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

Electronic Meeting, 21 February – 3 March, 2022

**Agenda item: 8.8.2**

**Source: CMCC**

**Title: Report for [AT117-e][241][Slicing]** **Closing slice-specific reselection open issues (CMCC)**

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

**Document for: Discussion and Decision**

# Introduction

This document aims at address the remaining open issues for slice-specific cell reselection.

* [AT117-e][241][Slicing] Closing slice-specific reselection open issues (CMCC)

      Scope: Discuss and attempt to resolve remaining open issues for slice-specific cell reselection (as per previous open issue discussion). Can discuss further details of key aspects from [240] that require additional discussion.

      Intended outcome: Discussion report in [R2-2203650](file:///C:\Users\terhentt\Documents\Tdocs\RAN2\RAN2_117-e\R2-2203650.zip).

      Comment deadline: Thursday W1, 0900 UTC (for collecting views)

Rapporteur proposals: Thursday W1, 1200 UTC (proposed resolution of issues)

Document deadline: Friday W1, 0430 UTC (report, agreed CRs, final approved LS, etc.)

Rapporteur has provided suggested treatment for each open issue as identified in open issues list in R2-2202616.

* 1. **Simple issues, Company input into Pre117-e-offline**
  2. Company tdocs invited.
  3. CR rapporteur handled issue (CR rapporteur will propose resolution as input to next meeting).
  4. Other, e.g. immature area, reference to dependency, unclear status etc.

Since we already have a summary for slice-based cell reselection in R2-2203509, the open issues of slice-based cell reselection would be discussed based on the proposals in the summary. Considering that not all companies have contributions for each open issue, rapporteur suggests to confirm essential and simple proposals in this offline discussion. All company comments are welcome.

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|  |  |  |
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# Discussion

## List of 38.304 open issues

### OI 3.1: Details for option A without formula

***OI 3.1: Option A without formula: Solution 4, all NAS-prioritised slices with frequency priorities as well as legacy frequency priorities are considered, without iteration, without formula***

Rapp’s note: OI 3.1 and OI 3.2 are the most important issues for this meeting so be suggested to have offline and online discussion.

Working assumption in RAN2#116bis-e:

* Working assumption: We go with proposal A without formula, e.g. as proposed by Samsung or Apple. Exact details to be worked out for the next meeting.

***Summary from R2-2203509:***

From the above proposals, 4 out of 16 companies (Intel, CATT, Samsung, Qualcomm) definitely propose to confirm the working assumption on option A without formula. 13/16 companies give the details for option A without formula although they don’t definitely propose to confirm WA. Only one company (Lenovo) propose to use Proposal B (Solution 4) for further work.

Hence, rapporteur suggests to follow the majority view to confirm WA firstly.

**(15/16) Cat-a-Proposal 1: RAN2 confirm the working assumption on option A without formula.**

**Q1.1: Do you agree the cat-a-proposal 1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| **Qualcomm** | **Yes** |  |
| Lenovo, MotM | No | Since Option A without formular means “no iteration”, it leads to sub-optimal behaviour: e.g., a frequency will not be considered for a second highest priority slice if the reselection on said selected frequency does not work out for the highest priority slice. If there were just two (allowed) slices for a UE, **a slice based reselection will not be made even though a frequency supporting one of these is available**. |
| Huawei, HiSilicon | Yes |  |
| **Samsung** | **Yes** |  |
| Apple | Yes |  |
| LGE | Yes |  |
| CMCC | Yes |  |
| Intel | Yes |  |
| BT | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| NEC | See comment | Not sure if it is necessary to confirm this work assumption, we understand this is work assumption instead of agreement since it is not clear yet how to implement this into specification, which is quite important according to our experience of working on solution B. hence, we should just simply look into TPs |
| Nokia | Yes |  |
| Ericsson | Yes | Empty |
| ZTE | Yes |  |
| MediaTek | Yes |  |
| KDDI | Yes |  |

For details of option A without formula:

1. **The rules for slice specific frequency priority:**

Rapporteur try to summary some common rules from companies’ contributions.

