**3GPP TSG RAN WG3#129 R3-25xxxx**

**25th August – 29th August - 2025**

**Bengaluru, India**

Agenda Item: 13.2

Source: China Telecom

Title: Summary of pre-offline discussion on inter-CU LTM

Document for: Approval

# Introductions

This is a pre-offline discussion for inter-CU LTM topics, and try to achieve some consensus, and list some open issues to be treated in the online session on Wednesday.

In this offline, moderator plans to discuss to CSI-RS related issues and try to reach some consensus.

# For the Chairman’s Notes

Propose the following:

**WA: Confirm to have the explicit CSI-RS resource request indicator in the request message, and candidate node provides the CSI resource config in XnAP. Further check the stage3 details.**

**The candidate gNB/gNB-DU provides the CSI-RS Report configuration for CSI Acquisition separately via a new IE (e.g., refers to *ltm-CSI-ReportConfig-r19*) in** **via Xn HANDOVER REQUEST ACKNOWLEDGEMENT and F1 UE CONTEXT SETUP RESPONSE messages. Further check the LTM Configuration Update Acknowledge message and UE Context Modification Response message.**

**Turn the WA into agreement: RAN3 agrees that, for both F1AP and XnAP, the activation and deactivation of CSI-RS transmission in LTM candidate cells are performed at the level of individual CSI-RS Resource IDs.**

**Include the optional CSI-RS Resource ID(s) in the request message, and include the CSI Resource ID(s) and additionally the LTM configuration ID(s) in the response message.**

**Reuse the CSI-RS coordination procedure to deactivates the SP CSI-RS resources of candidate cell(s) in the candidate gNB-DU(s) or gNB-CU(s).**

# Discussion

## CSI-RS related issues

In the last meeting, we left following open issues on CSI-RS resource management:

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| *FFS on whether gNB-DU/gNB provides the report type (periodic or semi-persistent) of the CSI-RS resources in both F1AP and XnAP.*  *FFS on whether the* *TCI State/QCL-info List needs to be included in CSI-RS COORDINATION procedure.*  *FFS on whether to include the* *SP CSI-RS and SSB mapping in the HANDOVER REQUEST ACKKNOLEDGE message and UE Context Modification Request message.*  *FFS on whether to add a* *new IE for SP CSI-RS resource for CSI acquisition in the corresponding procedure of SP CSI-RS resource for L1 RSRP measurement in F1AP and XnAP.* |

### Issue 1: CSI-RS Resource type

Based on the Tdoc review, companies show following preference:

* + - **Explicit way**: Nokia, ZTE, HW, NEC, Lenovo, NTT DOCOMO
    - **Implicit way**: CT, E///, CATT

Based on the latest RAN2 Running CR, the resource type has been introduced into the *LTM-CSI-ResourceConfig* IE as shown below*.*

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| --- |
| – *LTM-CSI-ResourceConfig*  The IE *LTM-CSI-ResourceConfig* defines a group of one or more CSI resources for one or more LTM candidate configurations.  ***LTM-CSI-ResourceConfig* information element**  -- ASN1START  -- TAG-LTM-CSI-RESOURCECONFIG-START  LTM-CSI-ResourceConfig-r18 ::= SEQUENCE {  ltm-CSI-ResourceConfigId-r18 LTM-CSI-ResourceConfigId-r18,  ltm-SSB-ResourceSet-r18 LTM-SSB-ResourceSet-r18,  ...,  [[  ltm-NZP-CSI-RS-ResourceSet-r19 LTM-NZP-CSI-RS-ResourceSet-r19 OPTIONAL, -- Need R  ltm-CSI-IM-ResourceSet-r19 LTM-CSI-IM-ResourceSet-r19 OPTIONAL, -- Need R  resourceType-r19 ENUMERATED {periodic, semiPersistent} OPTIONAL -- Cond CSI-RS  ]]  } |

As the *resourceType-r19* IE in RRC is per *CSI-RS Resource Set*, whether to include the report type (periodic or semi-persistent) of the CSI-RS resources depends on the design of IE (i.e. refer to which RRC IE) on the RAN3 interface:

* **Option 1: Explicit way – *refer to ltm-NZP-CSI-RS-ResourceToAddModList* as defined in TS 38.331**

Proposed by HW: Introduce two separate CSI-RS resource list for periodic and semi persistent respectively. The modification to the BLCR may look like:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 9.3.1.x1 CSI-RS Resource Configuration This IE contains the CSI-RS resource configuration used for LTM.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | IE/Group Name | Presence | Range | IE type and reference | Semantics description | | Periodic CSI-RS Resource Configuration To AddModList | O |  | OCTET STRING | Contains the *ltm-NZP-CSI-RS-ResourceToAddModList* as defined in TS 38.331 [8]. | | Semi Persistent CSI-RS Resource Configuration To AddModList | O |  | OCTET STRING | Contains the *ltm-NZP-CSI-RS-ResourceToAddModList* as defined in TS 38.331 [8]. | |

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| *LTM-Candidate* information element  -- ASN1START  -- TAG-LTM-CANDIDATE-START  LTM-Candidate-r18 ::= SEQUENCE {  ltm-CandidateId-r18 LTM-CandidateId-r18,  ltm-CandidatePCI-r18 PhysCellId OPTIONAL, -- Need M  ltm-SSB-Config-r18 LTM-SSB-Config-r18 OPTIONAL, -- Need M  ltm-CandidateConfig-r18 OCTET STRING (CONTAINING RRCReconfiguration) OPTIONAL, -- Need M  ltm-ConfigComplete-r18 ENUMERATED {true} OPTIONAL, -- Need R  ltm-EarlyUL-SyncConfig-r18 OCTET STRING (CONTAINING EarlyUL-SyncConfig-r18) OPTIONAL, -- Need R  ltm-EarlyUL-SyncConfigSUL-r18 OCTET STRING (CONTAINING EarlyUL-SyncConfig-r18) OPTIONAL, -- Need R  ltm-TCI-Info-r18 LTM-TCI-Info-r18 OPTIONAL, -- Need M  ltm-NoResetID-r18 INTEGER (1..maxNrofLTM-Configs-plus1-r18) OPTIONAL, -- Need M  ltm-UE-MeasuredTA-ID-r18 INTEGER (1..maxNrofLTM-Configs-plus1-r18) OPTIONAL, -- Need M  ...,  [[  ltm-NoSecurityChangeID-r19 LTM-NoSecurityChangeId-r19 OPTIONAL, -- Need M  ltm-ExecutionCondition-r19 SetupRelease {LTM-ExecutionConditionList-r19} OPTIONAL, -- Need M  ltm-NZP-CSI-RS-ResourceToAddModList-r19 SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-Resource  OPTIONAL, -- Need N  ltm-NZP-CSI-RS-ResourceToReleaseList-r19 SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-Resources)) OF NZP-CSI-RS-ResourceId  OPTIONAL, -- Need N  ltm-NZP-CSI-RS-ResourceSetToAddModList-r19 SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSet  OPTIONAL, -- Need N  ltm-NZP-CSI-RS-ResourceSetToReleaseList-r19 SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourceSets)) OF NZP-CSI-RS-ResourceSetId  OPTIONAL, -- Need N  ltm-CSI-ReportConfig-r19 LTM-CSI-ReportConfig-r18 OPTIONAL, -- Need N  ltm-CSI-IM-ResourceToAddModList-r19 SEQUENCE (SIZE (1..maxNrofCSI-IM-Resources)) OF CSI-IM-Resource  OPTIONAL, -- Need N  ltm-CSI-IM-ResourceToReleaseList-r19 SEQUENCE (SIZE (1..maxNrofCSI-IM-Resources)) OF CSI-IM-ResourceId  OPTIONAL, -- Need N  ltm-CSI-IM-ResourceSetToAddModList-r19 SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSets)) OF CSI-IM-ResourceSet  OPTIONAL, -- Need N  ltm-CSI-IM-ResourceSetToReleaseList-r19 SEQUENCE (SIZE (1..maxNrofCSI-IM-ResourceSets)) OF CSI-IM-ResourceSetId  OPTIONAL -- Need N  ]]  } |

If option1 is adopted, further check whether following IEs needs to be transferred over Xn and F1AP:

* + ltm-NZP-CSI-RS-ResourceSetToAddModList-r19
  + ltm-CSI-ReportConfig-r19
  + ltm-CSI-IM-ResourceToAddModList-r19
  + ltm-CSI-IM-ResourceSetToAddModList-r19
* **Option 2: Implicit way – refer to *ltm-CSI-ResourceConfigToAddModList* as defined in TS 38.331**

Proposed by E///: Rename the IE to “Request for CSI Resource Configuration”, then the candidate network node providing the CSI Resource Configuration for both SSB and CSI-RS.

