3GPP TSG-RAN WG2 Meeting #113bis-e R2-2104322

Electronic Meeting, April 12 – 20, 2021

**Agenda item: 8.8.3**

**Source: CMCC**

**Title: Summary for [AT113bis-e][252][NR] Slice-specific RACH**

**WID/SID: NR\_slice**

**Document for: Discussion and Decision**

# 1 Introduction

This contribution is the summary for the following email discussion during RAN2#113bis-e meeting.

Email discussions ([252]) - not kicked off before online session

* [AT113bis-e][252][NR] Slice-specific RACH (CMCC)

Scope:

* + - Summarize main open issues based on contributions and online agreements.
    - Highlight if there are topics that clearly require online discussion.
    - Identify topics that might benefit from email discussions.

Intended outcome:

* + - Discussion summary in [R2-2104322](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104322.zip) (by email rapporteur)

Deadline for providing comments and for rapporteur inputs:

* + - Initial deadline (for companies' feedback): 1st week Fri, UTC 0900
    - Initial deadline (for rapporteur's summary): 2nd week Mon, UTC 1200

**Company Context**

|  |  |
| --- | --- |
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| BT, Salva Diaz | salva.diazsendra@bt.com |
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| Awn Muhammad | Awn.muhammad@Rakuten.com |

# 2 Discussion

This email mainly discusses on the following topics: basic solutions, co-existence with legacy UE and legacy MPS/MCS, RA selection and fallback cases. Some proposals in contributions [1-4] that covers above topics are copied below for discussion.

## 2.1 Basic solutions

In WID RP-210921, it limits that only MO cases should be considered for RACH. It needs to be clarified firstly what is “MO case”, i.e., does it include MO signaling or data traffic?

Proposal: Only MO data arrival triggered RACH can apply slice specific RACH. MO signaling (e.g. mo-Signalling and mo-SMS) triggered RACH is not applied to slice-specific RACH. [1]

**Q1: Do you agree with above proposal?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CMCC | Yes | MO signaling should use the common RACH resources. |
| Huawei, HiSilicon | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes | Sometimes, there is no valid S-NSSAI information in NAS layer when it is mo-Signalling or mo-SMS. |
| Qualcomm | Yes | Agree with the point raised by OPPO. If we allow MO signaling, we may need to consider more issues. It seems the main intention of slice-based RACH is for access attempt caused by arriving MO data. |
| Nokia | No | We are not convinced it make sense to differentiate between RACH for data and signalling. From the NW side the gNB would provide RACH configuration in System Information, and when UE needs to start RA procedure then it read slice-specific RACH configuration from broadcast and uses the configured RACH resources. The split of configuration for MO signallign and MO data may bring more complexity than necessary. Further the distinction (between MO data and signalling) requires input from NAS layer, thus require more scattered UE operations. |
| Intel | Yes |  |
| Lenovo | Yes |  |
| LG |  |  |
| China Telecom | Yes |  |
| APT | Yes | - |
| Samsung | Yes | We share the view by OPPO. |
| CATT | No | We don’t think we need distinguish the MO data and MO signalling when applies the slice-specific RACH. If the As layer has the slice information for the access, it may select the slice-specific RACH firstly for isolation ,etc. if no slice information available when access, the UE may use common RACH |
| Spreadtrum | Yes |  |
| ZTE | Yes |  |
| Ericsson | Yes |  |
| Apple | Yes |  |
| Fujitsu | Yes/No | The WID description is broad. RAN2 needs discussion what it the intention of “MO case”. From my side, it is ok to have limitation that it is “MO data”. |
| Rakuten Mobile | Yes |  |

### Summary for Q1

19 companies shared comments for Q1.

* Yes: 15. [3 of the supporting companies commented that sometimes, there is no valid S-NSSAI information in NAS layer when it is mo-Signalling or mo-SMS.]
* No: 2. [2 companies don’t think we need to differentiate between RACH for data and signalling. And 1 company suggested to only consider whether there is available slice information when access. ]
* Yes/No: 1. [1 company suggested to discuss on the intention of MO case.]
* N/A: 1. [1 company didn’t share views]

Considering on the comments from all companies and 2 companies’ objection for distinguish MO data and MA signalling, rapporteur suggest to reword the proposal as “Slice specific RACH is only applicable if there is slice information available for AS layer when access”. Since the original proposal is supported by 15 companies, RAN2 is suggested to check which one can be agreed.

**Proposal 1: RAN2 is suggested to agree on one of the two options on whether MO signalling is applicable for slice specific RACH:**

* **Option 1 [15/19 Original proposal]: Only MO data arrival triggered RACH can apply slice specific RACH. MO signaling (e.g. mo-Signalling and mo-SMS) triggered RACH is not applied to slice-specific RACH.**
* **Option 2 [Rapporteur Proposal]: 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.**

In TR 38.832, it captured IDLE/INACTIVE UE can apply slice specific RACH. Companies are invited to share views on whether slice specific RACH can be applied to CONNECTED UE in below 3 highlighted cases in TS 38.300:

The random access procedure is triggered by a number of events:

- Initial access from RRC\_IDLE;

- RRC Connection Re-establishment procedure;

- DL or UL data arrival during RRC\_CONNECTED when UL synchronisation status is "non-synchronised";

- UL data arrival during RRC\_CONNECTED when there are no PUCCH resources for SR available;

- SR failure;

- Request by RRC upon synchronous reconfiguration (e.g. handover);

- Transition from RRC\_INACTIVE;

- To establish time alignment for a secondary TAG;

- Request for Other SI (see clause 7.3);

- Beam failure recovery;

- Consistent UL LBT failure on SpCell.

