**3GPP TSG-RAN2 Meeting #117- e R2-22xxxxx**

**e-Meeting, xxx, 2022**

**Source: email discussion Rapporteur (ZTE Corporation)**

**Title: UP open issues list for common RACH (email: [POST116bis-e][514])**

**Agenda item:** **xxx**

**Document for:** **Discussion and Decision**

# Introduction

This document contains summary of open issues and proposed resolutions for UP aspects of Common RACH partitioning:

* [POST116bis-e][514][RA Part] UP open issues (ZTE)

Scope:

- List of critical open issues to be resolved for WI completion

- Updated CR 38.321 for information and review

NOTE: NO contributions on these critical open issues are expected

Deadline:

- Open issues list Jan. 28th

- Company inputs Feb. 15th

Proposed format for comments is as below:

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| # | Description | Criticality(Essential / Optional / Enhancement)  | Company comments/PreferenceCompanies can use company ID and enter comment (see example) | Proposed resolution (to be updated by Rapporteur) |
| Zxxx | XXX is missing/wrong/open etc | Essential | ZTE: We think this is not neededXXX: We agree with YYY etc | Rapp: Will be implemented in the next revision |

# Discussion

## Procedural open issues

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| # | Description | Criticality(Essential / Optional / Enhancement)  | Company comments/Preference | Proposed resolution (to be updated by Rapporteur) |
| Z001 | Align the parameter names between MAC and RRC specs | Essential |  | Rapp: To be done before/during next meeting (after the RRC CR is stable) |
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## UP/MAC open issues

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| # | Description | Criticality(Essential / Optional / Enhancement)  | Company comments/Preference | Proposed resolution (to be updated by Rapporteur) |
| Z002 | What is the order of carrier selection and RACH partition selectionOptions: 1. Carrier selection happens before RACH partition selection
2. RACH partition selection happens before carrier selection
 | Essential | [Huawei]: We support Option 2 for several reasons:* it is aligned with legacy RACH procedure where carrier selection threshold is included in RACH configuration
* if carrier selection is happening before RACH partition selection, then it is impossible to have feature (combination) specific carrier selection threshold which was agreed for SDT for example and can be useful for other features as well (e.g. CE)
* Option 1 will become very complex when considering feature combination specific carrier selection thresholds and would diverge from legacy RACH procedure too much

OPPO:The issues for option1 could be:the SDT specific threshold i.e. sdt-RSRP-ThresholdSSB-SUL need be reverted i.e. legacy threshold should be followedThe issues for option2 could be:for CE it is not feasible to judge whether a CE based RACH is triggered or not because the RSRP threshold i.e. rsrp-Threshold-Msg3Rep is different between SUL and NUL assuming RAN2 still take CE as a featureOPPO’s prefer option 1. solution of the potential issue: the threshold for carrier selection for SDT follows legacy RSRP threshold. In addition sdt-RSRP-Threshold can be configured differently between SUL and NUL. Note such change may have impact on CG-SDT also. But we can leave this to SDT WID’s discussion. In current MAC running CR R2-2202041, carrier selection for both RA-SDT and CG-SDT is captured there, which need be updated anyway since the carrier selection for RA-SDT suppose to be covered in common MAC CR.ZTE: We do have some sympathy with Huawei comments. If companies agree to undo the previous agreement that CE is treated as a feature, then we think we can proceed as proposed by Huawei. In this case, CE resources will be treated like RACH type (i.e.) – each partition can have both CE and non-CE resources (i.e. similar to a partition having 2-step and/or 4-step RA resources). Then the UE can switch between CE and non-CE without switching between RACH partitions. Having said this, companies seem not willing to go this way in the previous meeting. So, we analyse the current situation below and propose how to make this work(without reverting the previous agreements). So, if we go with CE as a feature, then we think we can perform carrier selection first (i.e. option 1). * This means the carrier selection threshold is common to all BWPs (and all features and feature combinations). This is aligned with leagacy behaviour because even legacy case, the carrier selection threshold is configured common to all BWPs- see the RRC text below

