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

**E-Meeting, 21st February – 3rd March 2022**

**Agenda Item:** **8.18.2**

**Source:**  **Intel Corporation**

**Title:** **Report of [AT117-e][506]** **[RA Part] UP additional open issues (Intel)**

**Document for:** **Discussion/Decision**

# Introduction

This document aims to summarize all the papers that have been submitted to agenda item 8.18.2 of RAN2#117-e and handle the offline discussion below:

* [AT117-e][506][RA Part] UP additional open issues (Intel)

Remaining UP open issues

Deadline: W1 Thursday Feb 24 1200 UTC

# Companies’ point of contact

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| --- | --- | --- |
| **Company** | **Point of contact** | **Email address** |
| Intel Corporation | Seau Sian Lim | seau.s.lim@intel.com |
| Qualcomm | Linhai He | linhaihe@qti.qualcomm.com |
| OPPO | ZhongdaDu | duzhongda@oppo.com |
| Sony | Yassin Awad | Yassin.Awad@sony.com |
| Xiaomi | Xiaofei Liu | liuxiaofei@xiaomi.com |
| Nokia | Samuli Turtinen | samuli.turtinen@nokia.com |
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# Identification of additional issues

The following table identified the additional issues that are not covered by the open issue list

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| Tdoc number | Proposals | Rapporteur’s view |
| R2-2203206(Sony) [3] | **Observation 1:** If a separate search space for each RACH resource partition is allowed, there will be as many search spaces as the number of partitions, and therefore the search spaces will overlap, and this overlap may cause RNTI collisions as well as making difficult for the gNB to achieve scheduling flexibility. Hence, RAN1 must be consulted.**Observation 2:** If a configurable offset is allowed for each RACH resource partition, it can be easily added in the PRACH configuration parameters and there is no RAN1 impact (i.e., only RAN2 can decide it).**Proposal 1: Simply introduce RRC configurable offsets for the symbol index (*s\_id*) and the slot index (*t\_id*) in the legacy RNTI equation as a part of PRACH resource configuration for each separate partition. The legacy PRACH resource configuration should assume an offset = 0 for *s\_id* and *t\_id*.** | P1 is discussed in OI Z011 [Post116bis-e][514] (Proposal 11) |
| R2-2203459(Interdigital) [8] | **Proposal 1**:        Carrier selection happens before RACH partition/resource selection, as in legacy.**Proposal 2**:        If the agreement on having an SDT specific carrier threshold is kept: * RRC can indicate to UE MAC whether SDT is involved in the initiated RACH prior to carrier selection
* MAC applies the SDT specific carrier selection threshold if RRC indicates that SDT is involved.
* MAC selects the carrier according to the measured RSRP and the selected threshold, per legacy

