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

Electronic, 18th– 26th Apr, 2023

Agenda Item: 8.1.2

Source: Intel Corporation (Rapporteur)

Title: Summary of [Post121][702][NCR] Capabilities running CR for NCR (Intel)

Document for: Discussion and Decision

# Introduction

This is the summary of post email discussion:

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| [Post121][702][NCR] Capabilities running CR for NCR (Intel)        Scope:   1. Updates based on the agreements during RAN2#121 2. Can discuss open issues.         Intended outcome: revised running CRs, discussion paper with proposals (if needed)        Deadline:  Long |

Following two phases are considered for this email discussion:

Phase 1: NCR-MT capability open issue discussion; Deadline: 24th Mar

Phase 2: Proposal and conclusion review, draft CR review; Deadline: 5th Apr (TBD)

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

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| --- | --- | --- |
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# Discussion

## Phase 1

### Discussion on NCR-MT funcitonality and capability

Following agreements on NCR-MT capability were agreed in RAN2 #120 meeting:

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| * For reporting the capabilities of NCR-MT, the existing UECapabilityEnquiry and UECapabilityInformation messages are reused. * In NCR-MT capability discussion, to focus on mandatory features that are required for NCR-MT. * All existing optional features are considered as applicable to NCR-MT unless explicitly excluded (Same as IAB-MT). FFS on taking IAB specified features as a baseline for future discussion. |

In this email discussion, we will mainly focus on L2/3 functionality and capability。 For RAN1/4 related mandatory features, it is suggested to wait for more progress in RAN1/4.

#### Mandatory feature related

Regarding to L2/3 feature of NCR-MT, based on input to RAN2 #121 meeting, companies propose to take IAB-MT’s capability as baseline for NCR-MT. Following is the table of IAB-MT mandatory features captured in TS 38.306 Section 4.2.15. Rapporteur observes that Feature “0. General” is IAB procedure, which is only applicable for IAB-node and not applicable for NCR-MT.

Moreover, different from IAB-MT, RAN2 agreed handover and related RRM measurement is not supported by NCR-MT, and RRC\_INACTIVE state is optional for NCR-MT (i.e. RRC connection resume procedure is also optional for NCR-MT).

In the table below provides the existing table of the IAB-MT features along with rapporteur’s initial input of the applicability of these IAB features for NCR.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **IAB-MT mandatory features**  Table 4.2.15.1-1, Table 4.2.15.1-2 and Table 4.2.15.1-3 capture feature groups, which are mandatory for an IAB-MT. All other feature groups or components of the feature groups as captured in TR 38.822 [24] as well as capabilities specified in this specification are optional for an IAB-MT, unless indicated otherwise.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Features** | **Index** | **Feature group** | **Components** | **Additional information** | **NCR-MT Applicable (Rapp Input)** | | 0. General | N/A | IAB procedures | 1) Routing using BAP protocol, as specified in TS 38.340 [23] 2) Bearer mapping using BAP protocol, as specified in TS 38.340 [23] 3) IAB-node IP address signalling over RRC, as specified in TS 38.331 [9] |  | No | | 1. PDCP | 1-0 | Basic PDCP procedures | 1) (de)Ciphering on SRB 2) Integrity protection on SRB 3) Timer based SDU discard 4) Re-ordering and in-order delivery 6) Duplicate discarding 7) 18bits SN |  | Partially Yes, except:   * 3) is only configured for DRB [2], where DRB is optional for NCR-MT. To be discussed later in Section 2.1.1.2 * SN bit to be discussed later in Section 2.1.1.4 | | 2. RLC | 2-0 | Basic RLC procedures | 1) RLC TM 2) RLC AM with 18bits SN 3) SDU discard |  | Partially Yes, except:   * 3) is only configured for DRB [3], where DRB is optional for NCR-MT. To be discussed later in Section 2.1.1.2 * SN bit to be discussed later in Section 2.1.1.4 | |  | 2-4 | NR RLC SN size for SRB | NR RLC SN size for SRB |  | Yes | | 3. MAC | 3-0 | Basic MAC procedures | 1) RA procedure on PCell 2) IAB-MT initiated RA procedure (including for beam recovery purpose) 3) NW initiated RA procedure (i.e. based on PDCCH) 4) Support of ssb-Threshold and association between preamble/PRACH occasion and SSB 5) Preamble grouping 6) UL single TA maintenance 7) HARQ operation for DL and UL 8) LCH prioritization 9) Prioritized bit rate 10) Multiplexing 11) SR with single SR configuration 12) BSR 13) PHR 14) 8bits and 16bits L field |  | Yes | | 9. RRC | 9-1 | RRC buffer size | Maximum overall RRC configuration size | 45 Kbytes | Yes | |  | 9-2 | RRC processing time | 1) RRC connection establishment 2) RRC connection resume without SCell addition/release and SCG establishment/modification/release 3) RRC connection reconfiguration without SCell addition/release and SCG establishment/modification/release 4) RRC connection re-establishment. 5) RRC connection reconfiguration with sync procedure 6) RRC connection reconfiguration with SCell addition/release or SCG establishment/modification/release 7) RRC connection resume 8) Initial security activation 9) Counter check 10) UE capability transfer | 1) to 3) 10ms 4) 10ms 5): 10ms + additional delay (cell search time and synchronization) defined in TS 38.133 6) and 7) 16ms 7) 10 or 6ms (See details in clause 12, TS 38.331) 8) and 9) 5ms 10) 80ms | Partially Yes, except:   * 2) 7) are optional for NCR-MT due to RRC\_INACTIVE state is optional * 5) is used for HO. It is not supported by NCR-MT as handover is not supported * 9) is only used to verify the amount of data sent/received on each DRB. It is optional for NCR-MT as DRB is optional. To be discussed later in Section 2.1.1.2 * MR-DC related feature to be discussed later in Section 2.1.1.4 | |

