3GPP TSG-RAN WG2 Meeting #117-e  *R2-22xxxxx*

Electronic Meeting, 21 February – 3 March, 2022

**Agenda item: 8.8.3**

**Source: OPPO**

**Title: Report of [AT117-e][242][Slicing] Slice-specific RACH prioritization (OPPO)- Phase 2**

**WID/SID: FS\_NR\_slice**

**Document for: Discussion and Decision**

# Introduction

This document is for the following email discussion:

* [AT117-e][242][Slicing] Slice-specific RACH prioritization (OPPO)

 Scope: Discuss RAN slicing-specific RACH prioritization aspects from selected contributions indicated in the minutes.

 Intended outcome: Discussion report in [R2-2203636](file:///C%3A%5CUsers%5Cterhentt%5CDocuments%5CTdocs%5CRAN2%5CRAN2_117-e%5CR2-220xxxx.zip).

 Deadline: Deadline 2

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# Discussion

The discussions and questions are set up based on the selected contributions indicated in the minutes.

## Support for RA prioritization and RA partitioning via dedicated signalling

In RAN2#113bis-e, RAN2 has achieved the following agreements and leaves one open issue, i.e. whether the RACH prioritization parameters can be configured in dedicated RRC signalling.

* scalingFactorBI and powerRampingStepHighPriority can be configured at least in SIB (FFS for dedicated RRC signalling).
* RAN2 will prioritize the discussion for slice specific RACH for IDLE and INACTIVE mode. And CONNECTED mode is down prioritized and can be considered if time allows.
* Slice specific RACH (including RACH isolation and RACH prioritization) is only applied for CBRA but not for CFRA.

Another similar issue is whether to support dedicated RACH resources in the dedicated signalling. In [1], the above issues are categorized as OI 1.5, i.e. whether to support dedicated RACH resources and RACH prioritization parameters in the dedicated signalling. Several companies provide their views to this meeting and the majorities propose not to indicate the slice-based RACH configuration in the dedicated RRC signalling, considering 1) the current SIB has agreed to include slice-specific RACH configuration, 2) the CONNECTED mode is down prioritized. Proposal 1 of [6] is an example.

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| **R2-2202618** | CMCC | Proposal 1: For OI 1.5, R17 will not support dedicated slice based RACH resources and RACH prioritization parameters in RRC signalling for CONNECTED mode. |

Thus, the rapporteur would like to propose the following and check the companies' view.

**Q1) Do companies agree not to support the dedicated RACH resources and RACH prioritization parameters in the dedicated signalling?**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes | We agree with Rapporteur. |
| Huawei, HiSilicon | Yes |  |
| LGE | Yes |  |
| Xiaomi | Yes |  |
| Intel | Yes |  |
| Spreadtrum | Yes | We can accept, if it’s the majority view. |
| Apple | Can accept to go with majority view | Though we think the RRC reestablishment procedure is a good use case to also benefit from slice based RACH design, we can accept to go with majority view for the sake of progress. |
| OPPO | Yes |  |
| Nokia | Yes |  |
| CMCC | Yes |  |
| ZTE | Yes |  |
| Samsung | Yes |  |
| Ericsson | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes | Can follow majority view. |
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< Summary >

- Yes: 14 (Qualcomm, Huawei, LG, Xiaomi, Intel, Spreadtrum, OPPO, Nokia, CMCC, ZTE, Samsung, Ericsson, CATT, MTK)

- Can follow the majority: 1 (Apple)

It seems that all companies can accept the proposed solution(including 1 company that is willing to compromise).

**Proposal 1. (15/15) Not support the slice-based dedicated RACH resources and RACH prioritization parameters in the dedicated signalling.**

## Confirming SI assumptions on RA prioritization and RA partitioning

One remaining issue in the Running MAC CR for Slicing is whether RA prioritization and RA partitioning will work independently, which is also categorized as OI 2.1 in [1]. In [2, 3, 4, 7, 8, 9], several companies provide their views. For example, [2] confirms that RA prioritization and RA partitioning work independently. They indicate that RAN2 has already agreed with this working assumption in the SI phase and understand that the common RACH session didn’t specify any restriction on the simultaneous configuration of two or more than two RACH features. While, [3, 8, 9] provide the opposite views.

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| **R2-2202188** | Qualcomm Incorporated | Proposal 2: RA prioritization and RA partitioning work independently. |

**Q2) Do companies agree that RA prioritization and RA partitioning work independently?**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Yes | Proponent.1. In SI phase, it was agreed that they work independently in a complementary way and it was captured in TR 38.832. We think RAN2 should stick to SI conclusionSlice based RACH configuration can be applied to idle and inactive UE. Solution 1 and Solution 2 can work independently in a complementary way. Neither solution 1 nor solution 2 may not be applicable to all possible slices.2. From technique perspective, RA prioritization and RA partitioning are different and independent to each other. For example, it should be common understanding that RA prioritization can be configured in whole RA resource (i.e., no RA resource partitioning) |
| Huawei, HiSilicon | Can be Yes | In our paper, we think that it may be good to discuss them together, and the reason is that other features may also introduce RA prioritization so that common RACH session may be a good place for such discussions. However, if majority of companies say Yes to Q2, we can be ok. |
| LGE | No | We support to configure the RA prioritization and RA partitioning simultaneously with following reasons:1. In common RACH session, it is agreed that RACH parameters are configured per RACH partition rather than per feature within the partition. For slicing, it is a baseline to configure the slice-specific RA prioritization parameter per feature combination (i.e., per RACH partition). Therefore, we prefer to align with the common RACH discussion for the unified RA framework of feature/feature combinations.
2. Since there are the multiple cases of feature combinations, the RA procedure for slicing should be defined as simple as possible, rather than allowing slice-specific operation.
3. Considering that there are multiple RACH configurations for feature combinations, independent configuration of RA prioritization would cause significant signalling overhead in SIB1, which should be avoided.
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| Xiaomi  | Yes | According to current RACH partition selection rule decided by common session, even though there is a slice specific RACH partition configured, it may not be selected. In this case, if the slice specific RA prioritization parameters are configured only in slice specific RACH partition, it will also lead the specific RA prioritization parameters not applied. In addition, if slicing UE can get access based on any dedicate RACH partitions, there seems not much benefits to configure the prioritization still. Thus, compared with including that parameters in all RACH partitions, only configuring that for legacy RACH resource (i.e. RACH resource that are feature combination agnostic) seems better and reasonable. |
| Intel | See comments | It depends on how the signalling structure works. If it follows the legacy structure, the ra-prioritisation will be part of the RACH partition. If it needs to be independent, then the ra-prioritisation has to be pulled out from the RACH partition. |
| Spreadtrum | No, but no strong views | The common RACH part has agreed the followings:

