**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. |
| Intel | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| LGE | Yes | It is already agreed in RAN2#116bis-e meeting as a baseline:1. RACH parameters (e.g. power ramping step, max RACH transmissions etc) are configured per RACH partition rather than per feature within the partition.

Therefore, we support to keep this agreement. |
| CATT | Yes |  |
| Ericsson | Yes | Potentially any parameter could be partition-specific. But we should aim to have the shortest list possible to consider also SIB1 size considerations |
| NEC | Yes |  |
| vivo | Yes | We can discuss this feature by feature. |
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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.  |
| Intel | Partly | Maybe scalingFactorBI needs to be discussed together with RA-Prioritization. The rest of the parameters look fine to us. |
| Huawei, HiSilicon | Yes | @OPPO: RA type selection threshold is *msgA-RSRP-Threshold*, which was agreed to be at least SDT specific. But it is true this is redundant in the list above. For *msgA-CB-PreamblesPerSSB-PerSharedRO*, we wonder whether this is perhaps already covered by the *nrofPreamblesForThisPartition-r17* parameter in the latest CR, which can be configured for both 4-step and 2-step RA.@Nokia: We understand RA-Prioritization for Slicing has also to be captured in RACH partitioning common CR. We think such general principle can be used without the need to differentiate specific features, but if companies find this is needed, then the limitations can be captured in field descriptions, e.g. “this field can only be configured if *featureCombination* indicates SDT/Redcap/Slice”. |
| Samsung | Comment | For msgA-CB-PreamblesPerSSB-PerSharedRO we agree with Huawei. It is not needed. nrofPreamblesForThisPartition-r17 is sufficient. However, we would like to rename ‘nrofPreamblesForThisPartition-r17’ to ‘nrofCB-PreamblesPerSSB’ |
| Qualcomm | Partly | We think power control parameters should be configured per PRACH configuration. For example, we do not see clear use cases where different feature combinations should have different target received power. Similarly, power ramping step is more related to interference management and prioritization, instead of feature combinations.We are fine with other groups of parameters defined per preamble partition.  |
| Xiaomi | See comment | We share the same view with Nokia that the need of parameters configured per RACH partitions should come from separate WIs. And for the slice-specific RA prioritization parameters which is under discussion whether to work simultaneously with RACH partition, we think it should be pending and follow the conclusion of slicing. |
| LGE | See comment | Regarding “RSRP threshold for RA type selection”, we are ok to configure per partition, as it is agreed in SDT in RAN2#113bis-e as follows:* RSRP threshold for RA type selection is specific to SDT (i.e. separately configured for SDT)

