**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:

|  |
| --- |
| * [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.

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email Address** |
| Ericsson | Antonino Orsino | antonino.orsino@ericsson.com |
| CATT | Hao Xu | xuhao@catt.cn |
| Samsung | Jonas Sedin | j.sedin@samsung.com |
| Nokia | Andrew Lappalainen | andrew.lappalainen@nokia.com |
| Apple | Zhibin Wu | zhibin\_wu@apple.com |
| Qualcomm | Georg Hampel | ghampel@qti.qualcomm.com |
| Kyocera | Masato Fujishiro  | masato.fujishiro.fj@kyocera.jp |
| Intel | Ziyi Li | ziyi.li@intel.com |
| vivo | Boubacar Kimba D.A. | kimba@vivo.com |
| ZTE | LiuJing | liu.jing30@zte.com.cn |
| Fujitsu | Takako Sanda | Sanda.takako @ Fujitsu.com |
| Huawei, HiSilicon | Xubin | xubin10huawei.com |

# 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:

|  |
| --- |
| * 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”.

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

|  |
| --- |
| *# TS 24.501 section 5.2.2.3.2*5.2.2.3 Detailed description of UE behaviour in state 5GMM-DEREGISTERED5.2.2.3.2 LIMITED-SERVICEThe 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.

|  |
| --- |
| *# TS 24.501 section 5.2.3.2.4*5.2.3.2 Detailed description of UE behaviour in state 5GMM-REGISTERED5.2.3.2.4 LIMITED-SERVICEThe UE:a) shall perform cell selection/reselection;b) may perform de-registration locally and initiate an initial registration for emergency services; andc) 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 timerThe 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”.**

|  |  |  |
| --- | --- | --- |
| **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. |
| Samsung | Comment | The definition of an acceptable cell is the following in 38.304: ***acceptable cell:****An "acceptable cell" is a cell on which the UE may camp to obtain limited service (originate emergency calls and receive ETWS and CMAS notifications). Such a cell shall fulfil the following requirements, which is the minimum set of requirements to initiate an emergency call and to receive ETWS and CMAS notification in an NR network:**- The cell is not barred, see clause 5.3.1;**- The cell selection criteria are fulfilled, see clause 5.2.3.2.*For NCR-MT, none of these can be applicable as the NCR cannot make calls and there is no action to perform if emergency notification is signaled. Thus we believe that an NCR cannot camp on an Acceptable cell. Furthermore, in RAN2#121 we made the following agreement: * *The NCR-FWD is switched OFF if the NCR-MT in RRC\_INACTIVE state reselects a different cell than the last serving cell on which side control configuration was received.*