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| 6 RACH parameters (e.g. power ramping step, max RACH transmissions etc) are **configured per RACH partition** rather than per feature within the partition. 7 RA-type selection can happen like today based on the RACH parameters **signalled in the selected RACH partition** |

In our understanding, common RACH has agreed that RACH prioritization and RACH partition are configured together and work simultaneously. Although RAN2 agreed that RACH prioritization and RACH resources can be configured independently in SI phase, but more factors should be considered in WI phase, such as the alignment with other topics or signalling overhead (extra signalling to configure RACH prioritization for the slices that are not configured with specific RACH resources.)We prefer to follow the common RACH agreements. However, we have no strong views. If the majority view is to support independent configuration for slice, we can also accept it.  |
| Apple | Tend to Yes | If the ASN.1 is not too complex because of supporting independent configuration, we don’t see problem with doing it. |
| OPPO | Yes | We understand that the logic should be: slicing session decides whether RA prioritization and RA partitioning work independently, then the common session considers the impact, e.g. whether to put ra-prioritisation will be part of the RACH partition.In our understanding, there is no restriction on the simultaneous configuration, and we prefer to confirm the WA in the SI phase.  |
| Nokia  | Yes | Slice-specific RA prioritization is done on common RA resources by using different backoff and power ramping step parameters for a slice group. Therefore, if the RA resources are isolated/partitioned for a slice group, there is no need for additional RA prioritization. In our view, those two features should be separately configurable. |
| CMCC | Yes | Share similar views as Qualcomm. |
| ZTE | Yes | Similar view as QC. |
| Samsung | Yes |  |
| Ericsson | Yes | We assume there should be no major problem to ensure that RA prioritization and RA partitioning can be configured and hence be activated individually |
| CATT | Yes | We think RA partitioning and RA prioritization are two different features and should work independently. Furthermore, this is friendly to the backward compatibility. |
| MediaTek | Yes |  |
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< Summary >

- Yes or can be Yes: 12(Qualcomm, Huawei, Xiaomi, Apple, OPPO, Nokia, CMCC, ZTE, Samsung, Ericsson, CATT, MTK).

- No: 2 (LG, Spreadtrum). But, 1 company (Spreadtrum) also mentions they can follow the majority.

- It depends: 1 (Intel). Intel indicates that it depends on the signalling structure, i.e. if independent is support, ra-prioritisation has to be pulled out from the RACH partition.

Since there is a clear majority, the rapporteur proposes to confirm the working assumption in the SI phase.

**Proposal 2. (13/15) RAN2 confirms that RA prioritization and RA partitioning work independently.**

## RRC re-establishment and RACH prioritization

As agreed, the slice-based RACH in connected mode is down prioritized. While, [5] would like RAN2 to consider a special case in slice-based RACH design, i.e. the RRC re-establishment procedure triggered RACH. They indicate that the RRC re-establishment procedure is very time-critical to recover the RRC connection while at that time point UE can only use the RACH resource configured in SIB.

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| **R2-2202515** | Apple | Proposal 3: RAN2 to discuss if RRC re-establishment triggered RACH should be considered in slice based RACH design. |

**Q3) Do companies agree that the RRC re-establishment triggered RACH should be considered in slice-based RACH design?**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm | Deprioritize | We agree there is some benefit to allow it. However, as rapporteur mentioned, RACH in CONNECTED was agreed to be de-prioritized and we still have a lot of remaining issues in this meeting. Thus, we prefer to still de-prioritize this topic.  |
| Huawei, HiSilicon | Deprioritize | Agree with Rapporteur. |
| LGE | Deprioritize | Considering the Rel-17 timeline, we prefer not to support the slice-specific RACH in connected mode. The discussion on slice-specific RACH in RRC\_IDLE and RRC\_INACTIVE should be completed first. |
| Xiaomi | Deprioritize |  |
| Intel | Deprioritise | We also agree that there is some benefit with the proposal. But we prefer to not change the previous agreement not to consider RACH in connected mode. |
| Spreadtrum | Deprioritize | Prefer to focus on the identified open issues firstly. The RACH in connected should be deprioritized. |
| Apple | Can accept to go with majority view | For the sake of making progress, we can accept to go with majority view. |
| OPPO | Deprioritize |  |
| Nokia | Deprioritize  | We prefer to discuss the remaining other issues before new proposals |
| CMCC | Deprioritize |  |
| ZTE | Deprioritize |  |
| Samsung | Deprioritize | We think that slice based RACH in RRC\_CONNECTED should be deprioritized including RRC reestablishment case. |
| Ericsson | Deprioritize |  |
| CATT | Deprioritize |  |
| MediaTek | Deprioritize |  |
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< Summary >

- Yes: 14(Qualcomm, Huawei, LG, Xiaomi, Intel, Spreadtrum, OPPO, Nokia, CMCC, ZTE, Samsung, Ericsson, CATT, MTK)

- Can follow the majority: 1 (Apple)

It seems that all companies can accept to deprioritize the RRC re-establishment triggered RACH(including 1 company that is willing to compromise)

**Proposal 3. (15/15) Deprioritize the RRC re-establishment triggered RACH in slice-based RACH design.**

## Preamble Group selection

In legacy, if the UE performs the contention-based RA and if the preamble group has been selected during the RA procedure, the UE shall select the same preamble group for each RACH attempt, no matter this RA attempt is for RA fallback or not. If the preamble group was not selected during the RA procedure, the UE shall select the preamble group based on e.g. potential Msg3 size, RA resource configuration, etc. For simplicity, [4] proposes to reuse this existing rule in preamble group selection for slice-based RACH procedure.

