**3GPP TSG-RAN WG2 Meeting #119b-e R2-22xxxxx**

**Online, 10th – 19th October, 2022**

**Agenda Item:**  **8.13.6**

**Source: Huawei (Summary rapporteur)**

**Title:** **Pre-meeting summary of 8.13.6 (Huawei)**

**WI code(s): NR\_ENDC\_SON\_MDT\_enh2-Core**

**Document for: Discussion and Decision**

## 1 Introduction

This is a pre-meeting summary of 8.13.6 RACH enhancement, and the Tdocs are from the [1] R2\_119bis-e\_Skeleton\_v2.

## 2 Discussion

### 2.1 RACH report about RACH partitioning information

#### 2.1.1 Common information

##### 2.1.1.1 List of relevant proposals

For common information, the following proposals are listed:

[1], vivo

**Proposal 1: Introduce the RACH partitioning-related information in the RACH report to enable optimization of feature combination and/or feature priority.**

**Proposal 2: For the content of the RACH report enhancement for RACH partitioning, the following information can be considered:**

* **Intended feature combination;**
* **Priority of each intended feature;**
* **Used feature combination.**

[2], CATT

**Proposal 6: The UE indicates the feature /feature combination to the network to facilitate the RACH resource utilization.**

*Observation 1: The RACH feature/feature combination which is selected by the UE may not be same as the RACH feature/feature combination that is available for the UE.*

**Proposal 7: RAN2 to study whether and how to address the issue in above observation 1.**

[4], Apple

**Observation 1: it may be beneficial for the network to know which feature or features combination the UE would have preferred to use for that random access procedure.**

**Proposal 1: consider enhancing RA-Report, and possibly also RLF-Report and SuccessHO-Report, by adding to RA-InformationCommon information indicating which feature set triggered random access and which feature set the UE would have preferred.**

[5], Samsung

**Proposal 1: Include the feature or the combination of features that triggered the RACH along with the feature priorities in RACH report.**

[6], Huawei, HiSilicon

**Proposal 3: It is proposed RAN2 to add the following content to RA-InformationCommon in the granularity of RACH procedure in the RACH report enhancement in terms of feature/feature combination:**

* **Feature priorities configured by network**
* **a feature or feature combination triggering/initiating the random access procedure**
* **a feature or feature combination applicable to the RACH procedure, which is initiated with selected RA resource**

[7], Spreadtrum

**Proposal 1: The *FeatureCombination* information of the RACH partition used by the random access should be added in RACH report.**

**Proposal 2: The *FeatureCombination* information of the RACH partition that is expected to be used but was not used for the random access should be added in RACH report, in case the fully matched RACH partition is unavailable.**

[8], NEC

**Proposal 1: UE reports the combination of features associated with the set of RACH resources selected for the random access procedure for an unsuccessful completed RA procedure**

**Proposal 2: UE reports the features applicable for the RA procedure but not associated with the selected set of RACH resources**

**Proposal 3: RAN2 also considers to store and report RA related information with regarding the following RACH enhancement in Rel-17**

* **Msg3 repetition**
* **SCG activation/deactivation**
* **BFR recovery for two BFD-RS sets**

[9], Xiaomi

**Observation 1: The intention of the RACH partitioning RA report is to optimize the RACH resource allocation for features which is regardless of whether the random access procedure is successful or not.**

**Proposal 1: The RACH partitioning RA report can be supported for the RA-Report, RLF-Report and SuccessHO-Report.**

**Proposal 2: The RACH related information included in R16 and R17 RA report can also be applied for RACH partitioning RA report, with the extension to include the feature combination associated with the selected RACH partition.**

**Proposal 3: To include the UE intended feature combination as part of RACH partitioning RA report.**

[10], Ericsson

**Observation 4 A random access procedure may be triggered by a feature using configured subset of RACH resources that are allocated to set of features based on the feature combination configuration.**

**Observation 5 A gNB may reconfigure the RACH partitions based on the load over each partition.**

**Observation 6 The time associated to the reported RA related information in RA report is not visible by the network.**

**Proposal 2 RAN2 include the feature type(s) that triggered the RA procedure in the RA report.**

**Proposal 3 RAN2 agree that UE logs the elapsed time since logging the RA report until sending the report to the network.**