**Q2: Whether CONNECTED UE can also apply slice specific RACH when RACH is triggered by MO data arrival (i.e. when UL synchronisation status is "non-synchronised", or there are no PUCCH resources for SR available, or SR failure)?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CMCC | Yes | We don’t have strong preference, ok to consider CONNECTED UE. |
| Huawei, HiSilicon | Neutral | On one hand, it may be some benefits for applying slice based RACH for connected Ues. On the other hand, we are concerned about the TUs as such discussions may consume Tus and then other discussions may be impacted. |
| Xiaomi | Yes | Share the same view with QC that slice-specific RACH configuration can also be applied to CONNECTED UE. |
| OPPO | No | It is already agreed that RRC connected mode is with a low priority. We should settle down other issues firstly. |
| Perspecta Labs | Yes | RA prioritization is useful in all RA attempts since low latency is the objective. Share the view that this will consume more TUs. |
| Qualcomm | Yes, but.. | These 3 RACH cases for CONNECTED UE may be triggered with arriving MO data, similar to our agreed slice RACH scenario (for IDLE/INACTIVE UE). Because the target scenario is similar, we thought current agreed slice based RACH can be easily extended to the 3 RACH cases for CONNECTED UE, without much spec work. However, if people have workload concern, we can follow majority. |
| Nokia | Yes | We support unified behaviour |
| Intel | No | In our view, if UE is configured with any critical slice, the UE will be configured with dedicated SR and will not be allowed to go UL out of sync. |
| Lenovo | No | We should stick to the RAN2 conclusion. Furthermore, it is not clear to us why slice-specific RACH needs to be supported in connected. |
| LG | No | We haven’t carefully analyzed the benefit/impact for RRC\_CONNECTED in SI, e.g., data for multiple slices are arriving in RRC\_CONNECTED. Thus, it would be preferred to focus on IDLE/INACTIVE. |
| China Telecom | No | As discussed in SI phase, slice specific RACH for connected UE is with a lower priority. We shall focus on the higher priority issues first. |
| APT | No | We should follow the WI scope. Due to time limit, we should not enlarge the scope. |
| Samsung | No | As studied, we think RAN2 should focus on RRC\_IDLE/RRC\_INACTIVE scenario in this release. |
| CATT | No | We tend to agree that we should focus on the cases in RRC IDLE/Inactive mode. Meanwhile, we agree with Intel that latency sensitive traffic can be guaranteed by SR configuration or CG configuration. |
| Spreadtrum | Yes | The slice specific RACH resources should be used for above issues even if in UE connected state. |
| ZTE | Neutral | We are fine to consider it after progress has been made for idle and inactive mode. |
| Ericsson | Yes | We see no issues with allowing slice-specific RACH also for CONNECTED mode |
| Apple | Yes |  |
| Fujitsu | Yes | We also support unified UE behavior, but discussion priority should be given to IDLE and INACTIVE, and CONNECTED is de-prioritized (i.e. if time is permitted, this can be discussed later). |
| Rakuten Mobile | No | RRC connected mode should have lower priority |

### Summary for Q2

Yes: 8 companies. [3 companies thought that would be useful. 2 company support unified behaviour]

No: 9 companies. [8 companies commented that RRC CONNECTED was agreed to be downprioritized. 2 company commented dedicated SR can be configured for the CONNECTED UE.]

Neutral: 2 companies. [2 company see some benefits but concerned about the TUs and would be fine after idle and inactive mode has been done.]

15 companies are OK to down prioritize slice specific RACH for CONNECTED mode.

**[15/19] Proposal 2: 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.**

Proposal: Slice specific RACH (including RACH isolation and RACH prioritization) is only applied to CBRA rather than CFRA. [1]