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| **R2-2202440** | OPPO | Proposal 3 In slice-specific RACH, RAN2 considers to reuse the same rule as the legacy in preamble group selection, i.e. if the preamble group has been selected during the RA procedure, the UE shall select the same preamble group for each RACH attempt. |

**Q4-1) Do companies agree to reuse the same rule as the legacy in preamble group selection for slice-based RACH, i.e. if the preamble group has been selected during the RA procedure, the UE shall select the same preamble group for each RACH attempt?**

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| **Company** | **Yes/No** | **Comment** |
| Qualcomm  | Yes, but prefer to handle it in common session | We think it seems to be straight forward. However, since it is the same issue caused by fallback for all RACH features, we prefer to handle it in common RACH session.  |
| Huawei, HiSilicon | Yes, but to be discussed in common session |  |
| LGE | Yes | It is same as the legacy RA procedure. |
| Xiaomi | Yes | Legacy RA procedure can be reused and we are fine to discuss it in common session. |
| Intel | Yes | We think it can be decided here  |
| Spreadtrum | Yes | Legacy procedure can be further discussed in common RACH part. |
| Apple | Yes |  |
| OPPO | Yes | No matter the RA attempt is for RA fallback or not, we understand that the UE selects the same preamble group for each RACH attempt. It is aligned with the legacy RA procedure. |
| Nokia | Yes |  |
| CMCC | Yes | It is aligned with the legacy RA procedure but can be checked in common session. |
| ZTE | Yes, but prefer to handle it in common session |  |
| Samsung | Yes |  |
| Ericsson | Yes |  |
| CATT | Yes | We think this is covered in RIP. |
| MediaTek | Yes |  |
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< Summary >

- Yes: 12 (LG, Xiaomi, Intel, Spreadtrum, Apple, OPPO, Nokia, CMCC, Samsung, Ericsson, CATT, MTK)

- Yes but prefer to handle in the common session: 3 (Qualcomm, Huawei, ZTE)

It seems that all companies agree with this principle, although 7 companies prefer to handle it or further check it in the common session. Thus, the rapporteur would like to try in the following way.

**Proposal 4. (out of 15, 12 for Yes, 3 for Yes but discuss in common session) Reuse the same rule as the legacy in preamble group selection for slice-based RACH, i.e. if the preamble group has been selected during the RA procedure, the UE shall select the same preamble group for each RACH attempt(can be revisited in the common session).**

Assuming Q4-1 is agreed (depending on the company inputs), a follow-up question is to confirm the configuration restriction of RA preamble group B in the case of slice-based RA fallback enabled. In detail,

* In the case that 2-step and 4-step slice-specific RA resources are configured for a specific slice and RA preambles group B is configured for 2-step slice-specific RA, preambles group B should be configured for 4-step slice-specific RA.
* In the case that 4-step slice-specific RA resource is not configured for a specific slice and RA preambles group B is configured for 2-step slice-specific RA, preambles group B should be configured for 4-step common RA.

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| **R2-2202440** | OPPO | Proposal 4 In the case that slice-specific RA fallback is enabled and 2-step slice-specific RA is configured with preambles group B, RA preambles group B should be configured for 4-step slice-specific RA or 4-step common RA. |

[4] understands that the proposed solution is to follow the working assumption in the legacy 2-step RA switch.

**Q4-2) If Q4-1 is supported, do companies agree that RA preambles group B should be configured for 4-step slice-specific RA or 4-step common RA in the case that slice-specific RA fallback is enabled and 2-step slice-specific RA is configured with preambles group B?**

* **Option1: Yes, without any spec impact**
* **Option2: Yes, with any spec impact**
* **Option3: No (Please elaborate in comments).**

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| **Company** | **Option** | **Comment** |
| Qualcomm | No strong view | If we understand correctly, it is proposed to address issue on rebuilding of msg3. From UE perspective, msg3 rebuilding is not an issue when it switches/fallbacks to a different RACH feature. So, we keep neutral. |
| Huawei, HiSilicon | FFS | We think that common RACH session will also have some discussions on fallback, so it may be good to firstly wait for their progress and then we can further check the above options. |
| LGE | See comments | Option 1 for the fallback case from 2-step slice-specific RA to 4-step slice-specific RA, which is same as the legacy procedure. Option 3 for the fallback case from 2-step slice-specific RA to 4-step common RA, since this fallback case should be discussed in the common RACH session. |
| Xiaomi | Option 1 | The same issue existed when 2-step RA was introduced in R16, and this is guaranteed by MAC procedure and there is no restriction on NW configuration in spec, thus we think it can also be resolved in the same way(i.e. without any spec impact). And if the Q4-1 is discussed in common session, this can be confirmed as well. |
| Intel | Option 1 or should be handled by common session | Since it discusses on the fallback from 2-step to 4-step RACH. If Option 1 is not agreed, we would prefer it to be decided in common session. |
| Spreadtrum | See comments | The above fallback case is common to other R17 features. It should be discussed in common RACH session.  |
| Apple | Option 1 | Agree with xiaomi. |
| OPPO | Option 1 | The intention is to assure that a proper MSG3 grant is selected and to avoid the MAC PDU rebuilding issue. In our understanding, the principle is the same as the legacy working assumption for the 2-step RA switch, which seems most straightforward to follow and can keep the spec simple. |
| Nokia | Option 1 | We prefer Option 1, but ok to leave the discussion to common RACH session |
| CMCC | Option 1 | But Q4-1 and Q4-2 can be confirmed in common RACH session. |
| ZTE | Option 1 or should be handled by common session |  |
| Samsung | Option 1 | Same as legacy |
| Ericsson | Option 1 | Same as legacy |
| CATT | Option 1 | We think this can be discussed in common RACH. |
| MediaTek | Option 1 |  |
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< Summary >

- Option 1: 11 (Xiaomi, Intel, Apple, OPPO, Nokia, CMCC, ZTE, Samsung, Ericsson, CATT, MTK), where 1 company (Nokia) is also fine to discuss it in the common session and 1 company (CMCC) would like the common session to confirm Option 1. In addition, 1 company (LG) is fine with Option 1 if it falls back to 4-step slice-specific RA.