For RACH prioritization parameters (i.e., *scalingFactorBI* and *powerRampingStepHighPriority*), only RAN slicing may configure the RACH prioritization for slicing. However, there is ongoing discussion on whether the slice-specific RACH prioritization can be configured independently of slice-specific RACH partition. Depending on slicing’s decision, the RACH prioritization parameter per partition may not be needed (i.e., *scalingFactorBI* and *powerRampingStepHighPriority* for slice may be configurablewithout slice-specific RACH partition).For *msgA-CB-PreamblesPerSSB-PerSharedRO*, we tend to agree with Huawei, i.e., duplicated with *nrofPreamblesForThisPartition-r17*. Therefore, the additional field per partition is not needed.Regarding power control related parameters (i.e., *preambleReceivedTargetPower* and *powerRampingStep*), we tend to agree with Qualcomm’s view, because it may cause impacts to legacy UEs if the power-related control is configured differently in shared RO.We are ok with the rest of parameters. |
| CATT | Yes but comments | In general, we agree these feature specific parameters should be configured per preamble partition. This can avoid introducing many new parameters. But we think it is necessary to specify which feature these parameters are used for. According to the agreements in some feature WIs, some parameters are should not be feature specific. For example, in slicing WI, the feature specific parameters only include *scalingFactorBI* and *powerRampingStepHighPriority*, and **no addition parameters for this release**.In CE WI, it is agreed that in shared RO case, it is **not supported** to configure a separate set of RACH parameters (preambleReceivedTargetPower, powerRampingStep, preambleTransMax) for requesting Msg3 repetition.We think the signaling design in RACH common should align with the agreements in each WI and specify which feature these parameters are used for.Preamble group related parameters can also include *numberOfRA-PreamblesGroupA* which is agreed in CE. Perhaps, “for 2-step RA-SDT and 4step RA-SDT” can be deleted.**RSRP threshold for carrier selection** is specific to SDT. So this parameter can also be added. |
| Ericsson | Partly | Parameters related to PRACH slot definition are not all common, but are “RACH config.” Specific. Meaning that each “additional RACH” will have its own set of values regardless of the features (as it is now in the CR). So in sense this includes for instance power control etc.msgA-CB-PreamblesPerSSB-PerSharedRO: Already in the CR (with a different name)For others one should see which are commonly applicable for a partition or need to be feature specific in that e.g. only apply specifically to a feature. |
| NEC | Yes |  |
| vivo | Comments | We fail to see the motivation of feature-specific power control related parameters. numberOfRA-PreamblesGroupA, ra-ContentionResolutionTimer , ra-ResponseWindow, CB-PreamblesPerSSB and ra-PrioritizationForAccessIdentity should be considerd (per feature) as well.  |
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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 |  |
| Intel | OK with the principle | The question is not very clear whether this refers to the legacy RACH-ConfigCommon or the corresponding feature combination specific RACH-ConfigCommon. We think that if parameter values for feature combination specific RACH-ConfigCommonTwoStepRA is not provided, it will first follow the RACH-ConfigCommon of the same feature combination (if configured), otherwise it will follow the RACH-ConfigCommon of the common RACH in the BWP. |
| Huawei, HiSilicon | Yes | We have the same understanding as Intel. |
| Samsung | Yes |  |
| Qualcomm | Yes | Agree with Intel |
| Xiaomi | Yes |  |
| LGE | Yes | It looks straightforward. |
| CATT | Yes |  |
| Ericsson | Yes |  |
| NEC | Yes  |  |
| vivo | 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”?  |
| Intel | Probably No | We thought most of the PHY parameters are per RACH partition. |
| Huawei, HiSilicon | Yes, except preambleReceivedTargetPower, powerRampingStep and preambleTransMax | preambleReceivedTargetPower, powerRampingStep and preambleTransMax can be RACH partition specific as discussed in Q2. The rest of the parameters mentioned above should be configurable as RACH configuration specific, as ZTE suggests. |
| Qualcomm | No | PHY parameters listed in the question should definitively be configured per PRACH configuration, not feature combination. For MAC parameters, we can discuss on a case by case basis. We are fine with all feature combinations share those MAC parameters listed in the question.  |
| Xiaomi | See comments | Share the same view with Nokia. |
| LGE | Yes, with comments | Similar view with ZTE. We are ok at least for shared RO case. |
| CATT | Yes, except *rsrp-ThresholdSSB-SUL* | In SDT WI, RSRP threshold for carrier selection is specific to SDT. So *rsrp-ThresholdSSB-SUL* should be included in Q2. |
| Ericsson | Yes apart from comments | All parameters related to PRACH slot definition are not all common, but are “RACH config.” Specific. Meaning that each “additional RACH” will have its own set of values regardless of the features (as it is now in the CR)zeroCorrelationZoneConfig: there seems to be an agreement in CovEnh to have it feature-specific. FFSsome power ramping parameters are mentioned in Question 3 as well. Not clear which one are F.C. specific and which ones are commonNot sure about preambleTransMax, if Msg3/MsgA and RACH are tuned to have same success collision probability as legacy, then it can be common. |
| NEC | Yes, partially | We agree with ZTE. For PHY parameters, some (e.g. PreambleReceivedTargetPower, powerRampingStep as listed in Q2) can be per RACH partition. Others can be like that. |
| vivo | Yes | It is intended for the shared RO case. |
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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.  |
| Intel | 2 | Our understanding is that it is agreed to be per BWP for the eligibility criteria for CE/Non-CE as follow: From CE’s perspective, the RSRP threshold for requesting Msg3 repetition can be configured per BWP on both NUL and SULHence it does not need to be in the RACH partition  |
| Huawei, HiSilicon | 2 | We agree with the comment from OPPO/Nokia. That is also why option 1 does not seem appropriate. |
| Samsung | 2 |  |
| Qualcomm | 1 | Some thresholds should be allowed to (e.g. threshold for requesting Msg3 repetition) to depend on feature combinations (e.g. CE + RedCap vs CE + non-RedCap, CE + slicing vs CE alone).  |
| Xiaomi | 2 |  |
| LGE | 2 | For SDT, the RSRP threshold is common to CG-SDT and RA-SDT. Therefore, it should be feature-specific parameter, i.e., no need to configure per partition.For CE, since it is agreed that the RSRP threshold can be configured per BWP in CE perspective, we slightly prefer to configure using feature-specific signaling per BWP. |
| CATT | 2 | We agree with Intel. Option 1 will conflict with the agreements in CE. |
| Ericsson | 1/**2** | Both options are fine but think option 2 aligns better to current agreements in CE |
| NEC | 2 |  |
| vivo | 2 |  |
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## 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.  |
| Intel | No | We believe that we have already discussed this online and the understanding was that existing structure should be used if no critical issue is found. |
| Huawei, HiSilicon | No | We agree the current structure allows to achieve everything that we need.  |
| Samsung | No | Fine with current structure |
| Qualcomm | No | Agree with the companies above |
| Xiaomi | No |  |
| LGE | No | Considering the timeline for Rel-17, we prefer to keep the current signaling framework. |
| CATT | No | The modified signaling structure seems much simpler, but the current structure is sufficient. We prefer to keep the current structure. |
| Ericsson | No |  |
| NEC | No |  |
| vivo | No | We are finw with the existing modeling.  |
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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  |
| Intel | Yes | Agree with ZTE that the existing ASN.1 structure already allowed Case 2, as long as the sharing can be uniquely identified by the network via preamble |
| Huawei, HiSilicon | No | We do not think it is essential to support Case 2, but if it is possible to achieve that without disrupting the signaling too much, then we are OK.What ZTE describes seems to refer to sharing between Rel-17 4-step RA and Rel-17 2-step RA, not between 2-step RA and legacy 4-step RA? |
| Samsung |  | Ok to support, if possible without additional signaling |
| Qualcomm | Yes for part of Case 2 | We think it is useful to support legacy 4-step RA resource sharing the RO with R17 2-step RA partition, to enable fallback. And as ZTE has pointed out, the current signaling structure supports it. We do not see need to support legacy 2-step RA resource shares the RO with R17 4-step RA partition.  |
| Xiaomi | Case1 and partly Case2 | As 2-step RA is optional feature, thus the 2nd part of case2 is improper, otherwise, it seems that UE who can not support 2-step RA can not get the RO configuration of R17 4-step RA partition. |
| LGE | No | For OPPO’s commented case, our understanding is that case can be part of Case 1, since legacy 2-step RA resource shares the R17 2-step RACH partition anyway. Therefore, we also agree to support that case.For ZTE’s explanation, it seems that case that R17 2-step RA shares RO with R17 4-step RA, which is different case from the Case 2. An example of the problematic case (i.e., Case 2) is as follows:* RO 1: Legacy 4-step RACH
* RO 2: Legacy 2-step RACH shares with R17 4-step RACH