[12], ZTE

*Observation 1: In NR RACH optimization is achieved by including both RACH resource and performance information in RA report, which can also be used for study of RACH partitioning relevant optimization.*

**Proposal 1: RACH partitioning relevant RACH report includes both RA resource and performance information.**

**RACH resource information**

*Observation 2: A RACH partition is a portion of RACH resource shared by one or more features indicated by FeatureCombination, thus featureCombination information is needed to help evaluate the RA load or utilize rate of different combination of features.*

*Observation 3: A RACH partition could be configured to only utilize part of the RACH resource by preamble division, where the associated preambles are presented by a starting preamble index indicated by startPreambleForThisPartition-r17 and the total number of preambles indicated by numberOfPreamblesForThisPartition-r17 respectively.*

**Proposal 2: Include in the RA report the featureCombination information associated to utilized RACH resource when RA procedure is initiated for corresponding feature indicated by the FeatureCombination.**

**Proposal 3: Other than the existing RA resource information included in RA report, UE also includes below parameters in RA report if it is configured for the corresponding RA partition associated to this RA procedure:**

* **The starting preamble index associated to this RA partition**
* **The total number of preambles associated to this RA partition**

[13], CMCC

**Proposal 4: RAN2 is asked to work on the UE assistance information for RACH partitioning.**

[14], China Telecom

**Proposal 1: To design UE additional information to assist the network in RACH partition resource assignment.**

**Proposal 2: RACH partitioning information could be included in the extension of RACH report.**

##### 2.1.1.2 Summary

Some companies propose the content of RACH report enhancements for RACH partitioning, and the parameters are summarized as below:

* Intended feature combination, or the feature or the combination of features that triggered the RACH (vivo, CATT, Apple, Samsung, Huawei, HiSilicon, Xiaomi, Ericsson)
* Priority of each intended feature (vivo, Huawei, HiSilicon)
* Used feature combination, or the feature or the combination of features applicable to the RACH procedure (vivo, Huawei, HiSilicon, Spreadtrum, ZTE)
* Msg3 repetition (NEC)
* SCG activation/deactivation (NEC)
* BFR recovery for two BFD-RS sets (NEC)
* UE reports the features applicable for the RA procedure but not associated with the selected set of RACH resources (NEC)
* The starting preamble index associated to this RA partition (ZTE)
* The total number of preambles associated to this RA partition (ZTE)
* UE logs the elapsed time since logging the RA report until sending the report to the network. (Ericsson)

It can be observed that the following parameters have more supports than others, so the following summary proposals are made:

**[Agreeable] Summary proposal 1: Agree to add the following parameters into RACH report for RACH partitioning:**

* **Intended feature combination, or the feature or the combination of features that triggered the RACH**
* **Used feature combination, or the feature or the combination of features applicable to the RACH procedure**

**[For discussions] Summary proposal 1: Discuss whether to add the following parameters into RACH report for RACH partitioning:**

* **Priority of each intended feature**

**[For discussions] Summary proposal 2: Discuss whether to add the following parameters into RACH report for RACH partitioning:**

* **Msg3 repetition**
* **SCG activation/deactivation**
* **BFR recovery for two BFD-RS sets**
* **UE reports the features applicable for the RA procedure but not associated with the selected set of RACH resources**
* **The starting preamble index associated to this RA partition**
* **The total number of preambles associated to this RA partition**
* **UE logs the elapsed time since logging the RA report until sending the report to the network**

Some companies propose to discuss the relations between legacy RACH report and RACH partitioning RA report, and the proposals are as below:

**Proposal 2: The RACH related information included in R16 and R17 RA report can also be applied for RACH partitioning RA report, with the extension to include the feature combination associated with the selected RACH partition. (Xiaomi)**

The rapporteur understands that legacy RACH report parameters should be used for RACH partitioning purpose, unless there are some restrictions. So the following summary proposal is made:

**[Agreeable] Summary proposal 2: The RACH related information included in R16 and R17 RA report can also be applied for RACH partitioning RA report, with the extension to include the feature combination associated with the selected RACH partition.**

Some companies propose to study the following issues:

**Observation 1: The RACH feature/feature combination which is selected by the UE may not be same as the RACH feature/feature combination that is available for the UE. (CATT)**

**Proposal 2: The FeatureCombination information of the RACH partition that is expected to be used but was not used for the random access should be added in RACH report, in case the fully matched RACH partition is unavailable. (Spreadtrum)**

It is proposed RAN2 to discuss the above issue:

**[For discussions] Summary proposal 3: RAN2 to study whether and how to address the following issue:**

* **The RACH feature/feature combination which is selected by the UE may not be same as the RACH feature/feature combination that is available for the UE**

For unsuccessful completed RA procedure, some companies propose enhancements as below:

**Proposal 1: UE reports the combination of features associated with the set of RACH resources selected for the random access procedure for an unsuccessful completed RA procedure. (NEC)**

For Rel-17 RACH report, the following cases have been agreed:

1. upon successful completion of a random-access procedure
2. on successful or unsuccessful completion of a procedure for request of on-demand system information

The rapporteur thinks that the RACH partitioning use case should at least include successful RA procedure. It is FFS whether unsuccessful RA procedure should be considered for RACH partitioning.

**[For discussions] Summary proposal 4: UE reports the combination of features associated with the set of RACH resources selected for the random access procedure for an unsuccessful completed RA procedure.**

#### 2.1.2 RACH performance information

##### 2.1.2.1 List of relevant proposals

For RACH performance information, the following proposals are listed:

[12], ZTE

**RACH performance information**

*Observation 4: When selected BWP is configured with both RA resource with/without Msg3 repetition, UE compares downlink pathloss reference with configured threshold rsrp-ThresholdMsg3 to decide whether Msg3 repetition is applicable for the RA procedure.*

*Observation 5: Include whether Msg3 repetition is applied in the RA procedure can help NW to evaluate the performance of Msg3 repetition thus decide whether to configure Msg3 repetition or not.*

*Observation 6: R17 UE will include RSRP of downlink pathloss reference for 2step RA which can be extend to 4step RA as well for fine tuning of Msg3 repetition determination threshold.*

*Observation 7: NW needs to carefully decide how to configure Msg3 repetition( e.g., threshold used for Msg3 repetition determination and repetition number) to balance the RACH load and resource efficiency.*

*Observation 8: For RA with large number of RA attempts yet no contention issue is detected, if RSRP of most RA attempt is above rsrp-ThresholdMsg3, it could imply rsrp-ThresholdMsg3 is set too high that target UE cannot make use of the Msg3 repetition resource as intended.*

**Proposal 4: UE includes RSRP of downlink pathloss reference for 4-step RA.**

**Proposal 5: UE includes indication to indicate whether RSRP of selected beam is above *rsrp-ThresholdMsg3* or not per RA attempt.**

**Proposal 6: Include Msg3 repetition number configured and applied for the RA procedure.**

##### 2.1.2.2 Summary

For RACH performance information, the following summary proposal is made:

**[For discussions] Summary proposal 5: For RACH performance information, the UE includes the following parameters in the RACH report:**

* **RSRP of downlink pathloss reference for 4-step RA**
* **indication to indicate whether RSRP of selected beam is above *rsrp-ThresholdMsg3* or not per RA attempt**
* **Msg3 repetition number configured and applied for the RA procedure**

#### 2.1.3 Feature specific information

##### 2.1.3.1 List of relevant proposals

For feature specific information, the following proposals are listed:

[5], Samsung

**Proposal 2: When the applicable feature is slicing, include NSAG Id and NAS provided NSAG priority of the relevant NSAGs in RACH report.**

**Proposal 3: Include RACH information related to features involving RA partitioning (SDT, slicing, msg3 repetition and Redcap) in RACH report.**

[10], Ericsson

**Observation 7 The RA information and SDT information at the failure of an SDT operation is not currently logged in the RA report.**

