**3GPP TSG-RAN WG2 #117-e R2-220xxxx**

**E-meeting, 21 February – 3 March, 2022**

**Agenda item: 8.18.1**

**Source: Huawei, HiSilicon**

**Title:** **Report of: [AT117-e][505][RA Part] CP additional open issues**

**Document for: Discussion and decision**

# Introduction

This paper aims at discussing the issues mentioned in companies contribution submitted to Agenda Item “8.18.1 Common signalling framework” of RAN2#117-e meeting. Other than that, the issues that require further discussion after the online session are elaborated.

# Discussion

## 2.1 Handling of per feature or per feature combination parameters

In [1] and [4], how to handle feature/feature combination specific parameters is discussed. The rapporteur of the RRC CR for RACH partitioning suggested to wait for WI-specific input before resolving this issues. However, in [1] and [4] it is proposed that (most of) parameters which are currently provided in RACH-ConfigCommon should be configurable per feature combination (or per preamble partition, in other words). [4] notes that thanks to this the general framework can be used for all the feature combinations and there is no need to specify new feature specific parameters which are equivalents of the parameters in RACH-ConfigCommon. In [1] a general proposal is made while [4] mentions the parameters explicitly, but based on the discussion in both papers, it seems the intention is to allow this for parameters which were agreed to be feature specific at least for one of CE, SDT, Redcap and Slicing. In [2] the same topic is discussed from the perspective of Slicing WI only and the approach that is mentioned is to configure scalingFactorBI and powerRampingStepHighPriority as RACH partition specific in order to meet Slicing WI requirement, which seems to be aligned with the proposals in [1] and [4].

Based on the proposals, the companies are requested to answer the following questions.

**Question 1: Do companies agree that, as a general rule, parameters in the common RACH configuration can be different for different preamble partitions (i.e. can be configured as feature combination specific regardless of the features included within a feature combination)?**

**NOTE: This is supposed to be a “general rule” and not all parameters can be per feature combination, e.g. SSB-RO mapping has to be common within a RACH configuration. Exact parameters need to be decided, e.g. as per Q2.**

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| **Company** | **Yes/No** | **Justification / comments** |
| OPPO | Yes | We think if any parameter is agreed for one specific feature and it is related to RACH procedure, it should be partition specific unless it is clarified that relevant function is an independent function from RACH partition |
| ZTE | Yes |  |
| Nokia | Yes | Taking as an example slicing “partition”, it requires different handling. E.g. the agreed backoff timer and power ramping step or association of the partition to a group of slices. |
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In [4], an explicit list of the parameters which should be configured in a way proposed in Q1 is proposed, based on the WI-specific agreements. Also, the following agreement was made during an online session for RACH partitioning:

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| The current draft signalling for Slicing is kept for now, pending Slicing progress on details. As a baseline per slicing agreements we consider at least the following two parameters for feature combination: backoffindication and powerramping steps. Further parameters can be considered based on slicing progress. |

**Question 2: Do you agree with following baseline list of the parameters which can be configured per preamble partition (if some parameters are missing, please comment):**

* **RSRP threshold for RA type selection**
* **SSB selection related parameters, i.e., *rsrp-ThresholdSSB, msgA-RSRP-ThresholdSSB***
* **Power control related parameters, i.e., *preambleReceivedTargetPower/msgA-PreambleReceivedTargetPower, powerRampingStep/ powerRampingStepHighPriority/msgA-PreamblePowerRampingStep***
* **Preamble group related parameters, i.e., *msg3-DeltaPreamble/msgA-DeltaPreamble, messagePowerOffsetGroupB* for 2-step RA-SDT and 4-step RA-SDT, ra-Msg3SizeGroupA/ra-MsgA-SizeGroupA**
* ***msgA-CB-PreamblesPerSSB-PerSharedRO***
* ***scalingFactorBI***