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| ***rsrp-ThresholdSSB-SUL***The UE selects SUL carrier to perform random access based on this threshold (see TS 38.321 [3], clause 5.1.1). The value applies to all the BWPs. |

* The CE/non-CE selection threshold can then be configured per BWP (as agreed in the CE session) – again see the above picture.
* Now the only exception is with RA-SDT. However, we propose to handle SDT in such a way that the carrier selected verified in MAC upfront. i.e. in case of SDT, the assumption is that RA-SDT can only be triggerd if there is an available RACH partition. This can be captured in SDT MAC CR.

Then the overall procedure could look like below: 1. RRC will trigger RACH and indicate whether SDT/REDCAP/Slice is applicable
	1. If RRC indicates SDT, then it shall be ensured that there is an available RACH partition that supports SDT – this should be captured within SDT MAC CR.
2. If carrier is not indicated by RRC, MAC will select the carrier
	1. The carrier selection threshold is common to all BWPs. So, there is no issue with this step.
3. MAC will perform BWP selection
4. MAC will determine if CE is applicable
	1. The CE selection threshold is per BWP. So, once the BWP is selected UE can determine the CE/non-CE. So, again there is no issue.
5. MAC shall select the RACH partition

Based on the above framework, we propose the following procedure (in the order of the steps below): **Proposal 1: Carrier selection threshold is common to all BWPs****Proposal 2: The CE/non-CE selection threshold can then be configured per BWP (as agreed in the CE session)****Proposal 3: The overall procedure should be as follows*** **Carrier selection happens before RACH partition selection**
* **RRC will trigger RACH and indicate whether SDT/REDCAP/Slice is applicable**
* **If SDT is applicable, MAC would have checked already that the correct RACH partition is available**
* **If carrier is not indicated by RRC, MAC will select the carrier (this is same as legacy)**
* **MAC will perform BWP selection (this is also legacy behaviour)**
* **MAC will determine CE applicability after BWP is selected**
* **Finally, MAC will select the RACH partition**

