured list(s) of cells applying the indicated TCI state.
* Fujitsu
	+ When the cell switch command indicates a TCI state for a target cell, it also indicates the same TCI state for the Scells in the same simultaneousU-TCI-UpdateList.

##### [FL observation]

FL’s understanding is that RAN2 has already discussed and agreed not to introduce Scell activation state in cell switch command MAC CE. Thus, FL thinks that the introduction of new information in the MAC is not easy in maintenance phase.

On the other hand, FL wonders if some clarification to use *simultaneousU-TCI-UpdateList-r17* is necessary. The behaviour of Scell activation based on RRC configuration occurs after cell switch, and hence this may considered as a legacy behaviour. However, necessary clarification should be done in the spec to avoid the misunderstanding.

Given the large number of open issues, FL would like to suggest gathering companies view for the text proposal from Huawei (quoted below) in this meeting, aiming at the completing at the next meeting if necessary.

**21 L1/L2-triggered mobility procedures**

<omit unchanged part>

A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells, or on a set of cells in *simultaneousU-TCI-UpdateList-r17* of a candidate cell group, if configured, from the number of candidate cell groups. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, and is the SCS configuration for the TBD*.* If the MAC CE triggers a PRACH transmission [11, TS 38.321], the UE applies the *TCI-State* for receptions on the candidate cell, and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell, that are after the completion of the random access procedure associated with the PRACH transmission on the candidate cell and before a new TCI state is indicated for the candidate cell.

##### [Comments]

Companies are encouraged to provide their view on the proposed text proposal above if any

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | simultaneousU-TCI-UpdateList-r17 is only relevant for serving cell TCI states |
| CATT | No | According to the agreement of RAN1#115, beam indication for multiple cells should not be supported. |

### [Low] Clarification of pathloss RS for candidate cell(s)

It was agreed under RRC session that pathlossReferenceRS-Id-r18 is included in the LTM candidate TCI-state configuration.

##### [Summary of contributions]

* Huawei
	+ The pathlossReferenceRS-Id-r18 configured in LTM-Candidate-TCI-State-r18 or/and LTM-Candidate-TCI-UL-State-r18 can be used by UE to estimate downlink pathloss from candidate cell before cell switch. Total number of pathloss RS for candidate cells UE can be configured and measure before CSC should be specified. Adopt TP#5 in clause 21 of TS38.213.
		- A UE can be indicated, by *LTM-Config*, candidate cells and SS/PBCH blocks per candidate cell for the UE to obtain synchronization and measure corresponding L1-RSRPs [10, TS 38.133]. A MAC CE command can activate TCI states, provided by *LTM-Candidate-TCI-State-r18* or/and *LTM-Candidate-TCI-UL-State-r18*, associated with SS/PBCH blocks or TRS of corresponding candidate cells. The RS index for obtaining the candidate cell downlink pathloss estimate is provided by pathlossReferenceRS-Id-r18 in the *LTM-Candidate-TCI-State-r18* or/and *LTM-Candidate-TCI-UL-State-r18.* A UE does not expect to simultaneously maintain more than four pathloss estimates across all candidate cells.

##### [FL observation]

It is pointed out that the UE bahaviour on pathlossReferenceRS-Id-r18 has not captured. It is also proposed to have a restriction that *“A UE does not expect to simultaneously maintain more than four pathloss estimates across all candidate cells”*, which may need more discussion in RAN1.

Therefore, FL would like to suggest gathering the comments from companies first, aiming at the resolution at the next meeting, if necessary.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Huawei above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | 38.213 already includes A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells.This should be enough. The “max 4 PL RS” do not include the ones in the candidate TCI states. |
|  |  |  |

## [Void] Contents of Cell switch command

No issue was identified in this meeting

## TCI state activation

### [High-MonOff1] Deactivation of activated TCI states for LTM

Current design of MAC CE for candidate cell TCI states activation/deactivation in section 6.1.3.76 of 38.321 is as follows:

The Candidate Cell TCI States Activation/Deactivation MAC CE is identified by a MAC subheader with eLCID as specified in Table 6.2.1-1b. It has a variable size consisting of following fields:

- Candidate Cell ID: This field indicates the identity of an LTM candidate cell for which the MAC CE applies, corresponding to the *ltm-CandidateId* minus 1 as specified in TS 38.331 [5]. The length of the field is 3 bits;

- Pi: This field indicates whether each TCI codepoint has multiple TCI states or a single TCI state. If the Pi field is set to 1, the ith TCI codepoint includes the DL TCI state and the UL TCI state. If the Pi field is set to 0, the ith TCI codepoint includes only the DL/joint TCI state or the UL TCI state. The codepoint to which a TCI state is mapped is determined by its ordinal position among all the TCI state ID fields;

- D/U: This field indicates whether the TCI state ID in the same octet is for a joint/downlink or an uplink TCI state. If this field is set to 1, the TCI state ID in the same octet is for joint/downlink TCI state. If this field is set to 0, the TCI state ID in the same octet is for uplink TCI state;

- TCI state ID: This field indicates the TCI state identified by *TCI-StateId* in *ltm-DL-OrJointTCI-StateToAddModList* or *TCI-UL-StateId* in *ltm-UL-TCI-StatesToAddModList* as specified in TS 38.331 [5]. If D/U is set to 1, 7-bits length TCI state ID i.e. *TCI-StateId* as specified in TS 38.331 [5] is used. If D/U is set to 0, the most significant bit of TCI state ID is considered as the reserved bit and remaining 6 bits indicate the *TCI-UL-StateId* as specified in TS 38.331 [5]. The maximum number of activated TCI states is 16;

- R: Reserved bit, set to 0.



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

##### [Summary of contributions]

* Spreadtrum
	+ Not to pursue the mechanism to deactivate multiple candidate cells by a single MAC CE at maintenance phrase.
* Nokia
	+ Since the Candidate Cell TCI States Activation/Deactivation MAC CE can only activate TCI states of one candidate cell at a time, existing mechanism of deactivation, where the deactivation of a TCI state is implicit if the latest MAC CE providing the activation command does not include that activated TCI state, could not be used to deactivate TCI states for candidate cells not indicated in the MAC CE.
	+ Keep the UE tracking the timing of the TCI states of candidate cells which will not be selected as the target cell may cause the UE unnecessarily monitor TCI states that are no longer relevant for cell switch purposes.
	+ Send an LS to RAN2 to inform the issue on Deactivation of activated TCI states for LTM.
* Fujitsu
	+ There is no need to support (de)activating LTM TCI states for multiple candidate cells by a single MAC CE since the same (de)activating functionality can be already supported by the existing MAC CE structure as below.
		- One MAC PDU can include multiple MAC CEs and thus can (de)activate LTM TCI states for multiple candidate cells in one shot.
* Ericsson
	+ Send an LS to RAN2 asking them to update the Candidate Cell TCI States Activation/Deactivation MAC CE so that a single MAC CE contains all the TCI states for all candidate cells that shall be activated.
* Google
	+ Upon receiving TCI state activation for LTM, if the number of activated TCI state(s) in serving cell and activated TCI state(s) for candidate cell(s) is larger than UE capability, UE deactivates activated TCI states in serving cell.
		- FFS when to deactivate activated TCI state(s) in serving cell if the number of activated TCI state(s) in serving cell and activated TCI state(s) for candidate cell(s) is less than or equal to UE capability.

##### [FL observation]

Two companies showed their concern on the current MAC CE to activate/deactivate candidate cell TCI states. One company sees no problem on the current design, while one company thinks there will be no problem if the MAC CE in a MAC PDU is processed all together.

FL’s suggestion is to send an LS to RAN2, and leave the final decision on the necessity of spec change up to RAN2.

##### [FL Proposal 5.5.1-v1]

Send and LS to RAN2 with the following contents:

* According to the Candidate Cell TCI States Activation/Deactivation MAC CE specified in TS38.321, RAN1 understands that a single MAC CE can activate/deactivate TCI states for a candidate cell.
* RAN1 has a concern on this MAC CE design for, e.g., the following case:
	+ A UE is capable of 2 TCI states, and TCI state A-1 and A-2 for candidate cell A has been activated
	+ The gNB want to deactivate TCI state (A-1, A-2) and activate (B-1, B-2) for candidate cell B, then:
		- Two MAC CEs are sent to the UE: one is to deactivate TCI state (A-1, A-2), and the other is to activate TCI state (B-1, B-2) together in a single MAC PDU.
		- If the MAC CE to activate TCI state (B-1, B-2) is processed, the number of activated TCI states will exceed the UE capability. This interpretation comes from the understanding that a TCI state activation MAC CE for a candidate cell cannot deactivate the TCI states for other candidate cells, which is not the intended behaviour.
* RAN2 is respectfully asked to take this information into consideration, and update the design of MAC CE if the necessity is identified by RAN2.

##### [Comments to FL Proposal 5.5.1-v1]

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Support. Note that two MAC CEs in the same MAC PDU will not work, since the processing order of these MAC CEs is not specified. |
| CATT | Support |
|  |  |

### [High-MonOff2] UE behavior related to TRS provided under LTM-Candidate-r18

The following table is captured in the FL summary at RAN1#115.

|  |  |
| --- | --- |
| gNB behavior for TRS | UE behavior for candidate cell tracking |
| Provision of candidate cell TRS config. | Whether candidate cell TRS is transmitted before cell switch takes effect | UE capability | Before cell switch command | During cell switch command(until the completion of cell switch) | After cell switch (until receiving new MAC CE for TCI state activation) |
| Yes | Yes | Yes(UE can track TRS for candidate cell before cell switch) | Alt 1. Track TRSAlt 2. Track SSBAlt 3. Up to UE | Alt 1. Track TRSAlt 2. Track SSBAlt 3. Up to UE | Alt 1. Track TRSAlt 2. Track SSBAlt 3. Up to UE |
| No | Alt 1. Track TRS Alt 2. Track SSB(Q. How does the UE know that TRS is not transmitted) Alt 3. Up to UE(Q. How does the UE know that TRS is not transmitted) Alt 4. This operation is not allowed (i.e. UE can assume the presence of TRS if configured) | Alt 1. Track TRS (It should be clarified when the UE can assume the presence of TRS)Alt 2. Track SSB(Q. How does the UE know that TRS is not transmitted) Alt 3. Up to UE(Q. How does the UE know that TRS is not transmitted) Alt 4. This operation is not allowed (i.e. UE can assume the presence of TRS if configured) | Alt 1. Track TRS(It should be clarified when the UE can assume the presence of TRS)Alt 2. Track SSBAlt 3. Up to UE |
| No | Yes |  | Track SSB | Track SSB | Track SSB[Only DL scheduled by CSS (other than type 3 CSS) is allowed ??] |
| No |
| Yes | Yes | No | Alt 1. Track SSBAlt 2. This operation is not allowed (i.e. misconfiguration) | Alt 1. Track TRS (It should be clarified when the UE can assume the presence of TRS)Alt 2. Track SSBAlt 3. This operation is not allowed (i.e. misconfiguration) | Alt 1. Track TRS(It should be clarified when the UE can assume the presence of TRS)Alt 2. Track SSB[Only DL scheduled by CSS (other than type 3 CSS) is allowed ??]Alt 3. This operation is not allowed (i.e. misconfiguration) |
| No |
| No | Yes |  | Track SSB | Track SSB | Track SSB[Only DL scheduled by CSS (other than type 3 CSS) is allowed ??] |
| No |

Based on the table above and companies’ contributions, the following FL proposal was made at RAN1#115 (not discussed due to the lack of time).

* When TRS is configured for a LTM TCI state and it is activated, before the reception of cell switch command:
	+ Alt 1
		- A capable UE may expect the transmission of the TRS, and is required to track the TRS
		- An incapable UE is required to track the SSB, which is a QCL source of the TRS
	+ Alt 2
		- UE is required to track the SSB, which is a QCL source of the TRS, irrespective of the UE capability
		- This implies that TRS may not be transmitted before cell switch command
	+ Alt 3
		- UE may expect the transmission of the TRS
		- The UE behavior on which RS to use for tracking is up to UE implementation

