**3GPP TSG RAN2 #116-bis-e R2-21xxxxx**

**Online, 17 – 25 January 2021**

**Agenda Item:**  **8.8.1 Organizational**

**Source: Huawei (email rapporteur)**

**Title:** **Report of [Post116-e][243][Slicing] Running NR RRC CR for RAN slicing (Huawei)**

**Document for: Discussion and Decision**

### 1 Introduction

This is the email report of [Post116-e][243][Slicing] Running NR RRC CR for RAN slicing (Huawei):

* [Post116-e][243][Slicing] Running NR RRC CR for RAN slicing (Huawei)

Scope: Update running NR RRC CR for RAN slicing based on agreements. Can discuss whether to introduce new "T320" timer as part of this discussion.

Intended outcome: Running CR

Deadline: Short (not for RP)

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|  |  |  |
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In this report, whether to introduce new T320 will be discussed. In addition, RAN2#116-e agreed the following but the endorsed RRC CR has a different design on it. After checking with the session chair, it can be also discussed here.

* 2: The indication for whether slice override MCS, MPS or MPS override slice is common for all slice groups.

### 2 Discussion

#### 2.1 T320 timer for RAN slicing

We have agreed it in RAN2#113b-e:

2 UE is only configured with either the existing dedicated priority configuration or the slice info in RRC Release.

3 In the case that slice info is also provided to the UE in the RRC Release message while SIB also provides the slice info, UE follows the dedicated slice info from RRC Release while T320-like timer is running and only if it expires that it follows the slice info in the SIB

4 In the case that existing dedicated priority configuration is provided to the UE in the RRC Release message while SIB also provides the slice info, UE follows the dedicated priority configuration while T320 is running as per legacy and only if it expires that it follows the slice info in the SIB

6 For UE supporting slice based cell reselection, the UE should use slice info in the SIB for cell reselection if both slice info and existing cell reselection priority is broadcast in the SIB.

As pointed out by some compaines, agreement 2 has excluded the possibility that both legacy priority and slice based frequency priority are included in the same RRC release message, so it is reasonable to just reuse the legacy T320 for slice based frequency priority.

**Question 1: Do companies agree that legacy T320 timer is applied to slice specific frequency priority?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | We don’t see the need for a new timer because above agreement 2 has excluded the possibility that both legacy priority and slice specific frequency priority are included in same RRC release. Meanwhile please note T320 timer is included in UE dedicated RRC message. Thus, if slice specific frequency priority is included in RRC release, gNB can configure a suitable value via legacy T320 timer. |
| OPPO | No | In our understanding, the operation of the T320 timer covers more cases than what we want here, i.e. besides starting the T320 timer upon the reception of *RRCRelease,* the UE also needs to maintain the T320 timer when performing cell (re)selection to NR from another RAT. It is not suitable to apply the remaining validity time configured for the legacy priorities by another RAT to slice-specific cell reselection. To avoid the impact on the legacy timer and keep the spec clean, we propose to introduce a new timer. |
| Apple | Yes | From the agreement, UE is only provided one set of configuration from legay priority and slice specificic frequency priority. Then it becomes clear to us reusing T320 is sufficient. |
| Xiaomi | No | We share the same view with OPPO to introduce a new timer which is independent from T320 timer.  In our understanding, not only the valid time of the new timer for slice based cell reselection is different from the legacy T320 timer, the working mechanism is also different. For example, the T320 timer can be carried on to other RAT while the timer for slices can only work on NR frequency. Thus, to avoid the impacts on legacy cell reselection, a new timer is preferred. |
| LGE | Yes | We prefer applying legacy T320 timer to slice specific frequency priority because we don’t see any reason to introduce new timer. As UE is configured with either existing configuarion or slice specific configuration, one single timer associated with dedicated configuration is enough, and no issue has been identified when legacy T320 timer is reused. |
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[Summary]

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

At RAN2#116-e meeting, we have the following agreement:

* 2: The indication for whether slice override MCS, MPS or MPS override slice is common for all slice groups.