(Note: In this option, alignment with the F1 interface should be addressed. It is proposed to add semantic descriptions to the existing IE, i.e., SSB Information IE, for Rel-19.)

**CSI Resource Configuration over Xn/F1:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
| CSI Resource Configuration To AddModList | O |  | OCTET STRING | Contains the *ltm-CSI-ResourceConfigToAddModList* as defined in TS 38.331 [10]. |
| CSI Resource Configuration To Release List | O |  | OCTET STRING | Includes the*ltm-CSI-ResourceConfigToReleaseList*contained in the *LTM-Config* IE as defined in TS 38.331 [10]. |

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| --- |
| *LTM-Config* information element  -- ASN1START  -- TAG-LTM-CONFIG-START  LTM-Config-r18 ::= SEQUENCE {  ltm-ReferenceConfiguration-r18 SetupRelease {ReferenceConfiguration-r18} OPTIONAL, -- Cond NR-DC  ltm-CandidateToReleaseList-r18 SEQUENCE (SIZE (1..maxNrofLTM-Configs-r18)) OF LTM-CandidateId-r18 OPTIONAL, -- Need N  ltm-CandidateToAddModList-r18 SEQUENCE (SIZE (1..maxNrofLTM-Configs-r18)) OF LTM-Candidate-r18 OPTIONAL, -- Need N  ltm-ServingCellNoResetID-r18 INTEGER (1..maxNrofLTM-Configs-plus1-r18) OPTIONAL, -- Need N  ltm-CSI-ResourceConfigToAddModList-r18 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourceConfigurations-r18)) OF LTM-CSI-ResourceConfig-r18  OPTIONAL, -- Need N  ltm-CSI-ResourceConfigToReleaseList-r18 SEQUENCE (SIZE (1..maxNrofLTM-CSI-ResourceConfigurations-r18)) OF LTM-CSI-ResourceConfigId-r18  OPTIONAL, -- Need N  attemptLTM-Switch-r18 ENUMERATED {true} OPTIONAL, -- Cond LTM-MCG  ltm-ServingCellUE-MeasuredTA-ID-r18 INTEGER (1..maxNrofLTM-Configs-plus1-r18) OPTIONAL, -- Need N  ...,  [[  ltm-ServingCellNoSecurityChangeID-r19 LTM-NoSecurityChangeId-r19 OPTIONAL, -- Need N  ltm-ServingCellExecutionCondition-r19 SetupRelease {LTM-ExecutionConditionList-r19} OPTIONAL -- Need M  ]]  } |

**Moderator summary:**

**WA: Confirm to have the explicit CSI-RS resource request indicator in the request message, and candidate node provides the CSI resource config in XnAP. Further check the stage3 details.**

### Issue 2: Transfer SP CSI-RS and SSB mapping info

Based on the Tdoc review, companies show following preference:

* + - **Not needed**: NEC
    - **Needed**: HW, QC (include TCI state IDs for SP CSI-RS resources in RRC IE), NTT DOCOMO

From moderator’s point of view, the issues2 should be considered together with issue3.

For reference, following RRC spec is capture as below:

|  |
| --- |
| NZP-CSI-RS-Resource ::= SEQUENCE {  nzp-CSI-RS-ResourceId NZP-CSI-RS-ResourceId,  resourceMapping CSI-RS-ResourceMapping,  powerControlOffset INTEGER (-8..15),  powerControlOffsetSS ENUMERATED{db-3, db0, db3, db6} OPTIONAL, -- Need R  scramblingID ScramblingId,  periodicityAndOffset CSI-ResourcePeriodicityAndOffset OPTIONAL, -- Cond PeriodicOrSemiPersistent  qcl-InfoPeriodicCSI-RS TCI-StateId OPTIONAL, -- Cond Periodic  ...,  ----omitted----  } |

In addition, the TCI state list transmission is also discussed in the TEI 18 (i.e. in CB#8), the lasted status of the CR should also be considered together with issue.

**Moderator summary:**

**Companies need further check on this issue.**

### Issue 3: TCI State/QCL-info in CSI-RS coordination

Based on the Tdoc review, companies show following preference:

* + - **Needed**: Nokia, NEC, CATT, Lenovo
    - **Not needed**: HW

According to RAN2 agreement, the TCI state ID of the activated/deactivated CSI-RS resource is included in the new MAC CE to the UE. From the network point of view, how does source node to choose/decide the TCI state ID of candidate cell should be discussed.

One way of understanding is the source gNB/gNB-DU can determine the SP CSI-RS resources to be activated/deactivated based on the SSB measurement results and the SP CSI-RS to SSB mapping info, the TCI State/QCL-info List is necessary to, and the TCI State ID in CSI-RS coronation may not need if mapping info is provided.

If understanding#1 is adopted, following question needs to be solved:

* + - **Candidate Q1: Transfer the SP CSI-RS and SSB mapping info explicitly in F1AP/XnAP or implicitly in RRC IE (i.e. *NZP-CSI-RS-Resource*)?**
    - **Candidate Q2: Whether to include TCI State ID(s) in CSI-RS coordination procedure?**

Another way of understanding is the source gNB/gNB-DU can determine the SP CSI-RS resources to be activated/deactivated based on the SSB measurement results directly, no SP CSI-RS and SSB mapping info is needed, but the TCI State ID(s) in CSI-RS coronation is needed.

**Moderator summary:**

**Companies need further check on this issue.**

### Issue 4: New IE for CSI-RS resource config for CSI acquisition

This issue can be divided into following two candidate issues and should be considered together:

* **Issue 4-1: New IE for request the CSI-RS resource for CSI acquisition**

Based on the Tdoc review, companies show following preference:

* + - **Option 1: Needed**, Nokia, HW, NEC, QC, CATT
    - **Option 2: Not needed**, Ericsson, Jio Platforms, Verizon Wireless, ZTE, Ofinno
* **Issue 4-2: New IE for response the CSI-RS resource for CSI acquisition**

For this issue, companies show similar preference as new IE for CSI-RS for CSI acquisition Request:

* + - **Option 1: Needed**, Nokia, HW, CATT
    - **Option 2: Not needed**, Ericsson, Jio Platforms, Verizon Wireless, ZTE, Ofinno

From moderator’s point of view, firstly we need to figure out **whether in RRC spec can distinct the CSI-RS resource configuration used for L1 measurements or for CSI acquisition**.

In [R3-255424, HW], it gives following clarification on the difference between CSI-RS configuration for L1 measurements and CSI-RS configuration for CSI acquisition in RRC spec:

|  |  |
| --- | --- |
| In the *LTM-Candidate* IE in the latest RRC running CR, there is only one CSI-RS resource related IE named as *ltm-NZP-CSI-RS-ResourceToAddModList-r19* introduced for both CSI-RS based L1 measurement and CSI acquisition.  However, according to the latest RRC running CR, the CSI-RS resource for L1 measurement is indicated by the serving gNB in the *ltm-CSI-ReportConfigToAddModList-r18* IE in *CSI-MeasConfig* in *ServingCellConfig.* While the CSI-RS resource for CSI acquisition is indicated by the candidate gNB in the *ltm-CSI-ReportConfigToAddModList-r18* IE in *LTM-Candidate* which is required by RAN1 as per the incoming LS in [1]*.*  Furthermore, the following field description for the repetition parameter in the *NZP-CSI-ResourceSet* hints that the CSI-RS resource for L1 measurement and the CSI-RS resource for CSI acquisition cannot be reused, as the value and presence of the repetition parameter is different for the two cases.   |  | | --- | | ***repetition***  Indicates whether repetition is on/off. If the field is set to *off* or if the field is absent, the UE may not assume that the NZP-CSI-RS resources within the resource set are transmitted with the same downlink spatial domain transmission filter (see TS 38.214 [19], clauses 5.2.2.3.1 and 5.1.6.1.2). It can only be configured for CSI-RS resource sets which are associated with *CSI-ReportConfig* with report of L1 RSRP, L1 SINR or "no report". If *NZP-CSI-RS-ResourceSet* if configured in *LTM-Candidate*, the field can only be configured as *off*, if present. | |

As illustrate above, the candidate gNB/candidate gNB-DU needs to provide the CSI-RS resource for CSI acquisition separately via F1AP and XnAP.