To make this complete, we believe that we can make it clear that if no suitable cell is found, the NCR-Fwd is turned OFF. The agreements from this can be: **Proposal 1: If NCR-MT in RRC idle or inactive detects no suitable cell, the NCR-MT recovers using legacy NAS recovery mechanisms. NCR-MT does not camp on an Acceptable cell.** **Proposal 2: The NCR-Fwd is switched OFF if the NCR-MT in RRC\_INACTIVE detects no suitable cell.** |
| Nokia | Yes | Regarding Samsung’s comment, we agree that emergency calls/alerts do not seem very applicable to NCR-MT; however, we think the term *“limited service”* in the *acceptable cell* definition from 38.304 is perhaps ambiguous or not being used consistently with the term *“limited service”* from the CN specifications. The procedures provided from 24.501 above only state that the UE *may* initiate registration for emergency services. Hence, based on the procedures in 24.501, we think the NCR-MT would be able to camp on an acceptable without issue: i.e., *if the NCR-MT is 5GMM-REGISTERED, it shall perform cell selection/reselection*; and *if the NCR-MT is 5GMM-DEREGISTERED, it shall initiate an initial registration procedure when entering a cell which provides normal service*. Registration for emergency services is optional.There is probably no need to specify that the NCR-Fwd is OFF in the case where it camps on an acceptable cell, since this would only happen if no suitable cell is found during 1) cell reselection, 2) integration/startup (i.e. before acquiring SCI), or 3) RLF. In all of those cases NCR-Fwd would already be OFF.  |
| Apple | Yes | First, we believe camping on an acceptable cell does not allow NCR-Fwd to operate. The existing RAN2 agreements are clear on this aspect. Then, according to the current spec, the NCR-MT will enter limited service state and only emergency service is allowed. Since NCR-MT will not initiate emergency session, we think it is fine to leave it as it is and nothing more needs to be said. |
| Qualcomm | Yes | The NCR-MT uses legacy NAS recovery mechanisms. Agree with Samsung that the NCR-FWD is switched off if the NCR-MT detects no suitable cell. |
| Kyocera | Yes | We agree the rapporteur’s observation. We share companies that emergency call is still allowed for NCR-MT camping on an acceptable cell. We were just wondering if any special handling for OAM traffic is applicable, since NCR is considered as a network node. Regarding Samsung’s comment, we share Nokia’s view that NCR can camp on an acceptable cell, and we think the NCR-Fwd OFF is covered by the RAN2 agreement “*If NCR-MT enters RRC\_IDLE due to no suitable cell is find, NCR-Fwd is OFF*”, although it was agreed for RLF case. So, we don’t think these are needed to be agreed.  |
| Intel | Yes | There’s no difference between NCR-MT and normal UE regarding to the behavior when camping on acceptable cell or when no cell is found. We prefer to clarify in the observation as below:**When NCR-MT camps on acceptable cell or when no cell is found, same as normal UE, 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.**Regarding to NCR-Fwd turning OFF, based on our agreement in RAN2 #121 meeting, the NCR-Fwd will turn OFF when the NCR-MT reselects another cell. Hence, the behavior camping on an acceptable cell or no cell can be categorized into the same scenario as cell reselection. There’s no need to have another agreement on NCR-Fwd behavior in this case. |
| vivo | Yes | Same understanding with Rapp. We think there is no need to specify new mechanism for this scenario. |
| ZTE | Yes | Regarding Samsung’s comment, we share the same view as Nokia, please note that “IMS emergency call” is a conditional mandatory feature for legacy NR UEs.

|  |  |
| --- | --- |
| IMS emergency call | It is mandatory to support IMS emergency call over PLMN for UEs which are IMS voice capable in NR.It is mandatory to support IMS emergency call over SNPN for UEs that are SNPN capable and IMS voice capable over SNPNs. |

There are lot of cases that emergency call/alerts are not applicable in the field, e.g. industrial sensor, camera…; But we haven’t defined separate cell selection/reselection principle (e.g. to exclude acceptable cell) specifically for those cases. We think it is the same for NCR-MT. We are also afraid changing this will have SA/CT impacts. Regarding Samsung’s comment on “OFF”, we are fine with the proposal, I think the intention is to address the concern that previous RAN2 agreement (e.g. reselects to different cell) does not cover the case when no suitable cell is found.  |
| Fujitsu | Comment | Although we do not fully agree with Rapp’s observation (see below), we agree to the point “no need to specify new mechanism for this scenario”.As Samsung pointed out, acceptable cell is not applicable for the NCR-MT. Therefore, the NCR-MT in RRC\_INACTIVE never reselect acceptable cell and never goes to RRC\_IDLE with release cause “other”. In case not cell can be selected, as specified in TS 38.331, it is left to UE implementation how to behave. The NCR-MT may be able to stay in RRC\_INACTIVE and keep searching a suitable cell.<For Rapp’s observation>What we disagree is the last one (on the section 5.3.7 in TS 24.501). The sentence the Rapp picket up is for the case “the UE is registered for emergency services, and timer T3512 expires”. So, this is not applicable to the NCR-MT.But we agree to the other observations. Thanks Rapp for the analysis. |
| Huawei，HiSilicon | Comment | The following procedure is not applied to NCR-MT since it is based on the condition that the UE is registered for emergency services:*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.*According to the SA2 specs, it seems for NAS, the following mechanism can be reused for this case by delaying the periodical register update if the NCR-MT is in limited service state. *If the UE is not registered for emergency services, and is in a state other than 5GMM-REGISTERED.NORMAL-SERVICE or 5GMM-REGISTERED.NON-ALLOWED-SERVICE over 3GPP access when timer T3512 expires, the periodic registration update procedure is delayed until the UE returns to 5GMM-REGISTERED.NORMAL-SERVICE or 5GMM-REGISTERED.NON-ALLOWED-SERVICE over 3GPP access.*But for AS, if the UE reselects from the acceptable cell to a suitable cell, the UE has to wait until the timer T3512 expires to initiate the registering. Before that, there is no way for the NW to control the NCR-MT.[Rapp-ZTE] The above cited context includes the condition “when timer T3512 expires”, but it did not say the UE cannot initiate registration when it reselects a suitable cell and T3512 does not expire. In this case, we are not sure there is no specs impact at all and prefer to further think about it since we still have one meeting. Suggest to propose like this: **When NCR-MT camps on acceptable cell or when no cell is found, the NCR-MT shall enter limited service state and delay the periodic registration update procedure until the NCR-MT selects a suitable cell, according to the exsiting mechanism. FFS whether anything is needed in AS layer. ~~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.~~** [Rapp-ZTE] Based on your comment, I think you also agree that nothing needs to be changed in NAS spec, no matter when the NCR-MT initiates the registration procedure, it is all specified in NAS spec. I may not fully understand which AS part in our spec will be impacted, more clarification is needed. |