In the endorsed NR RRC running CR, the indication is included in the following fields:

|  |
| --- |
| RA-PrioritizationForSlicing-r17 ::= SEQUENCE {  ra-PrioritizationSliceInfoList-r17 RA-PrioritizationSliceInfoList-r17,  ra-PrioritizationSlicingType-r17 BOOLEAN, -> this is the ASN.1 change for the indication  ...  }  RACH-ConfigCommon ::= SEQUENCE {  ra-PrioritizationForSlicing-r17 RA-PrioritizationForSlicing-r17 OPTIONAL -- Cond InitialBWP-Only  }  RACH-ConfigCommonTwoStepRA-r16 ::= SEQUENCE {  ra-PrioritizationForSlicingTwoStep-r17 RA-PrioritizationForSlicing-r17 OPTIONAL -- Cond InitialBWP-Only  } |

The gap between the RAN2 agreement and the RRC changes is that, based on the RAN2 agreement, there should be one indication in SIB, however, there are two indications (for 4-step RACH and 2-step RACH respectively) in the RRC changes (and also MAC changes). One alternative is that the indication can be put under the IE BWP-UplinkCommon.

– BWP-UplinkCommon

The IE *BWP-UplinkCommon* is used to configure the common parameters of an uplink BWP. They are "cell specific" and the network ensures the necessary alignment with corresponding parameters of other UEs. The common parameters of the initial bandwidth part of the PCell are also provided via system information. For all other serving cells, the network provides the common parameters via dedicated signalling.

***BWP-UplinkCommon* information element**

-- ASN1START

-- TAG-BWP-UPLINKCOMMON-START

BWP-UplinkCommon ::= SEQUENCE {

genericParameters BWP,

rach-ConfigCommon SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M

pusch-ConfigCommon SetupRelease { PUSCH-ConfigCommon } OPTIONAL, -- Need M

pucch-ConfigCommon SetupRelease { PUCCH-ConfigCommon } OPTIONAL, -- Need M

...,

[[

rach-ConfigCommonIAB-r16 SetupRelease { RACH-ConfigCommon } OPTIONAL, -- Need M

useInterlacePUCCH-PUSCH-r16 ENUMERATED {enabled} OPTIONAL, -- Need R

msgA-ConfigCommon-r16 SetupRelease { MsgA-ConfigCommon-r16 } OPTIONAL -- Cond SpCellOnly2

]],

ra-PrioritizationSlicingType-r17 BOOLEAN OPTIONAL

}

-- TAG-BWP-UPLINKCOMMON-STOP

-- ASN1STOP

**Question 2:** **For the indication for whether slice override MCS, MPS or MPS override slice is common for all slice groups, do companies agree that the indication should be put under the IE BWP-UplinkCommon?**

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | Our understanding is that this indication is common to both 2-step and 4-step RACH. Then, if it is placed within RACH-ConfigCommon and RACH-ConfigCommonTwoStepRA-r16, RAN2 may further specify whether these two indications should be aligned or not. We prefer to avoid such discussion. |
| OPPO | Yes | In our understanding, there is no need to separate the indication for 2-step and 4-step RACH, since how to override is more related to slice characteristic, not the RA type. |
| Apple | Yes | It would be simpler to put into the IE BWP-UplinkCommon. |
| Xiaomi | Yes |  |
| LGE | Yes |  |
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[Summary]

### 3 Conclusion

Based on email discussions, the following proposals are made:

[To be added]

### 4 References

[1] RAN2-116-e LTE 71 GHz DCCA Multi-SIM and RAN slicing (Tero)\_2021-11-12-final

[2] R2-2110645 [Post115-e][245][Slicing] Running NR RRC CR for RAN slicing (Huawei) Huawei discussion

### 5 List of RAN2 agreements

## **RAN2#116-e agreements**

Slice based cell reselection

[R2-2110645](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2110645.zip) [Post115-e][245][Slicing] Running NR RRC CR for RAN slicing (Huawei) Huawei discussion Rel-17 NR\_slice-Core Late

* P2-5 covered by meeting discussions, P1 can be discussed as part of RRC running CR post-meeting discussion.
* 1: A serving cell can provide slice support of neighbour cells.
* Best cell principle for intra-frequency cell reselection should be maintained i.e. UE camps on the strongest cell according to existing cell reselection rules.
* Network broadcasts slice info for the purpose of inter-frequency reselection. This will also need slicing priority for the serving frequency. FFS in which SIB.
* RAN4 is not in the scope of the WI

[R2-2110699](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2110699.zip) Slice-based cell re-selection algorithm Ericsson discussion Rel-17 NR\_slice-Core

* There is suppport to go with this approach.
* Offline discussion [241] (Ericsson) to sort out the details of this solution. If no problems are found, we adopt this approach in the running CR. We try to decide in 2nd week CB session.

