3GPP TSG-RAN WG2 Meeting #123 R2-230xxxx

Toulouse, France, 21st – 25th August 2023

Agenda Item: x.x.x

Source: Ericsson

Title: [Post122][055][Mob18] Discussion on RRC open issues list for LTM

Document for: Discussion, Decision

# 1 Introduction

This contribution is to address the following email discussion:

* [Post122][055][Mob18] 38.331 Running CR and Open issues (Ericsson)

Scope: Reflect agreements, review the CR, address open issues, Capture newly identified open issues, determine points for R2#123 discussion.

Intended Outcome: Running CR, Report.

Deadline: Long

# 2 Discussion

According to the agreements and discussions taken so far in the context of LTM, a number of RRC open issues still remain to be addressed. Here the open issues are taken according to the section of the RRC running CR in which they are captured and grouped (whenever possible) if two of more Editor’s note refer to the same issue.

## FFS #1

*Editor’s Note: FFS on whether ltm-CandidateConfig applies also for the case of MBS or IAB.*

Generally, the interaction between different features is checked at the end of the release once that the specification work is done. About the interaction of LTM with MBS and IAB the proposal is to check this at the end of the release and leave this out for the time being.

**Question 1: Do companies agree to check the interaction of LTM with other features at the end of Release 18 once the work on LTM is completed?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | No strong view | If time allows, we can check it. |
|  |  |  |
|  |  |  |

## FFS #2

*Editor’s Note: FFS on whether the release of an SCell by an LTM candidate cell configuration is a valid case.*

According to legacy CellGroupConfig IE the SCell configuration is an AddModList/ToReleaseList structure and thus it should be possible for an LTM candidate cell configuration to add/modify/release SCell(s) at the UE upon an LTM cell switch procedure.

**Question 2: Do companies agree that it is possible for an LTM candidate cell configuration to add/modify/release SCell(s) at the UE?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | Agree | It is totally up to NW implementation. |
|  |  |  |
|  |  |  |

## FFS #3

*Editor’s Note: FFS on whether the UE performs the compliance check of the reference and LTM candidate cell configuration upon their reception of upon the execution of the LTM cell switch.*

*Editor’s Note: It is FFS is further actions are needed from the UE when a reconfiguration failure is detected because of an early compliance check of an LTM candidate.*

RAN2 has agreed already that the UE may perform early decoding and compliant check according to its implementation, and thus this Editor’s Note can be deleted. However, one remaining open issue is if some enhancements are needed in this particular case (e.g., UE reporting to the network which LTM candidate cell configurations have failed).

* 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.

So far when a UE detects a reconfiguration failure the RRC re-establishment procedure is triggered, and this should be the baseline also for the case of LTM. One question is whether there are any benefits in pursuing additional optimizations for a failure case and probably the easiest would be to align this behaviour with what we have for CHO.

**Question 3: Do companies agree that there is no need of further optimizations for the case on when an early compliance check on one or more LTM candidate cell configuration(s) fails?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | Agree | Please note that the current spec does not support any partial success or failure on the integrity check, so no subset of LTM candidates fail or success, and thus cannot notify NW to make reconfiguration of LTM candidates, or select one LTM candidates to perform the recovery.  Besides, we believe that the compliance check failure is indeed some corner case, so prefer not to perform any optimization. |
|  |  |  |
|  |  |  |

**Question 4: Do companies agree that if an early compliance check on one or more LTM candidate cell configuration(s) fails, this triggers an RRC re-establishment procedure (i.e., legacy behaviour is followed)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | Agree, but | Please note that the current spec does not support any partial success or failure on the integrity check, so no need to differ **on one or more LTM candidate cell configuration(s) fails.** |
|  |  |  |
|  |  |  |

## FFS #4

*Editor’s Note: FFS on how and whether to indicate that no RACH is needed for an LTM candidate cell.*

*Editor’s Note: FFS on what are actions the UE shall perform when executing a RACH-less LTM cell switch.*

*Editor’s Note: FFS how to indicate to the UE that RACH should be skipped when doing an LTM cell switch.*

The understanding is that this topic will be covered in email discussion [058] about the content of the LTM cell switch MAC CE. The proposal is to wait the outcome of that email discussion and discuss these again in case the issue is still not solved. Maybe good to leave only one FFS and delete the others.