**Q3: Do you agree with above proposal?**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Company** | **Yes/No** | | **Comments** | | |
| CMCC | Yes | | Dedicated RACH resource is applied for CFRA. | | |
| Huawei, HiSilicon | Yes | | Reasonable proposal as CFRA uses dedicated RACH resources so that it is no need to consider slice based RACH sources. | | |
| Xiaomi | Yes | |  | | |
| OPPO | No | | Even if it is CFRA, there is some benefits for applying slice-specific RACH. For example, slice-specific RACH prioritization can help the UE with a specific slice re-send MAG1/MSGA with a larger ramping power value than legacy UE does, which assures fast cell accessing for the UE with specific slice. | | |
| Qualcomm | Yes | | For CFRA, NW assigns dedicated preamble for the CONNECTED UE, to reduce collision. It serves the similar intention of slice RACH. Considering the redundancy, we prefer to make this clarification. Otherwise, we will have more spec work for co-existence between slice RACH and CFRA.  @OPPO, it seems your comment here is conflicted with your comment in Q2. CFRA works for CONNECTED UE. | | |
| BT | Yes | | NW assigns dedicate resources for CFRA therefore the collision probability is reduced. If at some point a company can justify the need, we can always add CFRA Slice specific RACH. | | |
| Nokia | Yes, but | | It may depend on how CFRA resources are assigned | | |
| Intel | Yes | | Our understanding of the proposal is that the network will not assign CFRA resources for the UE to perform slice specific RACH. The UE will just use the CFRA resource assigned by the network to perform PRACH transmission. Whether the CFRA resources are associated with the slice specific RACH resource or the common RACH resource is not something of concern to the UE. | | |
| Lenovo | Yes | |  | | |
| LG | Yes | | Assuming the slice-specific RACH is only used for RRC\_IDLE and RRC\_INACTIVE, it seems natural to apply slice-specific RACH only to CBRA. | | |
| China Telecom | Yes | |  | | |
| APT | Yes | | Since we are not sure whether to enlarge the scope, i.e., support slice-specific RACH for RRC\_CONNECTED UE, we prefer to only apply CBRA for slice specific RACH. | | |
| Samsung | Yes | |  | | |
| CATT | Yes | | CFRA is dedicated resource and this is already one better alternative to guarantee the low latency. | | |
| Spreadtrum | Yes | | CFRA has dedicated RACH resources configured by NW. | | |
| ZTE | Yes | |  | | |
| Ericsson | | Yes | | Agree with others above |
| Apple | | Yes | |  |
| Fujitsu | | Yes, but | | It is a bit early to exclude CFRA in this early state of discussion. CBRA should be prioritized, and CFRA is de-prioritized (i.e. if time is permitted, this can be discussed later). |
| Rakuten Mobile | | Yes | |  |

### Summary for Q3

20 companies shared views for Q3.

Yes: 17. [5 company commented that dedicated RACH resource is enough for CFRA. ]

Yes but: 2. [1 company suggest to de-prioritize CFRA]

No: 1. [1 company commented that larger ramping power for MSG1/A re-sending can be helpfully if slice-specific RACH prioritization is configured for CFRA.]

**[19/20] Proposal 3: Slice specific RACH (including RACH isolation and RACH prioritization) is only applied for CBRA but not for CFRA.**

## 2.2 Co-existence with legacy UE and non-urgent slice

It is important that the introduction of slice specific RACH resource shall not prevent from accessibility for Rel-15 / Rel-16 legacy UEs. In addition, Rel-17 UEs supporting RACH isolation should also have non-urgent slice, i.e. the Rel-17 should not switch to another BWP to trigger common RACH when non-urgent slice traffic arrival. [1]

Proposal: To support legacy UE and non-urgent slice, if slice specific RACH resource is configured in one BWP, common RACH resource (i.e. legacy CBRA resource) is required to be configured in the same BWP. [1]

**Q4: Do you agree with above proposal?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CMCC | Yes | To support legacy UEs, the common RACH resource need always be configured. |
| Huawei, HiSilicon |  | For initial BWP, we think it may required to differentiate between common RACH reosurces and slice based RACH resources.  For dediated BWP, it is allocated by the network for RRC connected mode Ues. Based on Q2, if CONNECTED UE can’t apply slice specific RACH, there will be no slice based RACH resources in dedicated BWP, and then Q4 may not exist. |
| Xiaomi | Yes |  |
| OPPO |  | It may happen only for initial BWP if slice-specific RACH is not supported by RRC connected mode UE. Whether common RACH resource is restricted to legacy CBRA resource depends on the conclusion for Q3. |
| Qualcomm | Yes | We agree with Huawei’s comments: this proposal works only for IDLE/INACTIVE under initial BWP. If CONNECTED UE can also use slice RACH (Q2), we agree that this proposal is not necessary.  So, maybe in proposal, we can add “in initial BWP” or “for IDLE/INACTIVE UE” |
| BT |  | Yes for initial BWP as common RACH resources need to be always configured.  Depends for dedicated BWP. The answer depends on Q2. |
| Nokia | No | RACH prioritization with new parameters can be supported in backward compatible manner. Any possible methods for legacy UEs do not require dedicated proposal or agreement in Rel-17. There is also no definition of non-urgent slice |
| Intel | Yes for initial BWP. For non-initial BWP, see comments | For initial BWP, common RACH resource needs to be configured to support legacy UE and for slices that are not enabled to use sliced specific RACH.  For non-initial BWP and if slice specific RACH is to be supported for connected mode, common RACH resource needs to be configured for slices that are not enabled to use slice specific RACH. However, if UE does not have allowed slices that are not enabled to use slice specific RACH, then common RACH resource may not be needed for the BWP. |
| Lenovo | Yes but | So far, we can assume to have only one initial UL BWP for initial RACH. Whether to support additional initial UL BWP for RACH configuration due to other features (Redcap, coverage enhancement, SDT) is FFS.  Furthermore, we dislike the term “non-urgent” slice and suggest not to use it. RAN2 agreed to support RACH resource isolation for slices in order to provide guaranteed RACH resources to meet certain market needs. Such slices can be of type URLLC, eMBB, MIOT or non-standardized types. Therefore, saying slices for which specific RACH resources have not been configured are non-urgent is not appropriate and misleading. |
| LG |  | It is up to network decision. Even today, the UE switches the BWP for RA if there is no RACH resource in the current BWP. In this light, the UE behavior of BWP switching seems not a problem. |
| China Telecom | Yes for initial BWP | Agree with Huawei. |
| APT | Yes | Agree with Huawei |
| Samsung | See comment | As commented by other companies, we need a clarification whether the proposal is for initial BWP. |
| CATT | Yes | We agree with Huawei. |
| Spreadtrum | Yes, at least for initial BWP | At least for initial BWP, the slice specific RACH resources and common RACH resources should be configured together. |
| ZTE |  | As mentioned by other companies, we understand this proposal would be fine for the initial BWP to ensure the access from the legacy UE. Also, we are not sure about the “non-urgent slice” as we did not have the limitation that slice specific RACH resources can only be configured for urgent slice. So we would like to remove non-urgent slice and only say this is for the legacy UE.  Since it is up to the NW to configure, we think we can clarify it as a common understanding and no need to put any limitation in normative specs. |
| Ericsson | No | Common RACH resources will always be available in initial BWP, but common RACH resources are not necessarily needed for dedicated BWP. It is up to network configuration to assign common RACH resources also for dedicated BWP. |
| Apple | Yes |  |
| Fujitsu |  | The question is not sure for us e.g. what the non-urgent slice is. Having said that, we are ok with “it is important that the introduction of slice specific RACH resource shall not prevent from accessibility for Rel-15 / Rel-16 legacy UEs”. |
| Rakuten Mobile |  | We agree its easiest way to insure back ward compatibility. |