Based on the above table, an updated mandatory feature table of NCR-MT is provided as below. Companies are invited to comment whether below table can be taken as baseline for NCR-MT L2/3 mandatory feature. NCR-MT specific optional features will be discussed in later sections.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Additional information** |
| 1. PDCP | 1-0 | Basic PDCP procedures | 1) (de)Ciphering on SRB 2) Integrity protection on SRB 4) Re-ordering and in-order delivery 6) Duplicate discarding |  |
| 2. RLC | 2-0 | Basic RLC procedures | 1) RLC TM |  |
|  | 2-4 | NR RLC SN size for SRB | NR RLC SN size for SRB |  |
| 3. MAC | 3-0 | Basic MAC procedures | 1) RA procedure on PCell 2) NCR-MT initiated RA procedure (including for beam recovery purpose) 3) NW initiated RA procedure (i.e. based on PDCCH) 4) Support of ssb-Threshold and association between preamble/PRACH occasion and SSB 5) Preamble grouping 6) UL single TA maintenance 7) HARQ operation for DL and UL 8) LCH prioritization 9) Prioritized bit rate 10) Multiplexing 11) SR with single SR configuration 12) BSR 13) PHR 14) 8bits and 16bits L field |  |
| 9. RRC | 9-1 | RRC buffer size | Maximum overall RRC configuration size | 45 Kbytes |
|  | 9-2 | RRC processing time | 1) RRC connection establishment 3) RRC connection reconfiguration without SCell addition/release and SCG establishment/modification/release 4) RRC connection re-establishment. 8) Initial security activation 10) UE capability transfer | 1) to 3) 10ms 4) 10ms 8) 5ms 10) 80ms |