[Intel] Thanks ZTE for the proposals on Option 1. We also have the same general understanding of the proposal. In RA-SDT, our understanding is that the SDT specific threshold i.e. sdt-RSRP-ThresholdSSB-SUL is agreed. Is this to be reverted in Proposal 1? We thought it can still be used if SDT is applicable. [Samsung]: Ok with proposal 1 and proposal 2 from ZTE. For proposal 3, in our view, for the case where carrier selection threshold is specific to RA partition e.g. SDT, RRC can indicate feature and selected carrier. For the case where carrier selection threshold is not specific to RA partition, RRC simply indicates feature applicable to RA procedure and not the carrier.[vivo]:We prefer option 1 for all feature. In fact, it has already confirmed for each separate feature.[Apple] Support Option1. For the feature specific carrier threshold, if RRC can identify the feature in-advance, RRC can indicate the feature or the feature specific threshold to MAC for carrier selection.Xiaomi: We prefer option 1 and share the same view with OPPO. If the RACH partition selection is performed before carrier selection, it is impossible to judge whether the CE can be triggered as the rsrp-Threshold-Msg3Rep is agreed to be configured per carrier.  |  |
| Z003 | If RACH partition selection is performed after carrier selection, how to configure separate carrier selection threshold for CE and SDT etc? (e.g. should we undo these agreements or should we design something else?) | Essential | [Huawei]: It would be possible to make carrier selection as part of feature combination selection, but we find it complex and we think we should not do carrier selection before RACH partition selection**.** We are not OK to undo the previous agreements.OPPO:In 116bis meeting , it is agreed that carrier selection for CE follow legacy threshold, so only agreement for SDT need be revertedZTE: We agree with Oppo that SDT needs some discussion, but for SDT, we can follow the above procedure. i.e. MAC will indicate to RRC that RA-SDT can be initiated only if there is RA-SDT resource (this is aligned with SDT agreement that carrier selection is made before CG and RA SDT selection is performed). The carrier selection threshold should be common for CE and non-CE (as already agreed in CE session. So, there is no issue for CE). [Intel] In this case and assuming that at least 2 features have different thresholds configured, UE shall always use the most stringent threshold. Currently, we think there is only SDT with a separate carrier selection threshold; therefore at most UE would need to choose between SDT specific threshold or legacy one when applicable[Samsung]: See comments to Z002[Apple]: If RRC can idenetify the feature in advance and indicate it to MAC when triggering the RACH, the separate carrier selection threshold can be used.Xiaomi: If RACH partition selection is agreed to be performed after carrier selection, the carrier threshold will be common for all RACH partitions. And currently, all features except SDT agreed to follow legacy threshold, thus only the agreements for SDT needs to be reverted to get aligned. |  |
| Z004 | How to capture RECAP BWP selection? Options: * In REDCAP CR
* In Common RACH CR
 | Essential | [Huawei]: This should be handled by Redcap CR as the Redcap specific BWP will be specified in Redcap CRs as well.OPPO:It is already captured in R2-2201890 and we think it should be fine.ZTE: It can be captured in REDCAP CR. [Intel] Like others, our understanding is that this is already being discussed in RedCap.[Samsung]: Redcap CR[vivo]: As the RedCap MAC CR rapporteur, we would like to confirm that it has been already captured in R2-2201890.[Apple]: Fine to capture it in the Redcap CR.Xiaomi: In REDCAP CR. |  |
| Z005 | Can the rsrp-Threshold-Msg3Rep and RSRP threshold for SSB selection for CE be configured differently in different RACH partitions? If so, how to select the correct value (before selecting the RACH partition)?  | Essential | [Huawei]: RAN2 made the following agreement which required further checking:CE will also be considered as part of the feature combination for each RACH partition. The eligibility criteria for CE will be determined before the RACH partition selection is performed. [CB need to confirm that it is compatible with the CE agreementsWe have a preference to have a common framework for all features, but this should not be at the expense of feature performance and by undoing the decisions from WI discussions. We think we should respect the decisions from CE session which were done after long technical discussions and not just undo the agreements, because of arbitrary decisions in RA part AI. Based on this, we think the above agreement is not compatible with CE agreements as it is not possible to have carrier specific CE threshold in case CE is treated as part of feature combination. Furthermore, as clarified in Z009, having CE as part of feature combination can violate another agreement from CE, i.e. that the fallback from CFRA to CE RACH is not supported. We then believe CE should not be part of feature combination, but should be optionally configured within RACH partition for a specific feature combination.Not necessary. UE should know that CE is one the feature to trigger RACH and then to find a RACH partition, but not the another way around.ZTE: If we stick with our agreements, the CE is treated as a feature. So, the rsrp-Threshold-Msg3Rep shall be configured per BWP – see Proposal 2 above. Then, RSRP threshold for SSB selection for CE can be configured per RACH partition. So, this threshold will be configured in a CE specific way only in the RACH partitions that support CE. [Intel] According to the CE’s agreement, 1. From CE’s perspective, the RSRP threshold for requesting Msg3 repetition can be configured per BWP on both NUL and SUL.
2. From CE’s perspective, CE RACH can be configured with a separate RSRP threshold for SSB selection and this threshold can be configured per BWP.