**Summary**

9 companies agree with the proposal, 3 companies provide comments but with different views.

One company thinks NCR-MT cannot camp on acceptable cell (i.e. limited service state) because emergency call is not supported by NCR-MT, but other company replied that the definition of “limited service state” is defined differently in NAS spec, and emergency call is not mandated. Based on RAN2 specification, we also see that IMS emergency call is not mandatory feature for all NR UEs, so it seems no strong motivation to exclude “acceptable cell” specifically for NCR-MT. Please note, for other IMS emergency incapable UEs (e.g. industrial sensor, camera…), acceptable cell is also supported.

Two company think the cited context for case 2 is incorrect, but one of them agrees that current spec is clear and no need to specify new mechanism for this scenario. The other company thinks based on the NAS spec, the periodic registration update procedure is delayed until NCR-MT selects a suitable cell, but rapporteur thinks the cited context does not say the NCR-MT cannot trigger registration if the NCR-MT selects a suitable cell before T3512 expires. But no matter of the timing of registration, all companies agree that NAS spec already specify the UE behaviour clearly.

One company indicates it is unclear whether anything is needed in AS layer, but without mentioning which kind of enhancement is needed?

To make progress, rapporteur suggests to agree the assumption from RAN2 perspective, but still companies to revisit it if problem is identified.

**Proposal 1 From RAN2 perspective, NAS spec already specifies the behaviour for the case when NCR-MT selects a suitable cell after it was camping on acceptable cell or no cell was found. No need to specify new mechanism for this scenario. (can be revisited if company identifies problem)**

In addition, one company suggests to confirm the NCR-Fwd should be OFF when no suitable cell is found. Rapporteur thinks the proposal is technically correct.