**Proposal 3**:        BWP selection precedes PRACH partition selection, as in legacy.**Proposal 4**:        the UE does not fallback to 4-step common RACH after selecting 2-step RA on a certain PRACH partition.**Proposal 5**:        Legacy fallback from 2-step to 4-step RA are triggered (e.g. based on reception of a RAR or after N 2-step attempts) is performed in the same feature partition.**Proposal 6**:        Network can optionally configure an RA-RNTI offset associated with a PRACH configuration. If configured, the offset is added in the formula for RA-RNTI/MsgB-RNTI for a preamble selected from that PRACH configuration. | P1 is being discussed in Z002 [Post116bis-e][514] (Proposal 1)P2 is also related and discussed in Z002 [Post116bis-e][514] (Proposal 2)P3 is also related and discussed in Z002 [Post116bis-e][514] (Proposal 4)Fallback mechanism issueP6 is discussed in OI Z011 [Post116bis-e][514] (Proposal 11) |
| R2-2203340 (Huawei) [7] | **Proposal 1: UE can be configured to switch from 2-step feature (combination) specific RA to 4-step feature (combination) specific RA of the same feature (combination).****Proposal 2: Fallback from 2-step feature (combination) specific RACH to 4-step common RACH is not supported.****Proposal 3: RAN2 to discuss whether it is MAC layer or RRC layer to perform the feature/feature combination selection.****Proposal 4: To avoid that SDT procedure is initiated while the feature/feature combination does not include SDT, RAN2 should consider updating the SDT CRs according to one of the following options:*** **Option 1: SDT is only initiated when the selected feature/feature combination includes SDT;**
* **Option 2: MAC layer indicates to RRC layer that SDT procedure should be cancelled when the selected feature/feature combination does not include SDT.**
 | Fallback mechanism issueP3 and P4 are related to Z002 [Post116bis-e][514] (Proposal 4) |
| R2-2203283 [4](Nokia) | **Observation 1: Network can provide RACH partition for certain features and/or feature combinations in a cell but not necessarily all.****Observation 2: The UE may need to select between RACH partitions that don’t match for the feature combination that triggered the service request/RA procedure but matches to subset of the features.****Proposal 1: NW signals priority order of the features with RACH partition configured in SIB.****Proposal 2: UE selects the RACH partition based on the highest priority feature of the feature set used for current RA procedure and available and available in a certain RACH partition.****Observation 3: The number of required RACH partitions in the cell is preferably minimized.****Proposal 3: SDT can be configured to use common RACH resources in which case Msg3 is used to indicate the SDT procedure to the network.****Proposal 4: When one RO provides preambles for multiple RACH partitions, it shall be possible to selectively apply backoff for specific RACH partition(s).** | P1 and P2 are discussed in OI10 [Post116bis-e][515] (Proposal 8 and 9)P3 SDT indication issueP4: Backoff issue |
| R2-2202976 [2](Oppo) | **Propsosal1: fall back from 2-step partition specific RACH to 4-step common RACH procedure is not allowed for feature combination including either CE or Redcap or SDT****Proposal1a: fall back from 2-step partition specific RACH to 4-step common RACH is allowed for Slicing****Proposal2: To introduce new RACH variable to record feature combination to enable above cases.** | Fallback mechanism issue |
| R2-2202694 [1](CATT) | **Proposal: As legacy, the UE can be configured the fallback from 2-step feature/feature combination specific RACH to 4-step feature/ feature combination specific RACH except for CE.**  | Fallback mechanism issue |

Based on the above analysis, the following issues will be discussed here (as remaining are covered by [Post116bis-e][514] and [515]):

* Issue#1: Fallback mechanism from 2-step RACH to Msg1 of 4-step RACH
* Issue#2: Selective Backoff in RO shared by multiple RACH partition
* Issue#3: Msg3 indication for SDT

The other issues are related to the open issues already being discussed in [6] and [9].

# Issue#1: Fallback from 2-step RACH to 4-step RACH

The proposals are listed below:

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| --- | --- |
| Tdoc number | Proposals |
| R2-2203459(Interdigital) [8] | **Proposal 4**:        the UE does not fallback to 4-step common RACH after selecting 2-step RA on a certain PRACH partition.**Proposal 5**:        Legacy fallback from 2-step to 4-step RA are triggered (e.g. based on reception of a RAR or after N 2-step attempts) is performed in the same feature partition |
| R2-2203340 (Huawei) [7] | **Proposal 1: UE can be configured to switch from 2-step feature (combination) specific RA to 4-step feature (combination) specific RA of the same feature (combination).****Proposal 2: Fallback from 2-step feature (combination) specific RACH to 4-step common RACH is not supported.** |
| R2-2202976 [2](Oppo) | **Propsosal1: fall back from 2-step partition specific RACH to 4-step common RACH procedure is not allowed for feature combination including either CE or Redcap or SDT****Proposal1a: fall back from 2-step partition specific RACH to 4-step common RACH is allowed for Slicing****Proposal2: To introduce new RACH variable to record feature combination to enable above cases.** |
| R2-2202694 [1](CATT) | **Proposal: As legacy, the UE can be configured the fallback from 2-step feature/feature combination specific RACH to 4-step feature/ feature combination specific RACH except for CE.**  |

As mentioned in the contributions, it is agreed in common RACH that in general all RACH retransmissions shall be performed over the same RACH resources and the same carrier as the one selected for initial RACH resource until RACH failure happens.