With the above agreements, our understanding is that the rsrp-Threshold-Msg3Rep and RSRP threshold for SSB selection for CE are the same in all the RACH partition within the BWP[Samsung]: Same view as ZTE[vivo]: Same view as ZTE.[Apple]: Same understanding as Intel. Xiaomi: Same view as ZTE. |  |
| Z006 | How to refer to the “legacy RACH partition”? Can we use the name of some RRC IE etc? | Essential | [Huawei]: We think we should refer to RRC parameter name. OPPO:One solution is to introduce a variant to record featureCombination as proposed also in answer to Z009. The RACH partition selection procedure in the running CR will result in two cases:Case 1: if a valid featureCombination is recorded , then a corresponding RACH partition is selected; elseCase 2: legacy RACH partition is selectedNote this variant could aLso help fallback procedure. if partition specific 2-step RACH procedure can fall to 4-step RACH of the same partition or common 4-step RACH, the this variant can be used differentiate between these two procedures[ZTE] In the latest RRC CR, the legacy IEs will also be used for providing RACH resources for features (in case of shared RO). So, it seems we cannot refer to IE names anymore. So, we propose to refer to use some different name. The rapporteur can select a sutiable name. [Apple] We can refer to the legacy RRC parameter IE. And we prefer to use the separate RACH partition for the shared RO case, and not to use the legacy configuration for the other feature specific RACH partition. Xiaomi: Firstly, in our understanding, the “legacy RACH partitions” also make confusion as it includes CFRA partitions and CBRA partitions, thus we’d like to remove it and if there is no feature specific RACH partitions is avaible, UE just continue to perform current procedure (i.e. legacy RACH procedure). | Propose to finalise this after the RRC structure is finalized.  |
| Z007 | Is RACH partitioning applicable in dedicated BWP (i.e. RRC\_CONNECTED)? | Essential | [Huawei]: At least Redcap and CE indication are applicable to RRC Connected state, so we think it should be supported. OPPO:SDT: noRedcap: maybe e.g. due to reception of msg2CE: yesslicing: noZTE: Since the UE in RRC\_CONNECTED mode the network should know the feature combination applicable. So, the dedicated BWP should have the corresponding RACH resources available for the applicable feature combination. If CE is applicable to the UE, it can be assumed that the network would configure CE resources on the dedicated BWP. So, this can be supported without any changes to the MAC CR. [Intel] Yes as we understand that RRC Connected mode is supported for CE and REDCAP~~?~~  [Samsung]: No for RAN slicing (We do not prefer slice based RACH in RRC\_CONNECTED. Anyhow this discussion is pending on RAN slicing WI) and SDT[vivo]Yes for RedCap (i.e. applicable for the separate initial BWP)No for SDT and RAN slicing. For CovEnh, wait for RAN1 input. [Apple] Yes for RedCap.Xiaomi: Same view with ZTE. |  |
| Z008 | Is RACH partitioning applicable to CFRA? | Essential | [Huawei]: If the question is whether to have separate CFRA preambles/ROs assigned for different feature combinations, then we believe this is not needed. However, interworking of CFRA and CBRA with RACH partitioning has to be considered, please see our reply to Z009 below.OPPO:The question is rather puzzling since RACH partition is selected based on triggered feature/feature combination while dedicated RACH resource is signaled by network for CFRA. Or the intention is to ask whether RACH partition specific parameter e.g. power control parameter is still applicable? Anyway no CFRA for SDT and slicing for sure.Redcap/CE: not clearZTE: We agree with Huawei that for CFRA itself, there is no need for RACH partition selection (since the preambles are dedicated). However, when the UE fallsback to CBRA, RP selection needs to be performed. Once RP is selected, the UE shall stick with the same RACH variables. However, the RACH variables are initialized right at the beginning (i.e. when CFRA is initiated). So, we propose that the corresponding RACH partition for CBRA shall be selected first and all RACH variables are initialized before CFRA is used. This needs further checking. [Intel] No as the network can provide dedicated preamble [Samsung] No[vivo]: it is not needed. [Apple] NoXiaomi: No. |  |
| Z009 | Is RACH partitioning applicable when CFRA fallsback to CBRA? How does the overall procedure look like in this case? | Essential | [Huawei] For CFRA, the UE needs to know rsrp-ThresholdSSB which is configured via RACH-ConfigCommon. Hence, for the UE to know which rsrp-ThresholdSSB to use, the UE needs to select RACH partition first, i.e. before doing CFRA. Furthemore, it was agreed in CE session that the fallback from CFRA to CE RACH is not supported, so we need to consider this somehow. Hence, the simplest would be to have the following procedure:1. Not to treat CE as part of feature combination as calrified in Z005.
2. UE performs RACH partition selection at the beginning of RACH procedure, no matter it performs CFRA or CBRA (as captured in the current MAC running CR). The UE uses rsrp-ThresholdSSB from the selected RACH partition.
3. When UE falls back from CFRA to CBRA, UE can directly move to select SSBs according to the corresponding threshold configured in the previously selected RACH partition and proceed to select RO and preamble as in legacy.

