**3GPP TSG RAN WG2 Meeting #130 R2-25xxxxx**

**St Julian, Malta, 19th – 23rd May 2025**

**Agenda item: 8.5.1**

**Source: ZTE Corporation, Sanechips**

**Title: Summary of [POST129b][121] Initial discussion on UE capabilities in NES**

**WID/SID: Netw\_Energy\_NR\_enh-Core**

**Document for: Discussion and Decision**

# 1 Introduction

This is a summary for initial discussion on UE capabilies:

* [POST129b][121][NES] (ZTE)

 **Scope:** Discuss initial discussion points for UE capabilities.

 **Intended outcome:** Discussion summary.

**Deadline: Long email discussion**

# 2 Discussion

## 2.1. Principle of UE capability handling in Rel-19

The following principle has been achieved for UE capability handling [1]:

**UE capability handling**

[R2-2502767](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_129b%5CDocs%5CR2-2502767.zip) Rel-19 UE capability handling Xiaomi discussion Rel-19 NR\_newRAT-Core

*Proposal 1: Same as Rel-18, if UE capability is implemented during RAN1/4 related NR Others discussion, draft CRs (running CRs) for 38.331 and 38.306 should be produced and endorsed, then merged to mega CR.*

*Proposal 2: RAN1/4 related CR contributor(s) to ensure that:*

*- Submitted endorsed CRs as draft CR is preferred.*

*- The author identity of the endorsed CRs for RAN1/4 related NR Others capability is set to the WI-code for all the changes in the CRs.*

*- For RAN1/4 related NR others, to add the Index and FG description on top of the UE capability in 38.331.*

*- The drafting rules, including the correct use of word-styles, using latest specification version are to be followed.*

*- Strictly following* [*R2-2501458*](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_129b%5CDocs%5CR2-2501458.zip) *‘Guideline on writing a CR’ while writing the CR.*

*Proposal 3: Same as Rel-18, to session chairs of WI and RAN2 WI-specific UE capability running CR rapporteurs, please be reminded to ensure that:*

*- RAN2 features and capabilities, that are developed only in RAN2, are developed individually per WI, under WI-specific agenda Items. Draft CRs (running CRs) for 38.331 and 38.306 are produced and endorsed.*

*- The author identity of RAN2 capability CR is set to the WI-code for all the changes in the CRs.*

*- The 306 CRs shall include an annex containing the RAN2 determined UE capabilities in the feature list format (similar to annex containing RAN2 agreements), for easy compilation into the TR38.822 in the later stage (as agreed in RAN2 #116-e). The annex of RAN2 determined UE capabilities feature list should align with field description.*

*- The drafting rules, including the correct use of word-styles, using latest specification version are to be followed.*

*- Strictly following* [*R2-2501458*](file:///C%3A%5CUsers%5Cpanidx%5COneDrive%20-%20InterDigital%20Communications%2C%20Inc%5CDocuments%5C3GPP%20RAN%5CTSGR2_129b%5CDocs%5CR2-2501458.zip) *‘Guideline on writing a CR’ while writing the CR.*

*Proposal 5: RAN2 to inform RAN1/4 on the following:*

*- For RAN1/4 TEI19 UE features, RAN1/4 provide RAN2 with the unique TEI identifier for each feature group introduced in TEI19. The corresponding TEI identifier can be added as part of ‘Feature’ column.*

*Based on above discussion,*

*Proposal 6: Same as Rel-18, the final CRs from the mega rapporteur to have:*

*- Implemented all feature groups based on RAN1/4 FL (author identify set to WI code for that WI), including RAN1/4 TEI19 feature list (author identify set to RAN1/4 defined TEI identifier).*

*o For RAN1/4 UE feature list, the feature list Tdoc numbers to be provided in the coversheet*

*- Merged RAN2 WI-specific UE capability endorsed CRs, RAN2 endorsed CRs in RAN1/4 related NR Others (if any) (author identify set to WI code for that WI).*

*o RAN2 Tdoc number of the endorsed CRs (title and number) in the coversheet.*

*- Note: Mega CR implementation timeline needs to be aligned with ASN.1 review*

* The proposals are endorsed and will be used as baseline for future UE capability work.