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| **Company** | **Yes/No** | **Justification / comments** |
| OPPO | Yes but | So far no WID agreed that “RSRP threshold for RA type selection” should be feature specific.For *msgA-CB-PreamblesPerSSB-PerSharedRO,* there are two cases:Case 1: parameter in RACH-ConfigCommonTwoStepRA-r16Case 2: parameter in RACH-ConfigCommonTwoStepRA-r17Case1 is not applicable since it is a legacy parameter i.e. should be common anyway.Case2 is also not applicable. Current ASN.1 suggest that ROs should be configured within RACH-ConfigCommonTwoStepRA-r17 otherwise no RO can be shared among feature combination. If ROs are configured, this parameter should be absent.We are fine with the rest parameters. |
| ZTE | Yes |  |
| Nokia | No, see comment | May be too generic. We believe parameters for a preamble partition should come from the specific Wis/features needs.  E.g. the baseline needs to consider the Slicing related agreements, where ra-Prioritization IE has been agreed to be slice specific. The ra-Prioritization IE (as in Rel-16) enables to configure powerRampingStep and scalingFactorBI  – RA-Prioritization The IE *RA-Prioritization* is used to configure prioritized random access. ***RA-Prioritization* information element** -- ASN1START -- TAG-RA-PRIORITIZATION-START   RA-Prioritization ::=           SEQUENCE {     powerRampingStepHighPriority    ENUMERATED {dB0, dB2, dB4, dB6},     scalingFactorBI                 ENUMERATED {zero, dot25, dot5, dot75}                               OPTIONAL,   -- Need R     ... }  -- TAG-RA-PRIORITIZATION-STOP -- ASN1STOP For slice specific concept (see also running Slicing CR in R2-2203022), it remains to be clarified how to apply the parameters that would be duplicated by the above baseline. It would be preferable to adopt Slicing specific agreements, but the agreed parameters become a subset of the baseline.  |

In [4], it is also noted that it is not mandatory and efficient from signalling overhead point of view to mandatorily provide these parameters per preamble partition. It is proposed to clarify that if a parameter is not provided for a specific preamble partition, then the parameter from RACH-ConfigCommon of the applicable RACH configuration should be used for this feature combination. Even though [4] focuses on 4-step RA, it is understood the same principle could apply to 2-step RA as well.

**Question 3: Do you agree that if a parameter is not provided for a specific preamble partition, then the parameter from RACH-ConfigCommon (or RACH-ConfigCommonTwoStepRA) of the applicable RACH configuration should be used for this feature combination?**

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| **Company** | **Yes/No** | **Justification / comments** |
| OPPO | Yes |   |
| Nokia | Yes |  |
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In [6] on the other hand, somewhat opposite proposal is brought up, i.e. that certain RACH parameters should always be the same for all features and feature combinations.

**Question 4: Do companies think that some parameters should always be configured commonly for all features, e.g. the ones mentioned in [6], i.e. (you may comment on certain parameters as well)**

* **PHY parameters: *prach-ConfigurationIndex*, *msg1-FDM*, *msg1-FrequencyStart*, *ssb-perRACH-Occasion*, *msg1-SubcarrierSpacing*, *restrictedSetConfig*, *prach-RootSequenceIndex*, *zeroCorrelationZoneConfig*, *preambleReceivedTargetPower*, and *powerRampingStep*.**
* **MAC parameters: *rsrp-ThresholdSSB-SUL*, *ra-ContentionResolutionTimer*, and *preambleTransMax*.**

