**3GPP TSG-RAN WG2 Meeting #123 *R2-23XXX***

**Toulouse, France, August 21 – 25, 2023**

Agenda Item: 7.4.2.3

Source: Huawei, HiSilicon

**Title:** **Summary of [Post122][058][Mob18] Contents of Cell Switch MAC CE**

Document for: Discussion and Decision

# Introduction

* [Post122][058][Mob18] Contents of Cell Switch MAC CE (Huawei)

Scope: Starting from proposals to R2 122 viewed in the light of agreements taken so far. Determine potentially agreeable points and points for discussion at R2 123 (open points)

Intended Outcome: Report

Deadline: Long

**Contact information**

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| **Company** | **Name (Email)** |
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**Related proposals @RAN2#122 meeting**

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| **Tdoc** | **Proposal** |
| [R2-2304688](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304688%20Discussions%20on%20cell%20switch.docx) CATT | Proposal 1: The LTM triggering MAC CE can include the following information,   * TCI state indication information; * TA information for target cell; * Value of LTM supervisor timer; * Preamble index for intra-DU CFRA-based LTM, FFS for inter-DU.   Proposal 2: The BWP indication information is not included in the LTM triggering MAC CE.  Proposal 3: Do not support SCell activation/deactivation via the LTM triggering MAC CE. |
| [R2-2304720](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304720_Remaining%20issues%20for%20Cell%20Switching.doc) Samsung Electronics Co., Ltd | Proposal 1: RAN2 to discuss and agree on one of the following options  Option 1: BWP IDs of BWPs to activate upon receiving cell change command are always signaled in MAC CE used for cell change.  Option 2: For LTM, the fields’ firstActiveUplinkBWP and firstActiveDownlinkBWP are signaled in L1/L2 inter-cell mobility candidate (target) configuration. If BWP IDs of BWPs to activate are not included in MAC CE used for cell change, UE activates and uses BWPs indicated by these fields upon receiving cell change command.  Proposal 7: RAN2 to discuss and agree on one of the following for RA resources for RA upon cell switch command   * Approach 1: UE is configured with CFRA resources (list of one or more [preamble index/PO index/SSB index]) in candidate cell configuration in same manner as configured during the legacy handover/reconfiguration with sync i.e. by signaling rach-ConfigDedicated in candidate cell configuration. Common RACH configuration/parameters from RACH-ConfigCommon/ RACH-ConfigCommonTwoStepRA of BWP selected are used during RA procedure.   + Principles of RA type selection, carrier selection as in legacy handover/reconfiguration with sync are applied. * Approach 2: UE is configured with CFRA resources (list of one or more [preamble index/PO index/SSB index]) in cell switch command. Common RACH configuration/parameters from RACH-ConfigCommon/ RACH-ConfigCommonTwoStepRA of BWP selected are used during RA procedure. The advantage of this is that UE can be configured with CFRA resources for SSB (s) based on latest measurement results. * Approach 3: UE is not configured with CFRA resources. Common RACH configuration/parameters from RACH-ConfigCommon/ RACH-ConfigCommonTwoStepRA of BWP selected are used during RA procedure.   Proposal 8: Value indicating that the UE shall apply the TA of one source cell is not signalled in cell switch command. |
| [R2-2304889](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304889%20Open%20Issues%20for%20LTM%20Procedure.docx) MediaTek Inc. | Proposal 2: In RACH-less LTM, network should provide UL grant for the first UL message in target cell. RAN2 to discuss the method, e.g.,   * Configured grant in candidate RRC configuration, or * UL grant field in LTM command MAC CE. |
| [R2-2304891](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304891%20Triggering%20MAC%20CE%20for%20LTM.docx) MediaTek Inc. | Proposal 1: The LTM command MAC CE should include at least the following fields:   * + Candidate configuration identity: [2] bits   + TCI state ID(s): [7] bits for joint/DL TCI state, [6] bits for UL TCI state   + Joint or separate TCI state indication: 1 bit   + DL/UL indication: 1 bit   + TA value: [12] bits   + BWP IDs: 2 bits for DL BWP and 2 bits for UL BWP   Proposal 2: Wait for RAN1 decision on the following fields in LTM command MAC CE:   * Triggering of aperiodic TRS transmitted from the target cell * Triggering the CSI acquisition of the target cell and reporting to the target cell * Triggering of aperiodic SRS transmission to the target cell * Additional TCI state activation   Proposal 3: RAN2 to decide the following fields in the LTM command MAC CE, after agreements on related discussions:   * Serving cell index * SCell activation/deactivation * CFRA resources availability * UL grant for the first message * C-RNTI |