|  |
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| 6. As a baseline, the RA procedure design for Rel-17 should adhere to the following general principles: c: As a general rule, all RACH retransmissions (if any are needed, until RACH failure happens) shall be performed over the same RACH resources (and same carrier – NUL/SUL) as the one selected for initial RACH resource. However, we can discuss fallback on a case by case basis if there is a strong motivation and discuss them together in this AI. |

However, there are still FFS on whether to support fallback from 2-step slice specific RACH to 4-step common RACH, if 4-step slice specific RACH is not configured. Even though the FFS is on slicing, it is more a general case whether this is to be supported.

For slicing, unified partitioning framework should take priority

FFS for next meeting – whether RAN2 confirms the following agreements/assumption made in the Slicing WI regarding fallback for slice-specific 2-step RACH

=> The agreement 9 needs to be aligned to common framework where the UE falls back (switching) to the same RA type it has initially selected and we will update the wording next meeting

6  For RACH type selection, UE first selects between slice-specific and common RACH, then selects between 2-step and 4-step.

**9  The following fallback case is supported?:**

**–** **Fallback case 2: Fallback from 2-step slice specific RACH to 4-step common RACH, if 4-step slice specific RACH is not configured.**

10 The following fallback cases are not supported in this release:

– Fallback case 1: Fallback from 4-step slice specific RACH to 4-step common RACH

– Fallback case 3: Fallback from 2-step slice specific RACH to 2-step common RACH, if neither 4-step slice specific RACH nor 4-step common RACH is configured

Based on the proposals in the contribution, the following proposal seem to be common among the contributions:

**Proposal 1: UE can be configured to switch from 2-step feature (combination) specific RA to 4-step feature (combination) specific RA (if configured) of the same feature (combination) after N 2-step feature (combination) specific RA attempts (like in legacy fallback from common 2-step RACH to common 4-step RACH after** *msgA-TransMax* **common 2-step RACH attempts).**

**4-1. Do companies agree to the above proposal?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| Intel | Yes | It is already implied by the baseline:6. As a baseline, the RA procedure design for Rel-17 should adhere to the following general principles: c: As a general rule, all RACH retransmissions (if any are needed, until RACH failure happens) shall be performed over the same RACH resources (and same carrier – NUL/SUL) as the one selected for initial RACH resource. However, we can discuss fallback on a case by case basis if there is a strong motivation and discuss them together in this AI. |
| Qualcomm | Yes | It helps keep UE behavior simple and is not hard for network to configure.  |
| OPPO | Yes |  |
| Sony | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes | Since there is no RACH partition change in this case, there is no issue with this switching. No changes needed to running CR as pointed out by others.  |
| Nokia | Yes | The legacy behaviour should already allow this. |

As on whether to support fallback from 2-step feature (combination) specific RACH to common 4-step RACH after N 2-step attempts, if 4-step feature (combination) specific RACH is not configured, [7] and [8] think that it should not be supported, while [2] generally think so except for slicing. The reason for not supporting it is that it does not conform to what we agreed in common session and it may not work for some features such as SDT due to TB rebuilding, RedCap and CE. Unless such fallback is only allowed for slicing on its own, it would be good to follow an uniform approach as with the proposal below:

 **Proposal 2: Fallback from 2-step feature (combination) specific RA to 4-step common RA (I.e. if 4-step feature (combination) specific RA of the same feature (combination) is not configured) after N 2-step feature (combination) specific attempts (like in legacy fallback from common 2-step RACH to common 4-step RACH after** *msgA-TransMax* **common 2-step RACH attempts) is not supported.**

**4-2. Do companies agree to the above proposal?**

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| **Companies** | **Yes/No** | **Comments** |
| Intel | Yes |  |
| Qualcomm | Yes |  |
| OPPO | No | The main intention to differentiate slice group via msg1 or msgA is for access control. In case 2-step RACH is triggered but failed and it is not allowed to fallback to common 4-step RACH, it means the RACH will stop immediately. If this associated slice will be originally accommodated by network it means UE loss the chance from beginning. |
| Sony | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes | i.e. this should NOT be supported (just highlighted NOT above to avoid confusion).  |
| Nokia | Yes |  |

# Issue#2: Selective Backoff in RO shared by multiple RACH partition

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| R2-2203283 [4](Nokia) | **Proposal 4: When one RO provides preambles for multiple RACH partitions, it shall be possible to selectively apply backoff for specific RACH partition(s).** |

[4] think that multiple RACH partitions sharing the same RO may encounter congestion, but there is no means for the network to selectively indicate the RACH partition to perform the backoff.