### Summary for Q4

20 companies shared comments for Q4.

Yes: 13 companies [All the supporting companies agree this proposal is applicable for initial BWP. 2 companies suggest not to use the term non-urgent slice]

N/A: 5 companies [1 company commented that for initial BWP, it may require to differentiate between common RACH reosurces and slice based RACH resources. 2 companies agree with the backward compatibility]

No: 2 companies [2 companies thought that the new parameters for RACH is supported in backward compatible manner and no need dedicated proposal or agreement in Rel-17.]

In total, 18 companies are supporting the proposal for initial BWP to ensure the backward compatible.

**[18/20] Proposal 4: To ensure the backward compatibility, it is RAN2’s common understanding that common RACH resource should be configured in initial BWP if the slice specific RACH resource is configured in initial BWP.**

## 2.3 RACH type selection and fallback

During the online session, RAN2 agreed to support configuring 2-step RA resources or 4-step RA resources or both for slices, as well as the legacy fallback mechanism. Several contributions [1,2,3,6,7] are supportive to have RA type fallback for slice based RACH. In Qualcomm’s contribution [1], the following 5 cases for RACH type configuration, selection and fallback are proposed. Companies are invited to share views on whether these 5 cases should be supported.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cases | RACH resource configuration in one BWP | RACH type selection | Fallback after MSGA attempt number beyond threshold | Notes |
| Case 1 | 2-step slice specific RACH  4-step common RACH | Always perform 2-step slice specific RACH | UE switch to MSG1 of 4-step common RACH | Via only configuring 2-step slice RACH resource, high priority slice may only trigger 2-step RACH to reduce latency |
| Case 2 | 2-step slice specific RACH  4-step slice specific RACH  4-step common RACH | RACH type selection based on RSRP threshold | UE can switch to MSG1 of 4-step slice specific RACH | No fallback from 4-step slice specific RACH to 4-step common RACH |
| Case 3 | 4-step slice specific RACH  2-step common RACH | Always perform 4-step slice specific RACH | No fallback |  |
| Case 4 | 4-step slice specific RACH  4-step common RACH | Always perform 4-step slice specific RACH | No fallback |  |
| Case 5 | 2-step slice specific RACH  2-step common RACH  4-step slice specific RACH  4-step common RACH | RACH type selection based on RSRP threshold | UE can switch to MSG1 of 4-step slice specific RACH | No fallback from 4-step slice specific RACH to 4-step common RACH. Not preferred due to large RACH resource usage |

**Q5: Do you support above 5 cases for RA configuration, selection and fallback?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No/Part of them** | **Comments** |
| CMCC | Yes | We support to have flexible RA configuration for slices. And we are also ok with the RA selection and fallback in the table. |
| Huawei, HiSilicon | Yes | We think the above table is very good and it includes almost all cases for RACH type selection and fallback. We understand that it follows the concept of legacy fallback mechanisms, so we support the above table. |
| Xiaomi | Part of them | For the fallback mechanism of case2/4/5, in our view, the fundamental intention to support slice-specific RACH configuration is to gurantee UE fast access, thus, we think if UE failed on 4-step slice-specific RACH resource, it should be allowed to use 4-step common RACH resource to initiate access attemp other than just wait. |
| OPPO | Yes | It can be the baseline. |
| Qualcomm | Yes | For the fallback from 4-step slice RACH to 4-step common RACH mentioned by Xiaomi, we are not convinced with its benefit, unless UE can know heavier congestion on slice specific RACH resource than common RACH. However, the UE doesn’t know the load difference from common RACH. We tend to simplify the procedure. |
| BT | Yes | A flexible RA configuration is required so we support the table above. |
| Nokia | Limited | 2-step RACH is to reduce the RA latency, thus we are wondering if it make sense to use 2-step RACH as fallback after the first one already failed?  To avoid too much resource segregation, maybe fallback should be limited to common RACH only as 4-step. It will offer some form of fallback (assuming RACH prioritization for dedicated resources did not work), and would help to identify the problems with the slice specific configurations |
| Intel | Yes but | As one of the objectives of the WI is for fast access, case 3 seems a bit counter-intuitive to not support 2-step slice specific RACH. But we are OK to support it in specifications. We also wonder if this covers all cases – for example is it possible to have 2-step slice specific and 2-step common RACH configured? The fallback for MsgA attempts and the RACH type selection look logical to us. |
| Lenovo | No | Case 1 looks ok.  Case 2: We wonder about the use-case to specify different RA types for slices as it is resource-consuming.  Case 3: This case looks really odd. Why should the slower 4-step RA type be configured for slices? We thought the intention is to speed-up the RACH access for slices.  Case 4: Configuration is ok but wonder why a fallback from 4-step slice RACH to 4-step common RACH should not be supported. In case of congestion of 4-step RACH resources a fallback to common RACH may be beneficial.  Case 5: same comment as for case 2. The benefit to specify different RA types for slices is not clear to us.  A case 6 with “2-step slice specific RACH and 2-step common RACH” is missing. |