##### [Summary of contributions]

* Spreadtrum
	+ Prior to and joint with the reception of L1/L2 CSC, UE can track SSB in Rel-18 LTM, with no restriction for TRS transmission or not.
	+ After cell switch, UE can track TRS with its presence assumption.
* Huawei
	+ For a UE reporting “TRS” or “both” in the component of “Supported QCL source RS in the LTM TCI-state configuration” for FG45-3(45-4) and 45-3a(45-4a), the UE could assume the TRS is transmitted and track it, after it receives the MAC-CE of Candidate Cell TCI States Activation/Deactivation.
	+ UE can be configured with LTM TCI state with QCL type A/D with TRS or QCL type C/D with SSB.
	+ For a UE only supporting SSB as QCL source RS of LTM TCI state and receiving LTM TCI state in CSC, before application of serving cell TCI states in the target cell, UE assumes the DMRS of PDCCH/PDSCH of the target cell is QCL with the indicated SSB with QCL type A/D, although QCL type C/D is indicated in the LTM TCI state. Adopt TP#1 in clause 21 of TS38.213.
* Lenovo
	+ Change TRS to CSI-RS for the LTM TCI state configuration for section 21 of 38.213
		- A UE can be indicated, by *LTM-Config*, candidate cells and SS/PBCH blocks per candidate cell for the UE to obtain synchronization and measure corresponding L1-RSRPs [10, TS 38.133]. A MAC CE command can activate TCI states, provided by *LTM-Candidate-TCI-State-r18* or/and *LTM-Candidate-TCI-UL-State-r18*, associated with SS/PBCH blocks or ~~TRS~~ CSI-RS, which is provided by higher layer parameter *ltm-nzp-CSI-RS-ResourceToAddModList-r18*
* Vivo
	+ For candidate cell(s) which is an active SCell or an active AdditionalPCI for ICBM, TRS tracking can be performed for the candidate cell(s) by activating TCI state(s) before the reception of cell switch command;
	+ Otherwise, only SSB tracking is performed for the candidate cell(s) before cell switch command is applied. After that, TRS tracking for the candidate cell(s) could be performed if the QCL source RS of the TCI state indicated in the cell switch command is TRS.
* ZTE
	+ If UE has a capability of supporting SSB as QCL source in a TCI state activated before receiving LTM Cell Switch Command MAC CE and/or indicated in receiving LTM Cell Switch Command MAC CE, .
		- UE only track SSB before and/or during cell switch command where a new QCL assumption for SSB and DMRS of PDSCH and PDCCH needs to be defined, i.e., SSB w.r.t QCL-TypeC + SSB w.r.t QCL-TypeD, if applicable
	+ If UE has a capability of supporting TRS as QCL source in a TCI state activated before receiving LTM Cell Switch Command MAC CE and/or indicated in receiving LTM Cell Switch Command MAC CE,
		- UE can perform tracking TRS before and during cell switch command where legacy QCL assumption on TRS for DMRS of PDSCH and PDCCH can be reused, i.e., TRS w.r.t QCL-TypeA and TRS w.r.t QCL-TypeD, if applicable, and CSI-RS resource for TRS is associated with a candidate cell.
* Fujitsu
	+ On the UE behavior on tracking RS, the following should be supported. Hereafter, "after the cell switch command” means “after the cell switch command until a legacy TCI state activation MAC CE is received”.
		- When the TRS configuration is provided in LTM-Candidate-r18,
			* if the UE has the capability to track TRS before/during the cell switch command,
				+ if activated with a TCI state of which the resource RS is TRS before the cell switch command, the UE should track TRS before/during and after the cell switch command,
				+ if activated with a TCI state of which the resource RS is SSB before the cell switch command, the UE should track SSB before/during and after the cell switch command.
			* if the UE does not have the capability to track TRS before/during the cell switch command,
				+ if activated with a TCI state of which the resource RS is TRS before the cell switch command, the UE should track SSB (which is the source of TRS) before/during the cell switch command, and track TRS after the cell switch command.
				+ if activated with a TCI state of which the resource RS is SSB before the cell switch command, the UE should track SSB before/during and after the cell switch command.
		- When the TRS configuration is not provided in LTM-Candidate-r18,
			* if the UE has the capability to track TRS before/during the cell switch command,
				+ if activated with a TCI state of which the resource RS is SSB before the cell switch command, the UE should track SSB before/during and after the cell switch command.
			* if the UE does not have the capability to track TRS before/during the cell switch command,
				+ if activated with a TCI state of which the resource RS is SSB before the cell switch command, the UE should track SSB before/during and after the cell switch command.
* Ericsson
	+ Do not extend the RAN1 specification to allow a candidate TCI state where a TCI state is used.
		- For example, there is no need to change the allowed QCL relations in section 5.1.5 in 38.214
		- In other words, the text in the last paragraph of clause 21 in 38.213 is sufficient:
* NTT DOCOMO
	+ New QCL rule needs to be introduced for configuration of SSB /TRS from candidate cell as resource RS for TCI state for PDCCH/PDSCH from RAN1 perspective.
		- Send LS to RAN4.
	+ When TRS from candidate cell is configured as resource RS for TCI state for PDCCH/PDSCH, its association with SSB from candidate cell is also configured.
	+ Adopt following TP for TS 38.214.

For the DM-RS of PDCCH, if the UE is configured with *dl-OrJointTCI-StateList,* the UE shall expect that an indicated *TCI-State* indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource, the reference RS may additionally be a CSI-RS having a PCI different from the PCI of the serving cell if *LTM-Config* is configured, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition.*

- 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block having a PCI different from the PCI of the serving cell, if *LTM-Config* is configured.

For the DM-RS of PDSCH, if the UE is configured with *dl-OrJointTCI-StateList,* the UE shall expect that an indicated *TCI-State* indicates one of the following quasi co-location type(s):

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with the same CSI-RS resource*,* the reference RS may additionally be a CSI-RS having a PCI different from the PCI of the serving cell if *LTM-Config* is configured, or

- 'typeA' with a CSI-RS resource in a *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *trs-Info* and, when applicable, 'typeD' with a CSI-RS resource in an *NZP-CSI-RS-ResourceSet* configured with higher layer parameter *repetition.*

* + - - 'typeC' with an SS/PBCH block and, when applicable, 'typeD' with the same SS/PBCH block having a PCI different from the PCI of the serving cell, if *LTM-Config* is configured.
	+ If UE does not support TRS tracking for candidate cells before cell switch, UE measures/tracks SSBs for candidate cells before cell switch command. After cell switch command, UE measures/tracks TRS for target cell if TRS is provided in the indicated TCI state.
	+ If UE supports TRS tracking for candidate cells before cell switch, UE measures/tracks TRS for candidate cells before cell switch command if TRS is provided in the activated TCI states.
* Google
	+ If a SSB is QCL source RS of TCI state for a LTM candidate cell, QCL-TypeC and QCL-TypeD are provided by the SSB.
* MediaTek
	+ For Rel-18 L1/L2 mobility, when SSB is configured in the TCI state indicated in cell switch command, the indicated TCI state applies to signals/channels that follow or are configured to follow Rel-17 unified TCI at the target cell(s) before a new TCI state for target cell is indicated.
	+ For Rel-18 L1/L2 mobility, when candidate cell TRS is configured in a TCI state and the TCI state is activated before reception of cell switch command, UE is not required to track the candidate cell TRS before cell switch

##### [FL observation]

3 issues are identified by companies’ contribution, and the majority preference is summarized as below.

* **Issue 1: Availability and the use of TRS before cell switch command**
	+ Alt.1-1: If a UE is capable of TRS tracking and the UE is configured with TRS, UE is required to track the TRS
	+ Alt.1-2: Irrespective of the UE capability and TRS configuration, UE is required to track SSB
	+ Alt.1-3: No further clarification in the specification: the consequence is “up to UE implementation”
* **Issue 2: Availability and the use of TRS after cell switch command and before a new TCI state is indicated at the target cell**
	+ Alt.2-1: If TRS is configured, UE is required to track the TRS irrespective of the UE capability for TRS. Otherwise, UE is required to track SSB, which is handled with the similar approach as in section 10.1 of 38.213, i.e.
		- *The UE may assume that the DM-RS antenna port associated with PDCCH receptions in the CORESET configured by pdcch-ConfigSIB1 in MIB, the DM-RS antenna port associated with corresponding PDSCH receptions, and the corresponding SS/PBCH block are quasi co-located with respect to average gain, quasi co-location 'typeA' and 'typeD' properties, when applicable [6, TS 38.214], if the UE is not provided a TCI state indicating quasi co-location information of the DM-RS antenna port for PDCCH reception in the CORESET.*
	+ Alt.2-2: If TRS is configured, UE is required to track the TRS irrespective of the UE capability for TRS. Otherwise, UE is required to track SSB, which QCL type is newly introduced in section 5.1.5 of 38.214 or section 21 of 38.213
		- SSB with QCL type C and D
* **Issue 3: RAN1 needs clarification between “no TRS is configured” and the agreement in RAN1#115 below**
	+ *UE may expect that:*
		- *For a candidate cell, the configuration of an LTM TCI state in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 is same as its counterpart in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the first active BWP in ServingCellConfig, at least in terms of TCI state ID, the corresponding qcl-Type1 and qcl-Type2 for the DL or joint TCI state or referenceSignal for the UL TCI state.*
		- *The LTM TCI state(s) in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 of a candidate cell is a subset of serving cell TCI state(s) in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the same cell.*

FL’s understanding is Alt.1-2 is aligned with our discussion so far, and Alt.2-2 will have less impact to the specification.

##### [FL Proposal 5.5.2-v1]

Discuss offline how to solve the following 3 issues:

* Issue 1: Availability and the use of TRS before cell switch command
	+ Alt.1-1: If a UE is capable of TRS tracking and the UE is configured with TRS, UE is required to track the TRS
	+ Alt.1-2: Irrespective of the UE capability and TRS configuration, UE is required to track SSB
	+ Alt.1-3: No further clarification in the specification: the consequence is “up to UE implementation”
* Issue 2: Availability and the use of TRS after cell switch command and before a new TCI state is indicated at the target cell
	+ Alt.2-1: If TRS is configured, UE is required to track the TRS irrespective of the UE capability for TRS. Otherwise, UE is required to track SSB, which is handled with the similar approach as in section 10.1 of 38.213, i.e.
		- *The UE may assume that the DM-RS antenna port associated with PDCCH receptions in the CORESET configured by pdcch-ConfigSIB1 in MIB, the DM-RS antenna port associated with corresponding PDSCH receptions, and the corresponding SS/PBCH block are quasi co-located with respect to average gain, quasi co-location 'typeA' and 'typeD' properties, when applicable [6, TS 38.214], if the UE is not provided a TCI state indicating quasi co-location information of the DM-RS antenna port for PDCCH reception in the CORESET.*
	+ Alt.2-2: If TRS is configured, UE is required to track the TRS irrespective of the UE capability for TRS. Otherwise, UE is required to track SSB, which QCL type is newly introduced in section 5.1.5 of 38.214 or section 21 of 38.213
		- SSB with QCL type C and D
* Issue 3: RAN1 needs clarification between “no TRS is configured” and the agreement in RAN1#115 below
	+ *UE may expect that:*
		- *For a candidate cell, the configuration of an LTM TCI state in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 is same as its counterpart in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the first active BWP in ServingCellConfig, at least in terms of TCI state ID, the corresponding qcl-Type1 and qcl-Type2 for the DL or joint TCI state or referenceSignal for the UL TCI state.*
		- *The LTM TCI state(s) in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 of a candidate cell is a subset of serving cell TCI state(s) in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the same cell.*

Note: TP will be prepared after the solution is decided

##### [Comments to FL Proposal 5.5.2-v1]

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Not essential. |
| CATT | Issue-1: support Alt 1-3Issue-2: support Alt 2-1 |
|  |  |

### [High-MonOn4] Retain or deactivate TCI states after cell switch

Before entering maintenance phase, the following options were discussed, but we were not able to reach consensus due to the lack of time.

After cell switch, for the activated LTM TCI states,

* Option 1: UE retains the activated LTM TCI states only for the target cell
* ~~Option 2: UE retains the activated LTM TCI states for all candidate cells other than target cell~~
* Option 3: UE retains the activated LTM TCI states for all candidate cells (may need RRC configuration / MAC CE to deactivate– FFS condition)
* Option 4: UE deactivates all activated LTM TCI states other than indicated TCI state
* ~~Option 5: configurable between 1, 2,3,4,5 depending on UE capability~~
	+ ~~Support:~~

