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

Electronic meeting, 17th– 26th Apr, 2023

Agenda Item: 7.1.2

Source: ZTE Corporation (Rapporteur)

Title: Summary of [AT121bis-e][704][NCR] NCR RRC running CR (ZTE)

Document for: Discussion and Decision

# Introduction

This document is the summary of below offline discussion:

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| **[AT121bis-e][704][NCR] NCR RRC running CR (ZTE)**  Scope: Implement agreements from the meeting  Intended outcome: draft CR in R2-2304414  Deadline: NCR CB session |

In this document, we focus on the remaining RRC related proposals from the following summaries.

R2-2303288 Report of [Post121][703][NCR] Open issues on NCR RRC ZTE Corporation report Rel-18 NR\_netcon\_repeater

R2-2304411 Summary of agenda item 7.1.2 on signalling for SCI (ZTE)

R2-2304412 Summary of agenda item 7.1.3 on other RAN2 aspects for NCR (Nokia)

The RRC running CR will be updated based on the outcome of this discussion.

# Contact information

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

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# Discussion

## Wake-up timer

The following proposals are related to wake-up timer:

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| #from R2-2303288  **Proposal 3**  To further discuss the following 2 options.   * (6/12)Option 1: To define “wake-up timer” IE in RRCRelease message; * (6/12)Option 2: Do not define “wake-up timer” IE in RRCRelease message, if needed, it can be done via OAM (no specification impact).   #from R2-2304412  **Proposal 1:** If “wake-up timer” IE is agreed: The NCR-MT shall stop the wake-up timer when it performs cell reselection in RRC\_IDLE state.  **Proposal 2:** If “wake-up timer” IE is agreed: RAN2 should discuss how an NCR-MT not supporting DRB shall initiate connection setup:   * Option 1: RRC of NCR-MT sends a notification to NAS of NCR-MT, and NAS of the NCR-MT transmits a NAS message. RAN2 sends LS to CT1 to inform the decision. * Option 2: Leave it to implementation within “upper layers”. * FFS if establishmentCause impacts within RRCSetupRequest.   **Proposal 3:** If “wake-up timer” IE is agreed: RAN2 should discuss whether prohibit timer should be introduced in RRCRelease message to prevent NCR-MT from initiating new connections prematurely. |

Regarding whether to introduce wake-up timer in RRCRelease message, based on online discussion on Monday, slightly majority companies prefer Option 2, but some companies have strong concern on the OAM-based solution (Option 2). During online discussion, there was also comment on whether NCR-MT’s AS layer or NAS layer should initiate the RRC connection setup procedure upon timer expires.

**Q1. When releasing NCR-MT to RRC\_IDLE state, which option (1 or 2) do you prefer regarding the wake-up timer? Please elaborate your views on the following aspects:**

* For Option 1, whether NCR-MT’s AS layer or NAS layer will initiate RRC connection setup procedure upon timer expires, any impacts in RAN2 or CT1?
* For Option 1, do you think the NCR-MT shall stop the timer when it reselects a different cell?
* Is there a case that Option 2 (OAM) doesn’t work, e.g. DRB is not supported?
* For Option 2, do you agree there is no spec impact in RAN2?