**Q1: Do you agree to use the above table as baseline for NCR-MT’s mandatory feature (note that “DRB related”, “SN bit”, “MR-DC” will be further discussed in below questions)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| NEC | Yes with comment | Basically, we agree with the rapporteur input. However, we are not sure whether it is good to delete related items from “Components” column. Maybe it is better to keep the “Components” column as it is, add NCR-MT related information into “Additional information” column. |
| ZTE | Yes with comment | We have comment on the component 5) of feature 9-2.  5) RRC connection reconfiguration with sync procedure  ReconfigurationWithSync is not only used for HO, it is also used for intra-cell reconfiguration, for example:   * key refresh due to PDCP wrap around; * physical configuration update, if the network wants to avoid ambiguity effective time at network and UE.   In our view, although handover is not supported for NCR, disallowing reconfigurationWithSync is overkilled, maybe it is sufficient to use “handover” (as in Q7) in specification, and the “handover” means “reconfigurationWithSync + different PCI”. |
| Ericsson | Yes, with comment | For PDCP, the duplicate discarding should not be supported as we never discussed on whether PDCP duplication is supported.  About the reconfiguration with sync, since the NCR is static probably the reconfiguration with sync will never be used, so we are fine to not make it mandatory. |
| Nokia | Comment | Similar view as ZTE regarding reconfiguration with sync. Since reconfiguration with sync is used for AS security key derivation we should not exclude it (at least RAN2 should not make the decision to exclude it without SA3 feedback).  Ericsson raises good point regarding PDCP duplicate discard. In our understanding, RLC SDU discard needs to be supported if PDCP duplicate discard is supported.  We also wonder if, similar to IAB, there should be a section “0. General” in the table for NCR-specific features, with the component: “1) NCR side control configuration over MAC and RRC, as specified in TS 38.321 and TS 38.331, respectively”. |
| CATT | Yes with comments | Share the same view as ZTE regarding reconfiguration with sync, and suggest including it. |
| Huawei, HiSilicon | Yes with comment | For “duplicate discarding”, it is not referring to PDCP duplication, see the bubble comment above.  For “2-0 Basic RLC procedures”, RLC AM cannot be removed because NCR-MT mandatorily supports SRB. Since SRB uses 12bit SN. This should be change to “RLC AM with 12bits SN” for NCR-MT.  For “9-2 RRC processing time”, if we look at the feature group, it is about specifying RRC processing timing, not about optional/mandatory support of the RRC messages. So all elements should be kept here, even if the message itself is optional. |
| Samsung | Comment | 1) We can have a ***0. General*** section above with feature group ***NCR-MT procedures***, this can include the following:  1) Configuring and controlling operation of NCR-Fwd via RRC and MAC  2) Switching OFF NCR-Fwd during RRC Re-establishment [9], Beam Failure Recovery [8] and cell reselection [21]  2) In the current table it seems RLC TM is only supported. We understand that “RLC AM with 18bits SN” was removed as it is included below, but NCR-MT definitely need to support some type of RLC AM ability. At least *RLC AM with short SN* (Feature 2-1 in Table 4.2-1 in 38.822) needs to be supported. |

##### DRB related features

As agreed in RAN2 #120 meeting, DRB is optional supported by NCR-MT.

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| * NCR-MT indicates the maximum number of supported DRB in UE capability, values {1, 16}. If absent, the NCR-MT does not support DRB. |

Below mandatory features that are related to DRB can be conditionally mandatory supported by NCR-MT, subjected to whether DRB is supported by NCR-MT or not. Such features include:

* “Timer based SDU discard” in “1-0 Basic PDCP procedures”
* “SDU discard” in “2-0 Basic RLC procedures”
* “counter check” in “9-2 RRC processing time”

**Q2: Do you agree “timer based SDU discard”, “SDU discard”, “counter check” are conditionally mandatory features for NCR-MT (i.e., mandatorily supported only if DRB is supported)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| NEC | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes, but | RLC SDU discard could depend on PDCP duplicate discard, as commented above |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Samsung | Yes |  |

##### Handover related features

As agreed in RAN2 #120 meeting, handover and RRM measurement in RRC\_CONNECTED state is not supported by NCR-MT.

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| --- |
| * In Rel-18, NCR-MT does not support handover and RRM measurements in RRC\_CONNECTED. |

Following the same principle, handover related features should also not be supported by NCR-MT, including CHO, DAPS, CPAC, etc.

**Q3: Do you agree that other handover related features, e.g. CHO, DAPS, CPAC, etc, are not supported by NCR-MT?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| NEC | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Samsung | Yes |  |

##### Others

It is proposed by companies to consider 18bit SN to be optional for NCR-MT, considering there’s no high throughput requirement for NCR-MT. Therefore, different from IAB-MT, “18bit SN” in PDCP parameter and “RLC AM with 18bits SN” in RLC parameter can be optional for NCR-MT.

**Q4: Do you agree long SN bit (i.e. PDCP 18bit SN length and RLC AM 18bit SN length) is optional for NCR-MT?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| NEC | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes with comment | We should add 12bit SN length to the mandatory list. The NCR-MT should at least mandatorily support 12bit SN for SRB. See also our comments to Q1. |
| Samsung | OK with it | But as we stated above, some type of RLC AM functionality needs to be mandatory. |

#### Optional feature related

Similarly, NCR-MT may also take IAB-MT’s optional capabilities in Section 4.2.15 as baseline, however, considering some IAB-specific features, e.g. BH RLF indication related features, BAP related parameters, LCG extension related parameters, handover related parameters, etc are not applicable for NCR-MT, IAB-MT optional capabilities is not suitable to be taken as baseline for NCR-MT. Rapporteur proposes to discuss NCR-MT optional features in the table below, by considering commonality between IAB-MT and NCR-MT.