## FFS #5

*Editor’s Note: FFS on how UE should establish the TA for a LTM candidate cell.*

*Editor’s Note: FFS on how to handle the TA (and when the UE has no TA) in the source cell (in case no RACH is performed) upon an LTM cell switch and whether this should be specified in RRC or MAC.*

This issue is pretty much related to MAC and UE actions needs to be captured in TS 38.321 rather than in RRC. The proposal is to delete these issuee, unless companies have some concern about this.

## FFS #6

*Editor’s Note: FFS on the need of ltm-ConfigComplete to indicate to the UE that the LTM candidate cell configuration in ltm-Candidate is a complete configuration.*

RAN2 has discussed already this issue and the common understanding is that there could be a scenario where an LTM candidate cell configuration is a complete configuration itself, regardless of whether there is a reference configuration or not. According to this, in the RRC running CR has been proposed the use of the field *ltm-ConfigComplete* to indicate to the UE whether the received LTM candidate cell configuration is already a complete configuration or not, as this will impact the way how the complete LTM candidate cell configuration is generated. Since this flag has been already part of the RRC running CR for a couple of meetings and no objections has been received so far by companies it seems that this Editor’s Note can be deleted.

## FFS #7

*Editor’s Note: FFS on whether we need to rely on the full configuration procedure or a new procedure for LTM is created when the UE generates a complete LTM candidate cell configuration.*

RAN2 has agreed that at the execution of an LTM cell switch procedure only full configuration with respect to the current UE configuration is supported.

* Confirm that only the replacement procedure (the “full config without L2 reset”) is supported for Execution of LTM cell switch.

A remaining issue is now whether to re-use the legacy full configuration procedure or to spell out what actions are needed on the UE when an LTM cell switch procedure is executed. The current version of the RRC Running CR assumes that the legacy full configuration procedure (and flag in ASN.1) is not reused and only the necessary actions are spelled. Also, the full configuration procedure is not really about when generating the complete LTM candidate cell configuration but is when an LTM cell switch is executed.

**Question 5: Do companies agree with current implementation in RRC running CR about not re-using the legacy full configuration procedure (please note that this question is about the principle)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | Agree | New procedure is more straightforward and forward compatible for further enhancement in next release. |
|  |  |  |
|  |  |  |

## FFS #8

*Editor’s Note: FFS on whether it needs to be clarified that lower layers indicate an LTM candidate cell configuration ID, among other info.*

According to current implementation of TS 38.321 for LTM, when the MAC layer receives the LTM cell switch command one of the action is to send the Target Configuration ID to upper layer:

2> indicate to upper layers the Target Configuration ID included in the MAC CE;

This will be taken into account in the RRC running CR and the proposal is to delete this Editor’s Note. If more information are indicated by lower layer, this will be addressed in the RRC running CR accordingly.

## FFS #9

*Editor’s Note: FFS on whether the radio bearer needs to be kept when execution the LTM cell switch.*

*Editor’s Note: FFS on whether some other configurations should be released or kept.*

In current RRC Running CR section 5.3.5.x.5 there is a UE action to keep *radioBearerConfig* or *radioBearerConfig2* when executing an LTM cell switch procedure and the main motivation for this is because RAN2 agreed that the RadioBearerConfig IE is optional within an LTM candidate cell configuration. Nevertheless, it is also questionable whether the RadioBearerConfig IE can be exactly the same upon doing an LTM cell switch but maybe this can be the case on when an intra-DU LTM cell switch is done. Either way, even if the UE keeps the *radioBearerConfig* or *radioBearerConfig2,* the LTM candidate cell configuration can always reconfigure the radio bearer at the UE and thus this should not be a big concern.