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| **Company** | **Preferred Option** | **Unacceptable option (if you have)** | **Comments** |
| Samsung | Option 1 | Option 2 | To summarize our points on why we do not agree to Option 2:   * gNB does not know when it can reliably release an NCR as it does not know when OAM has configured NCR correctly. * We are solving a problem that we can solve with RRC. If companies think that they have a magic OAM solution, then they can decide to not configure the wakeup timer in RRC release * Releasing an NCR would likely be similar to releasing a UE as OAM does not trigger gNB to release specific Ues. When would a gNB release an NCR. In many cases, but one of these is done when maintenance/update of a gNB is being performed.   For the timer, we think that it can be entirely within the AS layer, but we are open to input on this. We think it can be designed in the following manner:   * The timer can trigger the RRC establishment procedures of 38.331 5.3.3.2 under the conditions T300 is not running and NCR-MT is camping on a suitable cell and is stopped on reception of RRCSetup. * The NAS message in *dedicatedNAS-Message* in *RRCSetupComplete* does not need to be present in order for the ASN1 decoder to function as OCTET STRING can be of zero length. Thus when the timer is triggered, the field is encoded with zero-length. The gNB does not see this as an error because gNB does not parse the NAS message. * Value range suggested in our contribution: 5, 10, 20, 30, 60, 120, 240, 480 min. |
| Qualcomm | Option 2 (not timer-related) | Option 1 | This whole problem shows up b/c we do not want the NCR-MT to retain an RRC connection for the sake of power saving, but we still want the NCR-FWD to remain operational.  NCR is a RAN-controlled node. If power savings is an issue, RAN-based power-savings methods can be applied, such as RRC inactive. It is counter-intuitive to use CN-based power-savings method if the NCR cannot be properly controlled by the CN.  This implies:   * If the NCR has a PDU session, the gNB can send it to RRC Idles since there are CN-based means to wake it up. * If the NCR has no PDU session, the gNB should not send it to RRC Idle. In fact, sending it to RRC idle can be considered erroneous behavior.   If the operator wants to have an NCR with power-savings capabilities, they can get an NCR that either supports RRC inactive or PDU session. |
| Nokia | Option 2 |  | We prefer Option 2 but can accept Option 1.  Regarding the OAM-dependency of Option 2, we agree with some other companies that OAM can exist without DRB. However, can RAN2 assume that there will always be OAM (of some sort) at the NCR? If OAM is not mandatory, then this might preclude Option 2 (OAM for wake-up). Do we need to verify with RAN3 whether OAM is mandatory?  In terms of spec impact, Option 2 might still require us to clarify whether connection setup is triggered by AS or NAS.  Samsung suggested an empty NAS message for Option 1. This could also be applicable to Option 2. However, we wonder how the CN will treat an empty NAS message. If we select that approach, we may need to send an LS to CT1. |
| Apple | Option 2 | Option 1 | Option 1 adds the complexity of NCR-MT design. I remember that during the study phase that the reason to use RRC-based protocol stack for NCR-MT aims to simply reuse the existing off-the-shelf component to make NCR cheap. Enhance existing RRCRelease procedure is against this assumption.  For the DRB issue on Option 2, we are fine to revert the early agreement and mandate one DRB in NCR for OAM purpose. |
| NEC | Option 1 with modification or Option 2 | Option 1 as it is | The NCR-MT behavior when the timer is running should be specified additionally.  (Option 1 with modification) The NCR-MT reconnection to the network is restricted when the wake-up timer is running.  For Option 1 with modification, we think NCR-MT AS layer can initiate RRC connection setup without spec impacts. Regrading whether NCR-MT shall stop the timer when it reselects a different cell, it is up to NCR-MT behavior when the timer is running. For Option 1 with modification, NCR-MT shall stop the timer whereas for the original Option 1, keeping the timer running does not matter at all. For the last aspect, basically, OAM is up to implementation, we don’t see a solid relationship between OAM and DRB supporting and believe Option 2 has no spec impact in RAN2. |
| Vivo | Option 1 |  | The comments to the sub-bullets of Q1:  To 1st sub-bullet: The motivation to introduce wakeup timer is to bring the NCR-MT released to IDLE back to CONNECTED state. Detail procedure within the NCR-MT could be left for implementation considering the left time budget.  To the 2nd sub-bullet: When the NCR-MT is released to idle, the NW does not need to NCR node for forwarding. It is meaningless for the NCR-MT to keep monitoring the serving cell. In such sense, cell reselection may probably not happen after the NCR-MT is released to IDLE (i.e. when wakeup timer is running, if supported).  To the 4th sub-bullet: No. At least a trigger should be defined for NCR-MT to initiate the RRC connection setup procedure |
| Kyocera | Option 1 |  | We support introducing the wake-up timer.  For the details of Option 1, we think the AS should handle the timer, and when the timer expires the AS indicates the NAS like the current MT-access since the timer means the gNB intends to access to the NCR in IDLE. So, the NAS initiates RRC Connection Setup as it is today.  We think whether the NCR-MT stops the timer upon cell reselection is depending on the NCR-MT ehavior. RAN2 agreed that “*After cell reselection, the NCR-MT to resume so that it can receive side-control configuration from the new gNB*” but it’s for NCR-MT in INACTIVE in our understanding. So, we wonder if RAN2 first needs to clarify what the NCR-MT behaviour in IDLE is upon cell reselection.  For Option 2, as pointed out in the online session, if the NCR-OAM is optional, we cannot rely on such an implementation. In addition, we think the gNB intentionally released the NCR-MT to IDLE in this case. So, the gNB would intend the NCR-MT stays in IDLE for a certain time. However, the NCR-OAM does not know such gNB’s intention, so the NCR-OAM may initiate an UL packet immediately after the NCR-MT transitions to IDLE, unless the gNB and the NCR-OAM had some coordination. In this sense, we think the wake-up timer can ensure more inter-operability. In addition, as some companies pointed out in the online session, this timer may be considered as the prohibit timer, since even if the NCR-OAM generates an UL packet immediately after going to IDLE, the timer only allows the connection establishment upon its expiry. |
| Ericsson | Option1 | Option2 | For Option1, as other companies have clarified there are way to reduce the specification impact and keep the solution simple.  For Option2, we cannot assume that the OAM will always be there and thus Option2 may not work in certain circumstances. Further, in case the OAM of the NCR is different from the OAM of the gNB that is controlling the NCR, we are wondering how the RAN node will be aware on whether the NCR-MT is configured with this timer or not. |
| Intel | Option 2 | Option 1 | We would point out two aspects:   1. We are wondering the need to have this wake-up timer.   In our understanding, it is mainly used to let NCR-Fwd temporarily operate with last side control information, then reconnect to the network. It was agreed during online meeting that the NCR-Fwd is OFF when NCR-MT is in RRC\_IDLE state. Therefore, the motivation of having this wake-up timer will be only for reconnection purpose. However, timer is just an example of how the NCR-MT wants to go back to RRC\_CONNECTED, there could also be other reasons/solutions, which is an implementation issue. For example, if the network put the NCR-MT in IDLE, then it should only do so if it has (or is aware of) a mechanism to bring it back to connected. This mechanism can be either network triggered by OAM data (if DRB is supported) or NCR autonomous action (similar to when NCR initially powers up). Hence, we don’t think a wake-up timer is needed.  Besides, as listed in 1st and 2nd bullet, there are still a lot of open issues need to be discussed and coordinated with other WGs to make it work. There is currently no mechanism for AS in IDLE to trigger NAS to initiate an RRC Connection. Developing this will require discussion with and in CT1. The WI will be closed in next meeting and we don’t have time for that to continuously discuss and agree on expect behaviors and procedures.  Regarding to 3rd bullet, there could be other implementation specific reasons for NCR to turn itself ON or by OAM (e.g., time of day, traffic, radio conditions, neighbouring antenna tilts and cell coverage changes during a day etc.) that are outside of RAN2 discussions. |
| Lenovo | Option 1 | Option 2 | RRC release and re-establishment for NCR-MT is a dynamic behavior and can happens in any time. In our understanding after NCR-MT is released, trigger to reconnect to gNB cannot be realized by OAM solution which is a more static configuration way. |
| CATT | Option2 | Option1 | Timer solution will increase the complexity of NCR deployment and spec impacts. |
| Huawei, HiSilicon | Option 2 (no timer at all) | Option 1 | Agree with Intel’s comments very much, which is exactly what we clarified online.  We need to first understand the use case/motivation and problem, and then see if we need a timer. Currently proponents are only discussing how the timer works. Please note that “to bring the NCR-MT released to IDLE back to CONNECTED state” is not the motivation at all to introduce the timer, but still how the timer works.  If the motivation is “to let NCR-Fwd temporarily operate with last side control information, then reconnect to the network”, first we doubt about this motivation, and agree with Intel that it was against the agreement.  Regarding it is NAS or AS to trigger the RRC connection, our thinking is that it still at NAS. It can be based on CN paging (triggered by OAM data if DRB is supported), or based on MT initiation like NCR initial power-up. We don’t see specification impacts in RAN2 now. |
| Fujitsu | Option 1 | Option 2 | With Option 1, the NW can flexibly control the duration of NCT-MT in RRC\_IDLE.  For triggering RRC connection setup procedure, NAS shall be involved. But RAN2 and CT specifications impact will be small. i.e., RAN2 can only specify a notification to the higher layers at the timer expiry, and CT1 only add a triggering condition e.g., to Mobility and periodic registration update initiation like RRC connection failure case. (We also think “mo-Signalling” is suitable establishment cause).  For cell reselection during RRC\_IDLE, the timer should not be stopped. If it is stopped, the NCR\_MT will not have a chance to come back to RRC\_CONNECTED until periodic registration update timing, where the initial value of the timer for periodic registration update is almost 1 hour.  For Option2, although it does not have specification impact, it does not work for the NCR-MT not supporting DRB. Also, inter-vender interoperability will be difficult with Option 2. |

