**3GPP TSG RAN WG2 Meeting #121-bise**    **R2-230xxxx**

Electronic, 18th– 26th Apr, 2023

Agenda Item: 8.1.1

Source: ZTE Corporation (Rapporteur)

Title: Summary of [Post121][703][NCR] RRC running CR for NCR (ZTE)

Document for: Discussion and Decision

# Introduction

This is the summary of post email discussion:

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| * [Post121][703][NCR] RRC running CR for NCR (ZTE)   Scope:   * Updates based on the agreements during RAN2#121 * Can discuss open issues.   Intended outcome: revised running CR, discussion paper with proposals (if needed)  Deadline: Long |

In this document, we focus on the remaining open issues for RRC spec. The TS 38.331 running CR which captures RAN1/2 agreements is discussed via separate document.

The outcome of this discussion will be captured into RRC running CR after the proposals are agreed in RAN2#121bis-e.

Please companies provide your inputs before 31th Mar.

Rapporteur will provide summary with proposals before 5th April.

# Contact information

Companies providing input to this email discussion are invited to leave contact information below.

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| **Company** | **Name** | **Email Address** |
| Ericsson | Antonino Orsino | antonino.orsino@ericsson.com |
| CATT | Hao Xu | xuhao@catt.cn |
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# Discussion

## Select back to suitable cell

During RAN2#121 meeting, companies discussed the NCR-MT’s behaviour when cell reselection occurs and made the following agreement:

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| * After cell reselection, the NCR-MT to resume so that it can receive side-control configuration from the new gNB (can be done by network configuration using existing specifications). The case when a NCR-MT selects/reselects to an acceptable cell or when no cell is found and comes back is FFS. |

Companies think the NCR-MT behaviour is unclear when the NCR-MT moves back to suitable cell if it was camping on acceptable cell or if no cell was found.

For this issue, rapporteur has observed the following in CN specs:

Firstly, when a UE (NCR-MT) camps on acceptable cell or if no cell can be found, according to TS 23.122, the UE (NCR-MT) shall enter “limited service state”.

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| *# TS 23.133 section 3.5*  3.5 No suitable cell (limited service state)  There are a number of situations in which the MS is unable to obtain normal service from a PLMN or SNPN. These include:  a) Failure to find a suitable cell of the selected PLMN or of the selected SNPN; |

Then in TS 24.501, there are two specified UE 5GMM sub-states for limited service state:

* Case 1: 5GMM-REGISTERED.LIMITED-SERVICE
* Case 2: 5GMM-DEREGISTERED.LIMITED-SERVICE

For Case 1, according to TS 24.501, after the UE (NCR-MT) reselects to a suitable cell, the UE shall initiate NAS registration procedure.

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| *# TS 24.501 section 5.2.2.3.2*  5.2.2.3 Detailed description of UE behaviour in state 5GMM-DEREGISTERED  5.2.2.3.2 LIMITED-SERVICE  The UE shall initiate an initial registration procedure when entering a cell which provides normal service.  The UE may initiate initial registration for emergency services. |

For Case 2, the UE (NCR-MT) behaviour is defined as below, as we can see that, after registration, the UE will be configured with a timer T3512. When the timer expires, although the UE cannot trigger periodic registration update procedure immediately, the UE is expected to re-initiate NAS registration procedure when the it finds a suitable cell which can provide normal service.

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| *# TS 24.501 section 5.2.3.2.4*  5.2.3.2 Detailed description of UE behaviour in state 5GMM-REGISTERED  5.2.3.2.4 LIMITED-SERVICE  The UE:  a) shall perform cell selection/reselection;  b) may perform de-registration locally and initiate an initial registration for emergency services; and  c) if configured for eCall only mode as specified in 3GPP TS 31.102 [22], shall perform the eCall inactivity procedure at expiry of timer T3444 or timer T3445 (see subclause 5.5.3).  *# TS 24.501 section 5.3.7*  5.3.7 Handling of the periodic registration update timer and mobile reachable timer  The periodic registration update procedure is used over 3GPP access to periodically notify the availability of the UE to the network. The procedure is controlled in the UE by the periodic registration update timer, T3512.  …  If the UE is registered for emergency services, and timer T3512 expires, the UE shall not initiate a periodic registration update procedure, but shall locally de-register from the network. When the UE is camping on a suitable cell, it may re-register to regain normal service. |

Based on above analysis, rapporteur thinks the current specification already defines NAS procedure for the case when UE reselecting back to suitable cell, the NCR-MT won’t become unreachable.