For LCID, in current specification, LCID, one-octet eLCID for MAC CEs, two-octet eLCID for eIAB are supported. Though it is highly possible that one-octet eLCID may be used by side control information related MAC CEs, rapporteur would suggest waiting for conclusion in [Post121][705][NCR] MAC running CR for NCR (Samsung) and then decide if there’s a need to introduce LCID extension related UE capability.

Observation 1: IAB-MT optional features in TS 38.306 Section 4.2.15.2, Section 4.2.15.5, Section 4.2.15.6, Section 4.2.15.8 are not applicable for NCR-MT. Note that LCID extension is subject to MAC email discussion.

**Q5: Do you agree above observation?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| NEC | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes | From our perspective, one-octet eLCID is beneficial for NCR-TM and two-octet eLCID is not necessary. |
| Samsung | Yes |  |

For other features, below is a table summarizing proposals of optional features/features that are not supported by NCR-MT based on companies’ input to RAN2 #121 meeting. Rapporteur would like to invite companies to comment on whether features below can be “optional” or “not supported” for NCR-MT.

**Q6: Please comment in below column on whether a feature could be “optional” or “not supported” by NCR-MT.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company\Feature** | **CA** | **MR-DC** | **SDAP related (e.g. QoS, SDAP header) parameters** | **SRB2 without DRB** | **Other Layer2 and Layer 3 mandatory features in TS38.822** |
| (Example) | Not supported | Not supported | Optional | Optional | Optional |
| NEC | Not supported or Optional | Not supported or Optional | Optional | Mandatory | Optional |
| ZTE | Not supported in R18 | Not supported in R18 | Optional | Mandatory  Comment: we already have agreement that SRB2 is mandatory for NCR-MT. | Optional |
| Ericsson | Not supported | Not supported | Optional | Mandatory | Optional |
| Nokia | Not supported | Not supported | Optional | Optional  (see comment) | Optional |
| CATT | Not supported | Not supported | Optional | Mandatory | Optional |
| Huawei, HiSilicon | Not supported | Not supported | Optional | NA  (see the bubble comment) | Optional |
| Samsung | Not supported in R18 | Not supported in R18 | Optional | Mandatory | Optional |

### Discussion on TS38.306 structure

Based on above discussion, it is noted that some optional UE capabilities (e.g. SDAP parameters, *non-DRB-IAB-r16,* SN bit, CA, MR-DC, etc) of IAB-MT/Redcap UE may also be adopted by NCR-MT, considering the similarities between the two. In this section, we mainly focus on how to capture NCR-MT’s capability for optional/not supported features.

If other handover related features, e.g. CHO, DAPS, CPAC, etc are not supported by NCR-MT, the question comes to how to capture those unsupported feature in TS 38.306. In general, there are two options:

* **Option 1**: Find all handover (including CHO, DAPS, CPAC, etc) related fields and add “this capability is not applicable to NCR-MT” in each handover related UE capability.
* **Option 2**: Add the clarification in general part, e.g. NCR specific section. For example: “handover (e.g. CHO, DAPS, CPAC, etc) related UE features and corresponding capabilities are not supported by NCR-MTs.”

It is observed that CA, MR-DC related UE features are not supported by RedCap UEs, and such capabilities are captured in TS 38.306 as below:

|  |
| --- |
| CA, MR-DC, DAPS, CPAC and IAB (i.e., the RedCap UE is not expected to act as IAB node) related UE features and corresponding capabilities are not supported by RedCap UEs. |

Based on discussion in Rel-17 RedCap [4], Option 2 is used for RedCap UE’s unsupported features, e.g. CA, DC, DAPS, etc. It is observed that Option 2 is more future-proof, e.g. there’s no need to update for each new handover related UE capability in future releases. For example, there’s no need to update specification if we introduce new mobility enhancement (e.g. such as LTM in Rel-18). Compared to Option1, it also requires less specification work, but general clarification may not be clear.