## NCR-MT in RRC\_INACTIVE

### NCR-Fwd ON/OFF

The following proposals are related to NCR-Fwd ON/OFF when NCR-MT is in RRC-INACTIVE state:

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| #from R2-2303288  Proposal 2: The NCR-Fwd is switched OFF if the NCR-MT in RRC\_INACTIVE detects no suitable cell.  Proposal 7 To discuss whether the NCR-MT indicates the NCR-Fwd to resume forwarding when the NCR-MT reselects back to the serving cell on which side control configuration was received. |

For Proposal 2, most companies share the same understanding during Post email discussion, so rapporteur suggests to confirm the understanding, currently, TS 38.304 only captures the NCR-Fwd is OFF when NCR-MT reselects to a different cell, it does not capture the case when no suitable cell is found.

**Q2. Do you agree with Proposal 2 in R2-2303288?**

* Proposal 2 The NCR-Fwd is switched OFF if the NCR-MT in RRC\_INACTIVE detects no suitable cell.

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| **Company** | **Yes or No?** | **Comments** |
| Samsung | Yes | This is needed as the current procedures does not explain what happens if no cell is found. If we use the current text, the NCR-Fwd would remain ON if no cell is found.  We see some companies arguing that this agreement is not needed because we made an agreement on RLF that mentions NCR-Fwd is no suitable cell detected. But the problem is that what has been captured in spec text for this agreement is that NCR-Fwd is turned OFF after RRC re-establishment has been triggered. This does not cover the problem that this proposal is addressing. |
| Qualcomm | Yes |  |
| Nokia | Yes |  |
| Apple | Yes | Moreover, to be safe, we think the simple approach is to just discard the last configuration whenever NCR-MT reselects a different cell. |
| NEC | Yes | TS38.304 Clause 4.4 defines the following two levels of services that may be provided by the network to a UE in RRC\_INACTIVE mode:  - Normal service (for public use or non-public use on a suitable cell);  - Operator service (for operators only on a reserved cell).  Our understanding is that the NCR-MT will enter RRC\_IDLE due to no suitable cell is found, therefore prefer to align with the following RAN2#120 meeting agreement for NCR-MT RLF case:  If NCR-MT enters RRC\_IDLE due to no suitable cell is find, NCR-Fwd is OFF; |
| vivo | Yes |  |
| Kyocera | Yes |  |
| Ericsson | Yes |  |
| Intel | Yes |  |
| Lenovo | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes | Agree with NEC that NCR-MT should be in RRC\_IDLE when no suitable cell is found, and NCR-Fwd is off. |
| Fujitsu | Yes |  |

For Proposal 7 in R2-2303288 and Proposal 6 in R2-2304412, they both talk about the NCR-Fwd behaviour when the NCR-MT detects the change of DL radio quality.

For Proposal 7, as agreed in RAN2, the NCR-MT will inform the NCR-Fwd to be OFF when the NCR-MT reselects a different cell. However, it is unclear whether the NCR-Fwd can be ON again when the NCR-MT reselects back to the cell on which side control information was received.

**Rapporteur comments:**

* When reselection happens, the side control information configured by source cell may not be applicable even if the NCR-MT reselects back to previous serving cell. E.g. the beam indicated for backhaul link and access link may be not applicable any more, so it is safer to keep the NCR-Fwd OFF. If the network wants the NCR to resume forwarding in such situation, it can configure NCR to initiate RRC resume procedure upon cell reselection (e.g. by configuring RNA = serving cell).

**Q3. After NCR-Fwd turns OFF upon cell reselection, do you agree that NCR-Fwd is still OFF when the NCR-MT reselects back to the serving cell on which side control configuration was received?**

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| **Company** | **Yes or No?** | **Comments** |
| Samsung | Yes | Some companies are suggesting that the NCR-Fwd can be turned ON again after a ping-pong event, but the tricky part is to define what is considered a ping-pong event. If a long time passes in between reselecting to the old cell, then the NCR-Fwd configuration associated with the old cell may no longer be relevant to apply.  In this release we think we can make it simple and have the NCR-Fwd be OFF when reselecting another cell.  We think that this should probably also be reflected in 38.304, i.e the spec text should read that the *NCR-Fwd is turned OFF when re-selecting to a better cell*, which we originally proposed. |
| Qualcomm | Yes | At cell reselection, the NCR-FWD is switched OFF. When that happens, either the NCR-MT is self-triggered to resume, or as pointed out by the rapporteur, the network would have triggered the NCR-MT to resume via proper configuration of the RANAC. |
| Nokia | Yes | Originally we raised the ping-pong scenario as a case where it might make sense to resume with the old configuration; however, we now think this is not the best approach in general since a new beam could be selected by the NCR-MT. Hence it is better to keep the NCR-Fwd OFF and acquire a new side control configuration. |
| NEC | Yes | After reselecting a different cell, NCR-MT needs to wait for previous serving cell DL radio quality recovery to reselect back to it. It might be a quite long time until that happens. Agree with rapporteur comments above, it would be safer to keep the NCR-Fwd OFF. |
| Vivo | yes | In a first aspect, the radio environment may have been changed when the NCR-MT reselects back to the previous serving cell. The previous side control configuration may be sub-optimal.  In a second aspect, supporting this feature requires the NCR-MT to keep respective copies of side control information configurations from previous serving cells, which increases the cost and the complexity of NCR node. |
| Kyocera | Yes | We think the serving cell intended to keep the NCR-Fwd ON after releasing the NCR-MT to INACTIVE. It’s not valid in a different cell, but it’s still applied in the serving cell even if the NCR-MT reselects back to the serving cell (which is actually not observed from the serving cell point of view). It’s especially true in case the cell reselection happens in a short term (e.g., just ping-pong back to the serving cell). So, it’s a viable option to resume the NCR-Fwd operation in such a case.  Though, we agree with the rapporteur that it’s safer to keep the NCR-Fwd OFF even if the NCR-MT reselects back to the serving cell. |
| Ericsson | Yes |  |
| Intel | Yes | For reselection towards original serving cell, as mentioned by rapporteur, it is doubtful whether the last side control information is still valid or not. The NCR-MT can anyway be triggered to perform RRC\_Resume by configuring a cell as RNA and be configured with delta config for new SCI after resumption. |
| Lenovo | Yes |  |
| CATT | Yes | UE may reselect back to the serving cell after a long period, in this case, the side control configuration may be not suitable. |
| Huawei, HiSilicon | See comments | We need to be clear what is the “reselection back”, and what happened before the NCR-MT reselects back.  As we agreed in the last meeting, the NCR-MT should trigger RRC resume ***immediately*** when it reselect to a different cell (than the cell configuring NCR configurations), and the NCR-MT will get the new NCR configuration in the target cell. After that, if the NCR-MT is sent back to RRC\_INACTIVE again and reselects back to the source cell, there will be new RRC resume procedure. I guess this case doesn’t need to be discussed.  If we are talking about that after the cell reslection, before the NCR-MT has triggered RRC Resume, the MT reselects back to the source again, this should be a very short time, and I am not sure we need to consider it as “reselection back”. We may consider it as no reselection at all.  I am not sure we even considered the case of reselection-back previously in RAN2 for anything. |

