3GPP TSG-RAN WG2 #119bis-e R2-221xxxx

Online, 10th – 19th Oct, 2022

Agenda Item: 8.1.2

Source: ZTE Corporation

Title: Report of [AT119bis-e][NCR] NCR open issues (ZTE)

Document for: Discussion, Decision

# Introduction

This document is the report of the following offline discussion:

* Side control information signaling options (i.e. RRC vs. OAM)
* RRC states of NCR-MT
* Support of SRBs/DRBs
* NCR-Fwd ON/OFF
* SI impacts
* RRM functions

* [AT119bis-e][701][NCR] NCR open issues (ZTE)

Scope: see above.

Intended outcome: Report.

Deadline: TBD

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# Discussion

This document is to collect company views on the NCR open issues

## Side control information signalling options

According to the TR, there are 3 options for the NCR-MT to obtain the necessary configuration for receiving the L1/L2 signaling of the side control information.

- Option 1: The necessary configuration is from RRC.

- Option 2: The necessary configuration is from OAM or hard-coded.

- Option 3: The necessary configuration is partially configured by RRC and partially configured by OAM or hard-coded.

**Q1: Which option do companies prefer to configure NCR-MT for receiving L1/L2 signalling of side control information?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1 (RRC);  Option 2 (OAM);  Option 3(RRC+OAM) | Comments |
| Qualcomm | Option 1 | L1/2 signaling (DCI, MAC CE) is always RRC-configured. OAM configuration is out of scope.  OAM should not be used for L1/L2 signaling configuration. |
| ZTE | Option 1 |  |
| CATT | Exclude Option2 | Option 1 can be used as baseline, and option3 can be FFS, which we think it is better to wait for more information from other groups. |
| Huawei, HiSilicon | Option 1 | According to the TR 38867, the “necessary configuration for receiving the L1/L2 signaling of the side control information” includes the following two aspects:   * The configurations of PHY channels to carry the L1/L2 signaling * The configurations of L1/L2 signaling   In our understanding, such configurations need to be changed dynamically according to the network condition, and thus should be configured by RRC naturally. |
| Futurewei | Option 1 | Option 1 is consistent with the second objective, which is RAN2-led, in the WID. |
| LGE | Option1 | Sidelink control information for NCR-Fwd is tightly related to IAB-MT configuration/operation. Hence, it is reasonable to use RRC as baseline (mandatory support) to signal the side control information.  If we allow OAM option for side control information, we wonder if there is a high risk of inter-operability and unnecessary market segmentation. |
| CMCC | Option 1 | Option 1 is more flexible. |
| Apple | Option 1 | We can agree to use RRC as baseline, as ensuring inter-vendor inter-operability will be challenging for OAM based solution. |
| vivo | Option 1 | L1/L2 side control information receiving should be regarded as a part of radio resource configuration for NCR-MT and RRC signaling is the preferred option to provide the related configurations. |

## RRC states of NCR-MT

Companies are invited to show your views on which RRC state(s) can be supported by NCR-MT.