In order to support this case, the additional signaling method or duplicated configuration is needed. On the other hand, this case can be corner case. Therefore, we propose not to support this corner case (i.e., Case 2), unless the significant benefit is identified.  |
| CATT | Yes | We think there is no need to limit the configuration. We agree with OPPO that some sharing case between different RA types maybe exist.  |
| Ericsson | Yes | Agree with ZTE |
| NEC | No | We thought much signaling is expected, so no strong motivation to support this. If it is confirmed that this does not cause much additional overhead and majority wants, then we can go with majority. |
| vivo | Yes | In our understanding, the current signaling struct can support this. |
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## 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 |  |
| Intel | Yes |  |
| Huawei, HiSilicon | Yes | Of course, RAN2 can just choose a number, but what the CR rapporteur proposed is at least based on some reasonable rationale, so we are OK to follow it.  |
| Samsung | Yes |  |
| Qualcomm | Yes |  |
| Xiaomi | Yes |  |
| LGE | Yes, with comments | If we understand the intention of this proposal correctly, it should be [nrofSliceGroups+1] \*8. We also want to point out this number is a starting point, i.e., should not be precluded. |
| CATT | Yes |  |
| Ericsson | Yes | [nrofSliceGroups] \* 8 **– 1**Of course we can just set another number based on other considerations. This is the (Rel-17) maximum possible.-1 is to indicate reservation to one common RACH configuration to which a max number of additions are added. 8 is the (current) number of combinations possible per slice.  |
| NEC | Yes | It seems ok |
| vivo | No strong view |  |
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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