[R2-2111268](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-2111268.zip) [draft] Reply LS on Slice list and priority information for cell reselection CMCC LS out 8.8.1 Rel-17 NR\_Slice-Core SA2 SA2, RAN3 CT1 Late

* Offline discussion [240] (CMCC) to discuss reply to SA2. Should try to identify open points and find consensus (if possible). Discuss in two phases: 1st week for views, 2nd week for LS details.
* 1: A network slice can be associated to none or only one slice group.
* 3: Working assumption: The granularities of the slice groups for cell reselection are per TA. FFS on the details (e.g. how to resolve TA boundaries).
* 4: It is up to SA2/CT1 whether to consider the slice registration status. From RAN2 perspective, both registered slices and not yet registered slices can be considered for the slice priority.
* Remove "one type of" and use "RAN2 aims to use slice groups for both cell reselection and slice based RACH"
* Use " RAN2 understanding is that the granularities of the slice groups are per TA but RAN2 details are FFS."
* With the above change, the LS content is agreed
* Revised in [R2-211310](https://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_116-e/Docs/R2-211310%20.zip)  (use RAN2 as source, remove "[Draft]" from title)

Slice based RACH

* 1 RAN2 agrees there are no issues to be solved w.r.t. “Cell- vs. UE specific slice group signalling” in standards
* Proposal 2 The solution for how the nw operator configures the following (CN and/or RAN OAM):

- mapping of slices to slice groups, sent from CN to UE in NAS signalling

- broadcast of slice group and its slice specific RACH configuration in SIB.

Potential NGAP impact is left for SA2/RAN3 to discuss.

* No LS sent to SA2/RAN3. Companies can raise relevant aspects directly in those groups.
* 4 RAN2 will use the following assumptions on slice groups and slice-specific RACH configuration in the work on Stage 3 details:
* 1. For slice-specific cell re-selection, cell reselection priorities for one or multiple slice group for the serving frequency are indicated in SIB of the serving cell.
* 2. Slice to slice-group configuration is common to cell reselection and RACH. Configuration of whether to use slice-specific cell re-selection or slice-specific RACH is up to network configuration (i.e. some slice groups may use cell reselection but not RACH, some may use RACH but not cell reselection, some may use both).
* 3. In a cell, there may be multiple slice-specific RACH configurations.
* 4. One or more of the slice groups are linked to a slice-specific RACH configuration.
* 5. There may be slice groups that are not linked to a slice-specific RACH configuration (they use the common RACH configuration).
* 6. All slices of a slice group use the slice-specific RACH configuration of the slice group.
* 1: RAN2 confirm the following understanding and send LS to RAN3, SA2 and CT1 to indicate it:

1) Mapping between slice and slice group should be consistent between serving gNB and UE, in order to avoid misunderstanding of system information.

2) Mapping between slice and slice group can be consistent within the same TA.

* FFS if there are other aspects to consider for TA boundaries. Can discuss those in [240] if time allows.
* 2: The indication for whether slice override MCS, MPS or MPS override slice is common for all slice groups.
* 3: RACH prioritization parameters can be configured per slice group.

UE capability

* As baseline, consider the following capabilities. FFS on details, can consider changes in the next meeting.
* #1: UE indicates its support of slice based cell reselection in the UE capability signalling with the following TS38.306 description.

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| --- | --- | --- | --- | --- |
| Definitions for parameters | Per | M | FDD-TDD DIFF | FR1-FR2 DIFF |
| ***sliceInfoforCellReselection-r17***  Indicates whether the UE supports sliceInformation on RRC release for slice based cell reselection in RRC \_IDLE and RRC INACTIVE as defined in TS 38.304 [21]. | UE | No | No | No |

* #2: Since slice based RACH is only applicable for UE in RRC IDLE and RRC INACTIVE, there is no need for explicit capability to inform network and should just be “Optional without UE capability” as follow under Section 5.4 Other features:

|  |
| --- |
| **Definitions for feature** |
| **Slice based random access**  It is optional for UE to support slice based random access as specified in TS 38.321 [8]. |