* RRC\_CONNECTED;
* RRC\_IDLE;
* RRC\_INACTIVE

**Q2: Which RRC state(s) can be supported by NCR-MT?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | applicable RRC states  (answer Yes/No/FFS) | | | Comments |
| RRC\_  CONNECTED | RRC\_  IDLE | RRC\_  INACTIVE |
| Qualcomm | Yes | Yes | Yes | Same as IAB-MT. |
| ZTE | Yes | Yes | FFS | We understand RRC\_INACTIVE state is not so important for NCR-MT because NCR-MT will not change its RRC state frequently and SDT seems not needed.  Currently, RRC\_INACTIVE is defined as mandatory feature with capability signalling， if most companies want to support RRC\_INACTIVE state, we suggest to change it into optional feature for NCR-MT. |
| CATT | Yes | Yes | No | In our understanding, the main principle of introducing RRC\_INACTIVE state is that the UE is able to return to the connected state quickly. Considering the C-link doesn’t need this requirement, we prefer not to support RRC inactive state in the current release. |
| Huawei, HiSilicon | Yes | Yes, but | FFS | Clarification is needed when NCR-MT should be in IDLE, e.g. whether it should be released to IDLE by the gNB deliberately and if so, in which case.  For RRC\_INACTIVE, more justification is needed. |
| Futurewei | Yes | Yes | FFS | For RRC\_INACTIVE state, we can wait for more RAN1 progress. |
| LGE | Yes for NCR-Fwd to work | No for NCR-Fwd to work | No for NCR-Fwd to work | To us, question is unclear but we assume that the question intends to ask which RRC state of NCR-MT is applicable for NCR-Fwd to operate properly.  Like any other UEs, NCR-MT may go RRC\_IDLE/INACTIVE, but we assume that NCR-MT should be in RRC\_CONNECTED if NCR-Fwd is ON and functioning.  We can de-prioritize any optimization to support NCR-Fwd operation while NCR-MT is in RRC\_IDLE/INACTIVE. |
| CMCC | Yes | Yes | Yes | Similar to IAB-MT. The legacy procedures can be reused and no additional spec impact is needed. |
| Apple | Yes | Yes | FFS | To determine how RRC shall be tailored for NCR-MT, we need hold a consistent principle to determine which feature is necessary. We think RRC\_INACTIVE, cell selection, RRM measurements are all not needed for NCR. |
| vivo | Yes | Yes | Yes with comments | As NCR ON-OFF is one objective, RAN2 can justify whether RRC\_Inactive is supported to enable the NCR to quickly return to operating state, e.g. the NCR-MT return to RRC\_Connected state from RRC\_Inactive state. |

## Support of SRBs/DRBs

Whether NCR-MT supports SRBs (i.e. SRB0/1/2) and DRB?

To facilitate the discussion, rapporteur has provided some information from other WG:

|  |
| --- |
| *#RAN3 online agreement made on Thursday 10-13:*  **The NCR-OAM connectivity requirement should be supported, further details can be discussed.**  Nok: This OAM requirement has no impact in RAN3 |

So RAN3 just agreed to support NCR-OAM connectivity requirement, as proposed by some companies, one possible way for transmitting OAM traffic from NCR-MT to gNB (or vice versa) is to establish a PDU-session over a DRB, similar to IAB.

**Q3: Whether SRBs and DRB are supported by NCR-MT?**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Company | Support of SRB/DRB  (answer Yes/No/FFS) | | | | Comments |
| SRB0 | SRB1 | SRB2 | DRB |
| Qualcomm | Yes | Yes | Yes | Yes | SRB0 and SRB1 are mandatory for RRC setup  SRB2 is mandatory for NAS.  DRB should be optional. It may be used to enable OAM connectivity via PDU session.  Note: The OAM connectivity REQUIREMENT implies that 3GPP has to support a mechanism for OAM connectivity. It does not imply that implementations have to use this mechanism. |
| ZTE | Yes | Yes | Yes | Yes | For DRB, we understand it is still a mandatory feature for NCR-MT, otherwise, we will introduce a new connection type which was not supported by legacy UEs (i.e. SRB0/1/2 but without DRB), and this may cause more specification impacts. |
| CATT | Yes | Yes | Yes | Yes | Thanks rapporteur providing the information about NCR-OAM connectivity requirement, hence we think it is reasonable to support DRB as well right now. |
| Huawei, HiSilicon | Yes | Yes | Yes | FFS | The NCR-OAM connectivity doesn’t necessarily reuqire the support of DRB. RAN2 may need to discuss more about what should be transmitted via the NCR-OAM connectivity. |
| Futurewei | Yes | Yes | Yes | Yes | Support of DRB can be optional. And, the number of DRBs supported by NCR-MTs can be significantly reduced. |
| LGE | Yes | Yes | Yes | Yes | The required number of DRBs to support may be relaxed for NCR-MT (e.g., only 1 DRB). |
| CMCC | Yes | Yes | Yes | Yes | It is reasonable to support DRB for transmitting OAM traffic. |
| Apple | Yes | Yes | Yes | FFS | It is not clear the OAM traffic using DRB is a hard requirement or not. |
| vivo | Yes | Yes | Yes | Yes | The motivation on the need of DRB seems not clear. To save standardization efforts, RAN2 can consider DRB as an optional feature for NCR-MT. |

## NCR-Fwd ON/OFF

Several companies propose to discuss the linkage between NCR-Fwd ON/OFF and the RRC state of NCR-MT, rapporteur has summarized them into following options:

* Option 1: When NCR-Fwd is ON, NCR-MT can be in any RRC states (e.g. RRC\_CONNECTED or RRC\_IDLE/INACTIVE);
* Option 2: When NCR-Fwd is ON, NCR-MT must be in RRC\_CONNECTED state; when NCR-MT is in RRC\_IDLE/INACTIVE states, NCR-Fwd must be “OFF”;
* Option 3: When NCR-Fwd is ON, NCR-MT must be in RRC\_CONNECTED state; when NCR-MT is in RRC\_IDLE state, NCR-Fwd must be “OFF”; when NCR-MT is in RRC\_INACTIVE state, NCR-Fwd can be “ON” or “OFF”;
* Option 4: Up to RAN1, considering RAN1 is discussing the fallback mechanism for NCR.

**Q4: Which option is preferred for the linkage between NCR-Fwd ON/OFF and the RRC state of NCR-MT?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred Option | Comments |
| Qualcomm | Option 2 | ON/OFF is part of side control and therefore signaled on **slot-level time scale**. The NCR-MT must be **operational** when receiving side control signaling.  As the baseline, the NCR-MT is operational when RRC-CONNECTED.  The NCR-MT is certainly not operational and cannot receive side control in RRC-IDLE.  The question arises, if the NCR-MT could be operational in RRC-INACTIVE:   * What are the benefits? * How would it receive MAC-CE’s in this state? * How would it perform beam control, power control, etc on the BH link?   To keep things simple during the first NCR WI, we should assume that the NCR-MT can only receive side control including ON/OFF info when RRC CONNECTED. |
| ZTE | Option 4 | RAN1 is discussing the fallback mechanism for NCR, e.g. when the NCR-MT is in RRC\_IDLE/INACTIVE state, the NCR-Fwd can still “ON”, but it operates like a traditional RF-repeater (no side control information). See RAN1 agreements made last meeting:   |  | | --- | | The NCR-Fwd is always expected to be “OFF” unless otherwise explicitly or implicitly indicated by gNB.   * Note-1: This applies to the case regardless of the RRC state of NCR-MT. * Note-2: Indication (e.g., received when NCR-MT in RRC-connected) or DRX state of NCR-MT to control the ON-OFF behaviour of NCR-Fwd when the NCR-MT is in RRC-idle/inactive is not precluded.   The above is not meant to imply any signalling design for NCR-Fwd ON-OFF. |   From RAN2 perspective, we suggest to wait for RAN1 and then decide if there is any RAN2 impact. |
| CATT | Option 4 | Same view as ZTE. |
| Huawei, HiSilicon | Option 4 | To avoid duplicated discussion and contradictory solutions in RAN1 and RAN2, Better to wait for RAN1 first. |
| Futurewei | Option 4 | Or, if we want to capture any agreement made in RAN1 so far, it can be the following:  Option 5. When NCR-Fwd is OFF, NCR-MT can be in any RRC states (e.g. RRC\_CONNECTED or RRC\_IDLE/INACTIVE). |
| LGE | Option2 | We think Option 2 is a baseline and sufficient for R18.  Any optimization to support NCR-Fwd operations with NR-MT in RRC\_IDLE/ACTIVE can be considered in later releases. |
| CMCC | Option 4 | Share similar view with ZTE. |
| Apple | Option 1 or Option 4 | We think there is no need to entangle RRC state of NCR-MT with the operatios of NCR-fwd. But we are also fine to wait for RAN1. |
| vivo | Option 2 | Option 2 should be the baseline. |

## SI impacts

For legacy SIB configuration, companies are invited to check the following proposals:

* Proposal 1: NCR-MT should ignore cellBarred indication;
* Proposal 2: NCR-MT should ignore Unified Access Control (UAC) configuration;
* Proposal 3: NCR-MT should ignore cellReservedForOperatorUse, cellReservedForFutureUse，cellReservedForOtherUse and intraFreqReselection indications.