##### [Summary of contributions]

* Spreadtrum
	+ For UE assumption on the active TCI states for LTM other than the indicated TCI state after the reception of the cell switch command, support either Option 1 or Option 4.
		- Option 1: UE retains the activated LTM TCI states only for the target cell
		- Option 4: UE deactivates all activated LTM TCI states other than indicated TCI state
* Huawei
	+ The serving cell TCI state(s) of target cell corresponding to the activated LTM TCI state(s) should be regarded activated automatically after cell switch.
	+ gNB can configure UE whether to retain activated LTM TCI states after CSC for the candidate cells other than the serving cell according to UE capability. Adopt TP#3 in clause 21 of TS38.213.
* vivo
	+ All TCI states other than the indicated TCI state in the cell switch command are deactivated when UE receives cell switch command (i.e., Alt-4) to reduce UE energy consumption.
* Nokia
	+ Upon the cell switch, for the target cell, UE may consider BM TCI states active which have the same configuration as the active LTM TCI states.
	+ Observation 1: When more than one LTM TCI states are activated before the cell switch and the UE starts keep tracking the DL synchronization with the activated LTM TCI states, such time-frequency tracking/path loss measurements information could be beneficial at least to minimize the HO interruption latency for subsequent LTM.
	+ After cell switch, for the activated LTM TCI states, the UE also retains the activated TCI states for the candidate cell(s) other than the target cell.
	+ Adopt the text proposals from Appendix A.2 for clause 21 of 38.213 [3] and from Appendix A.3 for clause 5.1.5 of 38.214 [4].
		- 38.213/ A UE can be indicated, by *LTM-Config*, candidate cells and SS/PBCH blocks per candidate cell for the UE to obtain synchronization and measure corresponding L1-RSRPs [10, TS 38.133]. A MAC CE command can activate TCI states, provided by *LTM-Candidate-TCI-State-r18* or/and *LTM-Candidate-TCI-UL-State-r18*, associated with SS/PBCH blocks or TRS of corresponding candidate cells. The activated TCI states of candidate cells are retained after UE receiving cell switch command […..]. The UE is provided configurations by *LTM-CSI-ReportConfigToAddModList* for reporting L1-RSRP measurements [6, TS 38.214] that include a number of candidate cells and a number of SS/PBCH blocks per candidate cell from the number of candidate cells.
		- 38214/ The UE receives an activation command, as described in clause 6.1.3.xx of [10, TS 38.321], 6.1.3.47 of [10, TS 38.321] or 6.1.4.xx of [10, TS 38.321], used to map up to 8 TCI states and/or pairs of TCI states, with one TCI state for DL channels/signals and/or one TCI state for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, [and/] or up to 8 sets of TCI states, where each set is comprised of up to two TCI state(s) for DL and UL signals/channels, or up to two TCI state(s) for DL channels/signals and up to two TCI state(s) for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, and if applicable, for one or for a set of CCs/UL BWPs. When a set of TCI state IDs are activated for a set of CCs/DL BWPs and if applicable, for a set of CCs/UL BWPs, where the applicable list of CCs is determined by the indicated CC in the activation command, the same set of TCI state IDs are applied for all DL and/or UL BWPs in the indicated CCs. If the activation command maps *TCI-State(s)* and/or *TCI-UL-State(s)* to only one TCI codepoint, the UE shall apply the indicated *TCI-State(s)* and/or *TCI-UL-State(s)* to one or to a set of CCs /DL BWPs, and if applicable, to one or to a set of CCs /UL BWPs once the indicated mapping for the one single TCI codepoint is applied as described in [11, TS 38.133]. The UE can receive an activation command, as described in clause 6.1.3.76 of [10, TS 38.321], prior to LTM cell switch command, activating up to 8 TCI states or pairs of TCI states for a candidate cell. After the LTM cell switch to the target serving cell, the UE applies the activated TCI state ID(s) in the activation command as activated TCI state ID(s) for the DL BWP and if applicable, for a UL BWP of the serving cell corresponding to the candidate cell identifier in the cell switch command.
* Fujitsu
	+ On how to handle the activated LTM TCI states after the cell switch command, it is preferred that the UE retains the activated LTM TCI states only for the target cell due to
		- not much additional UE complexity, and
		- benefit on fast beam switching after the cell switch.
* Ericsson
	+ The candidate TCI states remain activated until explicitly deactivated. This is the same paradigm as for serving cell TCI states and may simplify subsequent LTM execution.
	+ All candidate TCI states except the indicated TCI states are deactivated once the LTM cell-switch command is received. This would remove the need for the UE to track candidate TCI states during parts of the connection. However, the peak complexity would not be reduced: once the candidate TCI states are pre-activated, the UE would have to track them.
		- From our point of view, either of the above solution is acceptable. Solutions where a subset of the pre-activated are kept are not relevant.
* NTT DOCOMO
	+ After the reception of cell switch command, subject to UE capability, UE can be configured to retain all the active TCI states for all candidate cells; otherwise, UE deactivates the active TCI states for candidate cells other than the indicated TCI state.
		- Send an LS to RAN2.
* MediaTek
	+ For Rel-18 L1/L2 mobility, UE deactivates all active LTM TCI states other than the indicated TCI state in a cell switch command after the reception of the cell switch command.
* OPPO
	+ The system can use MAC CE to activate some TCI states of candidate cell, but the current specification does not specify how and when to deactivate the activated TCI states of candidate cell. The consequence is when one TCI state of candidate cell is activated, it will be in activated status for ever. In the section of 21 of TS 38.213, specify that some activated TCI states of candidate cell are deactivated after a LTM cell switch command is applied
		- A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, and is the SCS configuration for the TBD*.* If the MAC CE triggers a PRACH transmission [11, TS 38.321], the UE applies the *TCI-State* for receptions on the candidate cell, and applies a spatial domain filter corresponding to the *TCI-State* or the *TCI-UL-State* for transmissions on the candidate cell, that are after the completion of the random access procedure associated with the PRACH transmission on the candidate cell and before a new TCI state is indicated for the candidate cell. When the UE receives the MAC CE, the UE can assume all the activated TCI states of corresponding candidate cells, other than the TCI state(s) indicated in the MAC CE, are deactivated.

##### [FL observation]

Firstly, FL doesn’t think it is appropriate to introduce additional UE capability and/or RRC signaling for this purpose as RAN2 has already entered the maintenance phase. Thus, FL believes that what RAN1 should do is to define a default behaviour only. Also, since the situation hasn’t been changed from the previous meeting, FL doesn’t think further offline discussion helps the progress.

##### [FL Proposal 5.5.3-v1]

Choose one option from the following based on show-of-hands without any offline session

* Option 1: UE retains the activated LTM TCI states only for the target cell
* Option 3: UE retains the activated LTM TCI states for all candidate cells
* Option 4: UE deactivates all activated LTM TCI states other than indicated TCI state
* Note: for each option, no RRC configurability and no UE capability signaling is introduced, i.e. only a single default behaviour should be defined.

If we failed to agree on the option above, we can just go with “no consensus”, which means:

* Retention or deactivation of the activated candidate cell TCI states after reception of cell switch command is up to UE implementation
* This implies gNB cannot make any assumption, and hence gNB has to activate the necessary candidate cell TCI states.

##### [Comments to FL Proposal 5.5.3-v1]

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | After further consideration, our understanding is that without consensus, all activated LTM TCI states remain activated. There is a dedicated procedure to activate/deactivate, and the specification does not allow the UE to deactivate.Having said that, we are OK with either option 3 or 4. |
| CATT | Support Option 1 |
|  |  |

### [Low] DL synchronization after TCI state activation

##### [Summary of contributions]

* Nokia
	+ Upon the reception of a TCI activation, UE is expected to perform and maintain DL synchronization using the reference signal(s) given in QCL-Info of the activated TCI state [5.1.5, 38.214]. Adopt the text proposal from Appendix A.5 for clause 21 of 38.213 [3].
		- A UE can be indicated, by *LTM-Config*, candidate cells and SS/PBCH blocks per candidate cell for the UE to obtain synchronization and measure corresponding L1-RSRPs [10, TS 38.133]. A MAC CE command can activate TCI states, provided by *LTM-Candidate-TCI-State-r18* or/and *LTM-Candidate-TCI-UL-State-r18*, associated with SS/PBCH blocks or TRS of corresponding candidate cells. The UE performs and maintains DL synchronization using the reference signal(s) given in QCL-Info of the activated TCI states [5.1.5, 38.214]. The UE is provided configurations by *LTM-CSI-ReportConfigToAddModList* for reporting L1-RSRP measurements [6, TS 38.214] that include a number of candidate cells and a number of SS/PBCH blocks per candidate cell from the number of candidate cells.

##### [FL observation]

According to the recollection of FL, there is no clear understanding on what is “DL synchronization” from RAN1 specification point of view. Even though it is true that the UE need to keep the DL synchronization, it is not clear for RAN1 whether/how to capture this aspect to the specification.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Nokia above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | This is implicitly captured in RAN4 specs (short delay if the TCI state is pre-activated)  |
| CATT | No |  |

## TA issues

### [Low] Contradiction between RAN1 and RAN2 agreement for collision handling

RAN2#123 agreement

* It is up to UE implementation to handle the RACH initiation collisions where the early RACH is getting involved. No specification change can be foreseen.

RAN1 Agreement

* When the UE does not support simultaneous/parallel transmissions of PRACH in candidate cell and UL channels and signals in serving cell, support serving cell UL TX is dropped.

##### [Summary of contributions]

* Nokia
	+ The RAN2 agreement is not aligned with the RAN1’s agreement:
	+ **It is up to UE implementation to handle the RACH initiation collisions where the early RACH is getting involved. The following RAN1 agreement applies to other types of UL transmissions.**
		- When the UE does not support simultaneous/parallel transmissions of PRACH in candidate cell and UL channels and signals in serving cell, support
			* serving cell UL TX is dropped.
	+ **Adopt the text proposal from Appendix A.8 clause 21 of TS 38.213 [3].**
		- A UE can be provided configurations, by *EarlyUlSyncConfig*, for PRACH transmission parameters for each of the candidate cells. The UE can be triggered a PRACH transmission on a candidate cell by a PDCCH order that the UE receives on a serving cell and includes an indication of the candidate cell for the PRACH transmission [4, TS 38.212]. If the serving cell and the candidate cell operate in a same frequency range and the UE would have transmissions that overlap in time, or when a gap between a first or last symbol of a PRACH transmission to the candidate cell is less than 𝑁 symbols from a last or first symbol, respectively, of an UL transmission to the serving cell, where is defined in Clause 8.1, the UE
			* drops the transmissions on the serving cell when the UE does not support transmissions that overlap in time or are separated by less than the gap on the serving cell and the candidate cell and the UL transmission to the serving cell is other than a RACH Msg 1, Msg A, or Msg 3 transmission.

##### [FL observation]

The proposal by Nokia addresses the contradiction. Companies’ inputs are welcome to make the final decision.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Nokia above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | Yes | Clarification is OK.  |
| CATT | Yes | It’ better to make the clarification. |

### [Low] Collection on prioritizations for transmission power reductions

##### [Summary of contributions]

* Nokia
	+ the main description (as highlighted) only mentions the “transmissions on serving cells” and does not include a “transmission on a candidate cell”. Therefore, the text should be updated to capture the transmission towards a candidate cell.
	+ **Capture the transmission on a candidate cell in clause 7.5 of 38.213. Adopt the text proposal from Appendix A.9 clause 7.5 of TS 38.213 [3].**
		- For single cell operation with two uplink carriers or for operation with carrier aggregation or for operation with L1/L2-triggered mobility procedures, if a total UE transmit power for PUSCH or PUCCH or PRACH or SRS transmissions on serving cells and if applicable, on a candidate cell [clause 21], in a frequency range in a respective transmission occasion 𝑖 would exceed 𝑃̂CMAX(𝑖), where 𝑃̂CMAX(𝑖) is the linear value of 𝑃CMAX(𝑖) in transmission occasion 𝑖 as defined in [8-1, TS 38.101-1] for FR1 and [8-2, TS 38.101-2] for FR2, the UE allocates power to PUSCH/PUCCH/PRACH/SRS transmissions according to the following priority order (in descending order) so that the total UE transmit power for transmissions on serving cells and if applicable, on a candidate cell [clause 21], in the frequency range is smaller than or equal to 𝑃̂CMAX(𝑖) for that frequency range in every symbol of transmission occasion 𝑖. If the UE transmits SRS on multiple SRS resources according the *XYZ* [6, TS 38.214], the UE allocates power so that all REs of the SRS transmission have same power.
		- For the purpose of power allocation in this clause, if a UE is provided *uci-MuxWithDiffPrio* and the UE multiplexes HARQ-ACK information in a PUSCH, a priority index of the PUSCH is the larger of (a) the priority index of the PUSCH according to clause 9 and (b) the larger priority index of the HARQ-ACK information. When determining a total transmit power for serving cells and if applicable, on a candidate cell [clause 21], in a frequency range in a symbol of transmission occasion 𝑖, the UE does not include power for transmissions starting after the symbol of transmission occasion 𝑖. The total UE transmit power in a symbol of a slot is defined as the sum of the linear values of UE transmit powers for PUSCH, PUCCH, PRACH, and SRS in the symbol of the slot.

##### [FL observation]

The proposal by Nokia addresses is good to clarify the sentence is applicable to a candidate cell. Companies’ inputs are welcome to make the final decision.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Nokia above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | Yes |  |
| CATT | Yes |  |

### [Low] Support of PDCCH ordered based RACH for CBRA

##### [Summary of contributions]

* Lenovo
	+ Add description on the restriction that only CFRA PRACH is supported for PDCCH-order based RACH for TA measurement for candidate cells in section 21 of 38.213
		- A UE can be provided configurations, by *EarlyUlSyncConfig*, for PRACH transmission parameters for each of the candidate cells. The UE can be triggered a PRACH transmission on a candidate cell by a PDCCH order that the UE receives on a serving cell and includes an indication of the candidate cell for the PRACH transmission [4, TS 38.212]. If the indication of the candidate cell for the PRACH transmission triggered by the PDCCH order indicates a candidate cell, the SSB index field in the PDCCH order [4, TS 38.212] is not zero.

##### [FL observation]

FL thinks this agreement has been captured in section 5.1.1 of 38.321 as below.

**5.1.1 Random Access procedure initialization**

The Random Access procedure described in this clause is initiated by a PDCCH order, by the MAC entity itself, or by RRC for the events in accordance with TS 38.300 [2]. There is only one Random Access procedure ongoing at any point in time in a MAC entity. The Random Access procedure on an SCell or an LTM candidate cell shall only be initiated by a PDCCH order with *ra-PreambleIndex* different from 0b000000.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Lenovo above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | 321 seems sufficient |
| CATT | No | Agree with FL’s assessment |

### [Low] Definition of T\_BWPswitchDelay

##### [Summary of contributions]

* Langbo
	+ Use instead of to compute the processing delay between PDCCH order and PRACH transmission and clarify is defined as a time duration of slots in Section 8.1 in TS 38.213.
		- PDCCH order reception and the first symbol of the PRACH transmission is larger than or equal to msec, where
			* is a time duration of symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] assuming corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission
			* if the active UL BWP does not change, or if a cell indicator field in the PDCCH order indicates a non-serving cell [5, TS 38.212], and is a time duration of slots defined in [10, TS 38.133] otherwise

##### [FL observation]

The proposal looks OK. Double check by the companies is highly appreciated.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Langbo above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | Yes |  |
| CATT | Yes |  |

### [Low] Provision of TA offset before cell switch

##### [Summary of contributions]

* Fujitsu
	+ Observation
		- The UE performs the TA measurement for candidate cell(s) after configured by RRC and the exact time when the UE performs the TA measurement is up to the UE implementation (RAN2 assumption).
		- The TA offset for the UE-based TA acquisition before the cell switch is not provided to the UE and thus the UE-based TA acquisition is not possible
	+ Proposal
		- RAN1 should agree that the TA offset information for candidate cell(s), which can be used for the UE-based TA acquisition before the cell switch, is provided to the UE.
		- A specific TA offset can be configured for the UE-based TA acquisition on the candidate cell(s) before the cell switch.
		- To determine the uplink timing for the target cell after the cell switch, the TA offset in the serving cell configuration of the target cell is used for the UE-based TA acquisition.