### Backhaul beam monitoring

The following proposal is related to backhaul beam monitoring when NCR-MT is in RRC\_INACTIVE.

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| #from R2-2304412  **Proposal 6:** RAN2 should discuss backhaul beam monitoring by NCR-MT in RRC\_INACTIVE:   * Option 1: NCR-MT in RRC\_INACTIVE state may perform backhaul beam monitoring. FFS if anything further to be specified or if left to implementation. * Option 2: NCR-MT in RRC\_INACTIVE state may not perform backhaul beam monitoring. gNB may perform link monitoring for the backhaul link by implementation when NCR-MT is in RRC\_INACTIVE state.   NOTE: If Option 1 is agreed, the following proposals can also be considered:   * **Proposal 6-1:** The NCR-FWD switches OFF if the NCR-MT in RRC\_INACTIVE mode detects beam failure. * **Proposal 6-2:** The NCR-MT in RRC\_INACTIVE resumes connection to receive updated side control configuration if it reselects a new beam of the same camped cell. |

For Proposal 6 in R2-2304412, two options are provided on whether/how to monitor the backhaul link.

* Option 1: NCR-MT in RRC\_INACTIVE state may perform backhaul beam monitoring. FFS if anything further to be specified or if left to implementation.
* Option 2: NCR-MT in RRC\_INACTIVE state may not perform backhaul beam monitoring. gNB may perform link monitoring for the backhaul link by implementation when NCR-MT is in RRC\_INACTIVE state.

**Rapporteur comments:**

* We think it is worth to clarify first which beam the NCR-Fwd will use for DL/UL backhaul link when NCR-MT in RRC\_INACTIVE state. In our view, we need to keep the alignment between NCR-Fwd and gNB (the gNB should know which beams are used for backhaul link), therefore, the NCR-Fwd should keep using the beam for backhaul link according to the last configuration received from the gNB, this means the beams used for backhaul link should not change even if NCR-MT detects other best DL beams.
* However, we think there is no need to specify beam monitoring specifically for NCR-MT. In our view, the beam quality monitoring can be performed by the gNB according to the reciprocity of downlink and uplink beam. For example, the gNB knows the uplink beam of the backhaul link, and the time resources configured for forwarding (i.e. the side control information that is applied in RRC\_INACTIVE state), it can keep monitoring the uplink signalling that is forwarded by the NCR-Fwd on the time resource associated with the backhaul uplink beam. Then gNB can deduce the downlink quality according to the uplink beam quality. Thus Option 2 is preferred and no specification impact is foreseen.
* For option 1, we think NCR-Fwd is unable to perform beam monitoring (only NCR-MT can do), but the beam used for backhaul link can be different from the beams used for C-link, so it is problematic to ask NCR-MT to do beam monitoring on behalf of NCR-Fwd.

Companies are invited to show your views.

**Q4. Do you think the issue is valid? And which option do you prefer regarding the backhaul beam monitoring?**

(If answers Option 1, please elaborate the expected NCR-MT’s behaviour on how backhaul beam monitoring is performed)