| [R2-2304909](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304909_Remaining%20issues%20on%20LTM%20procedures.docx) vivo | Proposal 6: A CFRA resource indication can be introduced in LTM cell switch command. Only when the indication indicates CFRA resource is available, UE applies the CFRA resource configured in the candidate cell configuration to access the target cell during LTM.  Proposal 7: Dedicated RACH resource can be included in LTM cell switch command. If LTM cell switch command indicates RACH resource (shared by multiple UE in S-DU, S-DU ensures no collision occurs), UE applies the RACH resource to access the target cell.  Proposal 8: For RACH-less LTM, a candidate cell can provide a UL resource poor to source DU. And source DU can dynamically allocate the UL resource of the pool to UE in LTM cell switch command. UE can use the indicated UL resource to send the first UL PDU in the target cell. |
| [R2-2304911](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304911_RRC%20configuration%20for%20LTM.docx) vivo | Proposal 12: UE determines the BWPs (for DL and UL) to be activated upon the execution of LTM based on the firstActivateDownlinkBWP-Id and firstActivateUplinkBWP-Id within the configuration of target cell(s).  Proposal 13: Upon the reception of LTM cell switch command, UE performs target SCell activation/deactivation based on the indication (i.e. sCellState field) within the pre-configured RRC configuration of target SCells. |
| [R2-2304953](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304953%20cell%20switch_v1.docx) Fujitsu | Proposal 1: At least the following information can be included in the LTM cell switch command MAC CE:   * Information to identify the target cell(s), FFS for the details, e.g. a set ID, a candidate configuration index and the indication of SpCell * TA related information * Unified TCI state index for the target cell, depending on RAN1 * Active DL and UL BWPs for the target cell, if it is different from the first active BWP signaled by RRC configuration   Proposal 2: In addition to existing SCell activation/deactivation mechanisms, the SCell activation/ deactivation state can be included in the LTM cell switch command MAC CE for intra-DU case so that the SCell activation/deactivation will be performed simultaneously with SpCell change.  Proposal 4: RAN2 to discuss how to handle the activated SCells which are unchanged after the LTM cell switch. |
| [R2-2305167](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305167%20NR%20MOB%20MAC%20CE.docx) Interdigital, Inc. | Proposal 1: The content of the cell switch MAC CE at least consists of:   1. Candidate configuration ID (already agreed) 2. TA related information (agreed by RAN1) 3. 1 joint or 1 pair of UL and DL unified TCI State index for the target Cell (agreed by RAN1) 4. Active DL and UL BWPs for the target cell (agreed by RAN1) 5. FFS RAN1: Triggering of aperiodic TRS transmitted from the target cell 6. FFS RAN1: Triggering the CSI acquisition of the target cell and reporting to the target cell 7. FFS RAN1: Triggering of aperiodic SRS transmission to the target cell 8. FFS RAN1: C-RNTI   FFS: the presence of each field (i.e. always present or configurable)  Proposal 2: By default the initial SCell state on the target cell after LTM cell switch is based on RRC configuration sCellState. At least for the intra-DU case, NW may indicate a new SpCell candidate configuration index and perform SCell activation/deactivation simultaneously using MAC CE.  Proposal 3: BWP can be indicated in the RRC configuration of candidate cells, MAC CE indication in cell switch command is optional.  Proposal 4: RAN2 to discuss whether the cell switch MAC CE may contain an indication of RACH resource and/or UL grant for the target cell. |
| [R2-2305295](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305295%20-%20Discussion%20on%20MAC%20CE%20content%20and%20partial%20MAC%20reset%20for%20LTM.docx) OPPO | [Proposal 1 LTM cell switch MAC CE can indicate TCI state info, i.e., 1 joint or 1 pair of UL and DL unified TCI State index for the target cell.](#_Toc134795825)  [Proposal 2 LTM cell switch MAC CE can contain TA info, if any.](#_Toc134795826)  [Proposal 3 SCell activation/deactivation indication is not contained in LTM cell switch MAC CE.](#_Toc134795827)  [Proposal 4 BWP information is not contained in LTM cell switch MAC CE.](#_Toc134795828)  [Proposal 5 CFRA resource is not contained in LTM cell switch MAC CE.](#_Toc134795829) |
| [R2-2305541](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305541%20LTM%20command%20MAC%20CE%20content%20and%20RAN3%20LS%20reply.docx) Huawei, HiSilicon, CATT, ZTE Corporation, Sanechips, vivo, China Unicom | Proposal 1: To support SCell activation simultaneously with LTM execution, the network (target cell) can set the “sCellState-r16” in the candidate configuration by RRC as supported currently, i.e. no need to include the SCell activation/deactivation in LTM MAC CE.  Proposal 2: In inter-DU LTM, RAN2 excludes to include the active BWP ID in the LTM MAC CE. (FFS for intra-DU LTM) |