## **RAN2#115-e agreements**

Slice based cell reselection

* Agreements
* RAN2 needs to check with SA2/ CT1 if it is alright for AS to expect to receive slice list as well as slice priority information from NAS for cell (re)selection. Ask about both slices and slice groups.
* Agreements
* 2 Following is taken as the baseline for Solution Option 4:
* The “slice info” (for a single slice or slice group) agreed to be provided to the UE in the last RAN2 meeting using both broadcast and dedicated signaling are provided for the serving as well as neighboring frequencies. The following steps are used for slice based cell (re)selection in AS:
* Step 0: NAS layer at UE provides slice information to AS layer at UE, including slice priorities.
* Step 1: AS sorts slices in priority order starting with highest priority slice.
* Step 2: Select slices in priority order starting with the highest priority slice.
* Step 3: For the selected slice assign priority to frequencies received from network.
* Step 4: Starting with the highest priority frequency, perform measurements (same as legacy).
* Step 5: If the highest ranked cell is suitable (as defined in 38.304) and supports the selected slice in step 2 then camp on the cell and exit this sequence of operation; FFS: How the UE determines whether the highest ranked cell supports the selected slice.
* Step 6: If there are remaining frequencies then go back to step 4.
* Step 7: FFS: If the end of the slice list has not been reached go back to step 2.
* Step 8: Perform legacy cell reselection.
* 1: Solution Option 4 is selected for further work i.e., resolve the FFSs, send any required LSs and consequently start to draft specification CRs.
* Other solutions can be discussed based on company contributions (with technical analysis) next time.
* After online session, it was noted that the solution 4 FFSs were not resolved. Email discussion is assigned to try to tackle those (as they may involve LS to RAN4).

R2-2108928 LS on Slice list and priority information for cell reselection RAN2 LS out Rel-17 NR\_Slice-Core To: SA2, CT1 Cc: SA1

* The above LS was approved after email discussion “[Post115-e][241][Slicing] Slice list and priority information for cell reselection (Lenovo)”.

Slice based RACH

* Bulk agreements
* 3 Network based solution is introduced to resolve the issue of prioritization parameter collision with MPS/MCS, i.e., Network indicates whether slice override MPS or MPS override slice.
* 5 For slice based RACH prioritization, RAN2 will stick to the current baseline parameters, i.e., scalingFactorBI and powerRampingStepHighPriority, and no additional parameters for this release.
* 7 Reuse the legacy threshold for the selection between 2-step and 4-step slice initiated RACH
* 1 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.
* 2 Working assumption: The mapping between S-NSSAIs and slice groups should be configured to the UE through NAS signalling. Discuss problems for cell- vs. UE-specific signalling via post-meeting email discussion.
* 4 If no network indication is sent in case of slice prioritization parameter collision with MPS/MCS, it will be left to UE implementation.
* 8 It is RAN2 common understanding that 4-step common RACH needs to always be supported in initial BWP for legacy UE. And whether to configure 2-step slice specific RACH only or 4-step slice specific RACH only or both is left to network configuration.

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

*9 The following fallback case is supported:*

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

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

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

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

* 6, 9, 10 will be aligned to the common RACH partitioning discussion decisions

## **RAN2#114-e agreements**

Slice based cell reselection

**1: Frequency priority mapping for each slice (slice -> frequency(ies) -> absolute priority of each of the frequency) is provided to a UE.**

**Note: Signaling optimizations are not excluded.**

**Note: "slice may also mean "slice group"**

**1b: Frequency priority mapping for each of the slice (slice -> frequency(ies) -> absolute priority of each of the frequency) is part of the “slice info” agreed to be provided to the UE using both broadcast and dedicated signaling.**

**2: RAN2 kindly allow one more meeting cycle for understanding the necessity of Slice priority along with the following shortlisted solution directions for Idle mode mobility:**

**a) Option 4): Slice priority first looping over slice-frequency combination**

**b) Option 5): Maximize slice support**

**c) Option 6): Frequency priority of highest priority slice with adjustment based on actually supported slice(s) in best ranked cell, without multiple iterations of cell reselection**

**d) Option 7): Perform legacy cell reselection mechanism based on slice specific frequency priority**

**3: RAN2 consider a scenario in its work for slice specific cell (re)selection where it is possible that (Suitable) cells on the same frequency belonging to different TAs support different Slice(s).**

* 4: Working assumption: The Best cell principle according to absolute priority reselection criteria specified in clause 5.2.4.5 of TS38.304 needs to be met also for slice specific cell (re)selection.