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| **Company** | **Preferred Option** | **Comments** |
| Samsung | Option 2 | We can partly see the problem as proposed originally by Qualcomm, but we think introducing BFR in RRC inactive will be too much of a challenging task for now in this release. We agree with the rapporteur that it should be clarified that the NCR-Fwd keeps using the beam for backhaul link according to the last configuration received from the gNB. |
| Qualcomm | Option 1 | **Option 2 does not work!** Based on the description from the rapporteur, it is assumed that there are UEs sending UL transmissions through the repeater, then the gNB is monitoring the quality of those transmissions and inferring in return the quality of the repeater’s BH link. **This solution fails if there are no indirect Ues, e.g., if the repeater was just extending SSB coverage for some time and no UE showed up.**  To Samsung’s comment, **Option 1 does NOT require defining BFR for RRC\_INACTIVE state**. **A simple solution is to just define an equivalent of BFD for the BH beam, e.g., BH beam measurement “deteriorates”. Behavior of NCR afterwards is same as cell reselection**, i.e., switch NCR-FWD OFF and resume NCR-MT’s connection. |
| Nokia | Option 2 | Have some sympathy for Qualcomm’s proposal, but this seems more like an optimization. |
| Apple | Option 2 | The reason to use RRC-based approach for NCR-MT configuration is to reuse RRC with little enhancements. Note that in RAN2#120, we agreed:   * WA: RRC\_INACTIVE is optionally supported without any specific enhancements   Option 1 requires adding a BH beam monitoring mechanism in RRC\_INACTIVE for NCR, which is not trivial work. If this is really needed, we would prefer to drop the support of RRC\_INACTIVE NCR-MT based on the prior working assumption. |
| NEC | comment | Option 1: For the case in which NCR-MT uses a beam different from NCR-Fwd (for example, NCR-MT uses a wider one whereas NCR-Fwd uses a narrow beam), it is impossible to monitor backhaul beam by NCR-MT.  Option 2: When NCR-MT is in RRC\_inactive mode, likely NCR-Fwd will only forward signals received in PRACH occasions, and possibly there is no PRACH transmission at all from UEs under NCR.  So not sure if it is feasible for gNB to perform backhaul beam monitoring based on these “None/wake” forwarded uplink signals. |
| Vivo | Option 2 | When NCR-MT is in INACTIVE state, it should follow the behavior of normal UE, i.e. no beam quality monitoring. If the NW wants the NCR-MT to keep monitoring the BH beam quality, it should keep NCR-MT in CONNECTED state. |
| Kyocera | Option 2 | We think, from the NCR point of view, the NCR-Fwd just forwards DL/UL signals in the configured/indicated timeslots, so it doesn’t matter if the beam is changed (especially in case the NCR-MT is in INACTIVE). We agree with the rapporteur’s analysis that the gNB can monitor the DL/UL link quality by the existing mechanisms. We think the gNB can always send RAN paging if it needs to update NCR configuration in order to improve the DL/UL link quality. |
| Ericsson | Option1 or Option2 | We think that both Option1 and Option2 are up to the UE and network implementation and there may be no need to specifying anything.  Fine anyway to go with majority view. |
| Intel | Option 2 | While we have some sympathy for point raised by Qualcomm, we don’t think it is critical to address it at this late stage. NCR still have some flexibility to implement the solution that Qualcomm mentioned within the current specification if it wants to. If this is indeed such a critical issue, we also feel that it is better to not use INACTIVE state – which again is possible in an implementation. |
| Lenovo | Option 2 | We think option 1 needs a lot work which seems not possible in this late stage. Anyway RRC state of NCR-MT is controlled by gNB, gNB can maintain NCR-MT in RRC connected state if this is critical issue |
| CATT | Option 2 | We agree with the rapporteur’s analysis that the gNB can monitor the DL/UL link quality by the existing mechanisms. |
| Huawei, HiSilicon | Comments | Our thinking was more like that the NCR-MT should keep monitoring C-link beams like legacy and use the C-link beams for backhaul link. If it doesn’t work, we think that the gNB may need to use RRC\_INACTIVE.  We may need to check with RAN1 on this. |

Q4b. The backhaul beam used by the NCR-FWD for forwarding may deteriorate, but the NCR-MT in RRC\_INACTIVE may still detect other good beams of the same camped cell (in which case no cell reselection occurs). Please address the following:

* Q4b-1: Do you agree that the side control configuration stored by the NCR may become invalid if the old backhaul beam for forwarding is lost?
* Q4b-2: If yes, what should be the ehaviour of the NCR?

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Q4b-1: Yes, if the NCR-FWD switches backhaul beams, the network is unaware of this change since the NCR-MT is in the inactive state and no connection resume has occurred yet. In this case, the network may send transmissions along the old backhaul beam which is not used by the NCR-FWD.  Q4b-2: Same as for cell reselection: NCR-FWD switches OFF, and NCR-MT resumes connection to receive updated side control configuration. |
| Huawei, HiSilicon | As we mentioned above, our thinking is more that the backhaul beam is following the C-link beam, and NCR-MT is always monitoring C-link beams as legacy and use the best beams.  We are fine to check with RAN1 on this, and also fine to even reverse our agreement on RRC\_INACTIVE. |
|  |  |
|  |  |

### Last configuration

For the clarification of last configuration, we have below proposal:

|  |
| --- |
| #from R2-2303288  Proposal 5 For NCR-MT in RRC\_INACTIVE state, the periodic beam indication configuration (if configured and not removed) is applied for NCR-Fwd ON/OFF.   * (2/12)FFS whether aperiodic beam indication configuration (if activated by DCI before RRCRelease) can be applied; * (3/12)FFS whether semi-persistent indication configuration (if activated by MAC CE before RRCRelease) can be applied; |

Based on the Post email discussion, majority companies agree that periodic beam indication configuration can be applied when NCR-MT is in RRC\_INACTIVE, but companies are encouraged to show your views to aperiodic and semi-persistent beam indication configuration.

**Q5. When NCR-MT is in RRC\_INACTIVE state, do you think the periodic beam indication configuration (if configured and not removed) can be applied for NCR-Fwd ON/OFF?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| Samsung | Yes | Confusing proposal. Based on the text and the discussions we interpret the question as:  **Q5bis. When NCR-MT is released to RRC\_INACTIVE state (NCR-Fwd is forwarding), do you think the periodic beam indication configuration (if configured and not removed) shall be still be applied?**  We think this is obviously needed, otherwise NCR-Fwd would clearly be OFF. |
| Qualcomm | Yes | Fine with Samsung rewording |
| Nokia | Yes |  |
| Apple | Yes |  |
| NEC | Yes |  |
| vivo | yes |  |
| Kyocera | Yes | We think it’s quite straightforward according to the RAN2 agreement, i.e., “*After NCR-MT enters RRC\_INACTIVE mode, the NCR-Fwd can be ON or OFF following the last configuration received from the gNB.*”. |
| Ericsson | Yes |  |
| Intel | Yes |  |
| Lenovo | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Fujitsu | Yes |  |