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| **Company** | **Yes/No** | **Justification / comments** |
| OPPO | See comments | If we agree the principle in Q3, not sure why it is necessary to list detail common parameters since there are a lot. Specifically, ***preambleReceivedTargetPower*** is listed as partition specific parameter. |
| ZTE | Yes/No | If the question is about the parameters for the feature combination which share the same RO, then the answer is yes. Otherwise, the answer is no. Different configuration should be allowed for different RACH occasion. |
| Nokia | See comment | The parameters identified as potentially “common” may require deeper insight (case by case, and/or per feature specific requirements). We are not sure the aim should be to identify “Common” feature specific set. It should be first clear which parameters are specifically tailored for a feature configuration. E.g. for PHY parameters, as mentioned in our reply to Q1, at least powerRampingStep has been considered as possible to be set specifically for a slice group (I.e. not being shared with other features).   Different features aimed at different RACH parameters optimization. If there are common parameters across the features, maybe it is sufficient if they are applied from the legacy Common RACH? I.e. not necessary to define them as “common set for features combinations” on top of generic “Common RACH”?  |

In [5], it is proposed to use RSRP thresholds determining the range of RSRP values for which the UE is allowed to use each partition. According to [5] this way, it would be simpler to support RACH partitions for all the potential feature combinations. On the other hand, as noted in [5], an alternative way is to rely on per-feature check of RSRP, where it is required (e.g. for CE and/or SDT). In this case the RSRP thresholds can be part of the correspondent feature-specific signalling (i.e.: not handled in the RACH partitioning WI / running CR).

**Question 5: Do you prefer to:**

1. **Introduce RSRP thresholds determining the range of RSRP values for which the UE is allowed to use each partition in FeatureCombinationPreambles-r17; or**
2. **Rely on the correspondent feature-specific signalling for feature validity determination?**

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| **Company** | **Option 1/2** | **Justification / comments** |
| OPPO | 2 | So far the relevant RSRP threshold is one for sdt-RSRP-Threshold and rsrp-Threshold-Msg3Rep. we think so far MAC running CR capture them correctly and not sure why a general parameter is better. |
| ZTE | 2 |  |
| Nokia | 2 | We should **“rely on the correspondent feature-specific signalling for feature validity determination”, but** in our view it does not imply per-feature specific RSRP threshold. Not all WI/features required this.  |

## 2.2 ASN.1 structure

In [1], a structure for ASN.1 signalling is proposed which is an alternative to the one proposed by the RRC CR rapporteur. In this structure each RACH configuration entry corresponds to one feature combination specific RACH partitioning, including the separate RO and the shared RO case and the featureCombination is located in the additionalRACH-ConfigCommonR17. The reason behind this alternative seems to be to allow different RACH parameters per RACH partition in shared RO case. However, it seems that the structure proposed by the CR rapporteur also allows to achieve that, in case the RACH partition specific parameters are captured in FeatureCombinationPreambles-r17 IE. It is also somewhat unclear how the proposed structure allows to achieve RO sharing between various feature combinations, which would have to be clarified.

**Question 6: Do you think there is a need to modify the RRC signalling in such a way that each RACH configuration entry corresponds to one feature combination specific RACH partition, including the separate RO and the shared RO case and the featureCombination is located in the additionalRACH-ConfigCommonR17, as proposed in [1]?**

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| **Company** | **Yes/No** | **Justification / comments** |
| OPPO | No | On Monday we just agreed:1 Use the current base line without the *FeatureCombination* in *RACHcommonConfig*In addition we agree with moderator if we go this way ROs in **additionalRACH-ConfigCommonR17** can’t be shared among feature combinations. And obviously legacy ROs can’t shared either. |
| ZTE | No | Current ASN.1 structure seems sufficient. |
| Nokia | No | For now it seems the proposal in [1] cannot achieve the flexibility assumed in the running CR.  |
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In [3], it is indicated that there could be two cases for RO sharing between Rel-17 preambles partition and legacy RACH:

* Case 1: RO is shared for **the same RA type**. In other words, legacy 4-step RA resource shares the RO with R17 4-step RA partition, or legacy 2-step RA resource shares the RO with R17 2-step RA partition.
* Case 2: RO is shared for **the for different RA type**. In other words, legacy 4-step RA resource shares the RO with R17 2-step RA partition, or legacy 2-step RA resource shares the RO with R17 4-step RA partition.

It is further noted that the RRC signalling structure proposed by the rapporteur supports only case 1, but not case 2. However, the proposal is to confirm that support of this case is not needed.