Based on the outcome of issue1, RAN3 further check whether to define a new IE for candidate gNB/candidate gNB-DU provides the CSI-RS resource for CSI acquisition:

* + - If explicit way is adopted for issue1 (i.e. CSI-RS Resource Configuration refer to *ltm-NZP-CSI-RS-ResourceToAddModList*), then a new IE is needed here;
    - If implicit way is adopted for issue1 (i.e. CSI-RS Resource Configuration refer to *ltm-CSI-ResourceConfigToAddModList*), then no new IE is needed here;

For issue 4-1, we need to discuss **which node (source or target) to make the decision on whether to configure CSI acquisition measurement for the UE**.

For option 1, it is the **source node** to determines whether the candidate gNB needs to provide CSI-RS resources for CSI acquisition, following the similar principle of CSI-RS for RSRP measurement.

For option 2, it is the **candidate node** to decide whether it wants the UE to be configured for Early CSI acquisition of a candidate cell (i.e. based on the UE-Capability info) and provide the CSI-RS resources for CSI acquisition accordingly.

Check companies’ views and decide which option to choose.

***Note****: If no new IE is introduced for CSI-RS for CSI acquisition request and response, then a new IE (to indicate the CSI-RS purpose) in CSI-RS coordination may be needed, check proposal from R3-255724 if needed.*

**Moderator summary:**

**Companies need further check on this issue.**

### Issue 5: CSI-RS report config for CSI acquisition

According to [R3-255724, Ericsson, Jio Platforms, Verizon Wireless, ZTE, Ofinno], the RRC encoding for the CSI-RS report configuration for CSI acquisition and for the CSI-RS report configuration for L1 measurements are different.

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| --- |
| The RRC encoding for the CSI-RS report configuration for CSI acquisition and for the CSI-RS report configuration for L1 measurements will be different. The source CU receives the CSI-RS report configuration for L1 measurements in the *LTM-CSI-ReportConfig* IE, included in the CellGroup (CellGroupConfig-> SpCellConfig-> ServingCellConfig->CSI-MeasConfig-> LTM-CSI-ReportConfig), but does not receive the CSI-RS report configuration for CSI acquisition. |

Therefore, a new IE (e.g., CSI-RS report configuration for CSI Acquisition) should be introduced in the UE CONTEXT SETUP RESPONSE F1AP messages and HANDOVER REQUEST ACKNOWLEDGE message.

In [R3-255138, Nokia], it proposes to provide the CSI-RS Report configuration for CSI Acquisition separately in LTM Configuration Update message.

**Proposal 5-1: The candidate gNB/gNB-DU provides the CSI-RS Report configuration for CSI Acquisition separately via a new IE (e.g., CSI-RS report configuration for CSI Acquisition) via Xn HANDOVER REQUEST ACKNOWLEDGEMENT and F1 UE CONTEXT SETUP RESPONSE messages.**

**Moderator summary:**

**The candidate gNB/gNB-DU provides the CSI-RS Report configuration for CSI Acquisition separately via a new IE (e.g., refers to *ltm-CSI-ReportConfig-r19*) in** **via Xn HANDOVER REQUEST ACKNOWLEDGEMENT and F1 UE CONTEXT SETUP RESPONSE messages. Further check the LTM Configuration Update Acknowledge message and UE Context Modification Response message.**

### Issue 6: Granularity of CSI-RS resource/resource set

This issue is related to the following WA:

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| WA: RAN3 agrees that, for both F1AP and XnAP, the activation and deactivation of CSI-RS transmission in LTM candidate cells are performed at the level of individual CSI-RS Resource IDs. |

Based on the Tdoc review, companies show following preference:

* + - **Option1: Include CSI-RS Resource set ID (*LTM-CSI-ResourceConfigId*):** NEC, Ericsson, Jio Platforms, Verizon Wireless, ZTE, Ofinno, CATT, Lenovo
    - **Option2: Include CSI-RS Resource ID (*NZP-CSI-RS-ResourceId*)**: Nokia, NTT DOCOMO, HW

In the incoming LS R3-255011, RAN2 confirmed that *LTM-CSI-ResourceConfigId* is included into SP CSI-RS activation/deactivation MAC CE.

1. UE deactivates SP CSI-RS resource of candidate cells (other than the target cell) after cell switch. FFS on the target cell.
2. Instead of candidate cell id and SP CSI-RS resource set id, LTM-CSI-ResourceConfigId is included into SP CSI-RS activation/deactivation MAC CE.

To align with RAN2 agreement, the granularity (currently indicated as CSI-RS Resource ID) should be updated to *CSI-ResourceConfigId*, and the candidate cell can be removed.

**Proposal 6-1: For both F1AP and XnAP, the activation and deactivation of CSI-RS transmission in LTM candidate cells are performed at the level of CSI Resource Configuration ID. Remove the NR CGI IE in the CSI-RS coordination procedures.**

**Moderator summary:**

**Turn the WA into agreement: RAN3 agrees that, for both F1AP and XnAP, the activation and deactivation of CSI-RS transmission in LTM candidate cells are performed at the level of individual CSI-RS Resource IDs.**

**Include the optional CSI-RS Resource ID(s) in the request message, and include the CSI Resource ID(s) and additionally the LTM configuration ID(s) in the response message.**

### Issue 7: CSI-RS-based L3 LTM

In the last meeting, the R18 L3 based LTM is supported by introducing a new F1AP CU-DU Mobility Initiation Request message from CU to DU. The SSB-based beam measurement results were agreed to be included in this F1AP message.

In Rel-19, the CU can also receive CSI-RS-based beam measurement results from UE, in [R3-255301, QC], it proposed that CSI-RS-based beam measurement results should be sent from the CU to the DU in the F1-AP *CU-DU Mobility Initiation Request* message.

**Proposal 7-1: The CSI-RS-based beam measurement results should be sent from the CU to the DU in the F1AP *CU-DU Mobility Initiation Request* message.**

**Moderator summary:**

Check online.

### Issue 8: Editorial updates on BLCRs

* **Misalignment on CSI-RS coordination procedure in F1AP and XnAP**

Currently the IE structure of CSI-RS coordination procedure in F1AP and XnAP is not aligned:

**CSI-RS COORDINATION in XnAP:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CSI-RS COORDINATION REQUEST This message is sent by NG-RAN node1 to NG-RAN node2 to coordinate the activation and deactivation of CSI-RS transmission for a UE at NG-RAN node2.  Direction: NG-RAN node1 → NG-RAN node2.  *Editor’s note: Based on the* WA: RAN3 agrees that, for both F1AP and XnAP, the activation and deactivation of CSI-RS transmission in LTM candidate cells are performed at the level of individual CSI-RS Resource IDs. *Details on IEs need to be continued.*   | IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality | | --- | --- | --- | --- | --- | --- | --- | | Message Type | M |  | 9.2.3.1 |  | YES | reject | | NG-RANnode1 UE XnAP ID | M |  | NG-RANnode1 UE XnAP ID 9.2.3.16 | Allocated at the source NG-RAN node | YES | reject | | NG-RANnode2 UE XnAP ID | M |  | NG-RANnode2 UE XnAP ID 9.2.3.16 | Allocated at the target NG-RAN node | YES | reject | | **CSI-RS Resource Request List** |  | *1* |  | Cell ID list to which the request applies. | YES | reject | | **>CSI-RS Resource Request Item** |  | *1 .. <maxnoofCSIRSResourceCells>* |  |  | – |  | | >>NR CGI | M |  | 9.2.2.7 |  | – |  | | >>Semi Persistent CSI-RS Transmission Request | M |  | ENUMERATED(activate, deactivate, …) |  | – |  | | **>>CSI-RS Resources ID List** | O | *1 .. <maxnoofCSIRSResourceIDs>* |  |  | – |  | | >>>CSI-RS Resource ID (FFS) | M |  | INTEGER (0..191) |  | – |  | |

**CSI-RS COORDINATION in F1AP:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| DU-CU CSI-RS COORDINATION REQUEST This message is sent by the gNB-DU to request the gNB-CU e.g. to activate/deactivate the SP CSI-RS transmissions from specific cells. (Detail is FFS)  Direction: gNB-DU → gNB-CU   | IE/Group Name | Presence | Range | IE type and reference | Semantics description | | --- | --- | --- | --- | --- | | Message Type | M |  | 9.3.1.1 |  | | gNB-CU UE F1AP ID | M |  | 9.3.1.4 |  | | gNB-DU UE F1AP ID | M |  | 9.3.1.5 |  | | **CSI-RS to be Activated List** |  | 0..1 | Detailed IE structure is FFS |  | | **>CSI-RS to be Activatedtem IEs** |  | 1 .. <maxnoofCellList> |  |  | | >>Candidate Cell ID | M |  | NR CGI  9.3.1.12 |  | | >>SP CSI-RS Resource ID | M |  | FFS |  | | **CSI-RS to be Deactivated List** |  | 0..1 | Detailed IE structure is FFS |  | | **>CSI-RS to be Deactivated Item IEs** |  | 1 .. <maxnoofCellList> |  |  | | >>Candidate Cell ID | M |  | NR CGI  9.3.1.12 |  | | >>SP CSI-RS Resource ID | M |  | FFS |  | |

**Moderator summary:**

Align the F1AP and XnAP IE design.