**Q6. When NCR-MT is in RRC\_INACTIVE state, do you think the aperiodic beam indication configuration (if activated by DCI before RRCRelease) can be applied for NCR-Fwd ON/OFF?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| Samsung | No, but no strong view | Assuming the question is:  **Q6bis. When NCR-MT is released to RRC\_INACTIVE state (NCR-Fwd is forwarding), do you think the aperiodic beam indication configuration (if configured and not de-activated by DCI before RRCRelease) shall still be applied?**  We have sympathy for the companies that want to allow for this, but we think we can keep the procedures simple and not allow for this in this release. |
| Qualcomm | Yes, not critical | The aperiodic configuration is going to expire shortly. Either way won’t make a big difference. Simple solution is for NCR to retain all configurations at RRC release and only the periodic ones will persist. |
| Nokia | No strong view | We also prefer to keep procedures simple. On one hand the specs could say “discard aperiodic configuration if configured”; on the other hand, it might be simpler to just keep the aperiodic configuration considering it is short-term anyway. |
| Apple | See comment | We think this can be up to NW configuration. If NW does not want this, it will deactivate it via DCI before RRCRelease. |
| NEC | No |  |
| vivo | No strong view | Aperiodic beam indication is a short-term beam indication. Whether to also to support this has minor impact on the performance. |
| Kyocera | No | In our understanding, it’s not considered as a configuration but an indication, so it’s not aligned with the RAN2 agreement. In addition, we think the NCR-MT in INACTIVE means such a dynamic control/operation is not needed, so the gNB should keep the NCR-MT in Connected if it needs. |
| Ericsson | No | We see this as an unnecessary optimization. Relying on the periodic configuration is already enough. |
| Intel | Yes | the aperiodic config activated by DCI can temporarily be activated until it expires. We don’t see a technical reason why it cannot be supported. |
| Lenovo | No | We think this is a kind of optimization |
| CATT | No |  |
| Huawei, HiSilicon | Yes | Agree with Qualcomm/Intel that this aperiodic configuration is only a short-term one-shot configuration.  We don’t need to do some additional specification work to differentiate the handling of periodic and aperiodic configurations. |

**Q7. When NCR-MT is in RRC\_INACTIVE state, do you think the semi-persistent beam indication configuration (if activated by MAC CE before RRCRelease) can be applied for NCR-Fwd ON/OFF?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| Samsung | No, but no strong view | Assuming the clarifications above, we have sympathy for the companies that want to allow this, but we think that we can keep the procedures simple and not allow for this in this release. |
| Qualcomm | Yes | Semi-persistent is similar to periodic. |
| Nokia | Yes | Don’t see a strong reason why semi-persistent configuration (if active) should be discarded upon release to RRC\_INACTIVE. Wouldn’t it be treated like other periodic configurations? |
| Apple | See comment | We think this can be up to NW configuration. If NW does not want this, it will deactivate it via MAC CE before RRCRelease. |
| NEC | No strong view |  |
| vivo | Yes | Periodic beam indication and semi-persistent beam indication and are actually the same functionality with different signaling procedures, just like Type 1 configured scheduling and Type 2 configured scheduling. If periodic beam indication can be applied when NCR-MT is in INACTIVE state, semi-persistent beam indication should be applied as well when NCR-MT is in INACTIVE state. |
| Kyocera | No | We have the same comment as in Q6 above. |
| Ericsson | No | We see this as an unnecessary optimization. Relying on the periodic configuration is already enough. |
| Intel | Yes | the semi-persistent config activated by MAC CE can temporarily be activated until it expires. We don’t see a technical reason why it cannot be supported. |
| Lenovo | Can follow majority |  |
| CATT | No |  |
| Huawei, HiSilicon | Yes | I assume that we are only talking about access link here. |

### Discard of last configuration

Regarding whether to discard the received side control information, we have below proposal:

|  |
| --- |
| #from R2-2303288  Proposal 6 Regarding whether/when to discard the received beam indication configuration (i.e. NCR-FwdConfig-r18), to discuss the following options:   * (8/12)Option 1: The NCR-MT in RRC\_INACTIVE discards the configuration when it initiates RRC resume procedure in a cell different from the released cell (this implies delta configuration is supported only in the released cell). * Option 2: The NCR-MT in RRC\_INACTIVE does not discard the configuration autonomously (this implies delta configuration is supported in any cell). |

**Rapporteur comments:**

* We think Option 1 makes more sense because when the NCR-MT resumes in a different cell, most likely the previous received side control configuration is not applicable any more (e.g. beams are changed), so it is unable for the network to do delta configuration. However, from signalling point of view, there is no big issue to keep the configuration and wait for the new configuration from target cell. E.g. the target cell can release the configuration if not applicable, so both options work and better to choose the one that most people like.

**Q8. Which option (1 or 2) do you prefer?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred Option** | **Comments** |
| Samsung | Option 2 | We argued for Option 1 before, but we think that Option 2 is actually more in-line with how a UE operates in RRC inactive where a new gNB can acquire the UE configuration from old gNB and resume the connection. Option 1 would require explicitly to state that the configuration is discarded. |
| Qualcomm | Option 1 | At cell reselection, the side control configuration is going to be invalid. This means the old configuration has to be released anyway. Option 1 allows to have this as default behavior. Option 2 requires the explicit release which is not necessary. |
| Nokia | Option 1 | Agree with rapporteur that previous side control is likely no longer applicable after reselection to a new cell. For that reason, it also does not make sense to exchange the side control configuration between gNBs. |
| Apple | See comment | Since the configuration is no longer useful when UE reselects a different cell. We think the last configuration needs to be discarded immediately after cell reselection. |
| NEC | Option 1 | Option 1 is sufficient for stationary NCR. |
| Vivo | Option 1 | Agree with the rapporteur’s comments. |
| Kyocera | Option 1 | We agree with the rapporteur’s analysis that the stored side control configuration is no longer applicable in a different cell. So, it’s simple to discard the configuration in this case. Additionally, if RAN2 goes with Option 2, since the NCR-Fwd was already OFF upon cell reselection as RAN2 agreed, we wonder if the delta configuration by the target cell triggers the resumption of NCR-Fwd operation. |
| Ericsson | Option 1 |  |
| Intel | Option 2 | We think it’s a simplified approach to consider a unified behavior between resume and reestablishment, i.e. delta configuration is supported, no matter it’s a new cell or original serving cell. |
| Lenovo | Option 1 |  |
| CATT | Option 1 | Delta configuration may be not possible if cell is changed. |
| Huawei, HiSilicon | Option 2 | Option 2 doesn’t need any additional specification work, which should be the baseline. There is no benefits to specify the handling in Option 1. |

## RRC re-establishment

RAN2 has agreed that NCR-Fwd is OFF when RLF is detected, regarding when to resume forwarding, we have below proposal:

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| --- |
| #from R2-2303288  Proposal 8 To discuss how to resume NCR-Fwd when RRC re-establishment is succeed:   * Option 1: Wait for the new configuration/indication (RRC/MAC CE/DCI) from the network. * Option 2: When RRC re-establishment is succeed, the NCR-MT indicates to NCR-Fwd to resume forwarding following the last configuration received before RLF. |

**Rapporteur comments:**

* Different from beam failure recovery, the network always sends RRCReconfiguration during RRC re-establishment procedure, so it is easy for the network to provide new side control information to the NCR-MT;
* Similar to the issue discussed in Q3 and Q4, when RRC re-establishment happens, it is possible the previous received side control information is not applicable, so it is safer to wait for the new configuration.