**Question 7: Do you think there is a need to support Case 2 as above in the RACH signalling?**

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| **Company** | **Yes/No** | **Justification / comments** |
| OPPO | Case1, partial of case 2 | If legacy 4-step resource already shared with legacy 2-step resource, then R17 2-step RACH partition can be configured since there is no ROs defined within RACH-ConfigCommonTwoStepRA, otherwise only R17 4-step RACH partition can be configured. So 1st part of case 2 should be supported.  |
| ZTE | Yes | We think case 2 can be supported by current ASN.1 structure with the clarification that absent of IEs in RACH-ConfigGenericTwoStepRA-r16 means the same configuration provided in RACH-ConfigGeneric with the same AdditionalRACH-ConfigIndex is reused. |
| Nokia | No | We thought the RO for Rel-17 feature specific partition is intentionally isolated from legacy  |

## 2.3 Non-handled issues from companies papers

Some of the issues mentioned in the company papers were also handled in the open issues discussion summarized in [7] and are not discussed here:

1. In [6], it is proposed that the FeatureCombination is kept in RACH common config, but the summary in [7] proposes the opposite based on the majority view.
2. In [6], a new extendable IE MsgA-ConfigCommon-r17 for Rel-17 RACH partitioning is proposed. In rapporteur’s understanding it is one potential way of handling OI#3 as discussed in [7], i.e. how to allow different msgA configurations to be configured for different feature combinations sharing the same RO set. This was supported by many companies in the pre-meeting discussion and the rapporteur concluded to handle this in the next update of the RRC CR. It is then proposed to discuss the issue further based on the structure proposed by the RRC CR rapporteur.

## 2.4 Issues resulting from online discussion

### 2.4.1 Maximum number of RACH configurations

In [7], the following proposal was made:

1. Do not update Maximum number of additional RACH configurations in Running CR but agree as baseline [nrofSlices] \* 8 – 1

During an online discussion, it was unclear why the above formula was proposed for the maximum number of RACH configurations and the following FFS was captured:

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| Do not update Maximum number of additional RACH configurations in Running CR. FFS on what the max is based on possible combinations |

In rapporteur’s understanding it results from a willingness to ensure all possible permutations of feature combinations can be configured with their own RACH partition. Since the number of features is “3” (i.e. Redcap, SDT, CE) plus Slicing, the formula used was [nrofSlices] \* 2^3 – 1. The rapporteur thinks it is one way to arrive at a number, although it may be too much in the end, considering that RACH partitions can be shared between feature combinations. On the other hand, this is barely a signaling limitation where a degree of flexibility and future-proofness is desired. The rapporteur proposes then to agree on this maximum number, with the following differences:

* nrofSlices should rather be nrofSliceGroups
* “-1” seems not needed as the number of additional RACH partitions will start from 1, not from 0

**Question 8: Do companies agree to set the maximum number of additional RACH configurations in RRC signaling to [nrofSliceGroups] \* 8? If not, please propose an alternative number.**

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| **Company** | **Yes/No** | **Justification / comments** |
| OPPO | No | We think RAN2 need define a proper number to have future proof and that’s it. We can take the number of slice groups into account but not necessary to define the maximum number based on number of slices. |
| ZTE | Yes |  |
| Nokia | Yes |  |

Another issue that requires further discussion after the online discussion is feature prioritization in case there is no RACH partition for the UE’s preferred feature combination, as per the following agreement:

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| 8 As a baseline - a priority is configurable per feature. FFS on details If several partitions are available for more than one feature, the UE selects only between available partition(s) with the highest feature priority. Details FFS. |

### 2.4.2 Feature prioritization

In the latest MAC CR, the partition selection is currently captured as follows:

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| 1> if one or more of the features including REDCAP and/or a specific slice and/or SDT and or MSG3 repetition is applicable for the current Random Access procedure:2> if none of the sets of Random Access resources are available for the current Random Access procedure (as specified in clause 5.1.1y):3> select the set of Random Access resources that are feature combination agnostic (as specified in clause 5.1.1c) for the current Random Access procedure2> else if a set of Random Access resources is available (as specified in clause 5.1.1y) and this set of Random Access resources can be used for indicating all the applicable features for this Random Access procedure: 3> select the available set of Random Access resources for the current Random Access procedure.2> else (i.e. there is one or more sets of Random Access resources available that do not satisfy all features triggering the RACH procedure):3> select a set of Random Access resources from the available set of Random Access resources based on the priority order indicated in the system information as specified in TS 38.331 [5]1> else (i.e. none of the REDCAP and/or a specific slice and/or SDT and or MSG3 repetition is applicable):2> select the set of Random Access resources that are feature combination agnostic (as specified in clause 5.1.1c) for the current Random Access procedure. |

There seem to be things that require further discussion:

1. How to indicate the feature priorities in RRC signalling.
2. What are the exact principles for choosing RACH partition based ion these signalled priorities.

When it comes to the priority signaling, RAN2 agreed that priorities should be signaled per feature. This can be achieved, e.g. with the following signaling:

***BWP-UplinkCommon* information element**

-- ASN1START

-- TAG-BWP-UPLINKCOMMON-START

BWP-UplinkCommon ::= SEQUENCE {

 genericParameters BWP,

 rach-ConfigCommon SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M

 pusch-ConfigCommon SetupRelease { PUSCH-ConfigCommon } OPTIONAL, -- Need M

 pucch-ConfigCommon SetupRelease { PUCCH-ConfigCommon } OPTIONAL, -- Need M

 ...,

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 rach-ConfigCommonIAB-r16 SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M

 useInterlacePUCCH-PUSCH-r16 ENUMERATED {enabled} OPTIONAL, -- Need R

 msgA-ConfigCommon-r16 SetupRelease { MsgA-ConfigCommon-r16 } OPTIONAL -- Cond SpCellOnly2

 ]],

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 additionalRach-ConfigCommonToAddModList-r17 SEQUENCE (SIZE(1..maxAdditionalRACH-r17)) OF AdditionalRACH-ConfigCommon-r17 OPTIONAL, -- Cond SpCellOnly3

 additionalRach-ConfigCommonToReleaseList-r17 SEQUENCE (SIZE(1..maxAdditionalRACH-r17)) OF AdditionalRACH-ConfigIndex-r17 OPTIONAL, -- Cond SpCellOnly3

 featurePriorities-17 SEQUENCE {

 redCapPriority-r17 FeaturePriority-r17 OPTIONAL,

 sliceGroupPriority-r17 FeaturePriority-r17 OPTIONAL,

 ce-Priority-r17 FeaturePriority-r17 OPTIONAL,

 sdt-Priority-r17 FeaturePriority-r17 OPTIONAL,

 ...

 }

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}

FeaturePriority-r17 ::= INTEGER (0..7)

-- TAG-BWP-UPLINKCOMMON-STOP

-- ASN1STOP

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| ***featurePriorities*** Determines the priority of the feature for the selection of the set of Random Access resources applicable to the Random Access procedure, as captured in TS 38.321, section 5.1.1b. Value “0” means the feature has the highest priority among the configured features, value “1” is the second highest priority and so on. |

**Question 9: Companies are invited to comment on the proposed signaling, i.e. is it OK or not, any modifications that are required, any alternative proposals etc.**

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| **Company** | **Comments / proposed modifications/ alternative proposals** |
| OPPO | yes |
| ZTE | We are fine with the structure in general. We prefer to clarify that if the priority is absent for one feature, then the feature will be considered as lowest priority, and it is up to UE implementation if two features are configured with the same priority. |
| Nokia | Seems a good baseline |
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Apart from signaling, it seems that also a partition selection procedure should be described in more detail in MAC specifications. This could be captured in a separate section in MAC, e.g. something as follows (this is supposed to present the overall principle, but may not be perfect):