**Rapp’s observation: When NCR-MT camps on acceptable cell or when no cell is found, the NCR-MT shall enter limited service state. After the NCR-MT selects a suitable cell, its NAS layer will initiate registration procedure and NCR-MT will initiate RRC connection procedure. No need to specify new mechanism for this scenario.**

**Q1. Do companies agree with above Rapp’s observation? please elaborate your comments if answers “No”.**

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | We have the same understanding as the Rapporteur. Current specification already handle the case that is FFS and there is no need of a new mechanism specific for NCR. |
| CATT | Yes | Share the same view as Rapp. The limited service state in CN spec can handle the concerned issue already, there is no any further optimization is needed right now. |
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## Wake-up timer

In RAN2#121, RAN2 agree that the gNB shall be able to release NCR-MT to RRC\_IDLE state, companies also discussed the solution for triggering the NCR-MT back to RRC\_CONNECTED mode, e.g. wake-up timer. If wake-up timer is configured to NCR-MT, the NCR-MT should start the timer when it enters RRC\_IDLE state, and the NCR-MT shall initiate RRC connection setup procedure when the timer expires.

Based on the online discussion in RAN2#121 meeting, company views are divergent and no conclusion was made. During online discussion, some companies also pointed out that this can be done via OAM, if necessary.

Technically, if wake-up timer is not introduced in RRCRelease, then after the NCR-MT is released to RRC\_IDLE, it is up to the NCR-MT to initiate RRC connection procedure, this can be done via NCR-MT’s OAM, or the gNB can provide “wake-up” timer to NCR-MT via OAM connection (if established).

In RAN2, we need to focus on our specification impact, so the question is whether to introduce explicit “wake-up timer” field in RRCRelease message, and there are two options on the table:

* Option 1: To define “wake-up timer” IE in RRCRelease message;
* Option 2: Do not define “wake-up timer” IE in RRCRelease message, if needed, it can be done via OAM (no specification impact).

**Q2. For NCR-MT in RRC\_IDLE state, which option do you prefer regarding the wake-up timer?**

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| **Company** | **Option 1/2** | **Comments** |
| Ericsson | Option 1 | The network may want to have different value for the wake up timer based on the situation on when the NCR is sent to IDLE. The solution where OAM provide the wake timer does not provide any flexibility as the OAM signaling is rather static then dynamic.  Also, we already agreed that the support of DRBs for an NCR is option and thus without support for DRB there is no OAM. We believe this will limit possible implementation of NCR.  Option 1 provide better flexibility for the network but also for the operator that may bring back to CONNECTED the NCR-MT based on the different use case in which an NCR node is used. |
| CATT | Option 2 | Considering OAM can solve this issue, hence no need to introduce additional specification work considering the limited time left. |
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## ON/OFF in RRC\_IDLE

For NCR-MT in RRC\_INACTIVE state, RAN2 made the following agreement in RAN2#120:

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| RAN2#120 agreement:   * After NCR-MT enters RRC\_INACTIVE mode, the NCR-Fwd can be ON or OFF following the last configuration received from the gNB. |

Since releasing to RRC\_IDLE mode is supported, RAN2 need to discuss the NCR-Fwd ON/OFF behaviour when NCR-MT is released to RRC\_IDLE mode.

Based on company contributions, there are two options:

* Option 1: NCR-Fwd is OFF when NCR-MT is in RRC\_IDLE state;
* Option 2: When NCR-MT is released to RRC\_IDLE mode, the NCR-Fwd can be ON or OFF following the last configuration received from the gNB.

Option 1 is straightforward, but it disallows the network to enable NCR-Fwd when releasing the NCR-MT to RRC\_IDLE; Option 2 is aligned with principle agreed for RRC\_INACTIVE state and no additional specification effort is needed. Companies are welcome to provide your preference.