|  |  |  |
| --- | --- | --- |
| LG | Part of them | 1/ It would be sufficient to configure either 2-step or 4-step slice-specific RACH per slice/slice group. Thus, we don’t think Case2 and 5 need to be supported.  2/ 4-step common RACH would need to be configured as a baseline as 2-step may not be available due to bad RSRP. Thus, Case3 should not be considered.  3/ We should consider the case6, which is 2-step slice-specific, 2-step common RACH, and 4-step common RACH are configured in one BWP.  For case 6, the UE would select RACH type based on RSRP threshold. UE can switch to Msg1 of 4-step common RACH. No fallback to 2-step common RACH. |
| China Telecom | Yes | We also support flexible RA configuration for slices. The above table can be the baseline. |
| APT | Part of them | We have concerns on case 3 since Rel-16 UE is not mandatorily to support 2-step common RACH without supporting 4-step common RACH. However, we are wondering whether we will down select one of them or support all of them in the specification. |
| Samsung | Yes with comment | Regarding the note in Case 1, the handling of high priority slice is not clear. We wonder if this note is related to UE behavior to select a slice among multiple intended slices. |
| CATT | Yes, but | We support the above cases. But we also have concerns whether slice-based RA could switch to common RA in case 2-5. If the number of UEs perform slice-based RA are large, we think switching to common RA is one good idea, especially when there is no extra RA resources are configured to slice-based RA in addition to existing RA resources. |
| Spreadtrum | Yes | As for Case 1, 2-step RACH cannot reduce latency if RSRP is below a certain threshold. |
| ZTE | - | We are fine to use this table for discussion and perform some down selection from them. |
| Ericsson | Yes | The table is a good starting point for the discussion |
| Apple | Yes | Our understanding is from spec design, flexible configuration should be allowed. |
| Fujitsu | Part of them | Case 1: It is fine.  Case 2: Wonder about “No fallback from 4-step slice specific RACH to 4-step common RACH”.  Cases 3: Wonder about “No fallback from 4-step slice RACH to 4-step common RACH”.  Case 4: Wonder about “No fallback from 4-step slice RACH to 4-step common RACH”.  Case 5: Wonder about “No fallback from 4-step slice specific RACH to 4-step common RACH”. |
| Rakuten Mobile | Yes | We can start discussing all five of them. |

### Summary for Q5

14 companies agree to take all these cases as baseline and to support flexible RA configurations.

Here are some specific comments for each case:

Case 1: Agreeable for all companies.

Case 2: 1 companies wonder about the use-case to specify different RA types for slices as it is resource-consuming. 1 company concerned whether slice-based RA could switch to common RA

Case 3: 4 companies thought case 3 looks odd and counter-intuitive. 1 company concerned whether slice-based RA could switch to common RA

Case 4: 3 companies thought fallback from 4-step slice RACH to 4-step common RACH should also be supported. But Qualcomm didn’t think so.

Case 5: 2 companies thought the benefit is not clear. 1 company concerned whether slice-based RA could switch to common RA.

2 companies proposed to add a case 6 with “2-step slice specific RACH and 2-step common RACH”

1 company proposed to add a case 7 “2-step slice-specific, 2-step common RACH, and 4-step common RACH are configured in one BWP”. The UE would select RACH type based on RSRP threshold. UE can switch to Msg1 of 4-step common RACH. No fallback to 2-step common RACH.

Considering the case 6 and case 7 are proposed by 1 or 2 companies, rapporteur add the two cased inside the table but with FFS on some unclear point.

1 company commented to avoid too much resource segregation, maybe fallback should be limited to common RACH only as 4-step. And 2 companies wondered whether to down select the cases.

And rapporteur found a case 8 maybe also missed that “4-step slice specific RACH, 2-step common RACH and 4-step common RACH are configured in one BWP”. The table is updated based on companies’ input and maybe taken as a starting point for further discussion. The changes and FFSes are marked with Red Font.