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

## 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?**

|  |  |  |
| --- | --- | --- |
| **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. |
| Samsung | Option 1 | Defining a Wakeup timer in RRC release allows for greater flexibility.We think using a timer similar to T380 can be used, T4XX can be a suitable name. It starts upon reception of the timer in RRCRelease and at expiry the actions of Section 5.3.3 are performed.Timer values can be similar to or more coarse as that compared to T380: {min10, min20, min30, min60, min120, min240, min480, min960}Handling it via OAM has a number of problems: 1) gNB is no longer in control of the timer duration, which may need to change according to its own conditions/implementation. 2) gNB may not know when the wakeup timer has been configured or re-configured before releasing an NCR-MT to RRC idle. This means that some proprietary solution is need to ensure that a gNB knows when it has been configured is needed.  |
| Nokia | Option 2 | In general, we do not see why it is essential to specify a flexible/dynamic wake-up timer. If flexibility is needed, wouldn’t releasing the NCR-MT to RRC\_INACTIVE state be preferable? Besides, timer granularity may not be a trivial issue to decide: if the timer is too short, more signalling overhead will be introduced and the benefit of sending the NCR to a low power state will be lost, while if the timer is too long the gNB cannot change the NCR-Fwd configuration very adaptively. This is where RRC\_INACTIVE seems like a better option.We think it is okay to leave how the NCR-MT wakes up from RRC\_IDLE to implementation/OAM. We disagree that lack of DRB means no OAM. We recall that some companies had previously stated that OAM could be accessed by other technologies, e.g. wired connection, which is why they did not support mandating DRB. |
| Apple | Option 2 preferred | Since the configuration of wake-up timer can be done anyway via OAM means, then there is no strong justificaiton to change RRC spec for this. |
| Qualcomm | Option 2  |  |
| Kyocera | Option 1 | Since the gNB intentionally released the NCR-MT to IDLE, it’s reasonable that the gNB still has the controllability of NCR-MT in IDLE in this case, so the wake-up timer is needed. We wonder how the OAM resolves this issue. For example, we’re not sure how the OAM knows the gNB intentionally released the NCR-MT to IDLE (since the NCR-MT cannot send any UL OAM traffic after it received RRC Release). In addition, if OAM (i.e., server in network) sends periodic DL OAM traffics (i.e., keep-alive messages), the NCR-MT is paged periodically, which is not the intention of gNB.  |
| Intel | Option 2 | We do not see a need for a specified solution. The triggers for NCR-MT to move back to RRC\_CONNECTED state can be left to NCR implementation (which may involve the timer or other solutions). . The trigger will also depend on the agreement to the next question – whether NCR will be ON or OFF while NCR-MT is IDLE.  |
| vivo | Option 1 | The wake-up timer is needed. Otherwise, we do not any efficient way for NCR-MT to get into RRC\_CONNECTED state. |
| ZTE | Option 1, but can accept Option 2  | Option 1 is simple and supports interoperation. However, we can also accept Option 2 if most companies have concern on Option 1.  |
| Fujitsu | Option 1 | Option 1 is simpler solution |
| Huawei, HiSilicon | Option 2 with comments | The most important thing here is to clarify the scenario first. Because once the scenario is clear, the solution is clear. To us, the only valid use case for gNB to release the NCR-MT to RRC\_IDLE is the need from NCR OAM. For instance, the NCR OAM may want to turn off the NCR node completely. Other than this case, we don’t see the necessity for gNB to release the NCR-MT to IDLE on intention without any request from NCR OAM. In any case, INACTIVE seems a better choice as mentioned by Nokia.[Rapp-ZTE] I may not fully understand your comment, if it is initiated by NCR OAM (not gNB), then the NCR should trigger NAS procedure to inform the AMF to release itself (like detach), in this case, the AMF will send UE context release command to the gNB. When gNB initiates the release procedure, it may be initiated by gNB’s OAM, or gNB’s algorithm, then the gNB may want to configure a wakeup timer to the NCR. But if we go for Option 2, it means such behavior can be done via OAM, either through OAM connection (if DRB is configured), or preconfigured in NCR’s OAM. Then follow this logic, it is straightforward that the OAM can trigger the UE to RRC\_CONNECTED by legacy paging, i.e., no timer is needed. |

**Summary**

6 companies support Option 1, 6 companies support Option 2.

Based on the comments, the proponent of Option 1 thinks it is more flexible, because the network is able to configure different wake-up timer value in different scenarios. While the proponent of Option 2 thinks all those can be done via OAM.

Since there is no clear majority, rapporteur suggests to further discuss it during the meeting.