**Q9. Which option (1 or 2) do you prefer?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred Option** | **Comments** |
| Samsung | Option 2 | We think that the Option 2 has merits because it allows for faster resumption of the NCR forwarding and is in line with how beam failure recovery functions. |
| Qualcomm | Option 1 | Following every reestablishment there is an RRC reconfiguration anyway. This procedure can provide new configuration to the NCR. New configuration is always needed due to cell change during reestablishment, which is the common scenario. |
| Nokia | Comment | We don’t think Option 2 makes sense if NCR-MT re-establishes on a different cell than the one where RLF occurred. Originally we preferred Option 2 for the case where NCR-MT re-establishes on the same cell, but perhaps it is does not make sense to optimize around these cases separately, so we can support Option 1 if most companies prefer it. |
| Apple | Option 1 | Agree with Qualcomm, we need to consider cell reselection case. |
| NEC | Option 1 | Agree with rapporteur comments. |
| Vivo | Option 1 | Upon RRC re-establishment due to RLF, the radio environment may have been changed. The previous side control information may not always be feasible. The safer way is to wait for the new side control information as the Rapporteur has commented. |
| Kyocera | Option 2 with comment | We support resuming NCR-Fwd operation, only if RRC Reestablishment succeeds towards the source cell. So, if it’s towards a different cell, the NCR-Fwd should be kept OFF. We think this is not the same with Q3 above since Q3 is for INACTIVE mode while this is for Connected mode, i.e., the NCR is under full control of the gNB.  We rather see a commonality with Q8 above, i.e., the NCR-MT should discard the NCR configuration when it initiates RRC Reestablishment towards a different cell, while it keeps the NCR configuration when it initiates RRC Reestablishment to the source cell. |
| Ericsson | Option 1 | Agree with Qualcomm. |
| Intel | Option 1 | The time period between re-establishment and first reconfiguration is not much to do this. Besides it is also possible that the old configuration is not actually valid. |
| Lenovo | Option 1 |  |
| CATT | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |
| Fujitsu | Option 1 |  |

## RRC release with redirection for NCR-MT

The following proposal is related to RRC release with redirection for NCR-MT:

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| --- |
| #from R2-2304412  **Proposal 7:** NCR-MT supports RRC release with redirection. If NCR-MT reselects a new cell due to redirection, NCR-Fwd is OFF. |

The issue is that whether NCR-MT supports RRC release with redirection? If supported, what’s the expected behaviour when redirection is triggered?

**Rapporteur comments:**

* Considering the handover is not supported by NCR-MT, it is beneficial to allow the network to use RRC release with redirection to move the NCR-MT from serving frequency to another frequency, otherwise, if multiple NCR-MT are deployed in the same area, based on current cell reselection mechanism, they may camp on the same carrier (e.g. lower spectrum) at the same time.
* If companies have concern on how to initiate RRC connection setup after cell selection, in case suspendConfig is not included, the NCR-MT enters RRC\_IDLE state and wake-up timer (via OAM or RRC) can be applied. If suspendConfig is included, the NCR-MT enters RRC-INACTIVE state and the network can use RAN paging to wake the NCR-MT up.

**Q9. Do you agree that RRC release with redirection is applicable to NCR-MT, no further enhancement is needed and NCR-Fwd is OFF when NCR-MT selects a new cell due to redirection?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred Option** | **Comments** |
| Samsung | Agreed | Do not see why it should not be supported. If not supported, then we will likely limit some network-implementations as handovers are not supported. |
| Qualcomm | Agree |  |
| Nokia | Agree | Even though we do not think redirection is widely applicable to NCR-MT we do not see a good reason to restrict it. |
| Apple | Agree |  |
| NEC | Agree |  |
| vivo | yes | It is not meaningful to define a temporary solution with complex procedure. Better to leave it for implementation. |
| Kyocera | Yes | We agree with the rapporteur’s analysis, and also we think there is no reason to exclude the redirection. The NCR-Fwd should be OFF when NCR-MT selects a new cell, similar to the RAN2 agreement “*The NCR-FWD is switched OFF if the NCR-MT in RRC\_INACTIVE state reselects a different cell*”. |
| Ericsson | Agree |  |
| Intel | Yes |  |
| Lenovo | Agree |  |
| CATT | Agree |  |
| Huawei, HiSilicon |  | There is no capability for redirection, which should be mandatorily supported. If there is a use case, the network can just use it. No need to discuss it. |
| Fujitsu | Agree |  |

## Other proposals

The following proposals are considered as low-priority in R2-2304412.