**Proposal 5.1: RACH type selection between 2-step slice specific RACH and 4-step slice specific RACH is based on a RSRP threshold.**

**FFS to introduce a slice specific threshold or reuse the legacy threshold.**

**FFS UE should first select between slice specific RA and common RA or UE should first select RA type between 2-step RA and 4-step RA**

**Proposal 5.2: The following table is taken as starting point for further discussion. (The changes are made in red font comparing with the original table)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Cases** | **RACH resource configuration in one BWP** | **RACH type selection for slice triggered access** | **Fallback after MSGA or MSG1 attempt number beyond threshold** |
| Case 1 | 2-step slice specific RACH  4-step common RACH | FFS Always perform 2-step slice specific RACH | Fallback to 4-step common RACH |
| Case 2 | 2-step slice specific RACH  4-step slice specific RACH  4-step common RACH | RACH type selection based on RSRP threshold | Fallback to 4-step slice specific RACH.  FFS Fallback from 4-step slice specific RACH to 4-step common RACH |
| FFS Case 3 is valid | 4-step slice specific RACH  2-step common RACH | FFS Always perform 4-step slice specific RACH | FFS:  No fallback vs. Fallback to common RACH |
| Case 4 | 4-step slice specific RACH  4-step common RACH | Always perform 4-step slice specific RACH | FFS:  No fallback vs. Fallback to common RACH |
| Case 5 | 2-step slice specific RACH  2-step common RACH  4-step slice specific RACH  4-step common RACH | RACH type selection based on RSRP threshold | Fallback to 4-step slice specific RACH.  FFS Fallback from 4-step slice specific RACH to 4-step common RACH. |
| FFS  Case 6 is valid | 2-step slice specific RACH  2-step common RACH | Always perform 2-step slice specific RACH | FFS:  No fallback vs. Fallback to common RACH |
| Case 7 | 2-step slice specific RACH  2-step common RACH  4-step common RACH | FFS Always perform 2-step slice specific RACH | Fallback to 4-step common RACH.  No fallback to 2-step common RACH. |
| FFS  Case 8 is valid | 4-step slice specific RACH  2-step common RACH  4-step common RACH | FFS Always perform 4-step slice specific RACH | FFS Fallback from 4-step slice specific RACH to 4-step common RACH. |

## 2.4 co-existence with MPS/MCS

**For the topic of** **prioritization parameter collision with MPS/MCS, here are the candidate approaches:**

Option 1: It should be clearly specified in the specification.

Option 1a: slice specific RA prioritization parameter should override MPS/MCS specific RA prioritization parameter. [2][13]

Option 1b: MPS/MCS specific RA prioritization parameter should override slice specific RA prioritization parameter. [3][12]

Option 1c: UE select the most beneficial parameters: max{powerRampingStepHighPriority for MPS/MCS, powerRampingStepHighPriority for slice} and min{scalingFactorBI for MPS/MCS, scalingFactorBI for slice }

Option 2: It should be configurable by network. [4]

**Q6: which option do you prefer**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option** | **Comments** |
| CMCC | 1a | In order to guarantee the fairness among UEs initiating the same slice, we prefer the slice specific RA prioritization parameter should override MPS/MCS specific parameter |
| Huawei, HiSilicon | 1a | We share similar views as CMCC. |
| Xiaomi | Option 1b. and Option 2 | We think it should be configurable by network and if not, MPS/MCS specific RA prioritization should overrule slice specific RA prioritization because it is configured to specific UE and can provide more precise configuration. |
| OPPO | 1a | We share the similar view as CMCC. |
| Perspecta Labs | Prefer 2, 1b is ok | MPS/MCS RA prioritization configuration should at least be able to override the slice specific one since it matters only to those UEs with the special Access Identities. Also, MPS/MCS override (1b) covers the corner case where a slice has not configured its RA prioritization parameters, which would happen with 1a implementation. To address all use cases, configurability (Option 2) is preferred. Agree with Xiaomi. |
| Qualcomm | Option 1a and Option 2 | Considering RAN2 is introducing RACH prioritization for different scenarios / cases ever from Rel-15 to Rel-17, we tend to think specifying a flexible / configurable way is more forward compatible way. This priority can be configured by gNB or be pre-configured via UE’s subscription.  Default rule is also acceptable to us, especially if (pre)configuration on priority is not available. Then, we agree with CMCC and Huawei. |
| BT | Option 2 | We don’t see the need to agree on option 1a or 1b when option 2 offers the flexibility to choose among them.  It is important to note that different regions may have different requirements and only Option 2 offers the required flexibility. |
| Nokia | Option 2 | We believe it should dbe clear from procedures, but we are not convinced the conflict would appear. E.g. MCS as Access identity 2 may be not conficting with any Access Category if the NW configuration is set properly.  Our understanding is that it should be under NW control to prioritize one or the other type of access. This will be possible with barring configuration setup (no special prioritization rule on the UE side.) |
| Intel | See comments | We are not sure if this is a realistic use case where the access is for MPS/MCS and slice specific RACH priority at the same time and if so, whether we need to define a specific UE behaviour. |
| Lenovo | Option 1a | In general, we should follow the rule that if a NW configures a new feature then the UE that supports this new feature has to apply the configuration for that feature. Furthermore, we can assume that it’s up to NW implementation whether the RA prioritization parameters for slices and MPS/MCS can be same or different. |
| LG | Option 1b. ok to option 2. |  |
| China Telecom | 1a | Agree with CMCC. |
| APT | Option 1b, Option 2 | MPS/MCS is related to national security and emergency cases. Thus, we believe MPS/MCS has higher priority than slices. However, we also think the NW can configure by itself. |
| Samsung | See comment | We are not sure whether there is a need that slice specific RACH config include MPS/MCS specific RA prioritization parameter. |
| CATT | Option 2 | Network should give flexibility on configuration. |
| Spreadtrum | Option 2 | It is better to be configured by NW. The MPS/MCS and slice services have some overlapped scenarios. The prioritization should be flexible enough to fulfill the different requirement. |
| ZTE | Option 1c | We understand it would be better if we let UE select the scaling factor and power ramping step from the values configured for MPS and MCS which are more beneficial for UE’s access.  For example, for the two scaling factor values configured for MPS and intended slice separately, UE can select the smaller value. While for the two power ramping steps configured, UE will select the larger value. |
| Ericsson | Prefer 2 |  |
| Apple | Option 1b,  Fine to Option 2 |  |
| Fujitsu | 1a and 2 | We don’t have a strong view, but tend to think that NW configure can provide RA prioritization for RAN slice and MPS/MCS can be the same, so not sure if the conflict occurs. |
| Rakuten Mobile | Option 1b or option 2. |  |