**Q3. Which option do you prefer when releasing the NCR-MT to RRC\_IDLE state?**

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| **Company** | **Option 1/2** | **Comments** |
| Ericsson | Option 2 | We prefer to align with the RRC\_INACTIVE case. We don’t see the benefit of having two different behaviors for IDLE and INACTIVE. |
| CATT | Option 1 | In RAN2#120 meeting, the below agreement was reached:   * If NCR-MT enters RRC\_IDLE due to no suitable cell is find, NCR-Fwd is OFF;   If option2 is chosen, just wonder whether we need to revisit the agreed agreement already? |
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## Clafication on the “last configuration”

For NCR-MT in RRC\_INACTIVE state, RAN2 agree that the NCR-Fwd can be ON-OFF following the last configuration received from the gNB. However, it is not crystal clear what the “last configuration” means.

Based on RAN1 conclusions, 3 types of beam indication are supported for NCR-Fwd access link:

* Type 1: Periodic beam indication. Configured by RRC signalling.
* Type 2: Aperiodic beam indication. Configuration provided via RRC signalling and the network uses DCI to activate/deactivate.
* Type 3: Semi-persistent beam indication. Configuration provided via RRC signalling and the network uses MAC CE to activate/deactivate.

Based on company contributions, some company suggests to clarify that only periodic beam indication configuration is feasible for NCR-Fwd when NCR-MT enters RRC\_INACTIVE state. Because the NCR-MT cannot receive DCI/MAC CE in RRC\_INACTIVE state.

Considering periodic beam indication can be configured by RRC signalling only, then a straightforward solution is to rely on the RRC configuration. Please see rapporteur’s proposal below:

**Rapp’s Proposal When releasing the NCR-MT to RRC\_INACTIVE state, only periodic beam indication configuration is applicable to the NCR-MT (i.e. *ncr-PeriodicFwdResourceSetToAddModList-r18* IE included in RRCReconfiguration sent before RRCRelease). The NCR-Fwd is OFF if periodic beam indication is not configured.**

**(Note: This proposal also applies to NCR-MT in RRC\_IDLE mode if Option 2 in 3.3 is agreed)**

Companies are welcome to provide your views regarding the “last configuration”.

**Q4.1. Do you agree with above Rapp’s proposal? please elaborate your comments if answers “No”.**

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| **Company** | **Yes/ No** | **Comments** |
| Ericsson | Yes with comments | We agree in principle with the Rapporteur, but we are wondering on whether it would be enough to clarify that the “last configuration” is that one provided by RRC. However, no strong view. |
| CATT | Yes | Share the same view as Rapp. |
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In addition, another question is whether/when the NCR-MT should discard the beam indication configuration? As agreed in RAN2#120, the NCR-Fwd is OFF when NCR-MT reselects to a different cell. However, this does not mean the corresponding configuration is discarded at the same time.

Based on the online discussion in RAN2#121, in order to extend cell coverage, the NCR device may be deployed at cell edge, so Ping Pong cell reselection may happen if DL signal fluctuates. If the NCR-MT can store the received beam indication configuration, then it can be used whenever the NCR-MT camps on the releasing cell. However, if the NCR-MT moves to a different cell and triggers RRC resume procedure, it is better to discard the configuration and wait for new configuration from the network.

**Rapp’s Proposal The NCR-MT shall discard the received beam indication configuration (i.e. *NCR-FwdConfig-r18*) when it initiates RRCResume procedure in a cell different from the released cell.**

**Q4.2. Do you agree with above Rapp’s proposal? please elaborate your comments if answers “No”.**

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| **Company** | **Yes/ No** | **Comments** |
| Ericsson | Yes | We agree with the Rapporteur. We think there is no issue for the network to provide a new configuration when the UE resumes. Is not clear what is really the benefit is the NCR stores it. |
| CATT | Yes | Share the same view as Rapp. |
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## Other

Besides above questions, companies are welcome to provide your comments if other issues are identified. Please notice the WID is extended 1 quarter in RAN2, so please focus on **essential** issues.

**Q5. Any other RRC open issues that need to be discussed in RAN2?**

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| **Company** | **Comments** |
| Ericsson | From the RRC and MAC parameters list there are still a lot of FFS. Not sure if RAN1 will have discussions on NCR in the next meeting but if this is not the case we should definitively send them an LS. |
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# Conclusion

To be updated

# References

[1] RAN2#120 Chairman notes