|  |
| --- |
| **Proposal 8:** Cells in forbidden cell list (if configured) are considered as barred for NCR-MT. Cells not in allowed cell list (if configured) are considered as barred for NCR-MT.  **Proposal 9:** NCR-MT prioritization of cells for reselection is based on configured allowed and/or forbidden cell lists.  [Rapp-ZTE]: P8 and P9 are both related to the “allowed/forbidden cell list” agreed in RAN3. Based on RAN3’s conclusion, the cell list may be configured via OAM.  We understand technically, P8/P9 are aligned with RAN3’s intention when introducing the “allowed/forbidden cell list”, however, we think there is no need capture it explicitly in stage 3 as they are all OAM initiated and controlled behaviours.  **Proposal 10:** RAN2 should discuss if NCR-Fwd is turned OFF when the “NCR-support” in SIB1 of the last serving cell on which side control configuration was received has been toggled OFF.  [Rapp-ZTE]: As long as the NCR-MT is camping on a cell, the NCR-MT needs to check the NCR-support indicator in SIB1, for cell that does not broadcast “NCR-support”, it will be considered as barred for NCR-MT, in this case, the NCR-MT needs to reselect another cell and NCR-Fwd will turn OFF once reselection happens, so this is already covered based on current spec.  On the other hand, we think a smart network will not update the “NCR-support” indicator when it already knows there is NCR working(ON) in the cell.  **Proposal 11:** RAN2 should discuss and agree on the separation of compliance check for NCR-MT and NCR-Fwd configuration, and that NCR-MT indicates NCR-FWD’s configuration failure to the network via at least OAM.  [Rapp-ZTE]: In our understanding, although NCR-MT and NCR-Fwd are defined as two separate logic entities, only the NCR-MT will do compliance check of the RRC reconfiguration message, so there is no need to introduce separate compliance check for NCR-MT and NCR-Fwd.  **Proposal 12:** RAN2 should discuss whether NCR-MT shall support configuration of the same SMTC periodicities as IAB-MTs (i.e. periodicityAndOffset-r16 within SSB-MTC3-r16).  [Rapp-ZTE]: In our understanding, the SMTC3 was introduced for IAB node to discover and measure other IAB nodes. For NCR-MT, the NCR-MT will only measure the SSB sent by the network, considering usually the NCR-MT is operating in RRC\_CONNECTED mode and RRM measurement is not supported in RRC\_CONNECTED mode, the benefit of configuring large SMTC periodicity for NCR-MT is not clear. On the other hand, this is kind of optimization and not so critical at this stage.  **Proposal 13:** RAN2 should discuss if LS should be sent to RAN1 to enquire whether separate PRACH resources specific to NCR-MT should be defined, either based on separate PRACH occasions (like Rel-16 IAB) or based on PRACH partitioning (like Rel-17 RedCap, SDT, Slicing and Coverage Enhancement).  [Rapp-ZTE]: Firstly, the NCR-MT will not trigger RACH procedure frequently, so there is no need to worry about the RACH collision between NCR-MT and NCR. Secondly, PRACH partitioning was defined to address specific use cases, for example, 1) to identify UE’s type (RedCap), so the network can take proper action earlier; 2) to identify whether the UE triggers/requests specific actions (e.g. SDT, Msg3 repetition).  For NCR-MT, it is sufficient to identify the device type based on the indication in Msg5. It is not necessary to allocate specific RACH resource for NCR-MT.  **Proposal 14:** Define an NCR-specific q-RxLevMinNCR and specify that Qrxlevmin applied in NCR-MT cell selection criterion S is obtained from q-RxLevMinNCR.  [Rapp-ZTE]: Regarding whether to introduce a NCR-specific cell selection threshold, we share the views from Nokia in R2-2304412 that NCR is a network device and the RF characteristics of the device would already be quite different from other UEs. And this is also kind of optimization and not critical at this stage. |

Due to limited time, rapporteur has provided some comments to each proposal, rapporteur would suggest to focus on essential issues. So please companies check the proposals, and if you found anything that needs to be discussed or supported in RAN2, please indicate in below table:

**Q9. Which of above proposals do you think needs to be discussed (or supported) in RAN2 ?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Which proposal(s)** | **Comments** |
| Samsung | Proposal 11 | **We think it should at least be clarified that the compliance check is done only on the NCR-MT configuration.**  Regarding the Rapporteur’s comment (only MT is doing compliance check, so there is no need of separation of compliance check.) it seems like there has been a misunderstanding with this proposal. Our proposal is to let MT check only its own configuration, not for FWD configuration. Checking FWD config can be up to the implementation, and no need to be captured in the SPEC. If not doing this, MT always has to check both MT and FWD configuration, which means implementation restriction where Fwd should always report to the MT whether it can comply with the received FWD configuration in RRCReconfiguration. Moreover, MT will do the Reestablishment procedure even if Uu interface has no problem (i.e., MT configuration is compliant) due to only FWD configuration not being compliant. Why do we want this operation? |
| Qualcomm | None | P8, P9, P10, P12, P13, P14: agree with rapporteur  P11: simple behavior is to have reestablishment at every RRC configuration failure, whether the configuration is specific to the NCR-MT or NCR-FWD. |
| Nokia | Proposal 8 | Agree with Rapporteur that P8 does not need to be captured in Stage 3, but we are open to adding a note to Stage 2 if other companies want it (perhaps RAN3 already plans to capture it in Stage 2 TS 38.401). |
| NEC | Proposal 14 | Proponent.  Since NCR-Fwd may keep ON (i.e., continuous to provide services) following the last configuration received from the gNB when NCR-MT keeps camping on the same cell after entering RRC\_INACTIVE, we think it is essential to ensure backhaul link quality.  An example of providing services (i.e., data and/or signaling transmission) while remaining in RRC\_INACTIVE is SDT. To enable SDT, one condition is to ensure the DL RSRP is above a configured threshold. A similar requirement should be applied for keeping NCR-Fwd ON when NCR-MT is in RRC\_INACTIVE. |
| Kyocera | Proposal 9 | We believe the NCR-MT shall follow the idle/inactive mode procedure (i.e., TS38.304). According to the current specification, the NCR-MT is not allowed to prioritize a frequency/cell, even if the allowed/forbidden cell list is configured by the OAM. So, we think some short sentence should be captured in the cell reselection priority handling (i.e., section 5.2.4.1), which may be something like “The NCR-MT may consider a specific frequency/cell to be the highest priority or the lowest priority, if needed (e.g., according to the configuration by OAM).” |
| Ericsson | None | The other proposals seem not critical and, keeping in mind that this WI will need to finish in the next meeting, there is no need to address them. |
| Intel | P8 | Regarding to cell (re)selection, though the cell list(s) is configured by OAM, the current stage 2 stage text from RAN3 captures that UE is configured with these but the cell (re)selection stage-3 of the UE (NCR-MT) should be specified to avoid unpredicted behavior. Either we leave it entirely to OAM (that is, not capture the text by RAN3 in specs) or if it is captured (as it currently is), the corresponding UE behaviour also has to be captured. |
| Lenovo | None | We prefer to keep NCR as simple as possible in this release and seen no critical proposals |
| CATT | None | No critical issue is identified, considering the time limitation, we prefer to leave them to next release. |

# Conclusion

Based company inputs, the proposals are:

TBD

# References

[1] RAN2#120 Chairman notes