### Summary for Q6

* Option 1 (clearly specified): 14 companies
  + Option 1a (Slice override MPS): 7 companies
  + Option 1b (MPS override slice): 6 companies
  + Option 1c (select most beneficial parameters): 1 company
* Option 2 (configurable by network): 13 companies

And 3 companies wondered whether the conflict may occur, while 18 companies agreed the issue need to be resolved.

It seems each side got numbers of support, and looks difficult to converge at this meeting. Rapporteur suggest to postpone.

**[18/21] Proposal 6: RAN2 confirms that the issue of prioritization parameter collision with MPS/MCS need to be resolved. There is UE based solution (option 1, fixed rule) or network based solution (option 2, configurable rule) or both. Discussion on pros and cons can be left to next meeting.**

## 2.5 Collision of slice based RA-RNTI and legacy RA-RNTI

As if slice-specific RACH resources are configured in addition to legacy common RACH resources, based on legacy RA-RNTI calculation formula, the value of RA-RNTI calculated for using existing common RACH resources and slice-specific RACH resources may be same. And then UE can not recognize which RACH resource pool the RAR is associated. [3]

Q7: Do you think there is the collision of slice-based RA-RNTI and legacy RATI if slice-based RACH resources are configured in addition to the existing common RACH resources, and RAN2 need to address it?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes or No** | **Comments** |
| Xiaomi | Yes | As we analyze in [3], we think this issue exists and need to be considered to resolve. |
| OPPO | Yes | The issue on RA-RNTI collision exists, and it can be addressed by using a new RNTI associated with slice-specific RO, as we mentioned in our paper [8]. |
| Qualcomm | No | In Tuesday’s online discussion, RAN2 has agreed to use separate RO and/or preamble for slice-based RACH. Then we don’t see RA-RNTI collision at least in separate RO case  For the shared RO case, we also don’t think this RA-RNTI collision exists. In Rel-16, 2-step RACH introduced a new RA-RNTI but the reason is that legacy 4-step UE may decode 2-step MsgB in shared RO. Because payload of msgB and msg2 are different, it may cause ambiguous issue if the legacy UE decodes the msgB RAR content and misunderstands the network’s response. However, in slice-based RACH, we don’t have MsgB/Msg2 enhancement. Thus, we don’t have such legacy UE ambiguous issue. Instead, it will waste RA-RNTI space, especially if we target for a unified RACH design. |
| Nokia | No | We are not convinced this is a problem. MSG2 is aware from which preamble the answer is going for, so this can be differentiated at MSG3 |
| Intel | See comment | For shared RO, we think that there is no issue as the preamble can be used as the differentiator.  For separate RO, it depends on whether the same PDCCH search space will be used. If it is the same, there may be possibility of RNTI collision |
| Lenovo | No | We wonder why there is an RA-RNTI issue. Common and slice-specific RACH are separated in time/frequency so there should be no issue acc. To the RA-RNTI computation as specified in TS 38.321:  The RA-RNTI associated with the PRACH occasion in which the Random Access Preamble is transmitted, is computed as:  RA-RNTI = 1 + s\_id + 14 × t\_id + 14 × 80 × f\_id + 14 × 80 × 8 × ul\_carrier\_id  where s\_id is the index of the first OFDM symbol of the PRACH occasion (0 ≤ s\_id < 14), t\_id is the index of the first slot of the PRACH occasion in a system frame (0 ≤ t\_id < 80), where the subcarrier spacing to determine t\_id is based on the value of μ specified in clause 5.3.2 in TS 38.211 [8], f\_id is the index of the PRACH occasion in the frequency domain (0 ≤ f\_id < 8), and ul\_carrier\_id is the UL carrier used for Random Access Preamble transmission (0 for NUL carrier, and 1 for SUL carrier). |
| LG | No | For separated RACH resource, we see no issue. |
| APT | No | Agree with Lenovo |
| Samsung | Yes with comment | In shared RO, preambles will be different, so there is no issue.  In separate ROs, when slice specific RO is FDMed with legacy RO, s\_id, t\_id, f\_id for slice specific RO and legacy RO can have same values. This results in RA-RNTI collision. |
| CATT | No | We agree with QCOM. |
| Spreadtrum | No | Share similar views with QC. |
| ZTE | Yes | Agree with Samsung that the RA-RNTI collision would happen in separate RO case and we need to address it. |
| Ericsson | Yes, but… | We agree with the issue, but this can also be solved by network configuration. This issue has also been identified in the past but has been left to network implementation. This may be discussed with low priority. Other issues should be addressed first. |
| Apple | No | Perhaps proponents can illustrate more under what kind of RO configuration would collision happen. |
| Fujitsu | No | Agree with companies above. |
| Rakuten Mobiile | No | This shouldn’t be an issue as mentioned by other companies. |
| Huawei, HiSilicon | Yes with comments | We share similar views as Samsung and Intel. The conlision issue may happen in case of separate ROs. |

### Summary for Q7

Yes: 6 companies. [3 companies commented that the collision may happen in case of separate ROs.]