**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).**

## ON/OFF in RRC\_IDLE

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

|  |
| --- |
| 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?**

|  |  |  |
| --- | --- | --- |
| **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? |
| Samsung | 2 | As we mentioned in RAN2#121, we believe that Option 2 allows for greater network flexibility. This is important as RRC inactive is a feature that is both optional from network and NCR point of view. If for instance a network operator does not utilize RRC inactive due to various reasons, this means that the most typical operation of an NCR is not available and an NCR-MT needs to be kept in RRC connected mode. This is not only wasteful of network resources, but is also not entirely cost-free as it is very unusual for a network to keep a device in connected mode for a long time without any DL/UL – in other words this also requires implementation efforts. We want to keep NCR simple both for implementing the actual NCR device but also for the network to implement NCR. What CATT mentions above has entirely been taken out of context as that is for the purpose of RRC re-establishment.  |
| Nokia | Option 1 | We do not see why NCR-Fwd behaviour during RRC\_IDLE should be aligned with RRC\_INACTIVE. As we commented above, we think RRC\_INACTIVE can be used for a reduced-power state while still operating the NCR-Fwd and provides the flexibility that is needed vs a wake-up timer. Considering that NCR is a network device, RRC\_IDLE seems more applicable to the case where an operator would want to intentionally shut off the NCR-Fwd for a prolonged period with the intention of not providing coverage to users.We somewhat sympathize with Samsung regarding RRC\_INACTIVE. However, we are not really sure there would be much additional network resource consumption if the NCR-MT is kept in RRC\_CONNECTED. IAB has the same issue if there are no users. |
| Apple | Option 2 | Our understanding is that the IDLE and INACTIVE cases can be handled similarly, if the “unable to trigger CN paging” issue can be solved satisfactorily according to Q2. But if we really have no consensus on Q2, then to make progress, we can also accept Option 1 if Option 1 is the majority view. |
| Qualcomm | Option 1 | RRC IDLE should not be used as a FWD operation state, in particular, because the gNB has no option to pull it out of RRC IDLE in case it wants to reconfigure the NCR. For this purpose, RRC INACTIVE can be used.  |
| Kyocera | Option 1 | We agree with CATT that the behavior should be rather aligned with RLF case. We think, if the gNB wants to release the NCR-MT (for NCR power saving or for NW congestion), the gNB can release it to INACTIVE. We still assume the NCR-MT in IDLE is considered as a kind of unusual case (e.g., similar to camping on an acceptable cell above, or in RLF), even if the gNB released it to IDLE.  |
| Intel | Option 1 | We agreed NCR-fwd to be OFF when RLF is detected. To align NCR-MT behavior when it is in RRC\_IDLE state, we prefer NCR-Fwd to be OFF for simplicity. Moreover, according to TS 38.331 [2], when UE goes to RRC\_IDLE state, the UE shall discard the UE Inactive AS context, as well as release all radio resources, including RLC entity, MAC configuration, etc. The gNB also releases all UE context information and network will have no knowledge of the NCR state or last provided side control information. Since NCR-MT follows the same behavior as a normal UE, the configured side control information will also be discarded by upon NCR-MT goes to RRC\_IDLE state. It is simpler to follow the current principles that network and UE has no AS context in RRC\_IDLE and no side control information to follow, and so NCR-Fwd can be turned OFF.If power saving is important, NCR can use INACTIVE state. |
| vivo |  | Agree with Rapp that Option 2 is aligned with principle agreed for RRC\_INACTIVE state and no additional specification effort is needed.[Rapp-ZTE] Based on the comment, I understand your preference is Option 2.  |
| ZTE | Option 1 | We originally prefer Option 2, i.e. to keep consistency for NCR-MTs in RRC\_IDLE and in RRC\_INACTIVE, but it seems Intel raised a valid point that UEs in RRC\_IDLE do not store the AS context, so for Option 2, we need to update the text procedure (to request the NCR-MT to store the specific configuration), or to introduce the SCI configuration in RRCRelease message, both require additional spec change. For the sake of progress, we are fine with Option 1 in Rel-18. |
| Fujitsu | Option 1 | Option 1 is simpler. |
| Huawei, HiSilicon | Option 1 | See our above comments.Similarly, this question is also related to the use case for releasing the NCR-MT to IDLE. As the need comes from OAM, then it is not logical to still follow gNB’s last configuration. So the Fwd should be OFF state. |

**Summary**

8 companies support Option 1, 4 companies support Option 2 but one of them can also accept Option 1.

The proponent of Option 2 think it is better to align the behaviour in RRC\_IDLE and RRC\_INACTIVE states. And Option 2 brings more flexibilities.

Based on the comments, rapporteur thinks Intel has a point that currently, UEs in RRC\_IDLE do not store AS context, so if we want the NCR-MT to follow the last configuration in RRC\_IDLE, then we need to specify it explicitly, e.g. to store the SCI configuration in UE AS context in RRC\_IDLE. To avoid complexity. Rapporteur suggests to adopt Option 1.