##### [FL observation]

Before going to he proposal from Fujitsu, it should be confirmed if their observation is the group’s common understanding: UE should be able to acquire TA before cell switch command. After that, the solution can be discussed.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Fujitsu above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | The issue can be avoided by NW implementation.  |
|  |  |  |

### [Low] Switching between UE-based and RACH-based TA acquisition

##### [Summary of contributions]

* NTT DOCOMO
	+ For UE-based TA measurement, it is beneficial to focus on the synchronized case between current serving cell and candidate cells.
	+ It is beneficial to consider NW triggers UE-based TA measurement by a signal including related information (e.g., candidate cell ID).
	+ UE-based TA measurement for indicated candidate cells is triggered by MAC CE for TCI state activation for candidate cells.
	+ UE-based TA measurement for indicated target cell is triggered by cell switch command MAC CE, if not triggered by MAC CE for TCI state activation for candidate cells.
	+ Adopt the following TP for section 21 in TS 38.213.
		- If *ltm-UE-MeasuredTA-ID* of a candidate cell and *ltm-UE-MeasuredTA-ID* of the serving cell are provided to a UE and have same value, the UE can be triggered estimation of a timing advance for candidate cell(s) by TCI state activation MAC CE or cell switch command MAC CE ~~estimates based on the UE implementation a timing advance~~ to apply from a first transmission on the candidate cell that is after the reception of a cell switch command for the candidate cell [11, TS 38.321].
	+ If ueMeasuredTA is provided, RACH-less LTM is always performed for target cell.
* Samsung
	+ For the same candidate cell, a UE can be configured with both UE-based TA acquisition and RACH resource for TA acquisition
		- If a TA value is indicated by the cell switching command, the UE shall apply the indicated TA value rather than the TA value determined by the UE for the candidate cell;
		- Otherwise, the UE shall apply their determined TA value for the candidate cell.

##### [FL view]

Both companies proposed to introduce switching mechanism between UE-based and RACH-based TA acquisition. Since this looks an introduction of a new functionality, the essentiality of this mechanism is carefully assessed.

##### [Comments]

Companies are encouraged to provide their view on the proposal by NTT DOCOMO and Samsung above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | This is clear from the procedural text in 38.321: section 5.18.35  |
|  |  |  |

### [Low] Collision handling between candidate cell PRACH and serving cell(s)

##### [Summary of contributions]

21 L1/L2-triggered mobility procedures

**<** omitted **>**

A UE can be provided configurations, by *EarlyUlSyncConfig*, for PRACH transmission parameters for each of the candidate cells. The UE can be triggered a PRACH transmission on a candidate cell by a PDCCH order that the UE receives on a serving cell and includes an indication of the candidate cell for the PRACH transmission [4, TS 38.212]. If the serving cell and the candidate cell operate in a same frequency range and the UE would have transmissions that overlap in time, or when a gap between a first or last symbol of a PRACH transmission to the candidate cell is less than 𝑁 symbols from a last or first symbol, respectively, of an UL transmission to the serving cell, where is defined in Clause 8.1, the UE

- drops the transmissions on the serving cell when the UE does not support transmissions that overlap in time or are separated by less than the gap on the serving cell and the candidate cell

- prioritizes power allocation to the PRACH transmission on the candidate cell in clause 7.5 when the UE supports transmissions that overlap in time or are separated by less than the gap, and a total UE transmit power in the frequency range would exceed

* ASUS
	+ According to section 21 in TS 38.213, it’s not clear whether UL transmission on another serving cell, that is different than “the serving cell”, in same frequency range would be dropped due to the PRACH transmission.
		- For intra-band carrier aggregation, when the UE does not support simultaneous/parallel transmissions of PRACH in candidate cell and UL transmissions on serving cell, RAN1 down-select one of following option:
		- Opt1: UE drops UL transmission on serving cell only, in same frequency range as candidate cell, that the UE receives PDCCH order triggering PRACH.
		- Opt2: UE drops UL transmission(s) on serving cell(s), in same frequency range as candidate cell. (i.e., including serving cell(s) where the UE does not receive PDCCH order triggering PRACH)

##### [FL observation]

As long as FL checked the agreement in the past, the intention is not “a serving cell carrying PDCCH order” but “serving cells in general”. Thus, FL believes Option 2 is the correct interpretation. However, the specification looks as if Option 1 above is the intention. In this sense, FL thinks option 2 is reasonable and TP would be nice to have to avoid the misunderstanding.

##### [Comments]

Companies are encouraged to provide their view on the proposal by ASUS above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | Agree with FL assessment |
| CATT | No | Agree with FL |

### [Low] Capturing CFRA triggered by cell switch command MAC CE

##### [Summary of the contributions]

* Huawei
	+ When CBRA or CFRA configured by NW is performed after CSC, UE follows the SSB identified during a recent RACH procedure during and after the RACH procedure until a new TCI state is indicated by target cell. Adopt TP#6 in clause 8.1 and 21 of TS38.213.
		- For a PRACH transmission by a UE triggered by a PDCCH order or by a MAC-CE [11, TS 38.321], the PRACH mask index field, if the value of the random access preamble index field is not zero, indicates the PRACH occasion for the PRACH transmission where the PRACH occasions are associated with the SS/PBCH block index indicated by the SS/PBCH block index field of the PDCCH order or the MAC-CE and,
* Google
	+ propose to capture the CFRA triggered by LTM CSC MAC-CE as below in section 8.1 of 38.213. Otherwise, it is ambiguous since it is difficult to connect PDCCH order with LTM CSC command
		- For a PRACH transmission by a UE triggered by a PDCCH order or a LTM Cell Switch Command MAC CE, the PRACH mask index field, if the value of the random access preamble index field is not zero, indicates the PRACH occasion for the PRACH transmission where the PRACH occasions are associated with the SS/PBCH block index indicated by the SS/PBCH block index field of the PDCCH order or the LTM Cell Switch Command MAC CE and, if any, a cell indicator field indicates a cell for the PRACH transmission [5, TS 38.212].

##### [FL observation]

FL thinks the proposal is correct and reasonable.

##### [Comments]

Companies are encouraged to provide their view on the proposal from Huawei and Google.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | Yes |  |
| CATT | Yes |  |

### [Low] Number of bits for cell indicator in PDCCH order

##### [Summary of the contributions]

* ASUS
	+ According to section 5.3.5.18.1 in TS 38.331, UE operating in NR-DC may receive two independent ltm-Config, and the UE could be configured up to 16 LTM-Candidate with EarlyUL-SyncConfig.
	+ Proposal 2: Regarding size determination of Cell indicator field in DCI format 1\_0, RAN1 to clarify whether PDCCH order indicating a candidate cell supports cross-CG indication or not. If not supported, text proposal 3 is proposed to apply
		- Cell indicator - bits indicating the cell for the corresponding PRACH transmission if the UE is configured with higher layer parameter *EarlyUlSyncConfig*, where *C* is the number of candidate cells configured with higher layer parameter *EarlyUlSyncConfig* and associated with same serving cell group as the serving cell for receiving DCI format 1\_0; 0 bit otherwise. The bit field index 0 of the cell indicator field is mapped to the serving cell, and other bit field indexes are mapped to the candidate cells configured with higher layer parameter *EarlyUlSyncConfig* according to an ascending order of a candidate identity configured by *ltm-CandidateId*, with the bit field index 1 mapped to the candidate cell with the smallest candidate identity.

##### [FL observation]

The current description cannot read as cross-CG indication is possible as the green part in the specification above refers to a single *EarlyUlSincConfig.* Thus from FL point of view, the intention look clear without this proposal.

##### [Comments]

Companies are encouraged to provide their view on the proposal by ASUS above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | No | Agree with FL observation. In our understanding, all the text in 38.212 refer to the same CG |
|  |  |  |

### [Low] UL/SUL indicator field for candidate cell RACH

##### [Summary of the contributions]

* Google
	+ Endorse the following TP for supporting SUL for early TA acquisition for LTM in section 8.1 of 38.212
		- UL/SUL indicator – 1 bit. If the Cell indicator field is absent or the Cell indicator field indicates serving cell, if the value of the "Random Access Preamble index" is not all zeros and if the UE is configured with *supplementaryUplink* in *ServingCellConfig* in the cell, this field indicates which UL carrier in the cell to transmit the PRACH according to Table 7.3.1.1.1-1; If the Cell indicator field indicates a candidate cell, if the value of the "Random Access Preamble index" is not all zeros and if the UE is configured with *ltm-EarlyUL-SyncConfigSUL* in *LTM-Candidate* for the candidate cell, this field indicates which UL carrier in the cell to transmit the PRACH according to Table 7.3.1.1.1-1; otherwise, this field is reserved

##### [FL observation]

The use of UL/SUL indicator field for PDCCH-ordered candidate cell RACH is not clear yet. FL suggestion is to collect companies’ view in this meeting, aiming at the resolution at the next meeting.

##### [Comments]

Companies are encouraged to provide their view on the proposal by Google above.

|  |  |  |
| --- | --- | --- |
| Company | Essential correction or not(Yes or No) | Comment |
| Ericsson | Yes | Seems reasonable |
| CATT | Yes |  |

## LS

### [Paused] LS to RAN2,3 and 4

Void at this moment

## Other issues

FL think the following proposal have already covered by the discussion in the past, and hence no strong necessity is foreseen in this meeting.

Samsung

* Proposal 1: Activation of LTM TCI states on candidate cells doesn’t impact activated TCI states of the serving cell.
* Proposal 2: After indicating one or a pair of TCI state, from the LTM TCI state pool of the target cell, in the cell switch command, the activated TCI states of the serving cell can be deactivated.
* Proposal 3: After the cell switch command, the activated LTM TCI states of the candidate cell (the new serving cell) become the activated TCI states of the new serving cell and can be indicated to the UE until a new subset of TCI states is activated.
* Proposal 4: After the cell switch command and after a MAC CE activating TCI states on the new serving cell, the activated LTM TCI states become deactivated.

MTK

* For Rel-18 L1/L2 mobility, after receiving cell switch command, UE uses the LTM TCI state provided in the cell switch command until a TCI state in the target cell is indicated based on legacy beam management.

Samsung

* Rel-18 LTM and Rel-17 ICBM can operate together. A UE first uses a beam of the target cell, before switching to the target cell.
* If the QCL source RS of TCI state(s) indicated to the UE before cell switch and the QCL source RS of TCI state(s) in the cell switch command are the same, the UE maintains the same beam after cell switch.
* A UE can be configured by RRC a number of candidate cells on which the UE-based TA acquisition should be performed.

# Annex

# WID in RP-222332

The detailed objective of this work item is captured below:

1. To specify mechanism and procedures of L1/L2 based inter-cell mobility for mobility latency reduction:
* Configuration and maintenance for multiple candidate cells to allow fast application of configurations for candidate cells [RAN2, RAN3]
* Dynamic switch mechanism among candidate serving cells (including SpCell and SCell) for the potential applicable scenarios based on L1/L2 signalling [RAN2, RAN1]
* L1 enhancements for inter-cell beam management, including L1 measurement and reporting, and beam indication [RAN1, RAN2]
	+ *Note 1: Early RAN2 involvement is necessary, including the possibility of further clarifying the interaction between this bullet with the previous bullet*
* Timing Advance management [RAN1, RAN2]
* CU-DU interface signaling to support L1/L2 mobility, if needed [RAN3]

*Note 2: FR2 specific enhancements are not precluded, if any.*

*Note 3: The procedure of L1/L2 based inter-cell mobility are applicable to the following scenarios:*

* + - *Standalone, CA and NR-DC case with serving cell change within one CG*
		- *Intra-DU case and intra-CU inter-DU case (applicable for Standalone and CA: no new RAN interfaces are expected)*
		- *Both intra-frequency and inter-frequency*
		- *Both FR1 and FR2*
		- *Source and target cells may be synchronized or non-synchronized*
1. To specify mechanism and procedures of NR-DC with selective activation of the cell groups (at least for SCG) via L3 enhancements:
* To allow subsequent cell group change after changing CG without reconfiguration and re-initiation of CPC/CPA [RAN2, RAN3, RAN4]

*Note 4: A harmonized* RRC modelling approach for objectives 1 and 2 could be considered to minimize the workload in RAN2.

1. To specify data forwarding optimizations for CHO including target MCG and target SCG in NR-DC [RAN3].
2. To specify CHO including target MCG and candidate SCGs for CPC/CPA in NR-DC [RAN3, RAN2]
* CHO including target MCG and target SCG is used as the baseline
1. To specify RRM core requirements for the following, as necessary [RAN4]:
* L1/L2-based inter-cell mobility
* Enhanced CHO configurations addressed by this WI
1. To specify RF requirements to cover inter-frequency L1/L2-based mobility, as necessary [RAN4].
2. To study the following, with completion targeted by RAN#98 meeting [RAN4]:
* The impact of FR2 RRM mobility measurement acquisition and reporting on FR2 SCell/SCG setup/resume delay for a UE connecting from idle/inactive mode.
* The level of feasible improvement in FR2 SCell/SCG setup delay from defining new UE measurement procedures and RRM core requirements, and whether additional information from the network would help the UE to perform those measurements effectively. The following sequence of events should be assumed.
	+ - The UE initiates and performs improved measurements when it requests RRC connection setup/resume.
		- After acquiring those improved measurements, the UE subsequently reports those measurements to the network to support SCell/SCG setup.