**Question 6: Do companies agree that UE should not release *radioBearerConfig* or *radioBearerConfig2* upon the execution of an LTM cell switch procedure?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | Please see comments | The only concern from our perspective is whether not releasing the RB or the RLC related configuration will lead to misalignment between UE and NW. If UE does not clear the radio bearer related configuration upon LTM cell switch, the RB reconfiguration procedure is performed on top of the UE’s current RB configuration. But this is not the intention of NW. E.g., in current configuration, there is DRB 1/2/3, while NW only want to configure the DRB 1/2 within the complete candidate LTM configuration, performing LTM cell switch will result in DRB 1/2/3 in UE side, while the NW may consider there is only DRB 1/2 (replacement procedure is used for LTM cell switch as RAN2 agreed).  One may argue that NW can firstly instruct UE to perform the release procedure for all the RB/RLC via the toReleaseList, and then add, but the point is the corresponding entity will also be released as a consequence, regardless NW indication on L2 reset.  So we think, before answering this question, maybe we need to clarify the following aspects which impacts:   * What is complete configuration for LTM, does it is the same like the legacy complete configuration (all fields need to be used should be present even it is the same with the current configuration)? This impacts what fields/configurations shall be included within the complete LTM configurations. * Which part of the configuration of the RLC bearer or Radio Bearer configuration, can be reconfigured within the LTM cell switch, i.e., the SN length or the number of the RLC logic channel or the number of the radio bearer? |
|  |  |  |
|  |  |  |

A further question is whether some other configuration should be kept by the UE, e.g., the MeasConfig IE.

**Question 7: Which other configurations (e.g., MeasConfig IE) do companies think that UE should not release upon the execution of an LTM cell switch procedure?**

|  |  |  |
| --- | --- | --- |
| Company | None/specify which ones | Comment |
| CATT |  | Similar comments as above, RAN2 need to first clarify:   * What is complete configuration for LTM, does it is the same like the legacy complete configuration (all fields need to be used should be present even it is the same with the current configuration)? This impacts what fields/configurations shall be included within the complete LTM configurations. * Which part of the configuration of the measConfig can be reconfigured? |
|  |  |  |
|  |  |  |

## FFS #10

*Editor’s Note: FFS on whether ServingCellConfigCommon is always provided in a LTM candidate cell configuration or whether can be optional.*

Current RRC Running CR assumes that *ServingCellConfigCommon* is always provided within an LTM candidate cell configuration. While for a UE may be possible to maintain a use the existing *ServingCellConfigCommon* when perform an intra-DU LTM cell switch procedure, it may be necessary for the network to provide a new one when an inter-DU LTM cell switch procedure is performed. Since when an LTM candidate cell configuration is provided to the UE there is no guarantee on whether the next LTM cell switch is intra-DU or inter-DU, a safest approach would be to always provide *ServingCellConfigCommon*.

**Question 8: Do companies agree that *ServingCellConfigCommon* is always provided within an LTM candidate cell configuration (as implemented in current RRC running CR)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | Agree |  |
|  |  |  |
|  |  |  |

## FFS #11

*Editor’s Note: The handling of the MAC and RLC entity is still FFS as it depends on how the L2 reset is indicated by the network.*

*Editor’s Note: FFS on how to capture UE actions when the L2 reset is needed.*

*Editor’s Note: FFS on the UE actions (for L2 reset) based on ltm-CandidateNoResetL2-List.*

*Editor’s Note: FFS on whether the LTM-CandidateNoResetL2-List field should include separate reset flags for MAC, RLC, and PDCP recovery.*

RAN2 has reached the following agreements about L2 reset during an LTM cell switch procedure:

* 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).
* RAN2 assumes that network implementation allows speedy data recovery for RLC AM bearer at intra-DU LTM cell switch without specification impact.
* The PDCP data recovery procedure can be applied to the RLC AM bearers for inter-DU LTM cell switch.
* Will not support HARQ continue at LTM cell switch in this release.

According to this agreement, a possible implementation on how to indicate during an LTM cell switch on whether L2 reset is needed or not (and what are the UE actions) is provided in the RRC Running CR and companies are invited to provide their inputs directly there. These Editor’s Notes can be deleted.