- Discuss in common session: 3 (Spreadtrum, ZTE, Intel). In addition, 1 company (LG) prefers this way if it is the fallback to 4-step common RA.

- No strong view: 1 (Qualcomm)

- Wait for common session progress: 1(Huawei)

The rapporteur would like to try in this way,

**Proposal 5-1. (12/15) In the case that slice-specific RA fallback is from 2-step slice-specific RA to 4-step slice-specific RA and 2-step slice-specific RA is configured with preambles group B, RA preambles group B should be configured for 4-step slice-specific RA. No spec changes are needed.**

**Proposal 5-2. (11/15) In the case that slice-specific RA fallback is from 2-step slice-specific RA to 4-step common RA and 2-step slice-specific RA is configured with preambles group B, RA preambles group B should be configured for 4-step common RA. No spec changes are needed.**

## Slice-specific RACH parameters for RA fallback

In legacy, *msgA-TransMax* is a switch enabler for 2-step RA and 4-step RA, i.e. if *msgA-TransMax* is absent, switching from 2-step RA type to 4-step RA type is not allowed.

 ***msgA-TransMax***

Max number of MsgA preamble transmissions performed before switching to 4-step random access (see TS 38.321 [3], clauses 5.1.1). This field is only applicable when 2-step and 4-step RA type are configured and switching to 4-step type RA is supported. If the field is absent, switching from 2-step RA type to 4-step RA type is not allowed.

Considering many kinds of RA fallback are introduced beyond the legacy RA fallback in Rel-17, [4] proposes to introduce a new parameter for the slice-specific RA fallback in order to 1) assure the network can enable/disable different kinds of RA fallback respectively, 2) reflect the feature-specific characteristics, 3) provide configuration flexibility.

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| **R2-2202440** | OPPO | Proposal 5 For the slice-specific RA fallback, RAN2 considers to introduce the slice-specific max number of MsgA preamble transmissions. |

**Q5) Do companies agree to introduce the slice-specific max number of MsgA preamble transmissions for the slice-based RA fallback?**

* **Option1: Yes**
* **Option2: No**
* **Option3: To discuss in the common session**

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| **Company** | **Option** | **Comment** |
| Qualcomm | Not Option 1 | We are not convinced how it can bring benefit. Even if majority agree it, we think it is necessary to check with common session, because the same intention can be applied to all RACH features in Rel-17.  |
| Huawei, HiSilicon | Not option 1 | Share similar views as Qualcomm. |
| LGE | Option 2 | We do not see clear benefit, but we can follow option 1 if majority supports. |
| Xiaomi | Not option 1 | Share similar views as Qualcomm. |
| Intel | Option 2 | It should be discussed in slicing whether there is any benefit. And we are also not convinced it needs to be slice specific. Anyway, such parameter is already RACH partition specific (i.e. feature combination specific) |
| Spreadtrum | Not option 1 | Share similar views as Qualcomm.  |
| Apple | Option 2 | We also don’t see the real need to introduce a slice specific configuration on this. |
| OPPO | Can accept to go with majority view | We understand that different slices with different requirements may use different max numbers of MsgA preamble transmissions. But, we are fine to follow the majority. |
| Nokia | Not Option 1 | Similar view with Qualcomm |
| CMCC | Prefer option 1, acceptable for option 2/3 | We think that it would be beneficial to support different maximum transmission number for the slices which have different latency requirements. But we can also accept option 2/3 if majority supports. |
| ZTE | Option 2 or 3 |  |
| Samsung | Option 3 |  |
| Ericsson | Option 2 | Also see no real need of this. |
| CATT | Option 2/3 | Since there are other kinds of RA fallback, whether to introduce the feature specific max number of MsgA preamble transmissions should be discussed in RA common. |
| MediaTek | Not option 1 |  |
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< Summary >

- Option 1: 2 (OPPO, CMCC). 1 company(OPPO) is fine to follow the majority.

- Option 2: 13 (Qualcomm, Huawei, LG, Xiaomi, Intel, Spreadtrum, Apple, Nokia, CMCC, ZTE, Ericsson, CATT, MTK)

- Option 3: 10 (Qualcomm, Huawei, Xiaomi, Spreadtrum, Nokia, CMCC, ZTE, Samsung, CATT, MTK)

Since there is a clear majority, the rapporteur considers it is fine with Option 2.

**Proposal 6. (14/15) Not to introduce the slice-specific max number of MsgA preamble transmissions for the slice-based RA fallback.**

## The linkage between slice group and RACH configuration

In the previous RAN2 meetings, it is agreed,

* *Slice specific RACH is only applicable if there is slice information (e.g., slice group or slice related operator-defined access category) available for AS layer when access. FFS on details of slice group.*
* *A new slice grouping mechanism is introduced for RACH configuration. One slice belongs to one and only one slice group. Slice groups are assumed to be only updated when UE does Registration Update.*
* *In a cell, there may be multiple slice-specific RACH configurations.*
* *One or more of the slice groups are linked to a slice-specific RACH configuration.*
* *There may be slice groups that are not linked to a slice-specific RACH configuration (they use the common RACH configuration).*
* *All slices of a slice group use the slice-specific RACH configuration of the slice group.*

[4] would like to further confirm whether one slice group links to only one slice-specific RACH configuration.