* **Candidate cell SP CSI-RS deactivation after cell switch**

According to the incoming LS R3-255011, RAN2 made the following agreements.

1. UE deactivates SP CSI-RS resource of candidate cells (other than the target cell) after cell switch. FFS on the target cell.
2. Instead of candidate cell id and SP CSI-RS resource set id, LTM-CSI-ResourceConfigId is included into SP CSI-RS activation/deactivation MAC CE.

According to the RAN2 agreement, UE deactivates SP CSI-RS resource of candidate cells (other than the target cell) after LTM cell switch. When the UE deactivates the SP CSI-RS resource of candidate cells after cell switch, the status of the SP CSI-RS resource should be synchronized to the corresponding candidate gNBs.

There are two options. One approach is to task the source gNB or source gNB-DU to invoke the CSI-RS coordination procedure towards candidate gNBs with the SP CSI-RS resources that need to be deactivated. The other one is to allow the new serving gNB to deactivate the SP CSI-RS resources in the candidate gNBs by LTM CONFIGURATION UPDATE message.

* + - **Option1:** Reuse the CSI-RS coordination procedure to deactivates the SP CSI-RS resources in the candidate gNB-DU(s) or gNB-CU(s).
    - **Option2:** Reuse the LTM CONFIGURATION UPDATE message deactivates the SP CSI-RS resources in the candidate gNB(s).

***Notes:*** *For option2, intra-CU case may need to reuse the CSI-RS coordination procedure.*

**Moderator summary:**

Adopt option 1, and update the stage2 BCLR.

**Reuse the CSI-RS coordination procedure to deactivates the SP CSI-RS resources of candidate cell(s) in the candidate gNB-DU(s) or gNB-CU(s).**

## Security key handling

According to the incoming LS [R3-253009] on RAN2 agreements for security key handling in inter-CU LTM:

|  |  |
| --- | --- |
| Regarding the security key handling in Rel-19 Inter-CU LTM, RAN2 made the following agreements at RAN2#129bis meeting:   |  | | --- | | Agreements:   1. For security key update in inter-CU LTM, RAN2 agree to include actual NCC value in the LTM cell switch command MAC CE. 2. NCC is included in the LTM cell switch command MAC CE if the R19 set ID is different between the target cell and source cell. Conversely, if the R19 set ID is same for both cells, the NCC will not be included. 3. NW configures the corresponding sk-Counter in all LTM candidate configurations, and UE uses the configured value for generating the SN key when security key update is performed in MCG. 4. A list of sk-counters is linked to a Rel-19 set ID configured by the SN. 5. At RLF and reconfiguration with sync failure: 6. If RLF:  * If the selected candidate cell has the same Rel-19 set ID as source (no security key change), the UE performs fast failure recovery (same as in Rel-18).  1. If reconfiguration failure (inter-CU LTM):  * If the selected candidate cell has the same Rel-19 set ID as target, the UE performs fast failure recovery. FFS if fast failure recovery with different Rel-19 set IDs is allowed.  1. The indication on whether to allow or not the SN to configure an inter-SN candidate is included in the inter-node RRC message. |   The term “R19 set ID” refers to the “LTM no security change ID” configured to the UE for serving cell and candidate cells separately. RAN2 assumes that even for intra-CU LTM, the network is allowed to configure different R19 set IDs for different cells (including serving and/or intra-CU candidate cells) if the network wants to trigger security key update. From UE perspective, security key update is performed when the R19 set IDs are different between the serving cell and the target cell, whether it is intra-CU or inter-CU LTM can be transparent to the UE. |

RAN3 needs to discuss how to configure the Rel-19 set ID of each candidate cell and evaluate the spec impact. In the last meeting, we left following open issues on the Rel-19 Set ID(s) assignment among CUs:

|  |
| --- |
| *FFS on the Rel-19 Set ID(s) assignment among CUs, down select from Option1 and Option2:*  *Option 1: Source gNB sends the Rel-19 Set ID(s) or Rel-19 set ID range assigned to the candidate gNB in the HANDOVER REQUEST message, then candidate gNB assigns Rel-19 set ID(s) to its own candidate cells and feedback via HANDOVER REQUEST ACKNOWLEDGE message.*  *Option 2: Candidate gNB provides Rel-19 set ID per candidate cell in HANDOVER REQUEST ACKNOWLEDGE message, then source gNB may update the Rel-19 set ID to ensure that the Rel-19 set IDs under different candidate gNB-CU are different.*  *FFS on the procedure to be used for source gNB to transfer Rel-19 set ID per candidate cell to the candidate gNB.* |

Based on the Tdoc review, companies show following preference:

* **Option 1**:
  + Rel-19 Set ID per candidate cell: HW, CATT, CT
  + Rel-19 Set ID range/list of Rel-19 Set ID per-node: E///, LGE, Lenovo
  + Both is fine: Nokia, NEC, NTT DOCOMO
* **Option 2**: ZTE, SS

**Proposal 3.2-1: Adopt Option 1 for Rel-19 Set ID(s) assignment among CUs, further check whether source CU sends the Rel-19 Set ID per candidate cell or Rel-19 Set ID range/list of Rel-19 Set ID per-node to candidate CUs.**

**Moderator summary:**

Check whether above proposal1 is agreeable.

Regarding to the procedure to be used for source gNB to transfer Rel-19 set ID per candidate cell to the candidate gNB, companies show following preference:

* + **Option 1**: Via Cell Switch Notification message:
  + **Option 2:** Via LTM Configuration Update message: Nokia, NEC, Lenovo, E///, CT
  + **Option 3:** Via both message: LGE

From moderator’s point of view, the Rel-19 set ID per candidate cell is the sync-up info (do not change during subsequent LTM) and can be transferred together with other sync info (i.e. early sync config) via LTM Configuration Update procedure. Therefore, moderator propose to follow the majority companies view with below proposal:

**Proposal 3.2-1: Agree to reuse LTM Configuration Update message to transfer Rel-19 set ID per candidate cell to the candidate CUs.**

**Moderator summary:**

Check whether above proposal2 is agreeable.

## Handling of multiple UE associations

### Issue 1: Single UE association

RAN3 has agreed to implement a single UE XnAP association during inter-CU LTM preparation towards a certain candidate CU. The following agreement was made at RAN3 #127bis meetings:

|  |
| --- |
| **Turn the WA into agreement:** **Use a single UE association (e.g. identified by a pair of {Source NG-RAN node UE XnAP ID IE and Target NG-RAN node UE XnAP ID IE}) for multiple LTM handover request to the same candidate gNB.** |

And RAN3 also agreed to support parallel LTM preparation over Xn interface and update the BLCR of XnAP as below:

|  |
| --- |
| 8.2.1 Handover Preparation8.2.1.1 General This procedure is used to establish necessary resources in an NG-RAN node for an incoming handover. If the procedure concerns a conditional handover or LTM, parallel transactions are allowed. Possible parallel requests are identified by the target cell ID when the source UE AP IDs are the same. |

However, the conditional handover supports two kinds of parallel transactions, same source UE AP IDs and different source UE AP IDs. While LTM only supports parallel transactions with same source UE AP IDs. Therefore, revision on current BLCR is needed.