**Proposal 4 UE includes RA and SDT information in RA report when an SDT operation fails.**

##### 2.1.3.2 Summary

Some companies propose to discuss slicing and SDT for RACH reports enhancements. The following summary proposal is made:

**[For discussions] Summary proposal 6: When the applicable feature is slicing, include NSAG Id and NAS provided NSAG priority of the relevant NSAGs in RACH report.**

**[For discussions] Summary proposal 7: UE includes RA and SDT information in RA report when an SDT operation fails.**

### 2.2 Addition of RACH information to other SON reports

#### 2.2.1 List of relevant proposals

For addition of RACH information to other SON reports, the following proposals are listed:

[6], Huawei, HiSilicon

**Proposal 4: In addition to enhance RA report, the corresponding enhanced RA-InformationCommon could possibly also apply to RLF and SHR.**

[4], Apple

**Observation 1: it may be beneficial for the network to know which feature or features combination the UE would have preferred to use for that random access procedure.**

**Proposal 1: consider enhancing RA-Report, and possibly also RLF-Report and SuccessHO-Report, by adding to RA-InformationCommon information indicating which feature set triggered random access and which feature set the UE would have preferred.**

[9], Xiaomi

**Observation 1: The intention of the RACH partitioning RA report is to optimize the RACH resource allocation for features which is regardless of whether the random access procedure is successful or not.**

**Proposal 1: The RACH partitioning RA report can be supported for the RA-Report, RLF-Report and SuccessHO-Report.**

#### 2.2.2 Summary

Some companies propose to include enhanced RA-Report (about RACH partitioning information) in the following SON reports:

* RLF report
* Successful Handover report

The rapporteur thinks that RACH report enhancements for RACH partitioning can be firstly discussed, and later RAN2 can further discuss whether these parameters are also needed for RLF report and Successful Handover report or not.

**[For discussions] Summary proposal 8: RAN2 can further discuss whether enhanced RA-Report (about RACH partitioning information) are also needed for RLF report and Successful Handover report.**

### 2.3 SgNB RACH report for MR-DC scenarios

#### 2.3.1 List of relevant proposals

For SgNB RACH report for MR-DC scenarios, the following proposals are listed:

[6], Huawei, HiSilicon

**Proposal 2: It is proposed RAN2 to agree that for the PSCell identity of stored SN RA report, encoded in NR format for (NG)EN-DC and in LTE format for NE-DC and put outside SN RA report container.**

[9], Xiaomi

**Proposal 4: To support the SN RACH report in the NE-DC scenario, UE shall support to log the E-UTRAN RACH information and report to the NR MN.**

**Proposal 5: To avoid the LTE impacts, the NR SN fetching the list of NR RA reports via SRB3 can be considered for the SN RACH report in the (NG) EN-DC scenario.**

[2], CATT

**Proposal 1: Study and support the SgNB RACH report of EN-DC and NG-EN-DC scenarios in R18.**

**Proposal 2: Includes NR container in LTE RACH Report to enhance the SgNB UE RACH Report for EN-DC and NG-EN-DC scenarios.**

**Proposal 3: Includes the cell ID in which the RACH occurred in LTE format together with the NR container to assist the network forwarding the SgNB RACH report content for EN-DC and NG-EN-DC scenarios.**

**Proposal 4: A new UE variable about SgNB RACH report information should be introduced in TS36.331.**

**Proposal 5: Additional capability may be needed for NR RACH Report enhancement in LTE for EN-DC and NG-EN-DC scenarios.**

[13], CMCC

**Proposal 1: The misalignment between RAN3 and RAN2 about SN RACH report in MR-DC should be resolved.**

**Proposal 2: RAN2 is asked to discuss the support of all the MR-DC scenarios for SN RACH report and to include PScell identity information outside the report.**

#### 2.3.2 Summary

At RAN2#119-e meeting, RAN2 agreed to discuss the support of (NG)EN-DC and NE-DC scenarios for SN RACH report, and a LS was sent to RAN3 for clarifications.

Based on the contributions in this meeting, the following solutions are proposed:

For NE-DC, the UE collects SN RA report container (for LTE) and reports to the NR MN. Additionally, the UE also includes the PSCell identity for the stored SN RA report (FFS on the format).