| [R2-2305576](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305576%20Contents%20of%20cell%20switch%20MAC%20CE.docx) Xiaomi | Proposal 1: The initial SCell state can be indicated by sCellState-r16 or the cell switch MAC CE.  Proposal 2: The dedicated PRACH resource can be indicated by the cell switch MAC CE. |
| [R2-2305641](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305641%3fFurther%20considerations%20on%20cell%20switch.doc) CMCC | Proposal 1: RAN2 to confirm that TCI state is supported in an MAC CE carrying LTM switch command.  Proposal 2: RAN2 to confirm that TA value is supported in an MAC CE carrying LTM switch command.  Proposal 3: RAN2 to confirm that L2 reset indication is not included in an MAC CE carrying LTM switch command.  Proposal 4: RAN2 to confirm that CFRA resource are not included in the MAC CE carrying LTM switch command.  Proposal 5: RAN2 to confirm that CFRA indication (i.e., valid or invalid) is included in the MAC CE carrying LTM switch command. |
| [R2-2305649](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305649%20Cell%20switch.docx) NEC | Proposal 3: If RAN2 can agree that the network can send the SCell Activation/Deactivation MAC CE with the LTM cell switch command MAC CE, it is up to network whether to activate/deactivate SCell(s) at LTM cell switch for intra-DU LTM. |
| [R2-2305908](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305908%20_Discussion%20On%20RRC%20Reconfiguration%20Aspects.docx) Nokia, Nokia Shanghai Bell | Proposal 3: BWP to be used upon the LTM execution is either indicated directly within the candidate cell configuration for L1/L2 inter-cell mobility using RRC Configuration message or indicated in the LTM triggering using MAC CE.  Proposal 4: If Option 2 is followed, the notification from the source to the target about the BWP used before the LTM is FFS. |
| [R2-2305909](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305909_On%20the%20cell%20switch%20in%20LTMmand.docx) Nokia, Nokia Shanghai Bell | For deciding the cell index three options exist:   1. Source DU determines the cell index: In this option, the Source DU associates the PCI of the prepared target cell with the cell index, and it provides the association between the cell index and PCI to CU which in turn send it to the UE (and the other DUs, in case of Dynamic Switching). 2. CU determines the cell index: In this option the CU associates the PCI of the prepared target cell with the cell index, and it provides the association between the cell index and PCI to Source DU (and the other DUs, in case of Dynamic Switching) and to the UE 3. UE uses the ID of the target cell configuration (i.e., RRC configuration for L1/2 mobility) as cell index: In this option the CU informs the (source) DU about the ID of the target cell configuration.   Proposal 7: RAN2 to decide which of the options 1, 2, and 3 should be followed for indicating the target cell index in the LTM MAC CE. |
| [R2-2306010](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2306010-%20Discussion%20on%20RRC%20aspects%20for%20LTM.docx) Ericsson | [Proposal 7 The BWP to be used by the UE upon the execution of the LTM cell switch procedure can be indicated directly within the LTM candidate cell configuration.](#_Toc134736810)  [Proposal 8 If UL/DL BWP IDs are included in the LTM cell switch command and are also present within the LTM candidate cell configuration, the UE shall consider as valid the one received in the LTM cell switch command (and ignore the ones in the LTM candidate cell configuration).](#_Toc134736811) |
| [R2-2306013](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2306013-%20LTM%20cell%20switch%20command%20and%20UE%20actions.docx) Ericsson | [Proposal 3 The BWP information in the LTM cell switch command MAC CE is indicated using BWP-ID referring to one of the configured BWPs within the LTM candidate cell configuration.](#_Toc134739287)  [Proposal 4 The BWP information in the LTM cell switch command MAC CE contains the BWP-ID the UE shall apply as firstActiveDownlinkBWP and firstActiveUplinkBWP.](#_Toc134739288)  [Proposal 5 As in legacy, the same BWP-ID is applied for both firstActiveDownlinkBWP and firstActiveUplinkBWP.](#_Toc134739289)  [Proposal 6 The TCI-state information in the LTM cell switch command MAC CE refers to a TCI-state configured within the LTM candidate cell configuration.](#_Toc134739290)  [Proposal 7 The initial state of an SCell upon an LTM cell switch is part of the LTM candidate cell configuration.](#_Toc134739291)  [Proposal 8 Existing MAC CEs for SCell activation/deactivation are supported to change the state of an SCell upon the execution of an LTM cell switch (the MAC CE for SCell activation/deactivation is sent after the LTM cell switch MAC CE).](#_Toc134739292) |
| [R2-2306479](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2306479%20Discussion%20on%20LTM%3fcommand%3fMAC%3fCE%3fcontent%3fand%3fRAN3%3fLS%3freply.docx) China Unicom | Proposal 2: Candidate SCell activation/deactivation information can be included in RRCReconfiguration message at the LTM preparation phase. Candidate SCell activation/deactivation can be optionally included in LTM MAC CE for intra-DU case. |