In [255628, Huawei, NEC, LG Electronics], it is proposed to capture the parallel transaction description for LTM separately to avoid any ambiguity as below. Similar proposal from [R3-255269, E///]

|  |
| --- |
| 8.2.1 Handover Preparation8.2.1.1 General This procedure is used to establish necessary resources in an NG-RAN node for an incoming handover. If the procedure concerns a conditional handover, parallel transactions are allowed. Possible parallel requests are identified by the target cell ID when the source UE AP IDs are the same.  If the procedure concerns a LTM, parallel transactions are allowed only when using the same source UE AP ID. Possible parallel requests are identified by the target cell ID. |

Similar proposal from [R3-255268, E///]:

|  |
| --- |
| This procedure is used to establish necessary resources in an NG-RAN node for an incoming handover. If the procedure concerns a conditional handover ~~or LTM~~, parallel transactions are allowed. Possible parallel requests are identified by the target cell ID when the source UE AP IDs are the same. If the procedure concerns an LTM when the candidate cells are configured within the same target NG-RAN node, parallel transactions are allowed using the same pair of source NG-RAN node UE XnAP ID and target NG-RAN node UE XnAP ID. |

**Proposal 3.6-1: RAN3 to capture the parallel transactions handling for LTM properly.**

Furthermore, once the UE Xn association is setup between the source gNB and the target gNB (meaning that the source gNB receives the target NG-RAN node UE XnAP ID in the HANDOVER REQUEST ACK message), the source gNB should include the target NG-RAN node UE XnAP ID in the handover requests for any follow-up preparation. The stage 3 change is shown as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 9.1.1.1 HANDOVER REQUEST This message is sent by the source NG-RAN node to the target NG-RAN node to request the preparation of resources for a handover.  Direction: source NG-RAN node → target NG-RAN node.   | IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality | | --- | --- | --- | --- | --- | --- | --- | | Message Type | M |  | 9.2.3.1 |  | YES | reject | | Source NG-RAN node UE XnAP ID reference | M |  | NG-RAN node UE XnAP ID 9.2.3.16 | Allocated at the source NG-RAN node | YES | reject | | <skip irrelevant part> | | | | | | | | **LTM Handover Information Request** | O |  |  |  | YES | reject | | >LTM Information Request | O |  | 9.2.3.xx1 |  | – |  | | >Request for CSI-RS Resource Configuration | O |  | ENUMERATED (true, …) |  | – |  | | >Target NG-RAN node UE XnAP ID reference | O |  | NG-RAN node UE XnAP ID 9.2.3.16 | Allocated at the target NG-RAN node | YES | ignore | | Early Sync Information Request | O |  | 9.2.3.xx3 |  | YES | ignore | |

**Proposal 3.6-2: Once the UE XnAP association is setup, the source gNB includes the target NG-RAN node UE XnAP ID in the handover request message for any follow-up preparation..**

**Moderator summary:**

Check whether the update on parallel transactions in stage2 and/or stage3 is needed.

### Issue 2: Subsequent UE association setup

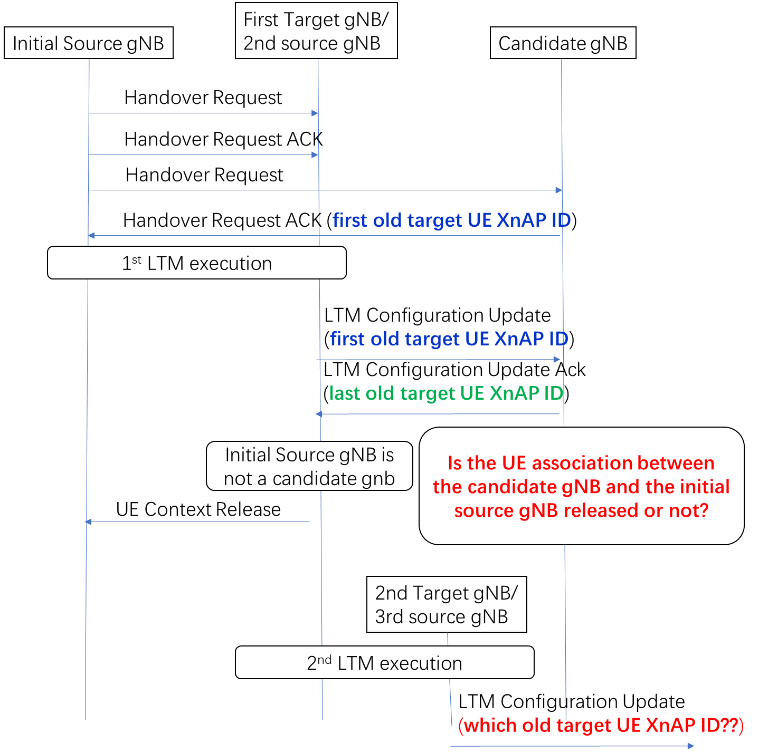
For subsequent LTM, the UE association need to be setup between the new serving gNB and the candidate gNB after each LTM cell switch, when establishing the UE association, the candidate gNB should identify that the UE is the same as the previously associated between the old serving gNB and the current candidate gNB. In the last RAN3 meeting, we agreed to use the old target UE XnAP ID to identify the UE context, but how to deliver the old target UE XnAP ID(s) to the new serving gNB is still FFS.

|  |
| --- |
| *For subsequent LTM, the candidate gNB uses the old target UE XnAP ID (the target UE AP ID it previously allocated between it and the old serving gNB) to identify the UE context when receiving the LTM Configuration Update message from the new serving gNB. FFS on how to deliver the old target UE XnAP ID(s) to the new serving gNB.* |

Regarding to this issue, in [R3-255424, HW], it proposed to clarify what is the “old target UE XnAP ID”, there are possible two kinds of understanding:

* One understanding is that **the** **old** **target UE XnAP ID is the target UE XnAP ID allocated by the candidate gNB at the initial LTM preparation** which is used to identify the UE association between the initial source gNB and the candidate gNB.
* The other understanding is that i**t is the target UE XnAP ID allocated** **by the candidate gNB after last LTM cell switch**, e.g., when receiving the LTM Configuration Update Request message from the new source gNB.

As the example gives in the tdoc, the UE association between the candidate gNB and the initial source gNB may be released by the candidate gNB if it the initial source gNB is released (i.e. no candidate cell exists in the initial source cell). Therefore, the “old target UE XnAP ID” should **refer to the target UE XnAP ID allocated by the candidate gNB after last LTM cell switch**.



**Proposal 3.6-1: To clarify that the “old target UE XnAP ID” is the target UE XnAP ID allocated by the candidate gNB after las****t LTM cell switch e.g., when receiving the LTM Configuration Update Request message from the new source gNB.**

In addition, in [R3-255268, Ericsson], it proposed to include the old source NG-RAN node UE XnAP ID, old target NG-RAN node UE XnAP ID, old source NG-RAN ID, old target NG-RAN node ID in LTM CONFIGURATION UPDATE message to allow the new candidate gNB to identify the same UE.

**Moderator summary:**

Check whether above proposal is agreeable, and whether additional information is needed to identify the same UE association.

Additionally, regarding to how to deliver the old target UE XnAP ID(s) to the new serving gNB, based on companies’ proposals, there are following options to deliver the old target UE XnAP ID(s) to the new serving gNB:

* + **Option1:** via the LTM Configuration Update procedure: NEC, E///, SS, Lenovo
  + **Option2:** via Cell Switch Notification message: QC
  + **Option3:** Both above messages: LGE, CATT

From moderator’s point of view, all the above option are workable, since the old target UE XnAP ID(s) may be updated after LTM cell switch and to give more flexibility to the network, we can go for Option3.

**Proposal 3.6-2: The old source gNB can deliver the old target UE XnAP ID(s) to the new serving gNB via Cell Switch Notification and Cell Switch Notification message.**

**Moderator summary:**

Check whether above proposal is agreeable.

## Data Forwarding

Currently, we still have an FFS on the *Data Forwarding Information* IE included in the LTM Configuration Update message in XnAP, RAN3 needs further discuss the granularity of this information (i.e. per-node, per-PDU session, per DRB):

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 9.1.1.x3 LTM CONFIGURATION UPDATE  This message is sent by the NG-RAN node1 to update LTM configuration data.  Direction: NG-RAN node1  NG-RAN node2.  *Editor’s note: Details on IEs need to be continued.*   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality | | Message Type | M |  | 9.2.3.1 |  | YES | reject | | NG-RAN node 1 UE XnAP ID | M |  | NG-RAN node UE XnAP ID 9.2.3.16 | Allocated at the NG-RAN node 1 | YES | reject | | NG-RAN node 2 UE XnAP ID | O |  | NG-RAN node UE XnAP ID 9.2.3.16 | Allocated at the NG-RAN node 2 | YES | reject | | LTM Information Request | O |  | 9.2.3.xx1 |  | YES | ignore | | **LTM Updates to Candidate Cell Information List** | *0..1* |  |  |  | YES | ignore | | ============omit the unrelated part================= | | | | | | | | Data Forwarding Information | FFS |  |  |  |  |  | |

In [R3-255063, E///] and [R3-255659, SS], it proposed to adopt per-PDU session level Data Forwarding Information, moderator wants to check whether following proposal is agreeable:

**Proposal 3.3-1: The source gNB sends the Data Forwarding Information as per-PDU session level to the candidate gNBs in the LTM CONFIGURATION UPDATE message.**

**Moderator summary:**

Check whether above proposal is agreeable.