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| **R2-2202440** | OPPO | Proposal 6 In slice-specific RACH, one slice group links to only one slice-specific RACH configuration. |

**Q6) Do companies agree that one slice group links to *only one* slice-specific RACH configuration in slice-based RACH?**

* **Option1: Yes**
* **Option2: No**
* **Option3: To discuss in the common session**

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| **Company** | **Option** | **Comment** |
| Qualcomm | Option 1 | We understand the only controversial part is on slice specific cell reselection. For slice RACH, we see no reason that one slice group can be linked to more than 1 RA resource. |
| Huawei, HiSilicon | Option 1 |  |
| LGE | Option 1 |  |
| Xiaomi | Option 1 |  |
| Intel | Option 1 | In one BWP |
| Spreadtrum | Option 1 |  |
| Apple | Option 1 |  |
| OPPO | Option 1 | Yes, in one BWP. |
| Nokia | Option1 |  |
| CMCC | Option 1 |  |
| ZTE | Option 1 | Yes, in one BWP |
| Samsung | Option 1 | This is a clear option for UE behaviour. |
| Ericsson | Option1 |  |
| CATT | Option 1 |  |
| MediaTek | Option 1 |  |
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< Summary >

All companies agree with Option 1. And 3 of them further indicate it should be for one BWP. From the rapporteur’s point of view, it is good to have this clarification since it is the way we used to configure the RACH resource. Thus, the rapporteur would like to confirm Option 1 with the clarification “in one BWP”.

**Proposal 7. (15/15) In one BWP, one slice group links to only one slice-specific RACH configuration.**

## The cross-layer impacts of slice-based RACH

[8] describes a cross-layer interaction for slice-based RA procedure. They understand that the UE AS should be aware of the selected slice group ID (s). And, the selected slice group known by the UE AS can be received from the UE NAS directly or derived based on the information provided by the UE NAS indirectly.

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| **R2-2203019** | Huawei, HiSilicon | Proposal 2: It is proposed that the UE AS should be aware of the selected slice group ID (s), no matter received from the UE NAS directly or deriving based on the information provided by the UE NAS indirectly. |

The rapporteur would like to check the companies’ views on whether/how the UE AS is aware of the slice group.

**Q7) Which option do your company prefer for slice-based RACH?**

* **Option1: The UE AS should be aware of the selected slice group ID (s), no matter received from the UE NAS directly or derived based on the information provided by the UE NAS indirectly.**
* **Option2: The UE AS should be aware of the selected slice group ID (s), which is received from the UE NAS directly.**
* **Option3: The UE AS should be aware of the selected slice group ID (s), which is derived based on the information provided by the UE NAS indirectly.**
* **Option4: Others(Please elaborate in comments).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| Qualcomm | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |
| LGE | Option 1 |  |
| Xiaomi | Option 1 |  |
| Intel | Option 1 | For idle mode, the UE AS receives the slice group from the UE NAS directly, while for inactive mode, UE AS derives based on the information provided by the UE NAS indirectly  |
| Spreadtrum | Option 1 |  |
| Apple | Option 1 |  |
| OPPO | Option 2 | We understand that the UE AS can obtain the slice group directly from the UE NAS. But, we can accept Option 1 if it is the majority view. One additional question is whether/how to reflect it in the spec. |
| Nokia | Option 2 |  |
| CMCC | Option 1 |  |
| ZTE | Option 1 |  |
| Samsung | Option 1 |  |
| Ericsson | Option1 |  |
| CATT | Option 1 |  |
| MediaTek | Option 1, but | This is related to SA2’ work. |
|  |  |  |

< Summary >

* Option 1: 13 (Qualcomm, Huawei, LG, Xiaomi, Intel, Spreadtrum, Apple, CMCC, ZTE, Samsung, Ericsson, CATT, MTK). 1 company(MTK) also indicates it relates to SA’2 work.
* Option 2: 2 Nokia, OPPO(The company is also fine to follow the majority).

Since there is a clear majority, the rapporteur considers it is fine with Option 1.

**Proposal 8. (15/15) The UE AS should be aware of the selected slice group ID (s), no matter received from the UE NAS directly or derived based on the information provided by the UE NAS indirectly.**

## Slice setting in RACH prioritization

Given that RA prioritization parameters settings would aim at the association of selected slices with some priority, [11] arises an issue on how to adopt priorities in RA-prioritization and provides the following solutions.

* Option1: Left to the network implementation
* Option2: RA-prioritization parameters are set in the appropriate order reflecting the priority, i.e., *scalingFactorBI*, *powerRampingStepHighPriority* values are set in the appropriate order reflecting the priority.

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| --- | --- | --- |
| **R2-2203401** | Nokia, Nokia Shanghai Bell | Proposal 2: RAN2 to discuss whether RA-prioritization parameters (scalingFactorBI and powerRampingStepHighPriority) are signalled according to a slice group priority. |

The rapporteur would like to check the companies’ views on the setting order for RA-prioritization parameters.

**Q8) Which option do your company prefer to signal slice-based RA-prioritization parameters?**

* **Option1: Left to the network implementation.**
* **Option2: RA-prioritization parameters are set in the appropriate order reflecting the slice group priority.**
* **Option3: Others(Please elaborate in comments).**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| Qualcomm | Option 1 | In our understanding, this proposal seems to restrict NW configuration, which is not aligned with 3GPP principle.  |
| Huawei, HiSilicon | Option 1 | No need to restrict NW configuration. |
| LGE | Option 1 | In our view, the order of RA-prioritization parameters does not depends on the slice group priority, so we prefer to leave as the network implementation. |
| Xiaomi | Option 1 |  |
| Intel | Option 1 | Not sure what is the motivation for Option 2 |
| Spreadtrum | Option 1 |  |
| Apple | Option 1 |  |
| OPPO  | Option 1 |  |
| Nokia  | Option 2  | Option 2 would enable setting some order, e.g high/medium/low. But Option 1 is also fine for us |
| CMCC | Option 1 | Agree with Qualcomm and Huawei that no need to restrict network configuration. |
| ZTE | Option 1 |  |
| Samsung | Option 1 | Same view as Qualcomm |
| Ericssn  | Option 1 | Also not sure on the motivation for Option 2 |
| CATT | Option 1 |  |
| MediaTek  | Option 1 |  |
|  |  |  |

< Summary >

* Option 1: 14 (Qualcomm, Huawei, LG, Xiaomi, Intel, Spreadtrum, Apple, OPPO, CMCC, ZTE, Samsung, Ericsson, CATT, MTK)
* Option 2: 1 (Nokia). The company is also fine with Option 1.