* 1. Considering the slice/slice group priority provided by NAS, the frequencies that support higher priority slice/slice group have higher slice based frequency priority than the frequencies that support lower priority slice/slice group; (7 companies, Spreadtrum, Apple, CMCC, CATT, Huawei, ZTE, Ericsson)
  2. Among the frequencies supporting a slice/slice group with the same priority, the UE should follow the slice specific frequency priority received in SIB or RRCRelease (if configured); (9 companies, Spreadtrum, Apple, CMCC, Huawei, Samsung, QC, OPPO, ZTE, Ericsson)
  3. Among the frequencies supporting the same slice/slice group, the frequency not configured with slice specific reselection priority should be considered as lowest priority; (4 companies, Samsung, QC, OPPO, ZTE)
  4. The frequencies that support any slice/slice group have higher slice based frequency priority than the frequencies that support none of slice/slice group; (10 companies, Apple, CMCC, CATT, Huawei, LG, NEC, Samsung, QC, OPPO, Ericsson)
  5. For the frequencies that not support any slice/slice group, the UE should follow the legacy CellReselectionPriority received in SIB or RRCRelease; (8 companies, Apple, CMCC, Huawei, Nokia, Samsung, QC, OPPO, Ericsson)

There are some rules without consensus:

1. The same frequency can be sorted only one time or multiple times, in other words, whether a frequency can be checked only one time or multiple times in slice based cell reselection procedure.
   * 1. Only one time; (Samsung, QC, Ericsson)
     2. It can be multiple times; (Apple, CMCC, Huawei)
2. Among the frequencies supporting the same slice/slice group with same frequency priority, how to handle the frequency priority:
3. the frequency supporting maximum intended slices may be prioritized; (Apple, LG)
4. they are considered as equal priority; (Samsung, QC)
5. Up to UE implementation; (China Telecom)
6. **How to keep the frequency priority:**

4 companies (Apple, CMCC, Huawei, China Telecom) propose to generate a candidate frequency pool/list, but 4 companies (CATT, Samsung, QC, OPPO) proposes that it is up to UE implementation how the UE realises the rules (e.g. using an internal priority list or a Matrix).

Hence, the following proposal can be summarized to follow majority views:

**Cat-a-Proposal 2: The UE should determine the slice specific frequency priority according to the following rules:**

* 1. **Considering the slice/slice group priority provided by NAS, the frequencies that support higher priority slice/slice group have higher slice based frequency priority than the frequencies that support lower priority slice/slice group;**
  2. **Among the** **frequencies supporting a** **slice/slice group with the same priority, the UE should follow the slice specific frequency priority received in SIB or RRCRelease (if configured);**
  3. **Among the frequencies supporting the same slice/slice group, the frequency not configured with slice specific reselection priority should be considered as lowest priority;**
  4. **The frequencies that support any slice/slice group have higher slice based frequency priority than the frequencies that support none of slice/slice group;**
  5. **For the frequencies that not support any slice/slice group, the UE should follow the legacy CellReselectionPriority received in SIB or RRCRelease;**