## FFS #12

*Editor’s Note: FFS on whether to use a new timer or re-use timer T304.*

*Editor’s Note: FFS on the supervision timer for the LTM cell switch.*

Current RRC Running CR assumes that a new timer is used for the LTM cell switch procedure as the start and stop of the timer may be different with respect to the legacy T304 (e.g., due to the RACH-less LTM). This will make the procedure a bit more clean and will also give the possibility to set value of this new timer differently from what we have in legacy T304 given also the nature of LTM (when the LTM cell switch is suppose to be much faster than normal L3 handover).

**Question 9: Do companies agree to use a new timer for the LTM cell switch procedure (as implemented in current RRC running CR)?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Comment |
| CATT | Yes to use timers other than T304, but | We prefer two new timers, one for RACH-based, one for RACH-less, since the RACH-less LTM cell switch is faster than the RACH-based LTM cell switch.  Or alternatively, we can also accept that there is one timer, but with a set of candidate values, and then NW indicate the value to be used in LTM cell switch command based on whether it is RACH-based and RACH-less cell switch, but this solution also requires the MAC to indicate to RRC on the value for the timer. |
|  |  |  |
|  |  |  |

However, about the supervision timer, one open issue that is still open is when the supervision timer should be stopped. Last time this topic was discussed, the outcome was that the UE should stop the supervision timer when upon successful completion of the RACH-less LTM cell switch procedure (i.e., reception of the first UL data). However, about how the UE determines the correct reception of the first UL data there are still three options on the table. About these three options the following can be observed (as also emerged by the last offline when this was discussed):

Option 1. RLC ACK of the *RRCReconfigurationComplete* message

* With this solution the UE determines that the *RRCReconfigurationComplete* has been received by the network and that the *RRCReconfiguration* message has been correctly applied. The RLC ACK delay may trigger the supervision timer expiry and LTM RLF is triggered. However, the maximum number of RLC re-transmissions is configurable by the network, so this should not be an issue.

Option 2. C-RNTI addressed PDCCH

* In case the C-RNTI can be send to the UE in PDCCH but this does not provide really an acknowledge. Even if this can generally work, also if UE has no UL data to transmit/schedule this may inefficient.

Option 3. DL Contention Resolution MAC CE

* With this solution the network is forced to send a MAC CE at every LTM cell switch procedure and probably not the most desirable option.

**Question 10: Which option companies believe should be considered for the UE to determine the correct reception of its first UL data by the network?**

|  |  |  |
| --- | --- | --- |
| Company | Option | Comment |
| CATT | Option 3 |  |
|  |  |  |
|  |  |  |

## FFS #13

*Editor’s Note: FFS on whether it is allowed to trigger an LTM cell switch (at the MCG or SCG) while timer T316 is running.*

This FFS is to address the scenario on when there is timer T316 running, and network may decide to trigger an LTM cell switch at the UE. In this case, if timer T316 is running it means that transmissions on the MCG are suspended and thus the network may not be able to trigger an LTM cell switch procedure at the MCG. However, the network may still trigger an LTM cell switch procedure at the SCG due one may question what is the benefit in doing so when the MCG is failed and the UE may need to do anyway a L3 handover. Therefore, the simplest solution would be to not trigger an LTM cell switch while timer T316 is running (or after receiving an *MCGFailureInformation* message).

**Question 11: Do companies agree that an LTM cell switch procedure should not be triggered while an MCG failure recovery procedure is ongoing?**

|  |  |  |
| --- | --- | --- |
| Company | None/specify which ones | Comment |
| CATT | Yes for both MCG LTM and SCG LTM | If radio link of failure on MCG happen, how can UE to receive the LTM command for MCG LTM? And also, how can UE to feedback the *RRCReconfigurationComplete* message for MCG LTM and SCG LTM via SRB1 case? |
|  |  |  |
|  |  |  |

## FFS #14

*Editor’s Note: FFS on whether the “apply” of the LTM configuration should explicitly refer to section 5.3.5.3.*

According to the inputs received by companies in previous meetings/offlines, current RRC Running CR the application of the complete LTM candidate cell configuration upon an LTM cell switch execution explicitly refer to section 5.3.5.3 and thus this Editor’s Note can be deleted.