# Agreements at RAN1#115

* UE may expect that:
* For a candidate cell, the configuration of an LTM TCI state in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 is same as its counterpart in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the first active BWP in ServingCellConfig, at least in terms of TCI state ID, the corresponding qcl-Type1 and qcl-Type2 for the DL or joint TCI state or referenceSignal for the UL TCI state.
* The LTM TCI state(s) in ltm-DL-OrJointTCI-StateToAddModList-r18 and ltm-ul-TCI-ToAddModList-r18 of a candidate cell is a subset of serving cell TCI state(s) in dl-OrJointTCI-StateList-r17 and ul-TCI-ToAddModList-r17 of the same cell.

Agreement

* Send an LS to RAN2 to inform the issue on MAC CE to activate/deactivate semi-persistent PUCCH report
* With an independent configuration of LTM CSI reporting which RAN2 has agreed, it is not clear how the activation/deactivation of semi-persistent PUCCH report for LTM CSI reporting can be supported.
* RAN2 is respectfully asked to take this issue into account.

Agreement

The draft LS in R1-2312547 is endorsed with the following revision:

With an independent configuration of LTM CSI reporting which RAN2 has agreed, the legacy MAC CE command cannot be used for LTM semi-persistent reporting on PUCCH because the MAC CE is used for the legacy CSI report configuration. It is not clear how the activation/deactivation of semi-persistent PUCCH report for LTM CSI reporting can be supported

Final LS is agreed in R1-2312642.

Agreement

* The TCI states in the candidate Cell TCI activation/deactivation command is associated with LTM TCI state pool of the target cell, i.e. configured under LTM-Candidate-r18.

**Conclusion**

* No consensus to include *simultaneousU-TCI-UpdateList* under *LTM-Candidate-r18* to activate and indicate TCI states for SCell(s) after cell switch command.

**Conclusion**

When RACH-less LTM is performed, for beam indication of target cell based on Rel-17 unified TCI framework applied to CORESET#0 and CORESETs (other than CORESET#0) associated with CSS sets other than Type3-PDCCH CSS sets where followUnifiedTCI-state is not enabled or not provided, whether using the TCI state indicated in the Cell Switch Command is up to UE implementation.

Agreement

* Processing of an LTM CSI report occupies 1 CPU
* CR to 38.214 is as follows

5.2.1.6 CSI processing criteria

The UE indicates the number of supported simultaneous CSI calculations with parameter *simultaneousCSI-ReportsPerCC* in a component carrier, and *simultaneousCSI-ReportsAllCC* across all component carriers. If a UE supports simultaneous CSI calculations it is said to have CSI processing units for processing CSI reports. If *L* CPUs are occupied for calculation of CSI reports in a given OFDM symbol, the UE has unoccupied CPUs. If *N* CSI reports start occupying their respective CPUs on the same OFDM symbol on which CPUs are unoccupied, where each CSI report corresponds to , the UE is not required to update the requested CSI reports with lowest priority (according to Clause 5.2.5), where is the largest value such that holds.

A UE is not expected to be configured with an aperiodic CSI trigger state containing more than Reporting Settings. Processing of a CSI report occupies a number of CPUs for a number of symbols as follows:

- for a CSI report with CSI-ReportConfig with higher layer parameter *reportQuantity* set to 'none' and *CSI-RS-ResourceSet* with higher layer parameter *trs-Info* configured

- for a CSI report with *LTM-CSI-ReportConfig* or a CSI report with *CSI-ReportConfig* with higher layer parameter *reportQuantity* set to 'cri-RSRP', 'ssb-Index-RSRP', 'cri-SINR', 'ssb-Index-SINR', 'cri-RSRP- Index', 'ssb-Index-RSRP- Index', 'cri-SINR- Index', 'ssb-Index-SINR- Index ' or 'none' (and *CSI-RS-ResourceSet* with higher layer parameter *trs-Info* not configured)

Agreement

The TCI state indicated in the cell switch command is associated with LTM TCI state pool of the target cell, i.e. configured under LTM-Candidate-r18.

Agreement

For the priority rule for CSI report, LTM CSI report is prioritized over legacy CSI report.

Agreement

* After RACH procedure until a new TCI state is indicated by the target cell, a UE follows the indicated TCI-state in the cell switch command at least for CFRA triggered by cell switch command.

Agreement

Use clause 8.1 of 213 as the reference clause for the value of N used to determine the overlap scenario between the PRACH transmission to a candidate cell and an UL transmission to the serving cell.

Agreement

n-TimingAdvanceOffset is pre-configured to UE for each candidate cell.

Agreement

Endorse in principle the TP below

**Reason for change:** specify the condition of performing UE-based TA estimation

**Summary for change:** the configuration of each candidate cell includes a field ltm-UE-MeasuredTA-ID. If the value of ltm-UE-MeasuredTA-ID for the serving cell is the same as the value of ltm-UE-MeasuredTA-ID for the candidate, the UE would perform UE-based TA estimation. If the value of ltm-UE-MeasuredTA-ID for the serving cell is different from the value of ltm-UE-MeasuredTA-ID for the candidate, the UE would *not* perform UE-based TA estimation.

**Consequences if not approved:** condition of performing UE-based TA estimation is not clear

|  |
| --- |
| **38.213 21 L1/L2-triggered Mobility Procedure**A UE can be indicated, by *LTM-Config*, candidate cells and SS/PBCH blocks per candidate cell for the UE to obtain synchronization and measure corresponding L1-RSRPs [10, TS 38.133]. A MAC CE command can activate TCI states, provided by *LTM-Candidate-TCI-State-r18* or/and *LTM-Candidate-TCI-UL-State-r18*, associated with SS/PBCH blocks or TRS of corresponding candidate cells. The UE is provided configurations by *LTM-CSI-ReportConfigToAddModList* for reporting L1-RSRP measurements [6, TS 38.214] that include a number of candidate cells and a number of SS/PBCH blocks per candidate cell from the number of candidate cells. If the *ltm-UE-MeasuredTA-ID (if configured)* of a candidate cell is equal to the *ltm-UE-MeasuredTA-ID (if configured)* of the serving cell, the UE estimates based on the UE implementation a timing advance to apply from a first transmission on a candidate cell that is after the reception of a cell switch command for the candidate cell [11, TS 38.321].A UE can be provided configurations, by *EarlyUlSyncConfig*, for PRACH transmission parameters for each of the candidate cells. The UE can be triggered a PRACH transmission on a candidate cell by a PDCCH order that the UE receives on a serving cell and includes an indication of the candidate cell for the PRACH transmission [4, TS 38.212]. If the serving cell and the candidate cell operate in a same frequency range and the UE would have transmissions that overlap in time, or when a gap between a first or last symbol of a PRACH transmission to the candidate cell is less than 𝑁 symbols from a last or first symbol, respectively, of an UL transmission to the serving cell, where is defined in Clause TBD, the UE - drops the transmissions on the serving cell when the UE does not support transmissions that overlap in time or are separated by less than the gap on the serving cell and the candidate cell- prioritizes power allocation to the PRACH transmission on the candidate cell in clause 7.5 when the UE supports transmissions that overlap in time or are separated by less than the gap, and a total UE transmit power in the frequency range would exceed The UE transmits the PRACH on the candidate cell as described in Clause 8.1 with a power determined as described in Clause 7.4. A UE can be provided by a MAC CE in a PDSCH reception on the serving cell [11, TS 38.321] a *TCI-State* and/or *TCI-UL-State* in *LTM-dl-OrJointTCI-StateToAddModList* and/or *LTM-ul-TCI-ToAddModList* indicating a unified TCI state [6, TS 38.214] for applicable receptions or transmissions on a candidate cell from the number of candidate cells. The UE applies the *TCI-State* and/or *TCI-UL-State,* if indicated by the MAC CE, from a first slot that is after the last symbol of a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE, and is the SCS configuration for the TBD*.* |

Agreement

The TP below is endorsed for TS 38.213

**Reason for change:** RACH based TA acquisition mechanism for candidate cells does not include UE receiving RAR corresponding to the PRACH transmission, however, such characteristic has not been captured in clause 8.2 TS 38.213. In other words, from perspective of RAN1 specification, UE still needs to detect PDCCH for RAR for a PRACH transmission towards a candidate cell. Hence, we suggest to capture the following text proposal for clarification.

**Summary of change:** To specify that UE does not detect PDCCH RAR for a PRACH transmission triggered for a candidate cell.

**Consequence if not approved:** RACH procedure without RAR for candidate cells is not supported from perspective of RAN1 specification.

|  |  |
| --- | --- |
| **Text Proposal to section 8.2, TS 38.213-i00.**

|  |
| --- |
| * 8.2 Random access response - Type-1 random access procedure

In response to a PRACH transmission, a UE attempts to detect a DCI format 1\_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. If a PRACH transmission is triggered by PDCCH order with non-zero Cell Indicator Field, the UE does not attempt to detect a DCI format 1\_0 with CRC scrambled by a corresponding RA-RNTI. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in clause 10.1, that is at least one symbol, after the last symbol of the last PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in clause 10.1. Ifor, as defined in [4, TS 38.211], is not zero, the window starts after an additional msec where is defined in [4, TS 38.211] and is provided by *kmac* or if *kmac* is not provided. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *ra-ResponseWindow*. * <Unchanged parts are omitted>
 |

 |

# Agreements at RAN1#114bis

Conclusion

* For the necessity of Padding bit in the L1 measurement report for LTM in the case where the report size is less than 12-bits, no enhancements are specified in the spec

Conclusion

* No specific specification change in RAN1 is pursued for scenario 3 for LTM (i.e. Beam indication after cell switch command)

Agreement

* For the LTM L1 measurement report,
	+ When a UE is configured is configured with SpCellInclusion, the SpCell measurements are the entries in the LTM-CSI-SSB-ResourceSet where the PCI and frequency information [SSB frequency/ARFCN] of the candidate cell is equal to the PCI and frequency information [SSB frequency/ARFCN] of the current SpCell.

# Agreements at RAN1#114

**Agreement**

Confirm the following working assumption achieved in RAN-112bis-e

Agreement

On top the confirmed working assumption, on the presence of beam indication within cell switch command, at least for scenario 2 following is supported:

* A field to indicate 1 joint or 1 pair of UL and DL unified TCI State index for the target cell field is always present in the cell switch command.
* FFS UE behaviour for the beam indication field for the RACH-based handover scenario after cell switch command

**Conclusion**

In R18 LTM, there is no consensus to support triggering of aperiodic SRS transmission to the target cell in the cell switch command.

**Agreement**

In R18 LTM, on the QCL source of the TCI state before/during the cell switch command,

* SSB or TRS can be configured in a TCI state for the candidate cell(s) before/during cell switch command
	+ Whether the TRS can be used for the candidate cell(s) before/during cell switch command is up to UE capability

Agreement

* + In Rel-18 LTM, only CD-SSB is supported for L1 intra- and inter-frequency measurement

Agreement

Draft LS 2308447 is endorsed in principle by revising

According to RAN1’s agreement in RAN1#112bis meeting, M x L beams are reported in a single report instance. Beam selection is performed across the L cells from configured cells, i.e., M beams for each of the L cells. According to the conclusion from RAN1#113, how to select the L cells is up to UE. Therefore, UE reports one or a subset of measured LTM candidate cell(s) in a report (option b in RAN2’s agreement). If L cells are configured for measurement, the UE would report all L configured cells.

to

According to RAN1’s agreement in RAN1#112bis meeting, M x L beams are reported in a single report instance. UE reports beams of L cells from configured cells with M beams for each of the L cells. According to the conclusion from RAN1#113, how to select the L cells is up to UE.

Agreement

Final LS 2308465 is endorsed.

Agreement

* For the beam selection for SSB based L1-RSRP measurement report,
	+ For the value of M, L
		- the RRC configured candidate values are:
			* M = 1, 2, 3, 4
			* L = 1, 2, 3, 4
		- Note: the maximum value of M\*L and combination of M and L is up to UE capability
* Note: the common understanding is that L=1 with configuration of inclusion of serving cell is not a typical case.
* No need to confirm the corresponding working assumption (made in RAN1#113).

Agreement

* Send an LS to RAN2,3,4 on the RAN1 agreements in this meeting
	+ All agreements in AI 9.10.1 and 9.10.2 in RAN1#114 are included

Agreement

Draft LS R1-2308624 is endorsed in principle.

Agreement

Final LS R1-2308625 is endorsed.