**Q1.2: Do you agree the cat-a-proposal 2?**

|  |  |  |  |
| --- | --- | --- | --- |
| **Company** | **Yes for which bullet** | **No for which bullet** | **Comments** |
| **Qualcomm** | **All** | **N/A** | **We think all above 5 rules are:**   * **Technically reasonable** * **Aligned with both Ericsson’s CR with formular and original option 4.** |
| Lenovo, MotM | a), b), d) and e) | c) -> needs clarification | First, we believe all slice/slice group mentioned in the rules are with respect to the slices of a particular UE (given from NAS to AS) => please confirm,  Second, is c) talking about a case where a frequency f0 supports slice x but there is no frequency priority signalled for the frequency f0 corresponding to slice x? |
| Huawei, HiSilicon | All |  |  |
| **Samsung** | **Yes to a), b), c), and d).**  **See comment for e)** |  | **Ok with a), b), c), and d).**  **Considering that the legacy cell reselection priority is CellReselectionPriority + CellReselectionSubPriority, we propose the following update to e):**  **e) For the frequencies that do not support any slice/slice group, the UE should follow the legacy cell reselection priority ~~CellReselectionPriority~~ received in SIB or RRCRelease;** |
| Apple | All |  | Samsung’s modification to e) is fine. |
| LGE | Yes to a), b), d) and e)  See comment for c) |  | 1. Among the frequencies supporting the same slice/slice group, the frequency not configured with slice specific reselection priority should be considered as lowest priority;   We think it’s “lower” priority, not “lowest”, than the ones with slice specific reselection priority. They have higher priority than the ones not supporting any slice. |
| CMCC | All |  | To Lenovo:  For the first comment, [CMCC]Yes, all slices/slice groups mentioned in the rules are the intended slices/slice groups of the UE.  For the second comment, [CMCC]Yes, the network may not assign frequency priorities for all frequencies supporting slices/slice groups. This is similar with the existing procedure in TS 38.304 as follows:  *“In the case of system information, an NR frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field cellReselectionPriority is absent for that frequency).”*  In addition, we are fine with Samsung’s modification to bullet e). |
| Intel | All (with comment on e) | - | We agree in principle with all 5. However, it is not clear to us whether the scenario where UE has a legacy priority in RRCRelease in conjunction with slice based priority for other frequencies can happen; is it allowed to have slice based cell reselection information in SIB and dedicated legacy priority in RRC Release, with the dedicated legacy priority only being applied for the frequencies that do not have slice based priority. If the scenario is supported, then the handling of relative priority between the legacy dedicated priority in RRC Release and Slice specific priority in SIB needs more discussion.  In summary, we propose to delete the “or RRCRelease” in rule e. |
| BT | All |  |  |
| Xiaomi | See comments | See comments | For rule b), we want to know whether the **slice/slice group with the same priority** means the same slice/slice group or the slice/slice group with priority but the priority is equal. And if it is the former one, we are fine with all rules.  However, we can note that there are some collisions in the implementation needs to be resolved.   1. The collision of the relative frequency priority determined by rule A and rule B needs to be resolved.   *For example, assume that*  *Slice priority: Slice1>Slice2*  *Slice specific frequency priority:Slice1(F1)Slice2(F2>F1)*  *In this case, based on rule A, the relative frequency priority of F1 and F2 is F1>F2 and based on rule b) , the relative frequency priority is F2>F1, collision occurs.*  Thus, we propose to have an additional rule  If the relative frequency priority decided by rule a) and rule b) are in conflict, frequency priority is finally decided by rule a).   1. Based on rule b), the collision of the relative frequency priority determined by different slice specific frequency priority needs to be resolved.   *For example, assume that*  *Slice priority: Slice1>Slice2*  *Slice specific frequency priority:Slice1(F1>F2) Slice2(F2>F1)*  *In this case, based on the rule a), there is no frequency priority decided, and based on rule b), the relative frequency priority of F1 and F2 decided by slice1 and slice2 is conflict with each other.*  Thus, we proposal to have clarification on rule b) to resolve this collision.  The relative frequency priority is finally decided by the slice specific frequency priority of higher priority slice. And if there are slices with the same slice priority, the relative frequency priority can be decided by UE implementation. |
| OPPO | All |  | We understand that all slice/slice groups mentioned in the rules are with respect to the slices of a particular UE (given from NAS to AS).  In addition, Samsung’s modification to e) is fine to us. |
| CATT | All |  |  |
| Spreadtrum | All, but see comments |  | Support all five rules, also agree Samsung’s modification to bullet e).  Just one question that in original solution 4, we have discussed that if no suitable cell supporting selected slice is found, UE will perform legacy cell reselection. However, one frequency may have two sets of frequency priorities: one for slice frequency priority, another is for legacy frequency priority.  Assume F1 support slice (group). It will be configured with slice-specific frequency priority according to the above five rules and not be considered when adding the frequencies using legacy frequency priority at the end of frequency priority list. In this case, if no suitable cell supporting slice is found, UE will select a cell without the consideration of the highest ranked cell in F1 (high priority frequency in legacy cell reselection). We just wonder whether this case is acceptable. |
| NEC | All but with clarification on b) and e) |  | Considering other rules will generate an priority order of frequency instead of using the priority value configured in SIB or RRCRelease directly, for b) and e) , UE should also not use the slice specific or legacy frequency priority received in SIB or RRCRelease directly ,but use them to sort out the frequency order. |
| Nokia | All, but comment |  | We assume that   * 1. all points are about slice groups that has a priority provided by NAS   2. only frequencies that are listed in reselection information are considered (as commented by Lenovo)   3. it is based on the on slice specific reselection information (slice group specific frequency priorities) whether a frequency supports a slice group (not based on measurement)   4. Agreement on these principles does not close the issue on the next question on multiplicity (Q1.3).   Rewording of e) by Samsung is OK |
| Ericsson |  |  | Agree with rewording by Samsung and LGE and clarification by NEC. |
| ZTE |  |  | Agree with rewording by Samsung and LGE and clarification by NEC. |
| MediaTek | All |  |  |
| KDDI | Yes to a), b), and d).  See comment for e) | c) -> needs clarification | c)  Which is the “lowest priority” in this case, reselection priority 0 or lowest priority in the same slice group?  In the case of reselection priority 0, if NW provides inter rat reselection priority 0 in SIB5, UE will be configured the same priority between inter RATs. Current mechanism does not support having equal priority between inter RATs.  e)  Share the similar views as Samsung. |