**Proposal 4 (9/12)NCR-Fwd is OFF when NCR-MT is in RRC\_IDLE state.**

## 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”.**

|  |  |  |
| --- | --- | --- |
| **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. |
| Samsung | Yes | In principle we think that it would have been fine to include both Type 1 and 2, but for release 18 this could be sufficient.  |
| Nokia | Yes |  |
| Apple | Yes |  |
| Qualcomm | No | Type 1 should be supported as indicated by the rapporteur.Type 2 should not be supported since it is aperiodic and will expire shortly.Type 3 is very similar to Type 1 and should be supported (*reception of MAC CE would still occur while NCR-MT is in RRC CONNECTED state*). Additionally, Type 3 gives control to the gNB-DU to decide which of the side control configurations for the NCR shall be activated. when the MT is sent to INACTIVE. |
| Kyocera | Yes |  |
| Intel | See comment | We are wondering if a DCI or MAC CE is received to activate/deactivate aperiodic/semi-persistent beam configuration before NCR-MT becomes RRC\_INACTIVE, whether NCR-Fwd can still stay ON when beam configured by DCI/MAC CE are still active. After beams configured by MAC CE/DCI is inactive, NCR-Fwd can follow the last periodic beam configuration received via RRC. |
| vivo | Yes |  |
| ZTE | Yes | Regarding Qualcomm and Intel’s comment on semi-persistent beam configuration, since the NCR-MT cannot receive MAC CE after it is released to RRC\_INACTIVE, the “activated” semi-persistent configuration actually becomes a periodic beam configuration. From network perspective, if it wants, the network can actually configure a periodic beam configuration (with the same periodicity and duration) before releasing the NCR-MT. Regarding Intel’s comment on aperiodic beam configuration, in our view, once the configuration is activated by DCI, it is simpler not to release the NCR-MT until the end of the aperiodic time resource. It is more like an optimization if the network wants to keep the NCR-Fwd ON for a while, but releases the NCR-MT earlier.  |
| Fujitsu | Yes |  |
| Huawei, HiSilicon | No | Not sure why Type 2 and Type 3 are not applied to RRC\_INACTIVE. The intention of releasing the NCR-MT to RRC\_INACTVIE may be the NW doesn’t want to change the Fwd operation for a while. So all indications received during RRC\_CONNECTED can be followed. If the NW wants to change anything, it can anyway paging the NCR-MT back to RRC\_CONNECTD. |

**Summary**

9 companies agree with the proposal that only periodic beam indication configuration is applied when the UE enters RRC\_INACTIVE state.

3 companies think semi-persistent beam configurations can also be applicable as long as it is activated by MAC CE before RRC Release. 2 of them also think aperiodic beam configuration can be applied if the time resource is activated by DCI before RRC Release.

Technically, the rapporteur agrees that if we specify explicitly, the NCR-MT can also follow the MAC CE or DCI activated resources after entering RRC\_INACTIVE. However, we need to consider how much benefit can be achieved by doing this.

For aperiodic beam configuration, the duration won’t last long, so in which scenario the network wants to release the NCR-MT before expiry? And for semi-persistent beam configuration, once activated, it is same as periodic beam configuration because MAC CE (for deactivation) cannot be sent in RRC\_INACTIVE state, then if the network wants the NCR-Fwd to keep forwarding periodically, the network can use the RRC message to provide periodic beam configuration before releasing the NCR-MT.

Considering all companies share the same view on periodic beam indication configuration, so rapporteur suggests to agree periodic beam case, and further discuss type 2/3 in RAN2.