## FFS #15

*Editor’s Note: FFS on whether to reuse the reconfiguration with sync procedure and IE.*

Current RRC Running CR implementation assumes that the reconfiguration with sync procedure (and ASN.1 IE) is not re-used for LTM. This is mainly for three reasons:

1. So far the presence of the reconfigurationWithSync within an RRCReconfiguration message always implies that random access procedure is triggered. This implies that exception for the RACH-less LTM would need to be captured in e.g., section 5.3.5.3 and section 5.3.5.5.2.

2. The UE actions upon the presence of the field reconfigurationWithSync are widely spread in the procedural text and ASN.1 field description (there are current about 125 where ”reconfigurationWithSync” is mentioned in RRC) and it would take much more effort to capture exceptions and restrictions if legacy reconfiguration with sync is reused rather than if a new procedure is specified for LTM.

3. Only few actions of section 5.3.5.5.1 are needed for LTM

Therefore, the proposal would be to not re-use the legacy reconfiguration with sync procedure for LTM.

**Question 12: Do companies agree to not re-use the legacy reconfiguration with sync procedure (and ASN.1 IE) in case of LTM (as implemented in current RRC running CR)?**

|  |  |  |
| --- | --- | --- |
| Company | None/specify which ones | Comment |
| CATT | yes | It is more straightforward and forward compatible to have new procedure and new IE. |
|  |  |  |
|  |  |  |

## FFS #16

*Editor’s Note: FFS on whether the sending of the RRCReconfigurationComplete message should be triggered in this section or in section 5.3.5.3 (i.e., Reception of an RRCReconfiguration by the UE).*

In current RRC Running CR the assumption is that the *RRCReconfigurationComplete* message is sent only after that the UE has confirmed that the UE has switched to the indicated target cell in the LTM cell switch MAC CE (e.g., the UE is switched to the new beam indicated). Therefore, due to these MAC-RRC interactions there are benefits to have the sending of the *RRCReconfigurationComplete* message within section 5.3.5.x.5 rather than in 5.3.5.3.

**Question 13: Do companies agree to have the sending of the *RRCReconfigurationComplete* message within the LTM cell switch execution section (as implemented in current RRC running CR, section 5.3.5.x.5)?**

|  |  |  |
| --- | --- | --- |
| Company | None/specify which ones | Comment |
| CATT | No | Firstly, we do not think this will lead to more MAC-RRC interaction (the assumption that the *RRCReconfigurationComplete* message is sent only after that the UE is switched to the new beam indicated), since RRC spec just specifies the generation of the RRCReconfigurationComplete message and then delivery it to lower layer, when to send the message totally up to MAC.  Secondly, the current description in 5.3.5.3 can be simply modified/reused to cover the case for sending the RRCReconfigurationComplete message within the LTM cell switch execution section procedure, so no need to separate the procedure here and there. |
|  |  |  |
|  |  |  |

## FFS #17

*Editor’s Note: FFS on whether further UE actions need to be specified for e.g., subsequent LTM cell switch or interaction with lower layers.*

This FFS is mostly related to the case on whether a subsequent LTM cell switch procedure is explicitly indicated to the UE or whether this is transparent from UE perspective. RAN2 has already made an agreement that during a subsequent LTM a UE does not need to be reconfigured an thus this imply that the same configured may be valid for both the “first” LTM cell switch procedure toward that particular LTM candidate cell but also for any subsequent LTM cell switch to the same LTM candidate cell.

In general, the understanding is that there are no particular differences on the UE actions for the case of a LTM cell switch and an LTM cell switch and thus we see no need to indicate a subsequent LTM cell switch explicitly to the UE.

**Question 14: Do companies agree that a subsequent LTM cell switch does not need to be explicitly indicated to the UE?**

|  |  |  |
| --- | --- | --- |
| Company | None/specify which ones | Comment |
| CATT | no | There is some difference on UE behavior for one-shot LTM and subsequent LTM:   * For one-shot LTM, UE need to release the configurations within the UE variable for LTM (so as to release the LTM candidate configuration and RACH configurations for LTM) upon triggering the LTM execution procedure; * For one-shot LTM, UE need to release L1 measurement and TCI configuration for LTM after the LTM cell switch execution procedure is successfully complete; |
|  |  |  |
|  |  |  |

About the cross-layer interaction, part of them are to be discussed in the MAC running CR and thus we can align the behaviour in RRC once that these interaction in MAC have been clarified.