 ...,

 [[

 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

 ]],

 [[

 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,

 ...

 }

 ]]

}

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

-- TAG-BWP-UPLINKCOMMON-STOP

-- ASN1STOP

|  |
| --- |
| ***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.**

|  |  |
| --- | --- |
| **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 |
| Intel | We are fine with proposal from the rapporteur  |
| Huawei, HiSilicon | With respect to the comment from ZTE, we could also clarify that the same priority cannot be assigned to more than one feature, which would avoid any ambiguity. For the same reason, we can also make the priority signaling conditionally mandatory, i.e. it is also present in case there is a RACH partition for a certain feature. |
| Samsung | Yes |
| Qualcomm | We are fine with the proposed signaling. |
| Xiaomi | Yes |
| LGE | We need more discussion whether fearturePriorities-r-17 is optional or mandatory. OK for the other part of current signaling structure.  |
| CATT | In general, it is OK to us. According to the online discussion, the priority is per feature. In our understanding, this means all slice groups should have the same priority. But the name of sliceGroupPriority-r17 may cause the confusion that the priority for slicing is per slice group. In order to avoid the confusion, we suggest rewording sliceGroupPriority-r17 to slicingPriority-r17. |
| Ericsson | Not sure if it should be in UplinkCommon - do we expect different priorities in every BWP?Propose to discuss if having this at a top layer IE, SIB1FeaturePriority-r17 should support the case where a feature is mandatory. For example where RedCap is mandatory as highest prio etc.e.g.:FeaturePriority-r17 ::= CHOICE { Priority INTEGER (0..7), Mandatory ENUMERATED (true)} |
| NEC | Yes, we also agree with clarification suggestions from ZTE |
| vivo | Fine with the proposal. |
|  |  |

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):

|  |
| --- |
| 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.**

|  |  |
| --- | --- |
| **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  |
| Intel | Instead of cycling through the feature priority within the feature combination of the RACH partition, we proposed taking the summation of the feature priorities within a feature combination. For example, SDT has priority value of 8 while RedCap has priority 2 and Slicing has priority 3, the aggregated priorities for feature combination SDT+Slicing is 11 while the aggregated priorities for feature combination SDT+RedCap is 10. In this example, the UE should select the feature combination SDT+Slicing.  Text proposal: The 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> derive the summation of the *featurePriorities* of all the features applicable in the identified subset of sets of Random Access resources. 2> select the set of Random Access resources with the highest value 2> If there are still multiple set of Random Access resources with the same highest value, it is left to UE to randomly select one among the identified set of Random Access resources  We are also not sure of the last case (I.e. ‘else (i.e. no set of Random Access resources is available)’). If none of the RACH partition matches the features applicable to the UE, shouldn’t the common RACH in the BWP be used? Intel1:@Huawei: Our example is assuming larger priority values as higher priority. Hence it can be made to work. Take your example* Redcap is highest priority, e.g. priority 7
* Slicing is second priority, e.g. priority 4
* SDT is third priority, e.g. priority 2