**Proposal 9. (15/15) Left to the network implementation on how to signal slice-based RA-prioritization parameters.**

Furthermore, for the issue with System Information capacity and size, [11] proposes to restrict the maximum number of slice-based RA prioritization configurations to 3. No matter which option in Q8 is selected, the rapporteur would like to check the companies’ views on the maximum number of RA-prioritization configurations.

|  |  |  |
| --- | --- | --- |
| **R2-2203401** | Nokia, Nokia Shanghai Bell | Proposal 3: RA-prioritization supports at most 3 different configurations (i.e. maxSliceInfo-r17= 3)). |

**Q9) Do companies agree to support at most 3 different RA-prioritization configurations (i.e. maxSliceInfo-r17= 3)?**

* **Option1: Yes**
* **Option2: No**
* **Option3: To be decided later.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| Qualcomm | Option 3 | It can be left to ASN.1 review. |
| Huawei, HiSilicon | Option 3 | It can be put to running 38.331 CR discussion. |
| LGE | No strong view |  |
| Xiaomi | Option 3 |  |
| Intel | Option 3 | Agreed with the other that this can be decided later after Q2 is decided. If the signalling for ra-prioritisation is independent to RACH partitioning, then it makes sense to limit the number of different ra-prioritisation. |
| Spreadtrum | Option 3 |  |
| Apple | Option 3 |  |
| OPPO  | Option 3 |  |
| Nokia | Option 1 | Potential signalling extensions constrain obvious issue with System Information capacity and size. Thus, if configuration setting for RA-prioritization adopts granularity per slice group id, RRC signalling can set fixed limitation to set maxSliceInfo-r17 corresponding to the possible sets of RA-prioritization configurations to 3 (reflecting high, medium and low priority). |
| CMCC | Option 3 |  |
| ZTE | Option 3 |  |
| Samsung | Option 3 |  |
| Ericsson  | Option 3 |  |
| CATT | Option 3 |  |
| MediaTek | Option 3 |  |
|  |  |  |

< Summary >

* Option 3: 13 (Qualcomm, Huawei, Xiaomi, Intel, Spreadtrum, Apple, OPPO, CMCC, ZTE, Samsung, Ericsson, CATT, MTK)
* Option 1: 1 (Nokia).
* No strong view: 1 (LG)

Since there is a clear majority, the rapporteur considers it is fine with Option 3.

**Proposal 10. (13/15) The maximum number of RA-prioritization configurations (i.e. maxSliceInfo-r17) is suggested to be further discussed.**

## The override indication for RAN slicing and MCS/MPS

In [12], it was discussed whether the override indication can be put under the IE *BWP-UplinkCommon*. Based on the companies’ inputs, the following proposal was made.

***Proposal 2: The indication (i.e. whether slice override MCS, MPS or MPS override slice is common for all slice groups) is put under the IE BWP-UplinkCommon.***

As instructed in the chairman's notes, the above proposal can be discussed as part of [AT117-e][242]. Thus, the rapporteur would like to add one question to check the companies’ views.

**Q10) Do companies agree that the indication (i.e. whether slice override MCS, MPS or MPS override slice is common for all slice groups) is put under the IE *BWP-UplinkCommon*?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| Spreadtrum | Yes |  |
| Qualcomm | Yes |  |
| Apple | Yes |  |
| OPPO | Yes |  |
| Xiaomi | Yes |  |
| Nokia | Yes |  |
| LGE | Yes |  |
| CMCC | Yes |  |
| ZTE | Yes |  |
| Samsung | Yes |  |
| Ericsson | Yes |  |
| CATT | Yes |  |
| MediaTek | Yes |  |
|  |  |  |

< Summary >

All companies agree with this solution.

**Proposal 11. (13/13) The indication (i.e. whether slice override MCS, MPS or MPS override slice is common for all slice groups) is put under the IE *BWP-UplinkCommon.***

## LS related(Phase-2 discussion)

According to the following instruction, LS related issues can be further discussed under this email discussion.

[R2-2202616](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2202616.zip) List of open issues for RAN slicing WI CMCC discussion Rel-17 FS\_NR\_slice [R2-2201730](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2201730.zip)

* Most open issues discussed via email discussions during the meeting
* Can discuss whether we need to send LS to SA2 (under [242])

According to the Open issue list, in the rapporteur’s understanding, the following issues may have an impact on SA2/CT1. Please note that SA2 already discussed some issues, but no consensus is achieved till now on whether or how to proceed.

* The granularities of the slice groups for cell reselection, i.e. per TA or per PLMN.
* The definition of the slice group.
* The provision of the slice priority for cell reselection.

For the sake of the progress, the rapporteur would like to add the following questions to check the companies’ views.

**Q11) Which option do your company prefer on the granularities of the slice groups for cell reselection?**

* **Option1: Per PLMN.**
* **Option2: Per TA.**

Please note that it is already agreed in RAN2#116bis-e, among multiple TAs in the same RA, RAN2’s understanding is that the configuration on slice grouping should be homogeneous.