**5-1. Companies are invited to provide their views whether the proposal should be addressed in Rel-17? If so, please provide the reason.**

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| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| Intel | No | This seems like an optimisation and would require more discussion as it requires changes to the MAC specification to provide such indication. |
| Qualcomm | No | As far as we can see, the only obvious use case for such differentiated backoff is slicing. But slicing already has prioritization enhancements which allows network to apply different backoff for slicing groups with different priorities. So we don’t think any additional enhancement is necessary at level of RACH partitions. |
| OPPO | No |  |
| Sony | No |  |
| Xiaomi | No |  |
| ZTE | No |  |
| Nokia | Yes | Otherwise, backoff feature cannot really be used or the RO sharing is useless. |

# Issue#3: Msg3 indication for SDT

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| R2-2203283 [4](Nokia) | **Proposal 3: SDT can be configured to use common RACH resources in which case Msg3 is used to indicate the SDT procedure to the network.** |

[4] thinks that the number of required RACH partitions in the cell is preferably minimized. One way to do it is to allow an alternative way to indicate SDT (i.e. SDT indication is in Msg3) instead of indicating via RACH partition. From the rapporteur’s point of view, this should have been discussed in SDT whether this is a possibility.

**6-1. Companies are invited to provide their views whether the proposal 3 above on SDT should be addressed in Rel-17? If so, please provide the reason.**

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| **Companies** | **Yes/No** | **Comments** |
| Intel | No (see comments) | RAN2 already discussed and agreed the following:RAN2 continues to progress the work based the separate RACH resources for SDT (i.e. explicit mechanisms to support common resources won’t be pursued unless there is sufficient support for this. However, use of common RACH resources will not be precluded if possible via implementationSo we don’t think providing any additional indication in msg 3 should be discussed again. However, the specs should not preclude the use of common RACH resources for SDT. |
| Qualcomm | See comment | We think this proposal is best discussed in the SDT session instead of in common RACH session, because it has no impact on any procedural or configuration aspects of common RACH. |
| OPPO | No | We are fine to conclude like this. Otherwise it should be left to SDT session. |
| Sony | No | It must be discussed in SDT session. |
| Xiaomi | No | As RAN1 has agreed in 106-e meeting to support RA-SDT by configuring separate RO or separate preamble in shared RO between SDT and non-SDT, we think there is no need to discuss this proposal. |
| ZTE | No | No, we think even if network wants to use msg3 based indication, it can just mark all partitions then as SDT partitions (and use larger msg3 size for all RACH attempts) nothing breaks in this case. So, no need for further optimisation.  |
| Nokia | Yes |  |

# Issues carried forward from [Post116bis-e][514][RA Part] [6]

## Proposals where technical discussion is not really needed

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| Proposal [6] |
| Proposal 3: The CE/non-CE selection threshold can then be configured per BWP (as agreed in the CE session) |
| Proposal 5: BWP selection is handled in REDCAP CR. |
| Proposal 7: RSRP threshold for SSB selection for CE be configured differently in different RACH partitions (note this is conditional IE configured only in rach partitions that support CE) |
| Proposal 8: RACH partitioning can be applicable also in connected mode  |
| Proposal 10: For the REDCAP BWP, network configures a RACH partition which is applicable to REDCAP (i.e. without combination with other features), similar to “legacy” RACH partition in non-Redcap initial BWP |

**7-1 Only comments if you have a strong concern on any of the above proposals. Otherwise, they will be considered as agreeable.**