This way we minimize the impact on RACH procedure.OPPO: If issue in Z008 is confirmed, then the answer is yes. We think another variant to record featureCombination-r17 is needed. Once CFRA is triggered UE can record what is potential featureCombination:Redcap or CE or Redcap+CEIn case CFRA fallsback to CBRA, RACH partition can be selected again based on recorded featureCombination.ZTE: We generally agree with the comment from Huawei above that even if CFRA is initiated, the corresponding RACH partition (for CBRA purpose) should be selected at the beginning. Then, once this partition is selected, this can be kept the same for the rest of the procedure. vivo: It seems this issue is only related to RedCap. And then the RedCap UE anyway select the feature before choosing CFRA or CBRA. Naturally, the legacy principle can be reused. Apple: CFRA for CE feature is still FFS. For RedCap CFRA, if the condition is not fulfilled to trigger the CFRA, UE can start the CBRA from the beginning as the general RACH partition framework.Xiaomi: Agree with HW and ZTE that RACH partitions is performed before doing CFRA or CBRA, and once the RACH partitions is selected, the same RACH resource shall be used until RACH failure happens. |  |
| Z010 | Can we assume that there is default RACH resource without feature combination in REDCAP initial BWP, which is similar as the legacy RACH resource on legacy initial BWP and can be selected if there is no available RACH partition can be selected on the REDCAP initial BWP? (otherwise we may need to specify some BWP switching procedure for this case) | Essential | [Huawei]: We agree with the handling suggested in the issue description, i.e. in RedCap specific BWP there is always RACH partition which is applicable to RedCap (i.e. without combination with other features), similar as “legacy” RACH partition in non-Redcap initial BWP.OPPO: It is captured in R2-2201885 that “If a RedCap-specific initial UL BWP is configured, RedCap UEs in RRC\_IDLE and RRC\_INACTIVE shall use only the RedCap-specific initial UL BWP to perform RACH”If a UE access the network via Redcap-specific initial U BWP, then it must be a Redcap UE i.e. at least RACH partition for Redcap should be there.ZTE: Yes, we agree with this assumption. [Intel] Yes.[Samsung] Yes[vivo] Yes, this separate BWP is used for initial access. So, anyway, there will be RACH resources. [Apple] Yes.Xiaomi: Yes. |  |
| Z011 | Do we need to handle the issue of RNTI collision? I.e. which option is preferred?Option 1: Do nothing (i.e. leave to network implementation)Option 2: the network should be able to (optionally) configure a specific search space for RAR/MSGB monitoring per RACH resource partitionOption 3: A custom offset, signalled through RRC and associated to each PRACH configuration, is added in the formula for RA-RNTI and/or MSGB-RNTI. The legacy PRACH configuration it is assumed to have offset = 0. | Optimisation  | [Huawei] We think this is essential to address this issue. With all the RACH partitions that we may now have, it is impossible for the network to deal with this by implementation and a solution is needed if RACH efficiency is to be kept. We propose not to rediscuss other solution, but focus on Option 2, which is simple and straightforward.[Rapp] Agree with the comment above. But since option 1 seems to be on the table still, it seems it is an optimisation (at least according to some companies). So, marked it as optimisaiton for now. OPPO: up to network’s implementation. The additional search space for SDT has nothing to do with RACH procedure.