**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;**

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”.**

|  |  |  |
| --- | --- | --- |
| **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. |
| Samsung | Neutral | On one hand, we think that maybe there is no need to specify when the beam indication configuration is discarded. On the other hand it could be useful to be explicit. Actually in some cases the beam indication configuration could potentially be the same regardless of the cell the NCR-MT is connected to, due to the NCR being stationary and serving the same area, but this would be an optimization.  |
| Nokia | Yes |  |
| Apple | No | We do not follow the logic of this proposal. If we do not consider ping-pong effect, then the “last configuration” will be discarded immediately after NCR reselects a different cell. If we do care about ping-pong, then the configuration will be kept until it has been override by gNB in a new RRCReconfiguration or RRCResume. Either way, we do not see why NCR has to be mandated to only release the ”last configuration” when sending RRCResumeRequest. It is very possible that the RRC Resume procedure may fail. If we follow the proposal and the RRC resuem procedure fails, then we create a singular state where NCR-MT is still vulnerable to “Ping-pong” but having no “last configuration” at all. |
| Qualcomm | Yes | Agree with rapporteur.  |
| Kyocera | - | We think more discussion is needed on this. We understand the rapporteur’s proposal is efficient in some cases, while we have some sympathy with Apple’s comment. We just wonder how the NCR-MT detects the “ping-pong” (e.g., how long time is it); in other words, we wonder if the NCR-MT can really store the last configuration from the source cell even when it camps on the target cell for a long time (and possibly the NCR-FWD is in operation by the last configuration).  |
| Intel | Yes (with comments) | No strong view. NCR-FWD will be OFF when the NCR-MT reselects another cell and so this question doesn’t impact NCR-FWD operation. Discard or not is simply a signalling optimization – if the configuration is retained, delta configuration can be applied in the Resume message but source cell has to forward the NCR side control information to the target to provide the delta (or release) the configuration. It is simpler to release the *NCR-FwdConfig-r18*and not support delta.  |
| vivo | Yes | Agree with Rapp. |
| ZTE | Yes | Currently, many configurations are released upon the initiation of RRC resume procedure, e.g. MCG SCell config, SCG context, overheating configuration, etc. Regarding Apple’s comment, in our understanding, when NCR-MT resumes to a different cell, most likely the entire SCI configurations (e.g. aperiodic/periodic/semi-persistent) are not applicable any more, so even if the target cell can obtain the old SCI configuration from the source cell, most likely, the target cell needs to release all and reconfigure new ones (delta configuration is less possible), so we think it makes sense to release the configuration if it performs RRCResume in a different cell. For the same cell case (most common scenario), of course, we expect the NCR-MT to keep it for delta configuration. If RRC resume procedure fails, the NCR-MT will enter RRC\_IDLE state, then anyway delta configuration is impossible.  |
| Fujitsu | Yes |  |
| Huawei, HiSilicon | See comments | Actually, we see no benefit for the UE to store the configuration of the source cell after re-selection. We agreed to turn off the Fwd after the re-selection. Even if the Ping-Pong happens, the Fwd cannot use the original configuration since the Fwd is OFF. Then what is the use to store the configuration? So our view is this should be left to UE implementation and no need for spec impact. |

**Summary**

8 companies agree with the proposal, 4 companies show different views. Two company think there is no need to specify when the UE should discard the SCI configuration, even if the UE triggers RRCResume to a different cell, the network can reconfigure SCI that overrides previous configuration. One company thinks more discussion is needed, one company thinks the UE should discard the configuration after reselection, because Fwd cannot use the old configuration anymore, but the technical reason is unclear.

Rapporteur would like to clarify that based on current specification (TS 38.331, section 5.3.8.3), unless specified, by default the SCI configuration will be considered as part of UE Inactive AS context. And since the SCI configuration will be used to indicate the ON/OFF for NCR-Fwd when NCR-MT enters RRC\_INACTIVE, so it worth discussing whether/when the NCR-MT discards the configuration. Rapporteur does not think leave to UE implementation is a right way, because the network should know whether delta configuration is supported or not.

**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).**

In addition, based on the comments, it seems companies have different understandings on the previous RAN2 agreement “ *The NCR-FWD is switched OFF if the NCR-MT in RRC\_INACTIVE state reselects a different cell than the last serving cell on which side control configuration was received.*” So rapporteur suggests to further clarify whether the NCR-MT can indicate the NCR-Fwd to resume forwarding when it reselects back to the released 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.**