**6: In addition to proposal 2, following aspects are FFS:**

**a) Content of “Slice Info” – to what extent the information needs to be and should be provided to support the Principle in proposal 5**

**b) If used, who provides the “Slice priority” (NAS/ AS, UE/ Network)**

**c) Can RAN2 continue to use “intended” slice for initial registration and idle-mode mobility**

**d) How UE in each of the solutions from proposal 2 uses slice info for cell reselection if both slice info and existing cell reselection priority is signaled (in the SIB and/ or dedicated signaling)**

Slice based RACH

* 4: RAN2 confirm for a slice group, separated RO and/or separate preamble can be configured within the existing RACH-ConfigCommon and RACH-ConfigCommonTwoStepRA
* 5: Same as NR Rel-15 conclusion, RAN2 conclude that there is no RA-RNTI collision between slice specific RACH and legacy RACH in shared RO
* 6: Same as NR Rel-15 conclusion, RAN2 conclude that the RA-RNTI collision between slice specific RACH and legacy RACH may happen in separate RO.
* Working assumption: this can be left to network implementation to resolve it (e.g. network configure RO in different time)
* FFS how many slice groups we can have and how they are indicated.

## **RAN2#113b-e agreements**

Slice based cell reselection

* Agreements
* 1 RAN2 aligns with SA2 assumption that support of slices in a TA is homogenous also for Rel-17 (i.e. all cells within a TA supports the same slice availability). If SA2 decides to support heterogeneous deployments, RAN2 can revisit this.
* 2 The criteria for determining the cell reselection priority for inter-frequency cell reselection should not be left to UE implementation, but should be defined in the specification (just like cell reselection priorities currently). The details of slice info and how the UE determines its priority list from slice info is FFS.
* 2b FFS how to define slice priorities for reselection and how to handle conflicts between different priorities (e.g. broadcast vs. dedicated slice-specific priorities)
* 5 UE is only configured with either the existing dedicated priority configuration or the slice info in RRC Release.
* 3 In the case that slice info is also provided to the UE in the RRC Release message while SIB also provides the slice info, UE follows the dedicated slice info from RRC Release while T320-like timer is running and only if it expires that it follows the slice info in the SIB
* 4 In the case that existing dedicated priority configuration is provided to the UE in the RRC Release message while SIB also provides the slice info, UE follows the dedicated priority configuration while T320 is running as per legacy and only if it expires that it follows the slice info in the SIB
* 6 For UE supporting slice based cell reselection, the UE should use slice info in the SIB for cell reselection if both slice info and existing cell reselection priority is broadcast in the SIB.
* 1: With regard the main solution for prioritisation for slice based cell reselection, the following topics to be the initial focus for discussion: Details of slice availability in terms of Slice grouping and frequency priority information for broadcast and RRC Release message, usage of “intended slice” (FFS whether we use this term in specification), UE prioritisation of slice when there is more than one intended slice and how UE determines frequency priority for inter-frequency cell reselection based on these.
* 2: Following topics are only considered after some progress on the main solution for prioritisation for slice based cell reselection: which SIB(s) to carry slice availability, whether an LS to SA3 is needed (if SST/SD is agreed for slice info), whether SIB segmentation/on-demand is required (if new SIB is defined).
* 3: Other topics that have some support and could be discussed further depending on companies providing more details on the motivation and level of support: slice based reselection for MO, different RSRP/RSRQ thresholds for inter and intra-frequency slice based cell reselection, need for Validity area in RRC Release

Slice based RACH

* Agreements
* 1 RAN2 aims to support both RO partition and preambles partition.
* 2 scalingFactorBI and powerRampingStepHighPriority can be configured at least in SIB (FFS for dedicated RRC signalling).
* 3 Network can configure slices with 4-step or 2-step (or both) RA resources.
* 4 Legacy 2-step RA fallback mechanism is supported.
* 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.
* 3: Slice specific RACH (including RACH isolation and RACH prioritization) is only applied for CBRA but not for CFRA.
* 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.
* 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.
* 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
* 5.2: The table from [R2-2104322](http://www.3gpp.org/ftp/TSG_RAN/WG2_RL2/TSGR2_113bis-e/Docs/R2-2104322.zip) can be used for further discussion.
* 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.