## TA Information Transfer

In RAN3#127 meeting, we agreed to introduce a new non-UE associated class-2 TA information Transfer message to transfer the TA information from the candidate gNB-CU to the source gNB-CU. But left an open issue on **whether to include the XnAP IDs** in this new message.

Regarding to what information should be included in the TA Information Transfer message, companies have following proposals:

* + ***Not include the XnAP IDs****: Nokia, ZTE, NEC, SS, QC, CT*
  + ***Include Tag ID Pointer****: NEC, ZTE, CATT, CT*
  + ***Include source gNB-DU ID/RACH resource request ID****: NEC, QC, DOCOMO, Samsung*

**Proposal 3.5-1: Include the *Tag ID Pointer and RACH resource request ID* in TA Information Transfer in XnAP.**

**Moderator summary:**

Check whether above proposal is agreeable.

In addition, similar as intra-CU LTM, there are companies propose the include the TA values in Cell Switch Notification message for subsequent LTM, while some companies think it is not needed:

* + ***Include the TA values in Cell Switch Notification message****: Samsung, Nokia, QC*
    - *In addition to TA values, also include the measured RSRP: Nokia*
    - *Include TA validity timer values associated with the TA values: QC*
  + ***Do not include the TA values in Cell Switch Notification message****: CATT, CT*

From moderator’s point of view, since this is the last meeting this WI, if there is no consensus on the transmission of TA values and related info, we can stop the discussion on this issue and leave it open in TEI 19.

**Moderator summary:**

Check companies’ views.

## Reference configuration

Currently, we still have a remaining issue on the reference configuration:

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| --- |
| *The source gNB can generate reference configuration and provide a reference configuration for LTM in a Handover Request and LTM configuration update message.*  *The candidate gNB indicates whether a LTM candidate configuration is a complete candidate configuration in the Handover Request Acknowledge and LTM configuration update acknowledge message.*  *FFS on whether the source gNB* *can request a candidate gNB to provide a reference configuration.* |

Based on companies’ contributions, companies’ preference on whether source gNB can request a candidate gNB to provide a reference configuration is listed as below:

* + ***Approach 1****:* *Allow the source gNB to request a candidate gNB to provide a reference configuration. [****Nokia, Google, CATT, China Telecom, ZTE, Lenovo, Huawei, NTT Docomo, Samsung, CMCC****]*
  + ***Approach 2****: For inter-CU LTM, only the source gNB can provide the reference configuration. [****Qualcomm, Ericsson****]*
  + ***Approach 3****: If the source CU does not provide the reference configuration, it is up to the candidate CU to provide the reference configuration to the source CU and the source CU can decide which one to adopt as a reference configuration.* ***[LG Electronics]***

Since we have stuck in this issue for several meetings, moderator propose to follow the majority companies view with below proposal:

**Proposal 3.4-1:** **RAN3 to allow the source gNB to request a candidate gNB to provide a reference configuration in Rel-19.**

**Moderator summary:**

Check whether above proposal is agreeable.

## Others

We can continue to discuss the following issues if time allows:

1. PRACH Resources for RACH-less LTM: Ericsson, Jio Platforms, Lenovo, NTT DoCoMo
2. gNB-DU initiated LTM resource reconfiguration: Rakuten Mobile Inc, Qualcomm Inc, NTT DOCOMO INC
3. No full connectivity between candidate gNBs: Ericsson
4. Reference to LTM Candidate in F1 and Xn: E///
   1. Add new IE in the UE CONTEXT SETUP RESPONSE and UE CONTEXT MODIFICATION REQUEST messages which refers to the LTM-Candidate IE
   2. Change the semantics description of the LTM Information Response IE to refer to the LTM-Candidate IE
5. Include the PDU Session Resource Information List of all Candidate gNBs via the LTM CELL SWITCH NOTIFICATION message: Nokia
6. After receiving the LTM CONFIGURATION UPDATE message, the candidate gNB discards the buffered data received from the original source gNB: HW
7. UE Based TA Measurement ID: SS (same as Rel-19 set ID allocation principle)
8. Add a “Cell Switch Type (ENUMERATED(RACH-lss, RACH-based))” in F1AP and XnAP CELL SWITCH NOTIFICATION messages: Nokia

# Conclusion, Recommendations [if needed]

If needed

# References

|  |  |  |
| --- | --- | --- |
| [R3-255011](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255011.zip) | LS on RAN2 agreements for SP CSI-RS activation/deactivation (RAN2(CATT)) | LS in |
| [R3-255027](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255027.zip) | Reply LS on security handling for inter-CU LTM in non-DC cases (SA3(Huawei)) | LS in |
| [R3-255426](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255426.zip) | [DRAFT] Reply LS on security handling for inter-CU LTM in non-DC cases (Huawei) | LS out To: SA3 CC: RAN2 |
| [R3-255625](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255625.zip) | Fetching reference configuration from candidate gNB in inter-CU LTM (Huawei, Google, Nokia, Jio Platforms, CATT, CMCC, NTT Docomo, Lenovo, China Telecom, Samsung) | discussion |
| [R3-255724](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255724.zip) | Support for Semi-persistent CSI-RS transmission (Ericsson, Jio Platforms, Verizon Wireless, ZTE, Ofinno) | discussion |
| [R3-255532](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255532.zip) | PRACH resources for RACH-less LTM (Ericsson, Jio Platforms, Lenovo, NTT DoCoMo) | discussion |
| [R3-255138](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255138.zip) | TP (BL CR TS 38.300, TS 38.473, TS 38.423) Remaining issues on Inter-CU LTM procedure (Nokia) | other |
| [R3-255374](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255374.zip) | (TP for TS38.401) On support of inter-CU LTM (China Telecom) | other |
| [R3-255197](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255197.zip) | (TP to BL CR for TS 38.423 and 38.473 on Inter-CU LTM) Remaining Rel-19 inter-CU LTM issues (NEC) | other |
| [R3-255268](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255268.zip) | Completion of Inter-CU LTM (Ericsson) | discussion |
| [R3-255424](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255424.zip) | (TP for LTM BLCR for TS38.300): Inter-CU LTM (Huawei) | other |
| [R3-255149](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255149.zip) | (TP to 38.423, 38.473) Inter-CU LTM (ZTE Corporation) | other |
| [R3-255659](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255659.zip) | (TP to BLCR for TS38.423 and TS38.473) Inter-gNB-CU LTM (Samsung) | discussion |
| [R3-255301](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255301.zip) | Signalling enhancements for Inter-CU LTM handover (Qualcomm India Pvt Ltd) | discussion  moved from 13.3 |
| [R3-255421](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255421.zip) | Discussion on inter-CU LTM (NTT DOCOMO INC..) | discussion |
| [R3-255604](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255604.zip) | Discussion for general issues in Inter-CU LTM (CATT) | discussion |
| [R3-255403](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255403.zip) | [TP to BLCR for TS 38.401] Inter-CU LTM (Lenovo) | other |
| [R3-255614](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255614.zip) | Discussions on finalizing the essential aspects of Inter-CU LTM (LG Electronics Inc.) | discussion |
| [R3-255550](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255550.zip) | gNB-DU initiated LTM resource reconfiguration (Rakuten Mobile Inc, Qualcomm Inc, NTT DOCOMO INC) | discussion |
| [R3-255150](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255150.zip) | (TP to BL CR for TS 38.300, 38.473, 38.423) Rel-19 Set ID assignment (ZTE Corporation) | other |
| [R3-255375](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255375.zip) | Discussion on inter-CU LTM in DC scenario (China Telecom) | discussion |
| [R3-255139](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255139.zip) | Discussion on Inter-CU LTM with Dual Connectivity (Nokia) | discussion |
| [R3-255660](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255660.zip) | Additional Discussion on inter-gNB-CU LTM (Samsung) | discussion |
| [R3-255198](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255198.zip) | (TP to BL CR for TS 38.423 and 37.340 on Inter-CU LTM with DC) Remaining issues of Rel-19 inter-CU LTM in DC scenario (NEC) | other |
| [R3-255404](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255404.zip) | [TP to BLCR for TS 38.423] Inter-CU LTM in DC (Lenovo) | other |
| [R3-255418](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255418.zip) | (TP to BL CR 38.423) Clarification on inter-CU LTM and LTM with SCG in NR-DC (Google) | other |
| [R3-255419](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255419.zip) | (TP to BL CR 37.340 and 38.473) Clarification on inter-CU LTM and LTM with SCG in NR-DCs (Google) | other |
| [R3-255283](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255283.zip) | Open Issues on Access Success for Inter-SN SCG LTM (Ofinno, LLC) | discussion |
| [R3-255281](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255281.zip) | Remaining Issues on Data Forwarding for SN initiated Inter-SN LTM (Ofinno, LLC) | discussion |
| [R3-255282](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255282.zip) | (TP for TS 38.423) Cell Switch Notification for LTM DC Scenario (Ofinno, LLC) | other |
| [R3-255269](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255269.zip) | (TP for LTM BL CR for TS 38.423, TS 38.473, TS 38.300, TS 38.401) – Support for inter-CU LTM (Ericsson) | other |
| [R3-255405](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255405.zip) | [TP to BLCR for TS 38.423] Inter-CU LTM in DC - text update (Lenovo) | other |
| [R3-255425](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255425.zip) | (TP for LTM BLCR for TS38.473):Inter-CU LTM (Huawei) | other |
| [R3-255440](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255440.zip) | (TP for LTM CR for TS38.423): LTM Resource Lifecycle Management in inter-CU LTM (Jio Platforms) | discussion |
| [R3-255533](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255533.zip) | (TP to BL CR for TS 38.423) – PRACH Resources for RACH-less LTM (Ericsson, Jio Platforms, Lenovo, NTT DoCoMo) | other |
| [R3-255534](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255534.zip) | (TP to BL CR for TS 38.473) – PRACH Resources for RACH-less LTM (Ericsson, Jio Platforms, Lenovo, NTT DoCoMo) | other |
| [R3-255601](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255601.zip) | Inter-CU LTM Robustness Enhancements (Jio Platforms) | discussion |
| [R3-255605](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255605.zip) | (TP to BL CR for TS37.340) Discussion for Inter-CU LTM in DC (CATT) | discussion |
| [R3-255615](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255615.zip) | (TP for NR\_Mob\_Ph4 TS 38.423) Inter-CU LTM (LG Electronics Inc.) | other |
| [R3-255626](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255626.zip) | (TP for LTM BLCR for TS38.423): Fetching reference configuration from candidate gNB in inter-CU LTM (Huawei, Google, Nokia, Jio Platforms, CATT, CMCC, NTT Docomo, Lenovo, China Telecom, Samsung) | other |
| [R3-255627](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255627.zip) | (TP for LTM BLCR for TS38.300): Fetching reference configuration from candidate gNB in inter-CU LTM (Huawei, Google, Nokia, Jio Platforms, CATT, CMCC, NTT Docomo, Lenovo, China Telecom, Samsung) | other |
| [R3-255628](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255628.zip) | Clarification on the single UE XnAP association in inter-CU LTM (Huawei, NEC, LG Electronics) | discussion |
| [R3-255629](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255629.zip) | (TP for LTM BLCR for TS38.300): Clarification on the single Xn UE association in inter-CU LTM (Huawei, NEC, LG Electronics) | other |
| [R3-255630](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255630.zip) | (TP for LTM BLCR for TS38.423): Clarification on the single Xn UE association in inter-CU LTM (Huawei, NEC, LG Electronics) | other |
| [R3-255725](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255725.zip) | (TP to BL CR for TS 38.423) Support for Semi-persistent CSI-RS transmission (Option 1) (Ericsson, Jio Platforms, Verizon Wireless, ZTE) | other |
| [R3-255726](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255726.zip) | (TP to BL CR for TS 38.473) Support for Semi-persistent CSI-RS transmission (Option 1) (Ericsson, Jio Platforms, Verizon Wireless, ZTE) | other |
| [R3-255727](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255727.zip) | (TP to BL CR for TS 38.423) Support for Semi-persistent CSI-RS transmission (Option 2) (Ericsson, Jio Platforms, Verizon Wireless, ZTE) | other |
| [R3-255728](file:\D:\3GPP%20WG%20tdoc\TSGR3_129\Docs\R3-255728.zip) | (TP to BL CR for TS 38.473) Support for Semi-persistent CSI-RS transmission (Option 2) (Ericsson, Jio Platforms, Verizon Wireless, ZTE) | other |