## 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?**

|  |  |
| --- | --- |
| **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.[Rapp-ZTE] RAN1’s agenda is available now, they will continue discussing the FFSs in April, but the next LS is expected to be sent in May according to RAN1 chair’s guidance. |
| Samsung | In RAN2#120 we made the following agreement: *On NCR-MT RLF:** *After RLF is declared by NCR-MT, NCR-MT performs cell selection and trigger RRC re-establishment;*
* *If NCR-MT enters RRC\_IDLE due to no suitable cell is find, NCR-Fwd is OFF;*
* *During RRC re-establishment procedure, NCR-Fwd is OFF.*

In the CR we only have text on turning OFF NCR-Fwd if the NCR-MT starts the action of performing RRC re-establishment. Similar to BFR operation as agreed in RAN1 (as is also captured in the MAC spec), we need to add turning on NCR-Fwd after successfully re-establishing. This can probably be done when NCR-MT has received RRCReestablishment. [Rapp-ZTE] For beam failure recovery (as discussed in MAC CR), the NCR-Fwd can resume forwarding by using the last SCI configuration received before BFD.For RRC reestablishment, we think the scenario is different because anyway the network will send RRC message to the NCR-MT. Based on RAN2 agreement, the NCR-Fwd is OFF when RLF is declared, so without adding new triggering condition, it means the NCR can wait for the new configuration from the network and follow the SCI(RRC/MAC CE/DCI) to resume forwarding, autonomously resume forwarding is not considered. |
| Qualcomm | We discussed the issue where the NCR-MT reselects a new cell while in INACTIVE state, in which case the NCR-FWD is turned OFF.A similar issue occurs if the **NCR-MT reselects a different beam of the same camped cell** while in INACTIVE state. In this case, the last received configuration may no longer be valid (i.e., the NCR FWD may forward the wrong SSB) and the NCR-FWD should be turned OFF until the NCR-MT resumes and receives new side control configuration.[Rapp-ZTE] Questions for clarification. 1. Currently, we don’t have the concept of “reselecting to different beams in RRC\_INACTIVE state”, for RRC reselection, it is evaluated based on cell level results, not beam level. From UE’s perspective, the UE PHY sends beam level measurement samples to UE RRC, the UE RRC will derive cell level result based on the received beam results and cell quality derivation configuration in SIB (may use multiple beams). So I am not sure the current mechanism supports the determination of different beam selection. Do you mean to introduce beam management/beam failure detection in RRC\_INACTIVE? 2. If we consider it specifically for beam level change, considering the best beam may be different for NCR-MT C-link and NCR-Fwd backhaul link, it seems more suitable to take NCR-Fwd backhaul link into consideration, instead of NCR-MT C-link. What do you think? |
| Kyocera | We wonder if NCR-FWD operation is resumed, when RRC Reestablishment is succeeded to the same cell, with the last configuration. [Rapp-ZTE] Please see above response to Samsung.We also wonder if the redirection is considered to make the NCR-MT to move to a proper cell, since it was agreed the handover is not supported. [Rapp-ZTE] This was proposed by ZTE last meeting, in our view, no restriction means this can be supported and no specification change is needed. If companies have different views, please bring contribution on this. |
|  |  |

**Summary**

More than one company commented that NCR-Fwd should resume forwarding when RRC re-establishment is succeed, but rapporteur replies that this is different from BFR because the network will anyway reconfigure the NCR-MT by sending RRC Reconfiguration message, in this case, the NCR-MT can follow the new configuration and new signalling(RRC/MAC CE/DCI), there is no need to define explicit triggering condition to autonomously switch on the NCR-Fwd.

In addition, it is unclear whether the SCI configuration is still available (e.g. not released) when initiating RRC re-establishment procedure.

Since not much companies provide views on this issue, rapporteur suggests to discuss it during the meeting:

**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.**

For other issue raised, rapporteur suggests interested companies to bring contribution, we can discuss further based on company contributions.

# Conclusion

Based company inputs, the proposals are:

**Proposal 1 From RAN2 perspective, NAS spec already specifies the behaviour for the case when NCR-MT selects a suitable cell after it was camping on acceptable cell or no cell was found. No need to specify new mechanism for this scenario. (can be revisited if company identifies problem)**

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

**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).**

**Proposal 4 (9/12)NCR-Fwd is OFF when NCR-MT is in RRC\_IDLE state.**

**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;**

**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).**

**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.**

**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.**

# References

[1] RAN2#120 Chairman notes