Yes but: 1 company. [1 company agree this issue may happen but can be solved by network configuration, and suggest to be discussed with low priority]

No: 10 companies. [The companies don’t think there is RA-RNTI collision issue.]

It seems companies have different views on whether the collision issue exist or not. Rapporteur suggest to postpone this issue and can be further discussed based on companies’ input.

**[7/17] Proposal 7: FFS whether there is collision between slice-based RACH RA-RNTI and legacy RA-RNTI.**

# 3 Conclusion

***The following proposals are suggested to be discussed and agreed during online session:***

**Proposal 1: RAN2 is suggested to agree on one of the two options on whether MO signalling is applicable for slice specific RACH:**

* **Option 1 [15/19 Original proposal]: Only MO data arrival triggered RACH can apply slice specific RACH. MO signaling (e.g. mo-Signalling and mo-SMS) triggered RACH is not applied to slice-specific RACH.**
* **Option 2 [Rapporteur Proposal]: 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.**

**[15/19] Proposal 2: 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.**

**[19/20] Proposal 3: Slice specific RACH (including RACH isolation and RACH prioritization) is only applied for CBRA but not for CFRA.**

**[18/20] Proposal 4: To ensure the backward compatibility, it is RAN2’s common understanding that common RACH resource should be configured in initial BWP if the slice specific RACH resource is configured in initial BWP.**

**Proposal 5.1: RACH type selection between 2-step slice specific RACH and 4-step slice specific RACH is based on a RSRP threshold.**

**FFS to introduce a slice specific threshold or reuse the legacy threshold.**

**FFS UE should first select between slice specific RA and common RA or UE should first select RA type between 2-step RA and 4-step RA**

**Proposal 5.2: The following table is taken as starting point for further discussion. (The changes are made in red font comparing with the original table)**

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| Case 4 | 4-step slice specific RACH  4-step common RACH | Always perform 4-step slice specific RACH | FFS:  No fallback vs. Fallback to common RACH |
| Case 5 | 2-step slice specific RACH  2-step common RACH  4-step slice specific RACH  4-step common RACH | RACH type selection based on RSRP threshold | Fallback to 4-step slice specific RACH.  FFS Fallback from 4-step slice specific RACH to 4-step common RACH. |
| FFS  Case 6 is valid | 2-step slice specific RACH  2-step common RACH | Always perform 2-step slice specific RACH | FFS:  No fallback vs. Fallback to common RACH |
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**[18/21] Proposal 6: RAN2 confirms that the issue of prioritization parameter collision with MPS/MCS need to be resolved. There is UE based solution (option 1, fixed rule) or network based solution (option 2, configurable rule) or both. Discussion on pros and cons can be left to next meeting.**

***The following issue looks difficult to converge at this meeting and can be captured with FFS.***

**[7/17] Proposal 7: FFS whether there is collision between slice-based RACH RA-RNTI and legacy RA-RNTI.**

# 4 References

1. [R2-2102697](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2102697.zip) Slice specific RACH Qualcomm Incorporated discussion
2. [R2-2103696](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2103696.zip) Discussion on slice based RACH configuration CMCC discussion Rel-17
3. [R2-2102761](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2102761.zip) Considerations on slice based RACH configuration Beijing Xiaomi Software Tech discussion
4. [R2-2104019](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104019.zip) Analysis on slice based RACH configuration CATT discussion
5. [R2-2102832](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2102832.zip) Considerations of slice based RACH Intel Corporation discussion Rel-17
6. [R2-2102989](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2102989.zip) Considerations on slice-based PRACH configuration Lenovo, Motorola Mobility discussion Rel-17
7. [R2-2103089](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2103089.zip) Slice based RACH configuration Samsung discussion Rel-17
8. [R2-2103214](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2103214.zip) Consideration on slice-specific RACH OPPO discussion Rel-17
9. [R2-2103240](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2103240.zip) Consideration on slice based RACH configuration Spreadtrum Communications discussion Rel-17
10. [R2-2103376](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2103376.zip) Slice based RACH configuration vivo discussion Rel-17
11. [R2-2103548](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2103548.zip) RACH prioritisation for slices Nokia, Nokia Shanghai Bell discussion Rel-17 FS\_NR\_slice

1. [R2-2103882](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2103882.zip) Discussion on slice based RACH Apple discussion Rel-17

1. [R2-2104005](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104005.zip) Discussion on slice based RACH configuration Huawei, HiSilicon discussion Rel-17
2. [R2-2104064](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104064.zip) Discussion on slice specific RACH resources and RACH prioritization ZTE corporation, Sanechips discussion Rel-17
3. [R2-2104099](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104099.zip) Slice-specific RA procedure LG Electronics UK discussion