With the above principle agreed, the rapporteur understand that:

**Observation 1a: RAN1/4 defined UE capability for NES covered by the feature list from RAN1 will be implemented and handled** **during RAN1/4 related NR Others discussion.**

**Observation 1b: RAN2 features and capabilities for NES that are developed only in RAN2 will be handled by the WI specific UE capability rapporteur under WI-specific agenda Items.**

Thus, in this email discussion, we will focus on the features and capabilities that are developed only in RAN2.

## 2.2. Latest status of the RAN1/4 feature list

R1-2502979 LS on updated Rel-19 RAN1 UE features lists for NR after RAN1#120bis [2] has been agreed in RAN1 with the feature list shared in R1-2502977 [3].

For NES, the following features have been covered:

|  |  |  |  |
| --- | --- | --- | --- |
| Features | Index | Feature group | Components |
| 61. Netw\_Energy\_NR\_enh | 61-1 | On-demand SSB SCell operation indicated by RRC based signaling in Case #1 | 1. Support RRC based signalling to indicate on-demand SSB transmission on the SCell in Case #1 (No always-on SSB on the cell) |
| 61. Netw\_Energy\_NR\_enh | 61-2 | On-demand SSB SCell operation indicated by RRC based signaling in Case #2 for same center frequency | 1. Support RRC based signalling to indicate on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency 2. Supported time domain relation between on-demand SSB and always-on SSB |
| 61. Netw\_Energy\_NR\_enh | 61-2a | On-demand SSB SCell operation indicated by RRC based signaling in Case #2 for different center frequency | 1. Support RRC based signalling to indicate on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequency between always-on SSB and on-demand SSB |
| 61. Netw\_Energy\_NR\_enh | 61-3 | On-demand SSB SCell operation indicated via MAC CE in Case #1 | 1. Support MAC CE based signalling to indicate on-demand SSB transmission on the SCell in Case #1 (No always-on SSB on the cell)[2. Supported on-demand SSB deactivation mechanisms: * + Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication

Deactivation via Number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated] |
| 61. Netw\_Energy\_NR\_enh | 61-4 | On-demand SSB SCell operation indicated via MAC CE in Case #2 for same center frequency | 1. Support MAC CE based signalling to indicate on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for same center frequency2.Supported time domain relation between on-demand SSB and always-on SSB[3. Supported on-demand SSB deactivation mechanisms: - Explicit indication of deactivation for on-demand SSB via MAC-CE for on-demand SSB transmission indication- Deactivation via Number N of on-demand SSB bursts to be transmitted after on-demand SSB is indicated] |
| 61. Netw\_Energy\_NR\_enh | 61-4a | On-demand SSB SCell operation indicated via MAC CE in Case #2 for different center frequency | 1. Support MAC CE based signalling to indicate on-demand SSB transmission on the SCell in Case #2 (Always-on SSB is periodically transmitted on the cell) for different center frequency |
| 61. Netw\_Energy\_NR\_enh | 61-5 | SIB1 request for idle/inactive UEs | 1. Reception of SIB1 request configuration associated with SIB1 request for a cell2. Transmission of PRACH on the uplink to request SIB1 of the cell3. Reception of SIB1 [in a window] [at least] upon SIB1 request |
| 61. Netw\_Energy\_NR\_enh | 61-6 | SSB burst periodicity adaptation for SCell operation | Support of adaptation of SSB burst periodicity for SCell by DCI format 2\_9 |
| 61. Netw\_Energy\_NR\_enh | 61-7 | Adaptation of RACH in time domain based on additional RACH resources | 1. Support of adaptation of RACH in time domain based on additional RACH resources in RRC idle/inactive/connected mode2. Configuration of additional PRACH resources via higher layer signaling3. DCI-based indication of additional PRACH resources by DCI format 1\_0 with P-RNTI4. DCI-based indication of additional PRACH resources by DCI format 1\_0 with C-RNTI for PDCCH-ordered PRACH[5. Support semi-static PRACH mask to identify the subset of additional resources]FFS: component 5 is kept in this FG or is separated to new FG |