For EN-DC and NG-EN-DC, one option is that: the NR SN fetching the list of NR RA reports via SRB3 can be considered for the SN RACH report in the (NG) EN-DC scenario. The other option is that the UE collects SN RA report container (for NR) and reports to the LTE MN, and additionally the UE also includes the PSCell identity for the stored SN RA report (FFS on the format).

**[For discussions] Summary proposal 9: For NE-DC, the UE collects SN RA report container (for LTE) and reports to the NR MN. Additionally, the UE also includes the PSCell identity for the stored SN RA report (FFS on the format).**

**[For discussions] Summary proposal 10: For EN-DC and NG-EN-DC, there are the following options:**

1. **the NR SN fetching the list of NR RA reports via SRB3 can be considered for the SN RACH report in the (NG) EN-DC scenario**
2. **the UE collects SN RA report container (for NR) and reports to the LTE MN, and additionally the UE also includes the PSCell identity for the stored SN RA report (FFS on the format).**

### 2.4 Enhancement of RA report for DC scenario

#### 2.4.1 List of relevant proposals

For enhancement of RA report for DC scenario, the following proposals are listed:

[10], Ericsson

**Observation 1 Performance of the RA procedure for a cell in the MCG can be significantly different from the performance of RA procedure for the same cell being part of SCG. This is due to the fact that network policies for DC connectivity can be different from single connectivity.**

**Observation 2 When a RA report is received and analysed by a RAN node, the RAN node is not aware whether the RA procedure is performed toward a cell in the MCG or in the SCG.**

**Observation 3 By knowing whether the RA report is associated to a random access procedure executed toward a cell belonging to SCG or MCG, the network can differentiate the RACH issues as well as coverage issues for a cell acting as MCG or as SCG.**

**Proposal 1 Include information in the RA report on whether the random access procedure was executed towards an MCG cell or an SCG cell.**

#### 2.4.2 Summary

It is proposed:

**[For discussions] Summary proposal 11: Include information in the RA report on whether the random access procedure was executed towards an MCG cell or an SCG cell.**

### 2.5 RACH Report Retrieval

#### 2.5.1 List of relevant proposals

For RACH report retrieval, the following proposals are listed:

[6], Huawei, HiSilicon

**Proposal 1: It is proposed RAN2 to discuss the availability indicator of RACH reports.**

[11], Nokia

**Proposal 1:** **Rel-18 supports RACH Report retrieval based on a separate availability bit.**

[13], CMCC

**Proposal 3: RAN2 is asked to discuss on the support of UE based solution.**

#### 2.5.2 Summary

In RAN3, the discussions focused on introducing a trigger from a gNB-DU to a gNB-CU when a RACH event is observed. Since RACH report information is known at the UE side, it is suggested RAN2 to discuss UE based solution.

**[For discussions] Summary proposal 12: RAN2 to discuss and agree on the availability indicator of RACH reports.**

## 3 Conclusions

Based on the analysis in section 2, the following summary proposals are made:

**For RACH report about RACH partitioning information**

Agreeable proposals:

**Summary proposal 1: Agree to add the following parameters into RACH report for RACH partitioning:**

* **Intended feature combination, or the feature or the combination of features that triggered the RACH**
* **Used feature combination, or the feature or the combination of features applicable to the RACH procedure**

**Summary proposal 2: The RACH related information included in R16 and R17 RA report can also be applied for RACH partitioning RA report, with the extension to include the feature combination associated with the selected RACH partition.**

Proposals that need discussions:

**Summary proposal 1: Discuss whether to add the following parameters into RACH report for RACH partitioning:**

* **Priority of each intended feature**

**Summary proposal 2: Discuss whether to add the following parameters into RACH report for RACH partitioning:**

* **Msg3 repetition**
* **SCG activation/deactivation**
* **BFR recovery for two BFD-RS sets**
* **UE reports the features applicable for the RA procedure but not associated with the selected set of RACH resources**
* **The starting preamble index associated to this RA partition**
* **The total number of preambles associated to this RA partition**
* **UE logs the elapsed time since logging the RA report until sending the report to the network**