[Sony] We think it is very important and essesntial to be addressed the issue in this release. Then between Option 2 and 3, we think Option 2 does not solve the issue because it allows as many search spaces as the number of partitions which may be impractical due to limited CORESET0 resource/space. It should be noted that search spaces have monitoring periodicity and offset, so if a lot of search spaces are allowed in the associated CORESET0, the search spaces will overlap, and this overlap may cause RNTI collisions as well as making difficult for the gNB to achieve scheduling flexibility. So before agreeing this solution, RAN1 must be consulted to check if it is visible.Option 3 just provides configurable offset(s) to either *s\_id* or *t\_id* or both, and it can easily be added in the PRACH configuration parameters, hence Option 3 does not need a separate search space for each partition. The specification is also in RAN2 domain and RAN1 does not need to be involved. We prefer a simple solution of Option 3.ZTE: We agree with Huawei and support option 2. Nothing else is needed (we don’t have time). How this is specified can be up to the RRC rapporteur (it should be noted that the RACH partitions are configured in the UL BWP, but the search space is configured in the DL BWP. So, somehow, we need some pointer to the search space from the UL BWP or some implicit mapping). This can be discussed as part of the RRC CR. [Intel] If majority of companies want to discuss solutions other than Option 1, we also prefer to focus on Option 2. [Samsung]: Option 2[vivo]: Option 1/2. Option 2 can only be used for SDT as agreed. [Apple]: With numbers of RACH partitioning configuration introduced, we donot think NW implementation can resolve the issue. We prefer Option 3 since it’s much simpler and flexible. If majority view is Option2, it’s also acceptable to us.Xiaomi: We agree with Huawei and prefer to adopt option2.  |  |
| Q001 | What is the rule for UE to select BWP when RACH is triggered in a dedicated BWP? E.g. UE performs RACH in the current BWP as long as it is eligible to use at least one RACH partition configured in that BWP or something else? | Essential | [Rapp] see also Z007[Huawei]: We agree with the suggestion as in the description of the issue, which is a similar rules as for RACH partition selection in RRC IDLE/INACTIVE. I.e. UE stays in the active BWP as long as there is an eligible RACH partition and otherwise it switches to the initial BWP.OPPO: BWP treatment for Redcap is already captured in WID specific running CR. So the issue is only about CE for CBRA. We think network should help to configure proper RACH resource to enable CE in concerned BWP. So no further optimization is necessary. Note initial BWP should be allowed not to configure one particular RACH partition.ZTE: We also agree and it seems the current MAC spec is aligned with this. i.e. no changes are needed. [Intel] Agree with the others that the MAC spec is already aligned to this (i.e. stays in active BWP if RACH exists otherwise switch to initial BWP)[Samsung]: If active BWP is configured with any RACH configuration (ROs), UE does not switch i.e. same as legacy[vivo] Agree with ZTE and Samsung.[Apple] Current spec description is fine.Xiaomi: We also agree with the suggestion which is aligned with current MAC spec. |  |
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| H001 | The RSRP threshold for selecting CE or non-CE can be configured differently on NUL and SUL. If RACH partition is selected before carrier selection, which threshold should UE use to perform CE/ non-CE selection? | Essential | [Huawei]: The current agreement to treat CE as part of feature combination brings issues to CE design. We can either revert this decision or the overall design will actually get more complicated instead of being less complicated (e.g. if we start treating carrier as part of feature combination as well). This is especially true if we would also decide to perform carrier selection before RACH partition selection – in this case it would be impossible to have even feature specific carrier selection threshold.OPPO: please refer to answer to Z005ZTE: We propose to perform carrier selection first (which is the majority view). In this case there seems to be no problem – please see Z002. [Intel] Please see our comment to Z002 and Z005. Xiaomi: There is no issue as we prefer to perform carrier selection first. |  |

# Conclusion and proposals

# References

1. R2-2201664, Report for Rel-17 Small data, URLLC/IIoT and RACH partitioning

# Annex (contact details for email discussions)

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