Agreement

* TCI state activation by MAC CE before cell switch command for one or more than one candidate cells is allowed

Agreement

* Absolute value and differential values are used for L1-RSRP reporting:
	+ For absolute L1-RSRP, the L1-RSRP value is quantized to a 7-bit value in the range [-140, -44] dBm with 1dB step size
	+ For differential L1-RSRP, the L1-RSRP value is quantized to a 4-bit value where the differential L1-RSRP value is computed with 2 dB step size from reference L1-RSRP value

Agreement

SSBRI among configured candidate cells is included for each L1-RSRP report

* The bit size of SSBRI is where is the number of configured SSBs in the corresponding resource set for the report
* The following format is used for reporting

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n | SSBRI #1 as in Table 6.3.1.1.2-6, if reported |
| SSBRI #2 as in Table 6.3.1.1.2-6, if reported |
| : |
| SSBRI #L\*M as in Table 6.3.1.1.2-6, if reported |
| RSRP #1 as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported |
| : |
| Differential RSRP #L\*M as in Table 6.3.1.1.2-6, if reported |

# Agreements at RAN1#113

Working Assumption

* For the beam selection for SSB based L1-RSRP measurement report,
	+ For the value of M, L
		- the RRC configured candidate values are:
			* M = 1, 2, 3, 4
			* L = [1], 2, 3, 4
		- Note: the maximum value of M\*L and combination of M and L is up to UE capability

Conclusion

There is no consensus to support the following procedures prior to the reception of L1/L2 cell switch command aiming at the reduction of handover delay/interruption in Rel-18 LTM

* CSI acquisition for candidate before reception of cell switch command

Note: At least for the candidate cells which are current serving cells, the CSI acquisition prior to cell switch command will be supported

**Conclusion**

There is no consensus to introduce additional mechanism to support the following procedures prior to and joint with the reception of L1/L2 cell switch command aiming at the reduction of handover delay/interruption in Rel-18 LTM

-        TRS tracking for candidate cells

FFS: Whether/How the QCL reference information of TCI states of the candidate cell should be mapped to the source SSB

Note: At least for the candidate cells which are current serving cells, TRS tracking prior to cell switch command is supported

Conclusion

For R18 LTM, in order to activate multiple joint TCI state or/and pair of (DL/UL) TCI states for candidate cell case, do not support TCI state activation together with beam indication of the candidate cell in the same MAC-CE message.

* FFS: UE assumption on the active TCI states other than the indicated TCI state after the reception of the cell switch command.

Agreement

A UE can be indicated and activated a single joint TCI state or a pair of UL/DL TCI state in the cell switch command.

Agreement

* For the configuration of SSB based L1-RSRP measurement,
	+ periodicity of SSB, SSB position in burst are provided as time domain information for intra- and inter- frequency

Agreement

* + Each TCI state included up to 2 qcl-types and each qcl-type source RS in a QCL-Info of the TCI state is provided at least based on the RS configuration for LTM
		- FFS: other RS index outside measurement RS configuration for LTM
		- FFS: Additional contents of TCI states for LTM

Agreement

* For TCI state activation for candidate cell(s) before the cell switch command,
	+ MAC CE is used and the details of MAC-CE for TCI state activation for LTM is up to RAN2
	+ Further study if PDCCH order for candidate cell(s) can be used

Agreement

* For the beam application time for Rel-18 LTM,
	+ Beam application time is supported, and starts after the last symbol of the PUCCH or PUSCH carrying the HARQ-ACK for the PDSCH which carries MAC-CE containing cell switch command with the beam indication for the target cell(s)
		- FFS: reference SCS, i.e. serving cell and/or target cell
	+ At least the following components are further studied to define the beam application time
		- Whether TCI state activation is received before/together with cell switch command
		- Legacy values, i.e. and BeamAppTime-r17
		- RF retuning time when inter-frequency switch is performed, which is up to RAN4
		- Whether the target cell is one of the current serving cells
* Cell switching time, which is defined by RAN2 and RAN4, may or may not include the potential components of beam application time above.
* Send an LS to RAN2 and RAN4 to ask their feedback

Agreement

* For the beam selection for SSB based L1-RSRP measurement report,
	+ The inclusion of current SpCell in the L1 measurement report is configurable.
		- * new UE capability(ies) are introduced and details can be discussed in UE feature
* Agreement
* Send an LS to RAN2,3,4 on the RAN1 agreements in this meeting
	+ - All agreements in AI 9.10.1 and 9.10.2 in RAN1#113 are included
		- The following information to RAN2 is included:
			* Whether C-RNTI that is to be used by target cell needs to be included within the MAC-CE containing cell switch command will be left to RAN2 decision.
			* It will be left to RAN2 decision whether the following fields are always present or not in the cell switch command:
				+ TA related information

Conclusion

* 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.

Conclusion

No consensus to introduce UE/event triggered report for L1 measurement results for LTM in Rel-18

# Agreements at RAN1#112bis-e

Agreement

* Adopt Alt.2 for beam indication of target cell(s) and TCI state activation for candidate cell(s) (if supported) ,
	+ Alt. 1: By indicating RS identifier, i.e. mapping between RS identifier and Rel-17 unified TCI state is done by a UE
	+ Alt. 2: By indicating Rel-17 TCI state index

Agreement

From RAN1 point of view, at least the following information can be included in the cell switch command, which is conveyed by MAC CE

* + Information to identify the target cell(s)
		- The details including bit number are designed by RAN2
	+ TA related information (details up to the discussion in A.I. 9.10.2)
	+ 1 joint or 1 pair of UL and DL unified TCI State index for the target Cell
		- Note: discussion on target SpCell is not precluded
	+ Active DL and UL BWPs for the target cell
	+ FFS: Triggering of aperiodic TRS transmitted from the target cell
	+ FFS: Triggering the CSI acquisition of the target cell and reporting to the target cell
	+ FFS: Triggering of aperiodic SRS transmission to the target cell
	+ FFS: C-RNTI
* FFS: the presence of each field (i.e. always present or configurable)

Agreement

For the beam selection for SSB based L1-RSRP measurement report,

* Beam selection is performed across the L cells from configured (or activated, if introduced) cells, i.e. M beams for each of the L cells
	+ FFS: How to select the L cells and M beams per cells is up to UE
* M x L beams are reported in a single report instance
	+ Max values of M and L are based on UE capability, and at least M x L=4 is supported as a UE capability, other UE capabilities are FFS
		- FFS if UE is allowed to report less than M x L beams
	+ The values of M and L are configured to the UE in the reporting configuration
* FFS: The following configurability is introduced in the report configuration
	+ 1) Whether serving cell is always selected in the L cell selection performed by the UE, and applicable when a UE is configured with L>=2
	+ 2) at least one of the inter-frequency cells is always selected in the L cell selection performed by the UE, and applicable when a UE is configured with L>=2 and at least one cell in inter-frequency

Agreement

For the Rel-17 unified TCI based beam indication in Rel-18 LTM, at least Alt 1 is supported:

* **Alt 1:** TCI state activation of a candidate cell is received before the reception of beam indication of the candidate cell,
* **Alt 2:** TCI state activation of a candidate cell is received together with the reception of beam indication of the candidate cell
	+ FFS: signalling details for TCI state indication, if both activation and indication are done in the same MAC CE message carrying switch command
* **Alt 3:** Alt 1 and/or Alt 2 can be supported based on the UE capability

**FFS:** signalling details for TCI state activation

**FFS:** For Alt 1, whether/how TCI state activation for candidate cell(s) is allowed

**Note:** If scenarios 1 and 3 are to be supported other beam indication/TCI activation timing relationships are not precluded.

**Agreement**

* RRC parameter ss-PBCH-BlockPower for candidate cells is included in the LTM configuration.
	+ UE needs the parameter to (at least) perform RACH towards candidate cells
	+ Note: how to capture this parameter and RRC structure are up to RAN2

**Agreement**

* Companies are encouraged to study the beam application time for Rel-18 LTM, which may be different from that without serving cell change
	+ Definition of the beam application time
	+ The exact value(s), condition and UE capability
	+ Consider the interaction with the application of the candidate RRC configuration.

Conclusion

* Whether active DL and UL BWP of the target Cell/SpCell field, within the cell switch command, is always present or not is left to RAN2 decision.

Working Assumption

On the presence of beam indication within cell switch command, at least for scenario 2, following is supported:

* A field to indicate 1 joint or 1 pair of UL and DL unified TCI State index for the target cell field is always present in the cell switch command.

Note: If scenarios 1 and 3 are agreed to be supported in R18 LTM other solutions may be considered.

**Agreement**

* Periodic and semi-persistent report on PUCCH are also supported for gNB scheduled L1-measurement reporting.

# Agreements at RAN1#112

Agreement

* RAN1 shares the same understanding as RAN2 on agreement:
	+ The LTM mobility trigger information is conveyed in a MAC CE
* The same MAC CE is used for the LTM triggering.

Agreement

* The agreement on scenario 2 (Beam indication together with cell switch command) at RAN1#111 is further clarified as the following:
	+ Beam indication for the target cell(s) is conveyed in the MAC CE used for LTM triggering for scenario 2

Agreement

* For L1-RSRP measurement RS configuration
	+ For SSB based L1-RSRP measurement:
		- As a starting point, at least the following information needs to be provided to a UE, e.g.
			* For intra- and inter- frequency: PCI or logical ID (e.g., as being defined in R17 ICBM), time domain (e.g. SMTC or periodicity and SSB position in burst)
			* For inter-frequency: frequency domain location (e.g. center frequency), SCS
			* FFS: transmission power (for pathloss calculation)
		- Note: other parameters included in the configuration can be further discussed
		- Including above agreement into the LS
	+ The detailed design of RRC structure is up to RAN2, and send an LS to RAN2 to request to work on the RRC structure design on the measurement configuration.
		- Following RAN1 understanding will be provided in the LS
			* RAN1 has discussed the following configuration options for L1 measurement configurations for SSB till RAN1#112:
				+ Option 1) Configurations for L1 measurement RS is provided under ServingCellConfig for the serving cells

is useful to reuses the mechanism for Rel-17 ICBM and necessary information to support inter-frequency measurement will be added there.

* + - * + Option 2) Configurations for L1 measurement RS is provided separately from ServingCellConfig for the serving cells and CellGroupConfig for the candidate cells

is useful to avoid the duplicated configurations for L1 measurement RSs, [and avoid UE to process configurations ~~for L1 measurement RS~~ provided under CellGroupConfig for the candidate cells]

* + - * + Option 3) Configurations for L1 measurement RS is provided under CellGroupConfig for the candidate cells

can achieve the similar benefit as Option 2) by directly referring to the candidate cell configurations.

* + - * Note RAN2 has a full flexibility to design the whole RRC structure design.
			* RAN1 believes this is RAN2 expert region, and respectfully asks RAN2 to finalize the RRC structure design after RAN1 finalizes the discussion on RRC parameters.
			* It is noted that RAN1 foresees the necessity of similar discussions on TCI state pool for candidate cells and L1 measurement report configurations.

Agreement

* Send an LS to RAN2,3,4 on the RAN1 agreements in this meeting
	+ All agreements in AI 9.12.1 and 9.12.2 in RAN1#112 are included
	+ The LS contents agreed in AI 9.12.1 (on L1 measurement configuration) and AI 9.12.2 (on RAR) are also included

Agreement

* At least for Rel-17 unified TCI framework based beam indication included in cell switch command (i.e. scenario 2), beam indication applies to signals/channels that follow or are configured to follow Rel-17 unified TCI at the target cell(s)
* FFS: beam indication for mTRP case

Agreement

Draft LS R1-2302193 is endorsed in principle by appending latest agreements.

Agreement

Final LS R1-2302194 is endorsed.

# Agreements at RAN2#120 (From RAN2 chair notes)

[R2-2211201](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2211201.zip) Discussion on RAN1 LS on measurement and configurations for L1L2-based inter-cell mobility CATT, Fujitsu discussion Rel-18 NR\_Mob\_enh2-Core

* RAN2 assumes that LTM (intra DU and inter DU) is network-controlled mobility where the control is from the source, i.e. measurements (L1 measurements) are configured in the UE from the source Cell, and the decision to switch cell is by the source cell, and enhancements considered for LTM before cell switch, e.g. pre-synchronization, TA handling, target beam mgmt (to the extent it is supported) may be by the source cell. RAN2 understands that this may require cooperation source DU CU target DU and/or OAM coord. RAN2 don’t see any blocking issue to share information between DUs but the support of this is in RAN3 domain. RAN2 see no necessity for a direct inter-DU-interface to support this.

[R2-2213332](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2213332.zip) 38.300 running CR for introduction of NR further mobility enhancements MediaTek Inc. draftCR Rel-18 38.300 17.2.0 B NR\_Mob\_enh2-Core

* Endorsed as baseline for further update

[R2-2211202](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2211202.zip) On Procedure Descriptions CATT discussion Rel-18 NR\_Mob\_enh2-Core

DISCUSSION

* Include a procedure in the MTK stage-2 offline (e.g. acc to proposal and comments)

[R2-2212438](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2212438.zip) Qualitative analysis on what to include in the RRC model for LTM Ericsson discussion Rel-18 NR\_Mob\_enh2-Core

* P1 RAN2 to confirm that the CellGroupConfig IE is (mandatory) needed within an LTM candidate cell configuration.
* P3 The RadioBearerConfig IE can be optionally supported in an LTM candidate configuration
* P5 The MeasConfig IE can be optionally supported in an LTM candidate configuration.
* P8 The OtherConfig IE is not required to be part of the LTM candidate cell configuration.
* P9 The LTM candidate cell configuration should be designed as a To AddMod/ToRelease structure.
* P10 The LTM candidate cell configuration ASN.1 structure comprises at least a CellGroupConfig IE and a configuration ID.

[R2-2211456](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2211456.zip) Discussion on configurations for multiple candidate cells of L1 L2 mobility Intel Corporation discussion Rel-18 NR\_Mob\_enh2-Core

DISCUSSION

**On Delta Configuration**

* A UE stores the reference configuration as a separate configuration.
* The reference configuration is managed separately

[R2-2211487](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2211487.zip) Trigger and Execution of LTM vivo discussion Rel-18 NR\_Mob\_enh2-Core

* The MAC CE agreed to carry LTM related information for cell switch is used for LTM triggering of the cell switch.
* LTM cell switch is supervised by a timer
* UE arrival in the target cell need to be indicated (somehow)

[R2-2213335](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2213335.zip) Report of #033 on Partial MAC reset for intra-DU LTM vivo discussion Rel-18 NR\_Mob\_enh2-Core

* RAN2 to have the mindset to have a common design for partial MAC reset for different cell change cases in intra-DU scenario (as far as reasonable)

[R2-2213336](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2213336.zip) Potential Partial MAC Reset for intra-DU LTM vivo, MediaTek, Xiaomi discussion Rel-18

* Noted
* The summary in [R2-2213336] could be considered as the starting point for partial reset in intra-DU.