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| CMCC | Prefer per PLMN, acceptable per TA | SA2 debated on per PLMN v.s. per TA, and they cannot reach consensus. Since RAN2 is the working group that have a whole picture of this WI, we suggest RAN2 make the final decision in this meeting and inform SA2 and RAN3. So that SA2 can start the normative TEI17 work in April just in time.Either per PLMN or per TA is acceptable for us. From spec complexity point of view, per PLMN would be much simpler and preferable at this late stage, since both RAN2/3 and SA2 don’t need to worry how to address the issue at TA boundary. The only drawback would be larger bits for slice group, e.g., 16bits or 24bits. That would be fine if we put slice info into a new SIB, rather than SIB4. |
| LGE | Option 2 | Based on the current understanding that slice support is homogeneous within a TA, we want to keep the previous agreement. However, the final decision shall be up to SA2  |
| CATT | Option2 | Per PLMN will cause the heavy signalling payload since the slice group ID need to indicate all slice groups in the whole PLMN. In our understanding, if the granularities of the slice groups are per TA, it is more flexible for network configuration. The UE only needs to receive the mapping relationships of all TAs in current RA. Considering the configuration of multiple TAs in the same RA on slice grouping should be homogeneous, the signalling payload will not be a big issue. The issues at TA boundary can also be resolved.If the majority prefer option1, we agree with CMCC that the slice info should be in a new SIB. |
| Xiaomi | Option2 |  |
| Nokia | Option 2 | If SA2 makes another decision, RAN2 should follow it, but from RAN2 perspective option 2 is better.  |
| Samsung | Option 2 | We think that RAN2 should keep the current agreement until the final confirmation is provided by SA2. |
| OPPO | Prefer Option 1, acceptable Option 2 | Either per PLMN or per TA is acceptable for us.Although we already assumed per TA granularity, considering there may much details/issues to be discussed/resolved under this solution and there is no consensus on per TA support in the SA2 discussion, we prefer a simple way to complete our WI. |
| Deutsche Telekom | Option 1 (preferable), Option 2 (acceptable) | We prefer per PLMN approach; however, option 2 is also acceptable for us. In any case, the final decision shall be up to SA2. |

It is clear that a group is associated with one or multiple slices. And a slice is associated with none or one slice group. The FFS part is whether a slice is associated with multiple slice groups.

**Q12) Do companies agree that a slice is associated with multiple slice groups?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comment** |
| CMCC | No  | From our point, for slice based RACH and reselection, a slice maps to only one group would be simpler without any confusion.We are ok to follow majority view, as long as there is no confusion on both UE and network side.  |
| LGE | No | We don’t need to re-discuss RAN2 agreement. RAN2 agreed the followings without FFS. * **A network slice can be associated to none or only one slice group**
* **A new slice grouping mechanism is introduced for RACH configuration. One slice belongs to one and only one slice group. Slice groups are assumed to be only updated when UE does Registration Update**.

Especially for slice-specific RACH aspects, if one slice is associated with more than one slice groups, one slice may be associated with more than one RACH configurations. Therefore it would cause confusion in slice-specific RACH if a slice is mapped to more than one slice groups.  |
| CATT | No | We have informed SA2 that a slice cannot be associated to multiple slice groups. There is no sufficient reason to revise the previous agreements. And if we allowed that the slice can associate to multiple slice groups, this will lead to confusion when UE adopt the frequency priority. As the frequency priority provided in system information or *RRCRelease* message is per slice group. If the slice associates multiple slice groups, UE cannot decide which slice group information to use. So we think we should stick to the previous agreements and a slice is not allowed to associate to multiple slice groups |
| Xiaomi  | No |  |
| Nokia | Yes | We think that the assumption that slice can at most belong to a single slice group creates a dependency between slice-based cell reselection and slice specific RACH enhancements. This may lead to each slice group mapping only to a single slice. The dependency between slice-based cell reselection and slice specific RACH enhancements introduces limitations when both are deployed in a network. See details in our paper in [R2-2203070.zip](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_117-e/Docs/R2-2203070.zip)  |
| Samsung | No | Same view as CMCC |
| OPPO | No | As we already agreed separate slice groups can use for slice-based RACH and cell reselection, we think it is not urgent to support the case that a slice is associated with multiple slice groups.  |
| Deutsche Telekom | Yes | We would prefer that a slice may belong to more than one slice group (more flexibility).  |

As described in Stage-2 Running CR for Slicing([R2-2203069](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_117-e/Docs/R2-2203069.zip)), in the UE, NAS provides the slice group(s) and their priorities to be considered during cell reselection. The FFS part is what is the granularity of the slice priority and how the UE is aware of the slice priority.

**Q13) Which option do your company prefer on the granularity of the slice priority for cell reselection?**

* **Option1: Per slice**
* **Option2: Per slice group**
* **Option3: left to the UE implementation.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| CMCC | Option 3 |  |
| LGE | Option 2 | It would be simpler when the slice priority for each slice group is provided for cell reselection.  |
| CATT | Prefer Option 1  | The slices are divided into slice group form network perspective. From UE perspective, the priority of slices in a slice group can be different. Per slice can accurately reflect the services that UE wants. |
| Xiaomi  | Option3 |  |
| Nokia | Option 2 |  |
| Samsung | Option 2 |  |
| OPPO | Option 2 | To avoid the work/complexity in RAN2. |

**Q14) Which option do your company prefer on how the UE is aware of the slice priority for cell reselection?**

* **Option1: Left to the UE implementation.**
* **Option2: The UE is aware of the slice priority via NAS signalling.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| CMCC | 1 or 2 | SA2 has discussed on this question and no consensus reached until now. If they don’t design the NAS signalling in Rel-17, we can leave to UE implementation. |
| LGE | None | We think the UE should be able to determine the slice priority and it shall be clearly specified:* In RRC\_INACTIVE, the slice priority for suspended service should be prioritized for service continuity.
* In RRC\_IDLE, no additional rule is needed
 |
| CATT | Option 2 | Option 1 is totally out of the network control. |
| Xiaomi  | Option 1/2 | Share the same view with CMCC. |
| Nokia | See comment | From RAN2 perspective the important point is that slice group priorities should come from NAS of the UE. It is not in the scope of RAN2 how NAS in the UE learns these priorities.  |
| Samsung | Option 2 | But we can wait for final confirmation by SA2. |
| OPPO | 1 or 2 | Agree with CMCC. |
| Deutsche Telekom | Option 2 | We can wait for SA2 decision/confirmation. |

If RAN2 has achieved progress on the above issue(s) at least for Q11-Q14 and Q7, the rapporteur would like to ask the follow-up question.

