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. |
| Sony | Option 1 |  |
| Intel | Option 1 | From specification point of view, we only need to work on Option 1. Option 2 can be done implementation without specification work and can be considered outside of RAN2 scope. |
| Fujitsu | Option 1 or Option 3 | Reusing legacy RRC reconfiguration will be much easier than introducing completely new methods for side control information related configuration. |
| Ericsson | Option 1 | Note: We interpret the question to be about how the UE (AS) is configured to receive the side control information. Its not about how the side control information itself is sent. For example: (pending RAN1 progress) side control info may be provided by DCI, and necessary configuration to receive such DCI may be provided using RRC.  Since most of the side control information needs to change in a dynamic or semi-static way, OAM is definitively not suitable for this purpose. RAN2 can take an initial assumption that carrying such information via RRC should be enough. However, RAN2 could wait for RAN1 progress before deciding if the configurations of side control information is carried in RRC, MAC CE, or DCI (or a combination of these).  Also, on whether OAM can be used to override some of the parameters/configurations provided by RRC, this should be discussed and decided in RAN3. |
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## 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. |
| Sony | Yes | Yes | Yes | NCR-MT should support all RRC states and avoid unnecessary optimisations. |
|  |  |  |  |  |
| Intel | Yes  (see comments) | Yes  (see comments) | Yes  (see comments) | Firstly, we don’t think this should be discussed first. We have to understand the signalling requirements and then discuss the states to be supported.  We think the protocol stack of NCR-MT function can follow legacy UE. With that, the existing principles and follow the existing specifications of RRC states and not make modifications to it specifically for NCR-MT function. Although the NCR-MT must be in RRC\_CONNECTED when it receives side control information, this does not mean the specification should prevent the NCR-MT from being in other states provided it is possible to transition back to connected sate when new signalling for NCR is needed. The RRC\_INCATIVE state may serve for the purpose to quickly return to connected state for side control information reception. All this can be left to implementation as it is currently up to network implementation on what RRC state to use.  Another potential reason to not consider RRC INACTIVE is for NCR-MT simplication (i.e., not support all the features of a UE). But that is a different discussion to be had later. |
| Fujitsu | Yes | Yes | FFS | For RRC\_INACTIVE, it may also be up to whether PDU session will be established for the NCR-MT. |
| Ericsson | Yes | Yes | FFS | There is no real benefit to bring the NCR-MT to RRC\_INACTIVE as the NCR-MT is not moving and the network is aware in which RNA or TA the NCS is.  The RRC\_INACTIVE state may be a quick transition to RRC\_CONNECTED in case a side control information should be send by the network but how much benefit this bring is questionable now. |
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## 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:

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| *#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. |
| Sony | Yes | Yes | Yes | Yes |  |
|  |  |  |  |  |  |
| Intel | Yes | Yes | Yes | optional | We share the same view with QC, and think DRB can be optional. It is similar as IAB-node.  Not supporting DRB is for potential NCR-MT simplication (i.e., not support all the features of a UE). But that discussion can be had later. |
| Fujitsu | Yes | Yes | Yes | Yes | Establishing DRB could be optional like IAB-MT. |
| Ericsson | Yes | Yes | Yes | Yes | At most 1 DRB may be needed for OAM. |
|  |  |  |  |  |  |

## 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. |
| Sony | Option 4 | We are ok to wait for RAN1 |
| Intel | Option 4 | We share the same view that RAN1 is discussing this issue. However, we don’t think fallback mechanism is a common understanding in RAN1. We suggest to remove the 2nd half sentence in Option 4:   * Option 4: Up to RAN1, ~~considering RAN1 is discussing the fallback mechanism for NCR.~~ |
| Fujitsu | Option 4 | It will be better to wait for RAN1's decision.  However, according to our RAN1 colleagues, there is no discussion on fallback mechanism for NCR. We have the same suggestion with Intel. |
| Ericsson | Wait for RAN1 | (agree with Intel’s suggestion) |
|  |  |  |

## 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 |  |
| Sony | P1-P3 | Same as IAB |
| Intel | P1-3 | Same as IAB |
| Fujitsu | P1, P2, P3 | Same as IAB |
| Ericsson | 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. |
| Sony | Yes | Yes | Yes | Yes | Yes | Yes | We think all RRM functions should be supported like a normal UE. |
| Intel | No (see comments) | No  (see comments) | Mandatory (may require some modifications to existing specs) | No  (see comments) | Mandatory  (see comments) | Mandatory  (see comments) | Firstly, we haven’t discussed the relationship between NCR-MT cell and NCR-FWD cell. Without that, it is not clear what impact NCR-MT RLM has on NCR-FWD or whether this discussion is only related to NCR-MT communication with gNB or whether an RLM on the NCR-MT has any implications on the NCR-FWD handling.  **Our responses here are only from MCR-MT point of view. Relevance to NCR-FWD needs further discussion.**  We don’t think handover should be supported as normally NCR is deployed by operator in a fixed location, which is covered by a fixed cell.  C3: to enable a standard solution for a NCR to join the corresponding gNB for coverage enhancement. We may need to ensure (depending on the relationship between NCR-MT cell and NCR-FWD cell) that NCR-MT selects a particular cell that is related to the NCR-FWD cell. This may require changes to the current cell (re)selection specification.  C5/6: to support detection of C-link, i.e. whether it is still stable to receive side control info, etc. |
| Fujitsu | No | No | Yes | No | Yes | Yes | As one of the focused scenarios for the NCR is "stationary", PCell change related functionalities will not be necessary.  In order to guarantee the reliable/robust communication between the gNB and the NC repeaters, BFD/BFR and RLM should be supported. |
| Ericsson | No | No | Yes | No | FFS | FFS | C1-C2: This seems completely unnecessary has the NCR is not mobility and there is no reason to allow the NCR-MT to perform measurements.    C3: When the repeater turns on and does initial access it needs to perform cell selection. In our mind cell reselection is basically the same procedure and may be needed as well, e.g. due to RLF (FFS).    C4: NCR is not mobile and thus there should be no handover.    C5-C6: This may be needed in case we want to allow some recovery mechanism for the NCR in case radio link problems are detected. However, this is too early to decide, and we can wait for some input from RAN1. |
|  |  |  |  |  |  |  |  |

# Conclusion

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

**TBD**