[R2-2212865](file:///C%3A%5CUsers%5Cjohan%5COneDrive%5CDokument%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CRAN2%5CDocs%5CR2-2212865.zip) Discussion on security issue in cell switch NTT DOCOMO INC. discussion Rel-18

* Permanent Identities such as PCI will not be used in L1 L2 signalling, instead L1 L2 signalling will use temporary identities configured by RRC.

# Agreements at RAN1#111

Agreement

* For Rel-18 LTM, L1 inter-frequency measurement is supported from RAN1 point of view.

Agreement

* Regarding the potential RAN1 enhancements to reduce the handover delay / interruption for Rel-18 LTM
	+ Support at least DL synchronization for candidate cell(s) based on at least SSB before cell switch command
		- Further study the necessary mechanism, e.g. signaling and UE capability

Agreement

* For L1 measurement report for Rel-18 L1/L2 mobility, if UE event triggered report for L1 measurement is supported based on further study
	+ At least the following aspects may be considered
		- How to define UE event and exact definition of events,
		- Report container
		- Resource allocation/assignment for UE event triggered report
		- Necessity of indication to gNB when the condition UE event is met, and how
		- Necessity to define the condition to start/stop the reporting,
		- Contents of the report/reporting format, PCI, RS ID, measurement result etc.
		- The interaction with filtered L1 measurement results (if supported)
		- Support of simultaneous configuration of both UE event triggered and any of periodic/semi-persistence/aperiodic reporting, and solutions when both of them are configured.
		- Report destination, whether the report is sent to serving cell only or can be sent to one or more candidate cell(s).
		- Benefit when L3 measurement is involved

Agreement

* For candidate cell measurement for Rel-18 LTM,
	+ SSB based L1-RSRP is supported for intra-frequency measurement
	+ SSB based L1-RSRP is supported for inter-frequency measurement from RAN1 point of view
	+ FFS: L1-SINR, CSI-RS based L1-RSRP

Agreement

* The beam indication of candidate cell(s) for Rel-18 LTM should be designed based on the following:
	+ Beam indication for Rel-18 LTM is designed based on Rel-17 unified TCI framework, if both serving cell and candidate cell support Rel-17 unified TCI framework
	+ FFS: whether/how to design mechanism for Beam indication for Rel-18 LTM when at least one from serving cell and candidate cell supports only Rel-15 TCI framework.
	+ Note: How and whether to indicate the new serving cell(s) and timing for beam indication are separately discussed

Agreement

* For gNB scheduled L1 measurement report for Rel-18 LTM, report as UCI is supported
	+ Semi-persistent report on PUSCH, and aperiodic report on PUSCH are supported
		- FFS: periodic and semi-persistent PUCCH
	+ In a single report instance, report for serving cell and candidate cell(s) for intra-frequency and/or inter-frequency can be included.

Agreement

* For beam indication timing for Rel-18 LTM,
	+ Support Scenario 2: Beam indication together with cell switch command,
		- For Rel-17 unified TCI framework,
			* Beam indication indicates TCI state for each target serving cell
	+ FFS: Scenario 1: Beam indication before cell switch command
	+ FFS: Scenario 3: Beam indication after cell switch command
* FFS: Activation of TCI state(s) of target serving and/or candidate cell(s).

Agreement

On mechanism to acquire TA of the candidate cell(s) in Rel-18 LTM, at least support PDCCH ordered RACH.

* The PDCCH order is only triggered by source cell
* FFS: the details including content of DCI, RACH resource configuration, RAR transmission mechanism, etc.
* Note: any other RACH-based solutions are for discussion separately

Agreement (Made in RAN1#110b-e)

Support TA acquisition of candidate cell(s) before cell switch command is received in L1/L2 based mobility.

* FFS: whether this can be applied to candidate cell when it is deactivated SCell (if defined in RAN2)

Agreement

For PDCCH ordered RACH in LTM, at least the following enhancements are supported

* Introduce indication of candidate cell and/or RO of candidate cell in DCI
* configuration of RACH resource for candidate cell(s) is provided prior to the PDCCH order
* FFS: whether/how to transmit RAR

 Agreement

On whether RAR is needed for PDCCH ordered RACH for a candidate cell in LTM, the following alternatives are considered for further study

* Alt 1: RAR is needed
* Alt 2: RAR is not needed
	+ Note: If Alt 2 is supported, TA value of candidate cell is indicated in cell switch command
* Alt 3: whether RAR is needed can be configured

Agreement

* TA updating (i.e. re-acquisition of TA) for candidate cell can be triggered by NW.
	+ same triggering mechanism reuse the initial TA acquisition, i.e., PDCCH order triggered RACH in a candidate cell

# Agreements at RAN1#110b-e

Agreement

* For Rel-18 L1/L2 mobility, L1 intra-frequency measurement for candidate cell is supported
	+ At least the following aspects are for RAN1 further study:
		- RAN1 assumes Rel-17 ICBM CSI measurement as starting point.
		- Whether and how to apply relaxation for the restrictions imposed on the Rel-17 intra-frequency L1 non-serving cell measurement defined in 9.13.2 of TS38.133, where RAN4 impact is foreseen, e.g.
			* SFN offset alignment compared with serving cell
			* BWP setting, i.e. non-serving cell SSB should be covered by serving cell active BWP
			* Introduction of symbol level gap or SMTC for larger Rx timing difference (i.e. larger than CP length)
		- Commonality with intra-frequency L3 measurement
		- Commonality with L1 inter-frequency measurement for measurement configuration
* Send an LS to RAN4 (CC RAN2)
	+ RAN1 to ask RAN4 if the restriction on e.g., SFN offset alignment, BWP setting and Rx timing difference, etc, described in 9.13.2 of TS38.133 for intra-frequency L1 non-serving measurement can be relaxed or not.
	+ RAN1 assumes Rel-17 ICBM CSI measurement as starting point.

Agreement

* For Rel-18 L1/L2 mobility,
	+ SSB is supported for L1 intra-frequency measurement
	+ SSB is supported for L1 inter-frequency measurement if inter-frequency L1 measurements are supported
* Further study the following L1 measurement RS for candidate cell
	+ CSI-RS for tracking, beam management, CSI and mobility, CSI-IM, which is for L1 intra-frequency and L1 inter-frequency (if supported)

Agreement

* For candidate cell measurement for Rel-18 L1/L2 mobility,
	+ L1-RSRP is supported for intra-frequency candidate cell measurement.
	+ Further study the following measurement quantities for candidate cell measurement
		- L1-RSRP for inter-frequency (if supported)
		- L1-SINR for intra-frequency and inter-frequency (if supported)
* FFS: to assess the use case and the benefit of UL measurement instead of/in addition to DL L1 measurement, which includes:
	+ How the UL measurement result is used, e.g. handover decision
	+ Signals/channels used for UL measurement, e.g. SRS
	+ Spec impact including other WGs, e.g. definition of gNB measurement, interface to transfer RS configuration or measurement results
	+ Note: The next discussion will take place based on companies’ contribution in future meeting.

Agreement

* For Rel-18 L1/L2 mobility, further study the potential RAN1 spec impact of L1 inter-frequency measurement
	+ The definition and scenarios of L1 inter-frequency measurement is determined by RAN4, and RAN1 assumes at least the following until receiving their confirmation
		- The scenarios not included in intra-frequency are regarded as inter-frequency, which includes at least the following scenarios:
			* The frequency of the measured RS not covered by any of the active BWPs of SpCell and Scells configured for a UE, but covered by some of the configured BWPs of SpCell and Scells configured for a UE.
			* The frequency of the measured RS not covered by any of the configured BWPs of SpCell and Scells configured for a UE
	+ At least the following aspect is studied:
		- Commonality with L1 intra-frequency measurement for measurement configuration
* Send an LS to RAN4 (CC RAN2)
	+ RAN1 would like to confirm our understanding that the supported scenarios not included in intra-frequency are regarded as inter-frequency, which includes at least the following scenarios:
		- The frequency of the measured RS not covered by any of the active BWPs of SpCell and Scells configured for a UE, but covered by some of the configured BWPs of SpCell and Scells configured for a UE.
		- The frequency of the measured RS not covered by any of the configured BWPs of SpCell and Scells configured for a UE
	+ It is RAN1 understanding that the introduction of measurement gap and SMTC for L1 inter-frequency measurement, if any, is expected to be a RAN4 issue
	+ Note: this content is included in the LS agreed for intra-frequency L1 measurement

Agreement

* For L1 measurement report for Rel-18 L1/L2 mobility, further study the following mechanisms:
	+ Report as UCI on PUCCH or PUSCH
		- Periodic report on PUCCH, semi-persistent report on PUCCH/PUSCH, and aperiodic report on PUSCH
		- Potential enhancements to Rel-17 ICBM report format to accommodate Rel-18 scenarios, e.g.
			* Inter-frequency measurement, if supported
			* Increasing the maximum number of reported beams, which is 4 for Rel-17 ICBM
			* Flexible size beam report, e.g., two-part UCI (e.g., the 1st part contains the best beam/cell and the number (e.g., N) of reported beams/cells, the 2nd part contains the rest (N-1) beams/cells
			* Reducing the reporting overhead by e.g. choosing beams/cells per frequency or across frequencies to report (FFS how)
	+ Report on MAC CE
		- Both gNB scheduled and/or UE initiated (if supported) report are studied

Agreement

* RAN1 to further study if the beam indication of candidate cell(s) L1/L2 mobility should be designed for a specific TCI framework below, and their potential RAN1 spec impact.
	+ **Option A:**  Beam indication for Rel-18 L1/L2 mobility is designed based on Rel-17 TCI framework mechanism
	+ **Option B:** Beam indication for Rel-18 L1/L2 mobility is designed based on Rel-15 TCI framework mechanism
	+ **Option C:** Beam indication for Rel-18 L1/L2 mobility is designed based on both Rel-15 and Rel-17 TCI framework mechanisms

Agreement

-  Send an LS to RAN2/RAN3 asking the clarification on intra-/inter-DU scenario:

-      RAN1 has started the discussion on the configuration for L1 measurement and TCI states for candidate cells. Regarding the following RAN2 agreements captured in RAN2 LS (R1-2208331/R2-2209257), it is not clear for RAN1 which kind of information/configuration for candidate cell(s) are available at a serving cell for inter-DU case for Rel-18 L1/L2 mobility. Thus, companies have different understanding on the implication of the sentence “as much commonality as reasonable” in the LS.

-      *The design for intra-DU and inter-DU L1/L2-based mobility should share as much commonality as reasonable. FFS which aspects need to be different.*

-  RAN1 respectfully asks RAN2 and RAN3 if the serving DU knows the measurement RS configuration and TCI state configuration of cells served by another DU

Agreement

* Send an LS to RAN2, 3 and 4 to inform them of the agreements under A.I 9.12.1 and A.I. 9.12.2
* If the LS related proposal under A.I 9.12.1 and 9.12.2 are agreed, the contents are also included.

Agreement

* RAN1 to further study the potential RAN1 enhancements and spec impact to perform at least the following procedures prior to the reception of L1/L2 cell switch command aiming at the reduction of handover delay / interruption
	+ DL synchronization for candidate cell(s)
	+ TRS tracking for candidate cell(s)
	+ CSI acquisition for candidate cell(s)
	+ Activation/Selection of TCI states for candidate cell(s), if feasible
	+ Note: Uplink synchronization aspect will not be discussed under this A.I.
	+ FFS: Whether the above procedures prior to the reception of L1/L2 cell switch command can be performed on candidate cell when it is deactivated SCell (if defined in RAN2)
* Detailed discussion will be commenced after receiving RAN2 LS.

Agreement

* From RAN1 perspective, the following scenarios can be considered for Rel-18 L1/L2 mobility for beam indication timing. This will be updated depending on further RAN1 assessment and RAN2 decision on the time chart
	+ Scenario 1: Beam indication before cell switch command
	+ Scenario 2: Beam indication together with cell switch command
	+ Scenario 3: Beam indication after cell switch command
* Interested companies are encouraged to further study the validity of the scenarios and the potential spec impact.

Agreement

* Interested companies are encouraged to perform technical analysis of the cell switch command from a RAN1 point of view, e.g.
	+ Necessary information included in the command, which is relevant for RAN1 discussion
	+ Necessary number of bits for the information
	+ L1 impact or concern to use DCI or MAC CE for L1/L2 cell switch command

**Agreement**

Support TA acquisition of candidate cell(s) before cell switch command is received in L1/L2 based mobility.