**Q15) Do companies agree to send LS to SA2/CT1 to inform RAN2 conclusions?**

* **Option1: Yes.**
* **Option2: No.**
* **Option3: Postpone.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| CMCC | Yes | SA2, CT1 and RAN3 all got stuck on the granularity of slice grouping and provision of slice priority. And there is risk that they will fail to converge before June if we don’t send the LS. And since RAN3 is discussing on the same topic, RAN3 should also put into the “To” list.So for the purpose of having a complete method in Rel-17, the LS to SA2, CT1 and RAN3 is needed. |
| LGE | Option 2 | In our understanding, there is ongoing discussion regarding slice grouping in SA2. Therefore, there is no need to send additional LS regarding this issue. |
| CATT | Option1 | For some issues, like the granularity of slice group, there is no consensus achieved in SA2. In order to accelerate the progress of the WI, we think RAN2 can make some decision from RAN2 perspective and send LS to SA2. |
| Xiaomi | Option 1 |  |
| Nokia | Yes | Our understanding is that the discussion on slice groups is contentious in SA2, thus it might be useful if SA2 gets the latest view from RAN2.  |
| Samsung | Option2 | Since SA2 is still under discussion on these issues, we do not think that a LS is necessary. |
| OPPO | Option 1 | To help other WGs to speed their progress.  |
| Deutsche Telekom | Option 2 | In our understanding, there is ongoing discussion regarding slice grouping in SA2; thus, a LS is not required. |

**Q16) If the answer to Q15 is YES, which issues/conclusions do your company prefer to mention in this LS?**

* **Option1: The issue in Q11**
* **Option2: The issue in Q12**
* **Option3: The issue in Q13**
* **Option4: The issue in Q14**
* **Option5: The issue in Q7**
* **Option6: Others (Please elaborate in comments)**

Please note that companies can select more than one option.

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comment** |
| CMCC | All | That would be helpful for the normative work in other WG. |
| CATT | All |  |
| Xiaomi | All |  |
| Nokia | All |  |
| OPPO | 1,2,3,4,5 | All issues may have impact on the SA2/CT1 work. |

# Summary

The summarized proposals are given below:

**Agreeable proposals:**

**Proposal 1. (15/15) Not support the slice-based dedicated RACH resources and RACH prioritization parameters in the dedicated signalling.**

**Proposal 2. (13/15) RAN2 confirms that RA prioritization and RA partitioning work independently.**

**Proposal 3. (15/15) Deprioritize the RRC re-establishment triggered RACH in slice-based RACH design.**

**Proposal 4. (out of 15, 12 for Yes, 3 for Yes but discuss in common session) Reuse the same rule as the legacy in preamble group selection for slice-based RACH, i.e. if the preamble group has been selected during the RA procedure, the UE shall select the same preamble group for each RACH attempt(can be revisited in the common session).**

**Proposal 6. (14/15) Not to introduce the slice-specific max number of MsgA preamble transmissions for the slice-based RA fallback.**

**Proposal 7. (15/15) In one BWP, one slice group links to only one slice-specific RACH configuration.**

**Proposal 8. (15/15) The UE AS should be aware of the selected slice group ID (s), no matter received from the UE NAS directly or derived based on the information provided by the UE NAS indirectly.**

**Proposal 9. (15/15) Left to the network implementation on how to signal slice-based RA-prioritization parameters.**

**Proposal 10. (13/15) The maximum number of RA-prioritization configurations (i.e. maxSliceInfo-r17) is suggested to be further discussed.**

**Proposal 11. (13/13) The indication (i.e. whether slice override MCS, MPS or MPS override slice is common for all slice groups) is put under the IE *BWP-UplinkCommon.***

**Proposals need further discussion:**

**Proposal 5-1. (12/15) In the case that slice-specific RA fallback is from 2-step slice-specific RA to 4-step slice-specific RA and 2-step slice-specific RA is configured with preambles group B, RA preambles group B should be configured for 4-step slice-specific RA. No spec changes are needed.**

**Proposal 5-2. (11/15) In the case that slice-specific RA fallback is from 2-step slice-specific RA to 4-step common RA and 2-step slice-specific RA is configured with preambles group B, RA preambles group B should be configured for 4-step common RA. No spec changes are needed.**

<TBD for Clause 2.10 - Phase 2>

# References

1. R2-2202616 List of open issues for RAN slicing WI, CMCC
2. R2-2202188 Remaining issues on slice specific RACH, Qualcomm Incorporated
3. R2-2202418 Consideration on remaining issues for slice specific RACH, Spreadtrum Communications
4. R2-2202440 Remaining issues on slice-specific RACH, OPPO
5. R2-2202515 Discussion on RACH in slicing, Apple
6. R2-2202618 Discussion on open issues for slice based RACH configuration, CMCC
7. R2-2202691 The remaining issues on slice specific random access, CATT
8. R2-2203019 Discussion on slice based RACH configuration, Huawei, HiSilicon
9. R2-2203064 Remaining issues on slice based RACH, LG Electronics Inc.
10. R2-2203388 Further consideration on slice specific RACH , ZTE corporation, Sanechips
11. R2-2203401 Detailed RRC signalling for RACH prioritization configuration, Nokia, Nokia Shanghai Bell
12. R2-2203021 Report of [Post116-e][243][Slicing] Running NR RRC CR for RAN slicing (Huawei), Huawei