# Appendix

**Previous meeting agreements:**

*RAN3#123bis:*

*Prioritize to support inter-CU LTM over Xn interface, and RAN3 specify the inter-CU LTM solutions for standalone scenario first.*

*Reuse existing Xn Handover Request and Handover Request ACK for Inter-CU LTM initial preparation.*

*Confirm the case that inter-CU LTM is not configured in both MCG and SCG at the same time.*

*Early data forwarding can be supported for inter-CU LTM.*

*Cell Switch Notification from source DU to target DU (in different gNB from source) for LTM execution.*

*RAN3#124:*

*Source gNB-CU initiates the handover preparation procedure for inter-gNB-CU LTM.*

*Introduce a new procedure on Xn to transfer the TA information.*

*A new XnAP class 2 procedure, namely LTM Cell Switch Notification is introduced on Xn to forward the target Cell ID and target TCI state ID(s) from the source gNB-CU to the target gNB-CU.*

*Reuse Handover Success procedure over Xn for Rel-19 Inter-CU LTM, to tell the source CU that the UE has accessed to the target Cell.*

*The Handover Cancel message is reused by the source gNB to release the reserved resource for LTM candidate cells in the candidate gNBs.*

*Early data forwarding can be triggered before the Source gNB triggers a MAC CE Command to the UE to change cells, timing is left to implementation.*

*Early sync configuration (TCI state and RACH configuration) can be obtained during the LTM preparation phase through the handover request and handover request acknowledge messages.*

*A candidate gNB can initiate cancellation of configured LTM candidate cell(s) of its own. Details are FFS.*

*FFS on the LTM modification procedures.*

*FFS on whether to reuse the existing XnAP UE CONTEXT RELEASE message at the source gNB if no LTM candidate cell(s) exist in the source gNB.*

*RAN3#125:*

*Introduce a new UE associated Class-1 XnAP procedure to update the LTM configurations for subsequent LTM.*

*Change the name of LTM Cell Switch Notification message to Cell Switch Notification message.*

*Reuse the Early Status Transfer and SN Status Transfer message for inter-CU LTM.*

*Adopt Class-2 procedure for candidate gNB-initiated LTM cancellation. Down select from Option1 and Option3 in the next meeting:*

*Option 1: Reuse CHO Cancel*

*Option 2: Rename CHO Cancel*

*Option 3: Introduce new procedure*

*RAN3#125bis:*

*Current SSB information in Xn Setup and Configuration Update procedures can be reused for LTM preparation phase.*

*WA: For inter-CU LTM mobility, a separate LTM request message (i.e. HANDOVER REQUEST message) is used for each candidate cell.*

*The error handling of multiple UE associations need to be considered.*

*The LTM Configuration IDs are allocated by the source CU.*

*WA: Reuse the existing XnAP UE CONTEXT RELEASE message at the source gNB if no LTM candidate cell(s) exist in the source gNB.*

*Follow F1AP, the source gNB-CU sends the CSI resource configuration of candidate cells to candidate gNB-CUs via Handover Request message for subsequent LTM, and the candidate gNB-CU sends the CSI report configuration to the source gNB-CU via Handover Request ACK message.*

*How the source gNB-CU sends the reference configuration to all candidate gNBs is pending on RAN2 progress.*

*Confirm the name of the new procedure as “LTM Configuration Update”.*

*Introduce a new procedure for candidate gNB-initiated LTM cancellation.*

*Allow UE association in-between candidate CUs (in case the Xn connectivity existed) for subsequent LTM. When and how to establish the UE association is FFS.*

*RAN3#126:*

*RAN3 move forward on Legacy framework with PDCP change/switch for inter-CU LTM in this release, not considering the PDCP anchor based solution.*

*The source CU can request candidate CU to provide CSI-RS configuration in HANDOVER REQUEST message, and candidate CU signals the CSI-RS configuration in HANDOVER REQUEST ACKNOWLEDGEMENT message.*

*The source CU generates common CSI-RS Resource Configuration and sends it to candidate CU in LTM CONFIGURATION UPDATE message, the candidate CU signals the CSI-RS Report Configuration in LTM CONFIGURATION UPDATE ACKNOWLEDGEMENT message.*

*Turn the WA into agreement: For inter-CU LTM mobility, a separate LTM request message (i.e. HANDOVER REQUEST message) is used for each candidate cell.*

*To support subsequent LTM, the LTM Configuration Update procedure is reused to establish UE association between the new source gNB and the other candidate gNB(s) after each inter-CU LTM Cell Switch.*

*Confirm the message name as LTM Cancel for candidate gNB-initiated LTM cancellation.*