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| **Companies** | **Comments** |
| Qualcomm | We do not support Proposal 3. We think CE selection threshold should be per partition. First, it is already agreed that CE is a feature. And depend on which feature(s) it is jointly configured with, CE selection threshold may be different. For example, it is desirable to have higher CE thresholds when configured in a partition for RedCap. Or network may want to configure different CE thresholds for different slices, depend on the different reliability/coverage requirements of the slides. ZTE: Unfortunately, this would require CE to be not treated as a feature but as something like RACH type. Seems very hard to convince companies to go this way.  |
| OPPO | For proposal 8: we need make it clear which feature(s) is applicable. Following the discussion, it seems SDT and slicing is not relevant, CE is applicable while it is not so clear for Redcap.ZTE: Agree with the above, but do we need to do this exercise of clarifying which features CFRA is applicable to (since it will not result in any spec changes anyway). The only spec change is from question in 7.2.2 below. So, we can just focus on that. The rest proposals are fine.As for the comment from QC, I think per partition configuration is complicated for UE since it has to select among potential partitions based on configured threshold. For Redcap we think the threshold could be different, but Redcap UE usually access a Redcap specific BWP which resolve the issue implicitly. For the rest we don’t think it is necessary to differentiate among features. |
| Xiaomi | We agree with all proposals including proposal 3. And for the comment from QC, we have not seen any strong motivation that the threshold can be different for different partitions and depend on which feature is jointed with CE. However, based on propsoal3, where to put the BWP-specific selection threshold can be discussed further, i.e. CE/non-CE selection threshold is configured in *BWP-UplinkCommon or RACH-ConfigCommon* (just like legacy RSRP threshold) or other position. |
| ZTE | We support all proposals. Please see more comments above.  |

## Proposals where technical discussion is needed

### Overall MAC procedure

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| Proposal [6] |
| Proposal 4: For overall MAC procedure (order of steps is as below):1. RRC will indicate to MAC whether SDT, REDCAP, SliceX is applicable for any RACH
2. [FFS wait for SDT session outcome] If SDT is applicable, MAC would have checked already that the correct RACH partition is available (this is also discussed as part of SDT)
3. If carrier is not indicated by RRC, MAC will select the carrier (this is same as legacy)
4. MAC will perform BWP selection (this is also legacy behaviour)
5. MAC will determine CE applicability after BWP is selected
6. Finally, MAC will select the RACH partition
 |

**7.2.1 Apart from the FFS part, companies are invited to provide their view whether the rest of the overall MAC procedure is agreeable.**

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| **Companies** | **Yes/No** | **Comments** |
| Qualcomm | No | SDT, CE, RedCap are features and hence should be considered during, instead of before, the selection procedure of RACH partitions. UE determines which feature to consider first based on the priority provided by network, as already agreed. |
| OPPO | Yes |  |
| Xiaomi | No |  |
| ZTE | Yes | @Xiaomi, did you mean to say yes or is there some specific concern?  |
| Nokia | Comments | What is a use case for RRC to indicate carrier?BWP selection is discussed in different WIDs whether it should be based on available partitions. |

### CFRA

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| Proposal [6] |
| Proposal 9: In case of CFRA, in order to initialize the RACH parameters such as rsrp-ThresholdSSB etc and for CBRA fallback: Option 1: Network signals an explicit RACH partition to be used Option 2: UE performs RACH partition selection up frontIn case of option 2 it is not clear if network and UE will have the same understanding of the parameters to be used.  |

**7.2.2 Companies are invited to provide their view on the options.**

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| **Companies** | **Option 1 or 2** | **Comments** |
| Qualcomm | Option 1 | It is CFRA. Let network tell UE what to do |
| OPPO | Option 1 |  |
| Sony | Option 1 |  |
| Xiaomi | Option 1 |  |
| ZTE | Option 1 | Agree with Qualcomm comment.  |
| Nokia | None | There is no possibility for NW to always indicate CBRA partition, e.g., with PDCCH order. Hence, we need to anyway specify UE behaviour in case this is not indicated.Simplest is the UE uses common RACH in this case, no need for additional specification effort. CFRA is anyway only for HO, BFR, and PDCCH order. |

### RNTI collision issue

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| Proposal [6] |
| Proposal 11: The network may configure a separate search space for RAR/MSGB per RACH partition (to be captured in RRC CR if agreed). No other mechanism is pursued apart from this for handling the RNTI collision problem. |

Agreeing to the above Proposal means that the configuration of the separate search space will be specified in the common RACH CR.