On the other hand, Option 1 also has its benefit that it is more specific and clearer, indicating which exact capability is not supported by NCR-MT. However, we need to identify each and every handover related capability and specify accordingly.

Companies are invited to comment on which option is preferred for unsupported features (e.g. handover related (if agreed in Q4), CA/MR-DC (if agreed in Q5)) by NCR-MT.

**Q7: If other handover related UE features (if agreed in Q3), CA, MR-DC (if agreed in Q5) are not supported by NCR-MT, do you agree to use a similar wording as RedCap (see below box) is used for NCR-MT (i.e. Option 2 in above)?**

|  |
| --- |
| CA, MR-DC, handover (e.g. CHO, DAPS, CPAC, etc) related UE features and corresponding capabilities are not supported by NCR-MTs. |

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| NEC | Yes | Option 2 is simple. |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| Nokia | Yes |  |
| CATT | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Samsung | Yes | Option 2 is more simple. Alternatively it can be added in Stage 2 text as well. |

Except CA, MR-DC, we further capture the following list of potential common UE capabilities between NCR-MT and IAB-MT/RedCap UE and corresponding UE capability signaling in TS 38.306:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Mandatory Feature component** | **Delta for IAB-MT/RedCap UE** | **UE capability IE** | **Definition** | **Section** |
| 18bit SN | Optional for RedCap UE | longSN-RedCap-r17 | Indicates whether the RedCap UE supports 18 bit length of PDCP sequence number. This capability is only applicable for RedCap UEs | Section 4.2.21.3 |
| am-WithLongSN-RedCap-r17 | Indicates whether the RedCap UE supports AM DRB with 18 bit length of RLC sequence number. This capability is only applicable for RedCap UEs | Section 4.2.21.4 |
| SDAP parameters | Optional for IAB-MT | sdap-QOS-IAB-r16 | Indicates whether the IAB-MT supports flow-based QoS and multiple flows to 1 DRB mapping, as specified in TS 37.324 [25]. | Section 4.2.15.3 |
| sdapHeaderIAB-r16 | Indicates whether the IAB-MT supports UL SDAP header and SDAP End-marker, as specified in TS 37.324 [25] | Section 4.2.15.3 |
| SRB2 without DRB | optional for IAB-MT | Non-DRB-IAB-r16 | Indicates whether the IAB-MT supports SRB2 configuration without a DRB, as specified in TS 38.331 [9]. | Sectopm 4.2.15.4 |

If you answered “optional” for above features in Q6, please comment below which option you prefer to capture it in TS 38.306.

* **Option 1:** Reuse existing UE capability IE of IAB-MT/RedCap UE and add “this UE capability is also applicable for NCR-MT” in the field description

Pros: Saving IOT (capability) bits

Cons: Not easy for reader to find all NCR-MT related capabilities

* **Option 2:** Introduce additional bits for NCR-MT, i.e. define a bit specifically for NCR-MT with the same optionality but with NCR-MT in the capability name

Pros: Easy readability with clear structure

Cons: Duplicate existing capability for IAB-MT/Redcap UE.

**Q8: If “18bit SN”, “SDAP parameters” and “SRB2 without DRB” are optional for NCR-MT, Companies are invited to show their preference of how to capture those common features for NCR-MT.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1/ Option2** | **Comments** |
| NEC | Option 2 |  |
| ZTE | Option 2 | We haven’t seen clear benefit of reusing existing capability bit for NCR. |
| Ericsson | Option 2 |  |
| Nokia | Option 2 | Option 2 is much clearer than Option 1 |
| CATT | Option 2 |  |
| Huawei, HiSilicon | Option 2 |  |
| Samsung | Option 2 | Reusing would have been nice, but since these capabilities already have the IAB in the field names, we prefer to introduce new ones. |

### Others

**Q9: Companies are welcome to comment any leftover issue of NCR-MT capability that is not covered in above discussion.**

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| --- | --- |
| **Company** | **Comments** |
|  |  |
|  |  |
|  |  |

## Phase 2

To be updated

# Conclusion

To be updated

# References

[1] TS 38.306, User Equipment (UE) radio access capabilities

[2] TS 38.323, Packet Data Convergence Protocol (PDCP) specification

[3] TS 38.322, Radio Link Control (RLC) protocol specification

[4] R2-2107676, Report of email discussion [Post114-e][105][RedCap] Capabilities (Intel)