*Turn the WA into agreement: Reuse the existing XnAP UE CONTEXT RELEASE message at the source gNB if no LTM candidate cell(s) exists in the source gNB.*

*Late data forwarding may be initiated after the source gNB decides to trigger the LTM Cell Switch Command to the UE, when exactly it is initiated is left to implementation?*

*RAN3#127:*

*For both inter-CU and intra-CU cases:*

*For the network Semi-Persistent CSI-RS coordination, source gNB-DU/source gNB triggers the activation/deactivation of the CSI-RS transmission in the candidate cell.*

*For the activation/deactivation procedure, a class 1 procedure is needed from the source gNB-DU/source gNB. FFS for reusing existing one or a new one.*

*The candidate gNB-CU responds the full SSB Time/Frequency Configuration (in SSB Information IE) of candidate cells to the source gNB-CU in the Handover Request ACK message.*

*The source gNB-CU sends the pair of (gNB ID, new ID of early RACH configuration resource (to be further discussed)) to the candidate gNB-CU to request early RACH configuration.*

*WA: Introduce a new non-UE associated class 2 procedure on Xn, namely TA information Transfer message, to transfer the TA information from the candidate gNB-CU to the source gNB-CU.*

*RAN3 agree the following scenarios to support LTM with NR-DC:*

*1.SN initiated inter-CU SCG LTM without MCG changes (high priority)*

*2.Inter-CU MCG LTM without SN release*

*3.Inter-CU MCG LTM with SN release*

*4.Inter-CU MCG LTM with SN addition*

*The format of the new introduced IE is same with the gNB-DU ID.*

*The source gNB can generate reference configuration and provide a reference configuration for LTM in a Handover Request and LTM configuration update message.*

*The candidate gNB indicates whether a LTM candidate configuration is a complete candidate configuration in the Handover Request Acknowledge and LTM configuration update acknowledge message.*

*FFS on whether the source gNB can request a candidate gNB to provide a reference configuration.*

*WA: Use a single UE association for multiple LTM handover request to the same candidate gNB.*

*Reuse the LTM Configuration Update procedure to sync up configurations among candidate gNBs for subsequent LTM, including early sync configuration, configuration ID, and data forwarding addresses, etc.*

*It is up to the network implementation when the sync up is performed: during the preparation step, or during the cell switch execution step, or after successful cell switch.*

*Normal data forwarding may be initiated after the source gNB decides to trigger the LTM cell switch for the UE, and when exactly it is initiated is left to implementation.*

*For SN initiated inter-CU SCG LTM, the source SN initiates the inter-CU SCG LTM preparation procedure by sending an SN Change Required message to the MN.*

*The MN requests each candidate SN to allocate resources for the UE via SN Addition request message.*

*Within the list of cells suggested by the source SN, the candidate SN provides the SCG part configuration of each candidate PSCell and may also provide the L1 RS (e.g. a list of SSB or a list of CSI-RS) configuration for L1 measurement, early UL sync configuration or TCI-state configuration, to the MN, via SN addition request ACK message.*

*In order to support subsequent inter-CU SCG LTM, the MN needs to transfer the common CSI resource configuration and the collected information of candidate cells to the candidate SN(s), via SN modification request message. Accordingly, the candidate SN(s) responds with the updated candidate SCG configuration to the MN via SN modification request ACK message.*

*The Cell Switch Notification message can be reused from the source SN to the target SN via the MN. The detailed IE can be further discussed.*

*RAN3#127bis:*

*Reuse the LTM configuration update procedure to transfer UE’s 5G security capabilities and/or UE’s UP security policy from the new serving gNB to the other candidate gNBs in subsequent LTM.*

*The new NCC value needs to be sent from gNB-CU to the gNB-DU via UE context modification procedure.*

*Introduce two new Class-1 UE-associated procedures over F1AP to support the source gNB-DU to trigger the activation/deactivation of the SP CSI-RS transmission in the candidate cell(s).*

*Introduce a new class-1 UE-associated procedures over XnAP for the SP CSI-RS activation/deactivation.*

*Open issues on the granularity of the CSI-RS resource/resource set, and need to be checked with RAN2 progress.*

*For the initial inter-CU LTM preparation, the source gNB computes the KgNB\*(s) (per candidate cell) for the candidate gNB, and forwards the {KgNB\*, NCC} pair(s) to the candidate gNB via a Handover Request message as legacy.*

*The new source gNB needs to provide the new KgNB\*(s) to the corresponding candidate gNB via a LTM configuration update procedure. FFS on the procedure design either per cell or per gNB.*

*Whether to define additional information from CU to DU to deliver NCC value.*

*Turn the WA into agreement: Introduce a new non-UE associated class 2 procedure on Xn, namely TA information Transfer message, to transfer the TA information from the candidate gNB-CU to the source gNB-CU.*

*Include the following information in the TA information transfer message:*

*Candidate Cell ID*

*TA value*

*Preamble index*

*RA-RNTI*

*FFS on the XnAP IDs.*

*Turn the WA into agreement: Use a single UE association (e.g. identified by a pair of {Source NG-RAN node UE XnAP ID IE and Target NG-RAN node UE XnAP ID IE}) for multiple LTM handover request to the same candidate gNB.*

*For subsequent LTM, the candidate gNB uses the old target UE XnAP ID (the target UE AP ID it previously allocated between it and the old serving gNB) to identify the UE context when receiving the LTM Configuration Update message from the new serving gNB. FFS on how to deliver the old target UE XnAP ID(s) to the new serving gNB.*

*Data Forwarding Information IE is a list including multiple data forwarding addresses from each candidate gNB(s).*

*RAN3#128:*

*WA: RAN3 agrees that, for both F1AP and XnAP, the activation and deactivation of CSI-RS transmission in LTM candidate cells are performed at the level of individual CSI-RS Resource IDs.*

*Add description in Stage 2 TS 38.401 for describing that CU can request Candidate DU to provide CSI-RS configuration in UE CONTEXT SETUP REQUEST message, and Candidate DU signals the CSI-RS configuration in UE CONTEXT SETUP RESPONSE message.*

*For Inter-CU LTM, LTM CONFIGURATION UPDATE procedure is per node level basis with a list of cells, and security key is per cell.*

*Remove Note in TS 38.300 BL CR “Editor’s Note: step 6 and 7 are optional.”*

*Update the online agreement to: CU can request Candidate DU to provide CSI-RS configuration in UE CONTEXT SETUP REQUEST and UE CONTEXT MODIFICATION REQUEST message, and Candidate DU signals the CSI-RS configuration in UE CONTEXT SETUP RESPONSE and UE CONTEXT MODIFICATION RESPONSE message.*

*Reuse the CSI-RS coordination procedure over F1AP and XnAP for source gNB/gNB-DU to activate or deactivate the SP CSI-RS resource for CSI acquisition in candidate cell.*

*In Xn interface, candidate gNB provides the LTM CFRA Resource Configuration of each candidate cell to source gNB for LTM cell switch command generation.*

*Source gNB generate the UE Based TA Measurement Configuration, and transfer it to all candidate gNB(s) via LTM Configuration Update message.*

*Include the Rel-19 set IDs of source cell and each candidate cell(s) in UE Context Modification Request message. Introduce Rel-19 set IDs into LTM Security Information IE.*

*FFS on the Rel-19 Set ID(s) assignment among CUs, down select from Option1 and Option2:*

*Option 1: Source gNB sends the Rel-19 Set ID(s) or Rel-19 set ID range assigned to the candidate gNB in the HANDOVER REQUEST message, then candidate gNB assigns Rel-19 set ID(s) to its own candidate cells and feedback via HANDOVER REQUEST ACKNOWLEDGE message.*

*Option 2: Candidate gNB provides Rel-19 set ID per candidate cell in HANDOVER REQUEST ACKNOWLEDGE message, then source gNB may update the Rel-19 set ID to ensure that the Rel-19 set IDs under different candidate gNB-CU are different.*

*FFS on the procedure to be used for source gNB to transfer Rel-19 set ID per candidate cell to the candidate gNB.*

*FFS on whether gNB-DU/gNB provides the report type (periodic or semi-persistent) of the CSI-RS resources in both F1AP and XnAP.*

*FFS on whether the TCI State/QCL-info List needs to be included in CSI-RS COORDINATION procedure.*

*FFS on whether to include the SP CSI-RS and SSB mapping in the HANDOVER REQUEST ACKKNOLEDGE message and UE Context Modification Request message.*

*FFS on whether to add a new IE for SP CSI-RS resource for CSI acquisition in the corresponding procedure of SP CSI-RS resource for L1 RSRP measurement in F1AP and XnAP.*