**Q5: Which proposal(s) do you support?**

|  |  |  |
| --- | --- | --- |
| Company | Supported proposals  (P1, P2, P3) | Comments |
| Qualcomm | P1, P2, P3 | Same as IAB |
| ZTE | P1, P2, P3 | Same as IAB |
| CATT | P1~P3 | Same as IAB |
| Huawei, HiSilicon | P1, P2, P3 | Same as IAB |
| Futurewei | P1, P2, P3 | Agree with above companies. |
| LGE | P1, P2, P3 | We understand that these three proposals are to mimic IAB-MT behaviors that are meant to exempt IAB-MTs from access control meant for UEs.  In addition, we think something similar to ‘iab-Support’ indication needs to be introduced for NCR per PLMN/NPN. |
| CMCC | P1, P2, P3 | Same as IAB. |
| Apple | P1, P2, P3 |  |
| vivo | P1,P2, P3 |  |

## RRM functions

For the following RRC functions, which one(s) should be or can be supported by NCR-MT?

* C1: RRM measurements in RRC\_IDLE/INACTIVE;
* C2: RRM measurements in RRC\_CONNECTED;
* C3: Cell (re)selection;
* C4: Handover;
* C5: RLM;
* C6: BFD, BFR

Note: based on the progress in RAN4, most companies suggest to wait for RAN2 input.

**Q5: Which RRM functions should be or can be supported by NCR-MT?**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Company | Supported RRM functions  (answer Yes/No/FFS) | | | | | | Comments |
| C1 | C2 | C3 | C4 | C5 | C6 |
| Qualcomm | Optional | Optional | Mandatoary | Optional | Mandatory | Mandatory | C3 is necessary for NCR-MT to connect to the network.  C5 is necessary for NCR-MT to determine RLF, i.e., if it is operational or not.  C6 is necessary for the NCR-MT to keep the BH link stable  C1/C2/C4: This is not necessary for NCR operation. It can be optional and left up to implementation. |
| ZTE | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Optional | C3 must be supported, so NCR-MT can select new cell when change its location;  C1 is the basis for supporting C3;  C4 is needed when operator/network wants to dynamically switch the NCR-MT to serve another overlapping cell or carrier;  C2 is the basis for supporting C4;  C5 must be supported, so NCR-MT can detect the radio link problem and reconnect if necessary;  C6 can be optional for NCR-MT if RLF is supported. |
| CATT | No | No | No | No | No | No | We think that NCR is mainly deployed by operator. And according to the WID, NCR is only single hop stationary network-controlled repeaters. Hence, cell (re)selection, handover RRM measurement may be unnecessary. Considering the cost of supporting more useless function, we prefer not need to support RRM measurement, cell (re-)selection and handover. For the other functions, we fail to see the necessity of mandatory requirement in the current release. |
| Huawei, HiSilicon | FFS | FFS | Yes for cell selection | No | FFS | FFS | * The cell selection in C3 should be supported for the NCR-MT to access a cell. * The cell re-selection in C3 should not be supported as the NCR doesn’t move. * C4 should not be supported as the NCR doesn’t move. * C1 should not be supported. According to 38.133, there is no requirement of RRM measurement on NCR-MT to perform cell selection. * C2 should not be supported as the NCR doesn’t move. * C5/C6 should be FFS in RAN2 and wait for RAN1 as at least BFD/RLM is up to RAN1. If BFD/RLM is supported by RAN1, RAN2 can further discuss BFR. |
| Futurewei | No | No | Yes | No | Yes | Yes | Per the WID, “For only single hop stationary network-controlled repeaters”, we think C3, C5, and C6 are sufficient for the operations of NCR-MT. C4, C1, and C2 are not needed and should be avoided to reduce complexity. |
| LGE | Dep. C3 | Dep.C4 | Yes for CS, FFS for CR | FFS | Yes | Yes | Mobility features (C3, C4) are not essential for NCR. But we need to further discuss if there is further complexity in supporting these? |
| CMCC | Yes | Yes | Yes | Yes | Yes | Yes | For C1~C4, share same view as ZTE. |
| Apple | No | No | No | No | FFS | FFS | For C1-C4, we think not necessary to be supported by NCR. |
| vivo | Yes | Yes | Yes | Optional | Yes | Yes | Except handover, that can be optional, other features should be considered. The environment change may affect the radio conditions of the BH link and control link, RRM/RLM and cell reselection can be helpful for unexpected radio condition changes. |

# Conclusion

Based on companies’ input, proposals are listed as follows.

**TBD**