**Summary proposal 3: RAN2 to study whether and how to address the following issue:**

* **The RACH feature/feature combination which is selected by the UE may not be same as the RACH feature/feature combination that is available for the UE**

**Summary proposal 4: UE reports the combination of features associated with the set of RACH resources selected for the random access procedure for an unsuccessful completed RA procedure.**

**Summary proposal 5: For RACH performance information, the UE includes the following parameters in the RACH report:**

* **RSRP of downlink pathloss reference for 4-step RA**
* **indication to indicate whether RSRP of selected beam is above *rsrp-ThresholdMsg3* or not per RA attempt**
* **Msg3 repetition number configured and applied for the RA procedure**

**Summary proposal 6: When the applicable feature is slicing, include NSAG Id and NAS provided NSAG priority of the relevant NSAGs in RACH report.**

**Summary proposal 7: UE includes RA and SDT information in RA report when an SDT operation fails.**

**For addition of RACH information to other SON reports**

Proposals that need discussions:

**Summary proposal 8: RAN2 can further discuss whether enhanced RA-Report (about RACH partitioning information) are also needed for RLF report and Successful Handover report.**

**For SgNB RACH report for MR-DC scenarios**

Proposals that need discussions:

**Summary proposal 9: For NE-DC, the UE collects SN RA report container (for LTE) and reports to the NR MN. Additionally, the UE also includes the PSCell identity for the stored SN RA report (FFS on the format).**

**Summary proposal 10: For EN-DC and NG-EN-DC, there are the following options:**

1. **the NR SN fetching the list of NR RA reports via SRB3 can be considered for the SN RACH report in the (NG) EN-DC scenario**
2. **the UE collects SN RA report container (for NR) and reports to the LTE MN, and additionally the UE also includes the PSCell identity for the stored SN RA report (FFS on the format).**

**For enhancement of RA report for DC scenario**

Proposals that need discussions:

**Summary proposal 11: Include information in the RA report on whether the random access procedure was executed towards an MCG cell or an SCG cell.**

**For RACH Report Retrieval**

Proposals that need discussions:

**Summary proposal 12: RAN2 to discuss and agree on the availability indicator of RACH reports.**

## 4 Relevant Tdocs

[1] R2\_119bis-e\_Skeleton\_v2

[2] R2-2209567 Discussion on RACH report enhancement for RACH partitioning vivo discussion Rel-18 NR\_ENDC\_SON\_MDT\_enh2-Core

[3] R2-2209572 RACH enhancement for SON CATT discussion Rel-18 NR\_ENDC\_SON\_MDT\_enh2-Core

[4] R2-2209766 SON enhancements for RACH partitioning Apple discussion Rel-18 NR\_ENDC\_SON\_MDT\_enh2-Core

[5] R2-2209825 SON/MDT Enhancements for RACH Samsung R&D Institute India discussion

[6] R2-2209898 Discussion on RACH enhancement Huawei, HiSilicon discussion Rel-18 NR\_ENDC\_SON\_MDT\_enh2-Core

[7] R2-2209986 RACH report enhancements for RACH partition Spreadtrum Communications discussion Rel-18

[8] R2-2209999 Discussion on RACH enhancements NEC discussion Rel-18 NR\_ENDC\_SON\_MDT\_enh2-Core

[9] R2-2210030 Discussion on the SON/MDT enhancement for RACH report Beijing Xiaomi Software Tech discussion Rel-18

[10] R2-2210179 RACH report enhancements Ericsson discussion NR\_ENDC\_SON\_MDT\_enh2-Core

[11] R2-2210271 RACH report related enhancements Nokia, Nokia Shanghai Bell discussion Rel-18 NR\_ENDC\_SON\_MDT\_enh2-Core

[12] R2-2210291 Consideration on RACH enhancements ZTE Corporation, Sanechips discussion Rel-18

[13] R2-2210511 SONMDT enhancement for RACH Enhancement. CMCC discussion Rel-18 NR\_ENDC\_SON\_MDT\_enh2-Core

[14] R2-2210574 Discussion on RACH partitioning China Telecom Corporation Ltd. discussion