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| 2> else (i.e. there is one or more sets of Random Access resources available that do not satisfy all features triggering the RACH procedure):3> select a set of Random Access resources from the available set of Random Access resources based on the priority order indicated in the system information, as specified in TS 38.331 [5], and as described in section 5.1.1d(…)5.1.1d Random Access resources selection based on feature prioritizationThe MAC entity shall:1> among the available sets of Random Access resources, identify those configured with an indication of a feature which has the highest priority assigned in *featurePriorities* among all the features applicable to this RACH procedure.1> if a single set of Random Access resources is available:2> select this set of Random Access resources.1> if more than one set of Random Access resources is available:2> repeat the procedure taking as an input the identified subset of sets of Random Access resources and the feature applicable to the current RACH procedure with the highest priority assigned in *featurePriorities* among all the features applicable to this RACH procedure, except the features considered already.1> else (i.e. no set of Random Access resources is available):2> repeat the procedure taking as an input the previous identified available sets of Random Access resources the feature applicable to the current RACH procedure with the highest priority assigned in *featurePriorities* among all the features applicable to this RACH procedure, except the features considered already. |

**Question 9: Companies are invited to comment on the proposed procedure, i.e. is it OK or not, any modifications that are required, any alternative proposals etc.**

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| **Company** | **Comments / proposed modifications/ alternative proposals** |
| OPPO | Not sure whether the 3rd case will occur i.e. no set of Random access resource available considering the relevant feature(s) applicable to the current RACH procedure.Then for the 2nd case i.e. multiple RACH resource are available, if all the relevant features has exhausted, then it should be up to UE’s implementation to choose one  |
| ZTE | We are OK to capture it in MAC. However, it is not clear whether we need to capture such detail procedure, or we simply capture a general principle and leave the detail to UE implementation.For example, we can simply say:2> else (i.e. there is one or more sets of Random Access resources available that do not satisfy all features triggering the RACH procedure):3> select a set of Random Access resources from the available set of Random Access resources such that the set of Random Access resources with higher priority, as indicated in the system information in TS 38.331 [5], are prioritized (i.e. selected) instead of the Random Access resources for features with lower priority.If majority companies want to capture the detail procedure, it is also fine for us, and we propose to change the wording as follow:5.1.1d Random Access resources selection based on feature prioritizationThe MAC entity shall:1> among the available sets of Random Access resources, identify those configured with an indication of a feature which has the highest priority assigned in *featurePriorities* among all the features applicable to this RACH procedure.1> if a single set of Random Access resources is identified:2> select this set of Random Access resources.1> if more than one set of Random Access resources is identified:2> repeat the procedure taking as an input the identified subset of sets of Random Access resources and the feature applicable to the current RACH procedure with the highest priority assigned in *featurePriorities* among all the features applicable to this RACH procedure, except the features considered already.1> else (i.e. no set of Random Access resources is identified):2> repeat the procedure taking as an input the previous identified available sets of Random Access resources the feature applicable to the current RACH procedure with the highest priority assigned in *featurePriorities* among all the features applicable to this RACH procedure, except the features considered already. |
| Nokia | Looks OK as baseline, detailed TP need to be discussed further  |
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# Conclusion

TBD

# References

1. R2-2202558 Signaling aspects of RACH partitioning Apple
2. R2-2203405 Slice-specific RACH prioritization in Common RACH Framework Nokia, Nokia Shanghai Bell
3. R2-2203063 Discussion on RO sharing cases for common RACH configuration LG Electronics Inc.
4. R2-2203339 Common signalling for RACH indication and partitioning Huawei, HiSilicon
5. R2-2203356 RSRP Thresholds for RACH Partitioning Ericsson
6. R2-2203393 Further Discussion on RACH Partitioning in RA Configuration Aspect vivo
7. R2-2203701 Report of [POST116bis-e][515][RA Part] CP open issues Ericsson