* FFS: whether this can be applied to candidate cell when it is deactivated SCell (if defined in RAN2)

**Agreement**

On mechanism to acquire TA of the candidate cells, the following solutions can be further studied:

•         RACH-based solutions

e.g., PDCCH ordered RACH, UE-triggered RACH, higher layer triggered RACH from NW other than L3 HO cmd

•         RACH-less solutions

e.g., SRS based TA acquisition, Rx timing difference based, RACH-less mechanism as in LTE, UE based TA measurement (including UE based TA measurement with one TAC from serving cell)

Agreement

For TA acquisition of a candidate cell before cell switch command is received, study at least the following alternatives of associating TA/TAG to candidate cell:

* Alt1: Associate TA/TAG and candidate cell implicitly, e.g.,
* the association between TA/TAG and TCI states can be configured
* Alt2: Associate TA/TAG and candidate cell explicitly, e.g.,
* the association is provided as a part of candidate cell(s) configuration
* the association between TA/TAG and SSB(s)/TRS(s) is provided as a part of candidate cell(s) configuration

# Agreements at RAN2#121bis-e

* Current Contents is agreeable as is. Include also agreements regarding L1 measurements for information (copy-past of agreements part), revise the title to be *Reply LS on L1 measurement RS configuration and PDCCH ordered RACH for LTM*
* The revised LS out is approved unseen in R2-2304553
* From RAN2 perspective, to enable shared preamble resource among multiple UEs, it is beneficial that the information that identifies the allocated CFRA resource (i.e., SS/PBCH index, RACH occasion, and Random Access Preamble index) can be indicated in the PDCCH order (as legacy intra-cell PDCCH order).
* RRC RACH configuration for early TA acquisition (e.g., including whether RAR needs to be received) is specific per target cell and is signalled separately (separate IEs) from the candidate cell configuration (the part that need to be applied at cell switch).
* R2 assumes that Early TA RACH option 3 (with RAR from candidate cell) is not needed in Rel-18.
* With the assumption that the UE will skip RACH in the target cell if a TA value is given in the cell switch command: It is FFS if the following TA values can be given to the UE:

- Value 0,

- Value indicating that the UE shall apply the TA of one source cell.

* R2 assumes RRCReconfigurationComplete message is always sent at each LTM execution.
* In RACH-based LTM, the target cell is aware of the UE’s arrival based on the reception of preamble in CFRA and on the reception of Msg3/MsgA in CBRA, like the legacy HO.
* In RACH-less LTM, the target cell is aware of the UE’s arrival based on reception of the first UL transmission from this UE
* In RACH-less LTM, RRCReconfigurationComplete can be the content of the first UL MAC PDU/transmission to indicate UE arrival, i.e. no need to introduce any new signaling to indicate UE arrival (for the MCG-switch case)
* For RACH-based LTM, the UE considers that LTM execution procedure is successfully completed when the RACH is successfully completed.
* For RACH-less LTM, the UE considers that LTM execution procedure is successfully complete when the UE determines the NW has successfully received its first UL data.
* Following behaviors of LTM supervisor timer are agreed:

- 1: The UE starts the LTM supervisor timer, upon reception of the LTM cell switch MAC CE;

- 2: The UE stops the LTM supervisor timer, upon successful completion of LTM cell switch;

- 3: If the LTM supervisor timer for MCG expires, as baseline, the UE considers LTM failure and initiates RRC re-establishment. (SCG switch case FFS)

* LTM supervisor timer is RRC layer timer.
* At RLF or LTM execution failure (for MCG), RAN2 intend to support fast recovery to a candidate cell by LTM execution.
* While configured with LTM candidate cells, the UE can also execute any L3 handover command sent by the network. R2 assumes that is could be up to the network to avoid any issue due to the race condition between LTM execution and RRC Reconfiguration (e.g. L3 HO cmd), e.g. avoid sending LTM switch cmd and L3 HO cmd in the same TB.
* Discuss terminology for the TS in the RRC stage-3 discussions when/if needed (not at current meeting).
* Whether the Reference configuration is a complete configuration or not is up to the network implementation.
* Reference configuration + LTM candidate configuration (in combination) has to be a complete configuration.
* The reference configuration is always explicitly signalled (not automatically derived from any other config, e.g. current).
* Confirm that only the replacement procedure (the “full config without L2 reset”) is supported for Execution of LTM cell switch.
* The UE may perform early decoding and early validity check. FFS whether Early validity check triggers early re-establishment. FFS the possible timing, FFS subset of cells, FFS if need to specify anything or just up to UE impl, FFS if other signalling to notify network is needed.

Initial agreements, from RAN2 point of view (may be dep on RAN1 progress).

* The location of RS configuration for SSB-based measurements of candidate cells is external to the ServingCellConfig(s) of current serving cells and external to the configuration of the LTM candidate cells. The RS configuration, per RAN1 agreement, can include PCI or logical ID, SMTC location, frequency location, and SCS.
* RAN2 assumes that the location of configurations of TCI states for the candidate cells (used before/at cell switch) is external to the ServingCellConfig(s) of current serving cells and external to the configuration of the LTM candidate cells (same location as RS configuration).
* RAN2 assumes that For L1 measurements of LTM candidate cells, the reporting configuration is placed inside the ServingCellConfig of current serving cell(s).

 *Chair: the agreements above may need to be further evaluated, e.g. wrt subsequent LTM switches.*

* RAN2 assumes that whether filtering, hysteresis, and time-to-trigger are needed for LTM specific L1 measurements is up to RAN1.
* FFS if the LTM specific L1 measurements of an LTM candidate SCell is independent of its activation status.
* Whether to assume L1/L2 signaling to control or change L1 measurement/reporting for LTM needs further discussion (parts may be discussed in RAN1). RAN2 assumes that such control would be limited to certain aspect that need frequent update and restricted by RRC configuration.

# Agreements at RAN2#121

**Agreed: Usage of reference configuration:**

**- Candidate delta configuration is applied on top of the reference configuration to form a complete candidate configuration (FFS if done at cell switch or before the cell switch)**

**- The complete candidate configuration is applied and replacing the current UE configuration (at the time of reconfiguration execution/cell switch), by a RRC reconfiguration procedure that makes replacements of configuration but doesn’t necessarily reset RLC or PDCP.**

**- To support reconfigurations that requires reset of RLC PDCP, this should be possible (in principle same a full config)**

**- FFS if more than RLC PDCP should be kept and how much of “replacing” need to be specified.**

**- FFS if the reference configuration can be derived from the current UE configuration at some point of time.**

**Potentially: R2 assumes that LTM without a separate reference configuration (if agreed) could work something like this:**

- **Alt A: The candidate configuration (which need to be complete) is applied and replacing the current UE configuration (at the time of reconfiguration execution/cell switch), by a RRC reconfiguration procedure that makes replacements of configuration but doesn’t necessarily reset RLC or PDCP. (Same procedure as above)**

**- Alt B: The candidate configuration (which can be a delta config) is applied to the current UE configuration (at the time of reconfiguration execution/cell switch), by legacy RRC reconfiguration procedure (it is assumed that the network need to coordinate if subsequent reconfigurations shall work, FFS feasibility).**

**agree to use Model 1: One *RRCReconfiguration* message for each candidate target configuration *RRCReconfiguration* to configure target candidate cells**

**Reference config can be empty**

**In the RRC procedures, the candidate delta configuration is applied on top of the reference configuration to form a complete candidate configuration when the UE receives the LTM configuration (before the LTM cell switch). UE implementation can postpone that step to the reception of the LTM cell switch command. FFS Discuss early vs late compliance check.**

**In the RRC procedures, the complete candidate configuration is applied and replacing the current UE configuration (at the time of reconfiguration execution/cell switch), by a RRC reconfiguration procedure that makes replacements of configuration but doesn’t necessarily reset MAC, RLC or PDCP. FFS whether we can rely on a modified version of the reconfiguration procedure with fullconfig flag set. FFS how to make sure the procedures work in case the LTM candidate configuration is a complete configuration.**

* No consensus to support HARQ continuation (and in order to resume discussion some new input may be needed, e.g. quantitative evidence of a serious problem).
* To determine if to reset L2 or not is based on RRC configuration (e.g. set of cells. FFS if separate for RLC, MAC, PDCP).

# Agreements at RAN2#119b-e(R2-2211061)

Terminology

* RAN2 to use “LTM” as term for the L1/L2-triggered mobility.
* Use the term “cell switch” for the procedure of triggering change of cells via the LTM feature
* Use the term “Subsequent” LTM for the case when cell switch between L1/L2 mobility candidates is done without RRC reconfiguration in between.

Target performance enhancements

* No security update support in Rel-18 with L1/L2 based mobility.
* FFS whether ASN.1 decoding and validity/compliance check of candidate cell configuration are performed upon reception of the candidate cells configuration. FFS if this need to be specified.
* For UE processing, the following (not exhaustive) is assumed to be performed after receiving the cell switch command:

MAC/RLC reset (when configured)

RF retuning (e.g. needed for inter-frequency), baseband retuning

* R2 assumes that the following items may be discussed by RAN1 and RAN4 (and may be scenario specific):

- Whether to perform DL synchronization to candidate/target cell before receiving the cell switch command. R2 assumes this is feasible at least for the case that the target cell is already an active serving cell.

- Whether to support of performing TRS tracking and CSI measurement of candidate/target cell before/by cell switch command

* L1L2 based mobility supports the following CA scenarios:

PCell change without SCell change

PCell change with SCell change

* Support NR-DC scenario in L1L2 based mobility, at least for the PSCell change without MN involvement case, i.e. intra-SN.

L1 measurements and beam indication

* RAN2 assumes that RAN1 will drive discussions on L1 measurement enhancements, if any. If RAN1 identifies the need for e.g. event reporting, filtering etc, RAN2 can then be involved if needed.
* Inter-freq L1L2 mobility: R2 Confirms that For L1L2 mobility inter-freq scenarios in general should be supported (including mobility to inter-frequency cell that is not a current serving cell), including the support of inter-frequency L1 measurements, if feasible by R4 and R1.
* RAN2 assumes that whether to use the unified TCI framework as the baseline for beam indication for L1L2 mobility is up to RAN1 (RAN2 observes that L1/L2 mobility need to support inter-freq cases).

RRC

* A L1/L2 inter-cell mobility candidate (target) configuration is received within an RRC message before the L1/L2 dynamic switch is triggered.
* For L1L2 mobility, Target Pcell/SCell can be current SCell/PCell, i.e., current SCell/PCell can be configured as candidates.
* RAN2 assumes that sequential L1L2 cell change between Candidates without RRC reconfiguration can be supported.

Dynamic cell switching

* RAN2 assumes L1/2 mobility trigger information is conveyed in a MAC CE, FFS if the MAC CE or a DCI is used for the actual triggering.
* RAN2 assumes the MAC CE for L1/2 mobility trigger contains at least a candidate configuration index.
* FFS if it should be possible to perform SCell activation/deactivation (amongst SCells associated with the candidate configuration) simultaneously with L1 L2 mobility trigger MAC CE (if so, FFS how this is determined).
* RAN2 assumes that both RACH-based (CFRA, CBRA) and RACH-less procedures for L1 L2 mobility switch may be supported. RACH-less if the UE doesn’t need to acquire TA during the cell switch. RAN2 understands that the feasibility of RACH-less may depend on RAN1, and expect that RAN1 is working on this.
* RAN2 assumes RACH resource for CFRA for L1 L2 dynamic switch may be provided in RRC configuration (or potentially by MAC CE FFS).
* FFS if the MAC CE can indicate TCI state(s) (or other beam info) to activate for the target Cell(s), dep on RAN1 progress.
* R2 assumes that at L1L2 cell switch: Whether the UE performs partial or full MAC reset (FFS what partial reset is, e.g. to avoid data loss), re-establish RLC, perform data recovery with PDCP is explicitly controlled by the network. R2 assumes that this can be configured by RRC. FFS if MAC CE indication(s) is/are needed.

# Agreements at RAN2#119-e (R1-2208331/ R2-2209257)

* Assumption: HO interruption time for L1/L2-based inter-cell mobility is the time from UE receives the cell switch command to UE performs the first DL/UL reception/transmission on the indicated beam of the target cell. FFS if TRS tracking after HO and CSI RS measurement should also be included, i.e. the time to use a high-performance beam (can be clarified further).
* Assumption: To reduce HO interruption time, investigate e.g. solutions to reduce the time for UE reconfiguration (already in the WID), downlink and uplink synchronization after handover decision (other parts of dynamic switch not precluded).
* Confirm to Support L1/L2-based inter-cell mobility for inter-DU scenario (as well as intra-DU scenarios).
* The design for intra-DU and inter-DU L1/L2-based mobility should share as much commonality as reasonable. FFS which aspects need to be different.
* R2 assumes that L2 is continued whenever possible (e.g. intra-DU), without Reset, with the target to avoid data loss, and the additional delay of data recovery.
* ICBM is one scenario considered for L1L2 mobility, but is not the only one, and is not a prerequisite for using L1L2 mobility.
* RAN2 to consider preparation of target cell configurations capable of dynamic switching without need for full configuration.
* Measurement delay can/may be considered in this work
* Assume that we rely on L1 measurements to trigger L1L2 mobility (still measurement for preparation could be L3, FFS)
* R2 will initially focus on PCell mobility.
* R2 assumption: Rel-18 L1/L2 mobility includes both non-CA (PCell only) and CA scenarios (PCell and SCell). This includes the following cases

a) the target PCell/target SCell(s) is not a current serving cell (CA 🡪 CA scenario with PCell change)

b) FFS the target PCell is a current SCell

c) FFS the target SCell is the current PCell.

* DC scenarios are FFS (e.g. PSCell mobility may be a low hanging fruit FFS).
* Current options on the table: to configure a L1/L2 inter-cell mobility candidate cell:

a. One RRCReconfiguration message for candidate target cell

b. One CellGroupConfig IE for each candidate target cell

c. One SpCellConfig IE for each candidate target cell

* Will send an LS to RAN1 and RAN3 on the progress of this meeting.