**Issue collection for [Post122][058]**

Following information is to be discussed in the long email [Post122][058][Mob18] Contents of Cell Switch MAC CE, on whether it can be included in the cell switch MAC CE (also about its format).

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| **Information** | | **Clarification** | |
| TA related information | TA value | It can be included. | The discussion point may be on the format design in MAC CE.  (pending on running CR discussion) |
| TA as zero | The need is confirmed by RAN1, and details on the format is up to RAN2.  *”From RAN 1 perspective, without performing PDCCH-ordered RACH for candidate cell(s), RACH-less mechanism can be supported by indicating TA value of target cell as TA=0 or keeping the same value as source cell in cell switch command.*” |
| TA same as source TAG/cell |
| UE-based TA measurement | We may need to postpone the discussion, until RAN4 confirms the feasibility and RAN1 concludes on the detailed solution. |
| Beam indication/TCI state ID | | It can be included. |
| Active BWP ID | | RAN2 to discuss the need of active BWP ID in LTM cell switch MAC CE, in addtion to the legacy *firstActiveUplinkBWP* and *firstActiveDownlinkBWP* in RRC configuration.  Also to clarify the applicable scenario:   * intra-DU or inter-DU; * RACH-less or RACH-based cell switch; | |
| SCell activation/deactication indication | | RAN2 to discuss the need of SCell activation/deactivation in LTM cell switch MAC CE, in addtion to the legacy “*sCellState-r16*” in RRC configuration.  Also to clarify the applicable scenario: intra-DU or inter-DU. | |
| CFRA resource | CF CFRA preamle index | Motivation is to reduce the RACH resource reservation.  Source cell can select the CFRA resource among the RACH resource shared by mulitple served UEs, by indicating the dedicated preable in LTM cell switch MAC CE.  Also, it may indicate whether the CFRA resource in candidate configuration is available/valid or not (e.g. if the pre-configured RA resource is release/reallocated by target cell).  Also to clarify the applicable scenario: intra-DU or inter-DU. | |
| CFRA resources availability/validity indication |
| UL grant (to be used by target cell) | | This is considered as the optimizaiton to the CG configured in RRC, which is related to the FFS in RAN2 agreement: ”*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*”  Is it dynamic grant like the UL grant in RAR? Is it still type1 like configured grant? Is it a index of some shared CG pool? | |
| C-RNTI (to be used by target cell) | | RAN2 to discuss the need of C-RNTI in LTM cell switch MAC CE, in addtion to the legacy *newUE-Identity* in *ReconfigurationWithSync* in RRC configuration.  See the RAN1#113 meeting agreement  ”*Whether C-RNTI that is to be used by target cell needs to be included within the MAC-CE containing cell switch command will be left to RAN2 decision.*” | |
| Value of LTM supervisor timer | | This is related to whether LTM reuses the same timer for both RACH-less and RACH-based cell switch.  Even if the RACH-less specific timer is agreed, it is still the baseline to consider using RRC to configure the timer value. | |

**Question A: Do you see the need of any other information to be included in the LTM cell switch MAC CE?**

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| **Companies** | **Other more content to be discussed** | **Motivation/Clarification** |
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Some outstanding open issues in the Editor’s Notes of MAC running CR are also to be discussed in the long email [Post122][058][Mob18] Contents of Cell Switch MAC CE:

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| **Open issue** | **Description/clarification** |
| #1 | For LTM completion, how UE to determine the successful reception of its first UL data by the network (left over issue which may need a new MAC CE in MAC):  -Option 1: RLC ACK of RRCReconfigurationComplete message  -Option 2: C-RNTI addressed PDCCH  -Option 3: UE Contention Resolution identify MAC CE |
| #2 | The fields size in MAC CEs:   * “Target Configuration ID” field in the LTM Command MAC CE, i.e. the maximum number of candiate cells in RRC configured LTM * 8/16/? * Considering the MAC CE format to be OCT aligned; * The maximum number for CHO candidate is 8; * “Candidate Cell ID” field in the Candidate Cell TCI States Activation/Deactivation MAC CE, i.e. the maximum number of candiate cells in RRC configured TCI state * 4/8/? * Note the maximum number of reported cell in L1 measuremeny reprot is 4, as agreed by RAN1. * “Candidate cell ID” in PDCCH order for early RACH, i.e. the maximum number of candiate cells in RRC configured early RACH resoure * 4/8/? * Note the maximum number of reported cell in L1 measurement report is 4 at one time, as agreed by RAN1. |
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**Question B: Do you see any other critical issue that can be discussed in this email discussion [Post122][058][Mob18] Contents of Cell Switch MAC CE?**

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| **Companies** | **Issue?** | **Motivation/Clarification** |
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# Discussion

**2.1 TBD**

TBD

**Summary: TBD**

# Conclusion and proposals

TBD

# Reference

1. [R2-2304688](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304688%20Discussions%20on%20cell%20switch.docx) Discussions on Cell Switch CATT
2. [R2-2304720](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304720_Remaining%20issues%20for%20Cell%20Switching.doc) Remaining issues for Cell Switching Samsung Electronics Co., Ltd
3. [R2-2304889](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304889%20Open%20Issues%20for%20LTM%20Procedure.docx) Open Issues for LTM Procedure MediaTek Inc.
4. [R2-2304891](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304891%20Triggering%20MAC%20CE%20for%20LTM.docx) Triggering MAC CE for LTM MediaTek Inc.
5. [R2-2304909](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304909_Remaining%20issues%20on%20LTM%20procedures.docx) Remaining issues on LTM procedures vivo
6. [R2-2304911](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304911_RRC%20configuration%20for%20LTM.docx) RRC configuration for LTM vivo
7. [R2-2304953](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2304953%20cell%20switch_v1.docx) Discussions on LTM cell switch execution Fujitsu
8. [R2-2305167](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305167%20NR%20MOB%20MAC%20CE.docx) LTM MAC CE content and functionality Interdigital, Inc.
9. [R2-2305295](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305295%20-%20Discussion%20on%20MAC%20CE%20content%20and%20partial%20MAC%20reset%20for%20LTM.docx) Discussion on MAC CE content and partial MAC reset for LTM OPPO
10. [R2-2305541](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305541%20LTM%20command%20MAC%20CE%20content%20and%20RAN3%20LS%20reply.docx) LTM command MAC CE content and RAN3 LS reply Huawei, HiSilicon, CATT, ZTE Corporation, Sanechips, vivo, China Unicom
11. [R2-2305576](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305576%20Contents%20of%20cell%20switch%20MAC%20CE.docx) Contents of cell switch MAC CE Xiaomi
12. [R2-2305641](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305641%3fFurther%20considerations%20on%20cell%20switch.doc) Further considerations on cell switch CMCC
13. [R2-2305649](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305649%20Cell%20switch.docx) Further discussion on cell switch NEC
14. [R2-2305908](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305908%20_Discussion%20On%20RRC%20Reconfiguration%20Aspects.docx) Discussion on RRC Reconfiguration Aspects Nokia, Nokia Shanghai Bell
15. [R2-2305909](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2305909_On%20the%20cell%20switch%20in%20LTMmand.docx) On the cell switch in LTM Nokia, Nokia Shanghai Bell
16. [R2-2306010](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2306010-%20Discussion%20on%20RRC%20aspects%20for%20LTM.docx) Discussion on RRC aspects for LTM Ericsson
17. [R2-2306013](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2306013-%20LTM%20cell%20switch%20command%20and%20UE%20actions.docx) LTM cell switch command and UE actions Ericsson
18. [R2-2306479](file:///D:\Tdoc%20review\RAN2%23122\word\R2-2306479%20Discussion%20on%20LTM%3fcommand%3fMAC%3fCE%3fcontent%3fand%3fRAN3%3fLS%3freply.docx) Discussion on LTM command MAC CE content and RAN3 LS reply China Unicom