## FFS #18

*Editor’s Note: FFS on how to provide the UL grant to the UE in case no RACH is performed during the LTM cell switch.*

RAN2 made the following agreements and thus this Editor’s Note can be deleted:

* Dynamic grant can be used for RACH-less LTM, for the first UL data transmission to the target cell:

- the UE monitors PDCCH for dynamic scheduling from the target cell, upon LTM cell switch.

- upon cell switch decision, R2 assumes that the source DU informs the target DU about the selected beam, so that the target DU can start scheduling dynamic UL grant.

* Configured grant can be used for RACH-less LTM, for the first UL data transmission to the target cell, the UE selects the configured grant occasion, which is associated with the beam indicated in the LTM MAC CE (as set by source cell). FFS further optimization

## FFS #19

*Editor’s Note: It is FFS how the UE receives the LTM MCG and the LTM SCG configurations and how to handle the SCG if LTM MCG is executed.*

In current RRC running CR there is an FFS on how the UE gets the *LTM-Config* for the MCG and SCG. Since RAN2 already agreed that LTM is done independently on the MCG and SCG and that on the SCG only the intra-SN LTM cell switch procedure (without MN involvement) is supported, the current assumption is that an MCG LTM configuration will not include any SCG LTM related fields. In few words, the *LTM-Config* IE is per-cell group and if the SN wants to configure LTM at the UE, it should either send the *LTM-Config* IE within an *RRCReconfiguration* via SRB3, or within an SCG *RRCReconfiguration* that is embedded within an MCG *RRCReconfiguration*. For this latter case, the *LTM-Config* will be part of the field nr-SCG within *MRDC-SecondaryCellGroupConfig*.

**Question 15: Do companies agree that the *LTM-Config* IE is per cell group and contains either the MCG LTM configuration or the SCG LTM configuration (i.e., not both)?**

|  |  |  |
| --- | --- | --- |
| Company | None/specify which ones | Comment |
| CATT |  | The question is a bit confusing, does it mean:   * For SCG triggered LTM configuration, the LTM configuration cannot include any MCG configuration (SCG LTM without MN involvement); or * For MCG triggered LTM configuration, the LTM configuration cannot contian any SCG configuration (SA/DC to SA after MCG LTM execution); or * Both of above   In general, considering the limited time, we do not support both of the above case in R18. |
|  |  |  |
|  |  |  |

**Question 16: Do companies agree that the *LTM-Config* IE for an SCG can be received by the UE either via an SCG *RRCReconfiguration* via SRB3 or embedded via an MCG *RRCReconfiguration* via SRB1 (i.e., contained in *nr-SCG* within** ***MRDC-SecondaryCellGroupConfig*)?**

|  |  |  |
| --- | --- | --- |
| Company | None/specify which ones | Comment |
| CATT | Yes | Yes if the SCG LTM can be supported in the quite limited time budget remained for R18. |
|  |  |  |
|  |  |  |

## FFS #20

The following Editor’s Note are related to aspect for which we would need input from RAN1. Therefore, the proposal would be to keep them as a placeholder until the RRC parameter list from RAN1 is received.

*Editor’s Note: FFS on what the configuration of ltm-EarlyUlSync actually is (e.g., RACH-Dedicated, CFRA, or something else). Wait for more RAN1 progresses.*

*Editor’s Note: This is a placeholder the advance TCI state pool configuration for LTM and what this IE should exactly include is FFS*

*Editor’s Note: This is a placeholder* *for the CSI report configuration for LTM and what this IE should exactly include is FFS*

*Editor’s Note: This is a placeholder* *for the CSI resource configuration for LTM and what this IE should exactly include is FFS*

# 3 Conclusion

Based on the discussion in the previous sections we propose the following:

# 4 References