Also hearing that RAN1 will continue the discussion on SIB1 request to cover the RLF case in connected mode, the rapporteur understand the following features and capability definition will be covered by RAN1:

* On demand SSB
* On demand SIB1
* SSB adaption
* RACH adaption

**Observation 2: The following features and capability definition will be covered by RAN1 and implemented during RAN1/4 related NR Others discussion:**

* **On demand SSB**
* **On demand SIB1**
* **SSB adaption**
* **RACH adaption**

## 2.3. UE capability developed in RAN2

Apart from the features and capabilities to be covered by RAN1, we understand RAN2 only need to define the UE capability for paging adaption and we have reached the following agreements so far:

RAN2#129 Agreement：

A new UE capability is added for R19 NES paging enhancement, and the new capability is included in UE-RadioPagingInfo. FFS on whether we have a common capability for all NES features.

And an FFS has been left on whether to have a common capability for all NES features. Since RAN1 has provided a feature list with all the features separate, the rapporteur understand it is not possible to have common capability for all NES features.

Also considering that paging adaption is not closely related to other features, e.g. on demand SSB, on demand SIB1, SSB adaption and RACH adaption, the rapporteur understand a separate capability would be more appropriate.

**Question 1: Do companies agree that** **the capability for paging adaption to be included in UE-RadioPagingInfo is a separate capability from other NES features and no need to define a common capability for all NES features?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| OPPO | Yes with comment | Intention (separate capability for paging rather than common capability) is agreeable, yet the CR has to be revised to align with 129b conclusion in main session**Agreements**1. Use a “container” using OCTET STRING with content generated by UE when new UE Radio Paging Capabilities are introduced. This is applicable only to new Rel-19 and future capabilities added to paging capabilities. This will only work for Rel-19 gNB
 |
| Vivo | Yes | Agree with OPPO. |
| Xiaomi | Yes |  |
| Apple | Yes | Agree with OPPO. |
| Huawei, HiSilicon | Yes | Agree with OPPO. |
| CATT | Yes | Agree with OPPO. |
| Qualcomm | Yes | Separate capability for paging. |
| ZTE | Yes | Agree with OPPO. |

Rapporteur’s Summary:

8 companies provided feedback and all the companies agree that the capability for paging adaption to be included in UE-RadioPagingInfo is a separate capability from other NES features and no need to define a common capability for all NES features.

Regarding how to capture this capability in 331, all the companies understand we should follow the latest agreement and use a “container” using OCTET STRING with content generated by UE for paging adaption.

The following proposal is given based on the comments provided:

**Proposal 1a: The capability for paging adaption to be included in UE-RadioPagingInfo is a separate capability from other NES features and no need to define a common capability for all NES features.**

**Proposal 1b: Use a “container” using OCTET STRING with content generated by UE for paging adaption capability.**

# 3 Comments on the CR

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments on 38.331 UE capability CR** | **Rapporteur Feedback** |
| OPPO | See reply to Q1 above | Thanks for spotting this. Will update accordingly. |
| Apple | We have two comments:1. The capability of paging adaptation is drafted as per UE. However, the legacy PEI capability is per band (i.e., the UE reports its supported band list via *pei-SubgroupingSupportBandList-r17*:

pei-SubgroupingSupportBandList-r17 SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicatorNRWe think paging adaptation should be similar to PEI capability, i.e., UE may only support it in some band (e.g. low frequency). And per band capability can provide more flexibility. Thus, we prefer the capability of paging adaption (*pagingAdaptation-r19*) is also per band, e.g. pagingAdaptation-r19 SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicatorNR OPTIONAL1. It seems that capability of L3 RRM with multiple SMTC for SSB adaptation is missed. We understanding maybe it is because it is not clear for now whether RAN4 may introduce it. We suggest to at least put an EN on FFS whether RAN2 or RAN4 to define this capability.
 | 1. As mentioned by Huawei, we understand it is more appropriate to define it as per UE capability as it mainly is related to the determination of PF and PO and do not see strong motivation to have it per band.
2. Ok to add FFS for SMTC adaption and wait for more input from RAN4 to see if it is covered.
 |
| Huawei, HiSilicon | 1) We may also need a PEI capability for R19 since RAN2 agreed to introduce R19 PEI configuration and related UE behavior.2) Regarding Apple’s comment on per-band capability, in our understanding the R17 PEI capability was trying to differentiate between FR1 and FR2, and considering the following agreement made in RAN2#116bis it was eventually designed as a per band capability:* From Rel-17 onwards, at least for new capabilities, if a UE capability requires at least FRx or at least xDD differentiation, it is defined with both FRx and xDD differentiation in per band signaling, i.e. no new UE capabilities will be defined in the FRX and XDD capability signaling branches.

From our perspective, a per-UE capability for paging should be fine because it mainly involves calculating PF and PO based on UE ID, and no clear difference is foreseen between FR1 and FR2. But we can follow majority views on this. | Ok to add this capability for PEI and would follow the current PEI capability design, i.e. per band. |
| CATT | Share the same view with Huawei,1. We need to further clarify PEI related capability with R19 paging adaptation.
2. A per-UE capability for R19 paging adaptation is enough.
 | Agree |
| Qualcomm | Share Apple’s and Huawei’s views.1. SMTC adaptation is UE capability
2. Paging capability (separate Rel 19 config)
3. PEI capability (separate Rel 19 config.)
 | 1. We can add FFS and wait for input from RAN4 as SMTC adaption is somehow related and RAN4 has not sent us the initial feature list yet.
2. Ok
3. Ok
 |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Company** | **Comments on 38.306 UE capability CR** | **Rapporteur Feedback** |
| Apple | Same 2 comments in 38.331. |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Rapporteur’s Summary:

5 companies provided feedback and the following issues have been mentioned:

* Paging adaption capability to be per UE or per band. Apple would like to align with PEI capability while HW/CATT and the rapporteur understand per UE would be sufficient.
* Capability for PEI in R19 NES. HW/CATT and QC would like to add capability for PEI in R19 NES and the rapporteur is fine with that.
* Capability of L3 RRM with multiple SMTC for SSB adaptation. Apple and QC raised this and the rapporteur would like to follow Apple suggestion by adding an FFS for now and wait for the initial feature list from RAN4 and see if it is covered or not.

The following proposal is given based on the comments provided:

**Proposal 2: The paging adaption capability is per UE.**

**Proposal 3: Introduce new capability for R19 PEI in NES and follow the existing PEI capability definition to have this new capability per band.**

**Proposal 4: Wait for RAN4 input to see whether capability of L3 RRM with multiple SMTC for SSB adaptation is covered in the feature list or not. If not, RAN2 will define it.**

# Conclusion

Based on post-meeting email discussion, the following proposals are given for formal decision:

**Proposal 1a: The capability for paging adaption to be included in UE-RadioPagingInfo is a separate capability from other NES features and no need to define a common capability for all NES features.**

**Proposal 1b: Use a “container” using OCTET STRING with content generated by UE for paging adaption capability.**

**Proposal 2: The paging adaption capability is per UE.**

**Proposal 3: Introduce new capability for R19 PEI in NES and follow the existing PEI capability definition to have this new capability per band.**

**Proposal 4: Wait for RAN4 input to see whether capability of L3 RRM with multiple SMTC for SSB adaptation is covered in the feature list or not. If not, RAN2 will define it.**