In this case Slicing has 5 while RedCap+SDT has 10 and RedCap+SDT will be selected. |
| Huawei, HiSilicon | @OPPO, Intel: the third case of an empty set can happen at least for the second and further iterations when there is no RACH partition for the combination of the UE’s first priority and second priority feature for example. Then the UE should check whether there is a partition containing its first priority and third priority feature and so on. The case of legacy RACH partition selection is already covered by the existing CR and in this case the above procedure is not even triggered.@ZTE: Agree that it should speak of “identified” sets, not “available”, in this case. We have some preference for capturing the procedure as the point was to have consistent UE behaviour.@Intel: The solution with priority summation does not work properly in our opinion, e.g.:* Redcap is highest priority, e.g. priority 0
* Slicing is second priority, e.g. priority 1
* SDT is third priority, e.g. priority 2

In this case Slicing has higher priority than Redcap+SDT, which is incorrect as Redcap access should get highest priority even together with SDT. |
| Samsung | Ok to capture in MAC but we should avoid over specifying  |
| Qualcomm | If we understood the TP correctly, it seems that the fallback case is not covered by the above TP. Because featurePriorities include only R17 features, it is possible that UE has stepped through all R17 features but no appropriate RACH partition can be identified. Then UE should perform random access over legacy RACH resource. We think the two paragraphs which start with “repeat the procedure taking…” probably can be made more precise. Other than the above two comments, we can accept the rest of the TP as a baseline.  |
| Xiaomi | Fine to consider it as baseline and agree with ZTE’s rewording to use “identified”. |
| LGE | Instead of introducing the iteration on the partition selection procedure, we propose the selection procedure of the RACH partition based on the highest feature priority associated with the available sets of RA resource. When there are multiple sets of RA resource with highest feature priority, UE may select one of the partition by UE implementation (i.e., UE only considers the highest priority to select the RACH partition). For example, when the RA is for F1 + F2 + F3, and the feature priority is F1>F2>F3,* Case 1: When there is one RA resource for F1 and another RA resource for F2, UE selects the RA resource for F1
* Case 2: When there is one RA resource for F2 and another RA resource for F3, UE selects the RA resource for F3
* Case 3: When there is one RA resource for F1+F2 and another RA resource for F1+F3, UE may select any of them.

Then, the selection procedure would be much simpler.Our text proposal is: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> determine the RA resource priority of a set of Random Access resources based on the highest feature priority assigned in *featurePriorities* among the priorities of the features associated with the set of Random Access resources; 3> select a set of Random Access resources having the highest RA resource priority among the available sets of Random Access resources.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~~(…) |
| CATT | We are fine with the TP. The description of the details maybe need some simplification. |
| Ericsson | The procedure should include the case where a feature may be mandatory. E.g.: a RedCap UE should always the Msg1 indication if gNB configures so, but Small Data may be used or not used without major impact (just loss in efficiency)There should be also a behaviour in case the UE cannot select any partition at the end of the procedure (e.g.: procedure failed)An example assuming that the UE initially wants to select RedCap+CovEnh+SliceX but only the Common and RedCap partitions are configured with the following priorities configured:* RedCap = Mandatory
* CovEnh = High
* Slicing = Medium
* SDT = Low

 |
| vivo | Fine with the proposal. |
|  |  |

# 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