**7.2.2 Companies are invited to provide their view whether the proposal is agreeable for handling the RNTI collision problem.**

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| --- | --- | --- |
| **Companies** | **Yes/No** | **Comments** |
| Intel | Yes |  |
| Qualcomm | No | We don’t think Proposal 11 is an effective/scalable way to solve the RNTI collision problem. That is because network has to ensure none of the RA search spaces has overlapping monitoring occasions. That limits the maximum number of partitions that can be configured. If companies still think having separate RA search spaces is the right approach, then we think a more sensible granularity would be separate search space per PRACH configuration. Moreover, whether different partitions need to have separate search space is a different issue. Some feature(s) may do, e.g. SDT, but we think that should be discussed separately on a case by case basis. |
| OPPO | No | We think network should control not to configure too much RACH partitions in the cell since the differentiation among features during RACH procedure is not a must. And network should also take RNTI collision into account. If more search spaces are configured in order to avoid RNTI collision, this feature is too “heavy” to have since both uplink and downlink signalling overhead is increased. |
| Sony | No | This solution of separate search space for RAR/MSGB per RACH partition does not solve the problem because it allows as many search spaces as the number of partitions which may be impractical due to limited CORESET0 resource/space, and the search spaces will overlap, and this overlap causes 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.However, there is another solution, that 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 this solution does not need a separate search space for each partition. The specification is also in RAN2 area and RAN1 does not need to be involved. RAN2 should consider this option in this Rel-17 before it is too late. |
| Xiaomi | Yes |  |
| ZTE | Yes | Or we can simply do nothing if there is no consensus |
| Nokia | No | It seems the search space proposal would need to be asked firstly from RAN1. |
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# Conclusion

To be added latter

# References

[1] R2-2202694 Remaining issues for common aspects of RACH procedure CATT discussion Rel-17 NR\_cov\_enh-Core, NR\_slice-Core, NR\_SmallData\_INACTIVE-Core, NR\_redcap-Core

[2] R2-2202976 Discussion on RACH partition UP open issues OPPO discussion Rel-17 NR\_SmallData\_INACTIVE-Core, NR\_cov\_enh-Core, NR\_redcap-Core, NR\_slice-Core

[3] R2-2203206 RNTI collision issue for different features in NR Sony discussion Rel-17 NR\_SmallData\_INACTIVE-Core R2-2200917

[4] R2-2203283 Common aspects for RACH partitioning Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_SmallData\_INACTIVE-Core

[5] R2-2203307 Introduction of common RACH partitioning aspects in MAC ZTE Corporation (rapporteur) CR Rel-17 38.321 16.7.0 1214 - B NR\_SmallData\_INACTIVE-Core, NR\_cov\_enh-Core, NR\_redcap-Core, NR\_slice-Core Late

[6] R2-2203309 [POST116bis-e][514][RA Part] - Open issue list summary ZTE Corporation (rapporteur) report Rel-17 Late

[7] R2-2203340 Further details of RACH procedure with RACH partitioning Huawei, HiSilicon discussion Rel-17 NR\_SmallData\_INACTIVE-Core, NR\_slice-Core, NR\_redcap-Core, NR\_cov\_enh-Core Late

[8] R2-2203459 Remaining issues for RACH partitioning InterDigital discussion Rel-17 NR\_SmallData\_INACTIVE-Core, NR\_cov\_enh-Core, NR\_redcap-Core, NR\_slice-Core

[9] R2-2203357 Report of [POST116bis-e][515][RA Part] CP open issues Ericsson report Rel-17 NR\_redcap-Core, NR\_slice-Core, NR\_cov\_enh2-Core, NR\_SmallData\_INACTIVE-Core Late