**Cat-b-Proposal 3: The following rules can be discussed online:**

1. **Whether a frequency can be sorted only one time or multiple times, in other words, whether a frequency can be checked only one time or multiple times in slice based cell reselection procedure;**
2. **How to handle the frequency priority among the frequencies supporting the same slice/slice group with same frequency priority;**

**Option 1: the frequency supporting maximum intended slices may be prioritized;**

**Option 2: they are considered as equal priority;**

**Option 3: up to UE implementation;**

**Q1.3: For bullet a), do you think whether a frequency can be sorted only once or multiple times?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Once or multiple times** | **Comments** |
| **Qualcomm** | **Up to UE implementation**  **(See comments)** | **Our understanding is: as long as UE follows all 5 rules in Q1.2, we will have the same cell reselection outcome, irrespective of whether a frequency is sorted only once or multiple times (i.e., they are just different UE implementations).**  **An example to illustrate our understanding:**        slice1  slice2    Legacy (slice 1>slice 2 in NAS)          F1：6               2          1 (value is frequency priority value)          F2：3               6            2          F3：\*               5            3          F4:   \*               \*            4  **Alt-1: a frequency sorted only once:**   * Based on 5 rules, the UE will generate frequency priority order:{F1(6), F2(3), F3(5), F4(4)} * If best ranked cell supports slice 1, the UE will camp on F1. * If best ranked cell doesn’t support slice 1, the UE recalculates the frequency priority order with only slice 2 and legacy being considered. And {F2(6), F3(5), F1(2), F4(4)} will be generated.   **Alt-2: a frequency sorted multiple times:**   * Based on 5 rules, the UE will generate frequency priority order:{F1(6), F2(3), F2(6), F3(5), F1(2), F4(4)} * If best ranked cell supports slice 1, the UE will camp on F1. * If best ranked cell doesn’t support slice 1, the UE don’t need to recalculate the frequency priority order, but starts checking from 3rd item of {F1(6), F2(3), F2(6), F3(5), F1(2), F4(4)}, i.e., checking {F2(6), F3(5), F1(2), F4(4)}, which is same as Alt-1 |
| Lenovo, MotM | More than once when required | Practically this need not lead to re-measurement/ re-evaluation of the same frequency again. The measurements will be left to UE optimizations, and we define here only rules to ensure good slice reselection performance. |
| Huawei, HiSilicon | Multiple times | In our opinion, the UE behaviours are as below:   * Step 1: Based on 5 rules, the UE will generate frequency priority order:{F1(6), F2(3), F2(6), F3(5), F1(2), F4(4)} * Step 2:   + 2a: If the UE checks PCI list on F1&Slice1, and a cell meets the cell reselection criteria, the UE will camp on that cell   + 2b: If the UE checks PCI list on F2&Slice1, and a cell meets the cell reselection criteria, the UE will camp on that cell   + 2c, 2d, 2e, ….. (by the order of the frequency priority order in Step 1)   + Note: We think that there is no strict sequence between different steps (2a, 2b, 2c,…) because it depends on UE RRM measurements. In addition, if the UE finds that one cell meets 2a and one cell meets 2b, the UE should camp on the cell mentioned in 2a as the frequency has higher priority   Compared with Alt-2 in Qualcomm’s comments, our option allows that the UE can try F2&Slice2, while Alt-2 does not (the UE directly tries slice2 related frequencies). If the UE can find a suitable on F2&Slice1, it will still camp on a cell supporting Slice 1, so we think our option is better. |
| **Samsung** | **See Comments** | **In normal scenario, a frequency needs to be checked only once, according to its highest priority slice.**  **When the best cell in the frequency doesn’t support the highest priority slice available (for e.g. S), we have proposed that UE can recalculate priority according to the highest priority slice supported by best cell (for e.g. S1). So if there is no other frequency supporting S, UE may recheck the criteria based on S1 priority.**  **This can be done either by sorting multiple times or moving the frequency from one position in the list to another on priority change or moving the frequency from one cell in matrix to another on priority change etc.**  **The exact method can be chosen by UE implementation** |
| Apple | Multiple times | We share the exact same understanding as Huawei.  Though I admit UE implementation can somehow achieve similar outcome as explained by QC, I personally feel having the multiple copies allow UE to simplify the checking procedure. I mean UE can determine if the best ranked cell on one frequency support multiple slices at one time. |
| LGE | Up to UE implementation |  |
| CMCC | Multiple times | We share the similar view as Huawei.  If the same frequency is sorted multiple times, when the highest ranked cell doesn’t support the highest priority slice, there is no need to recalculate the frequency priority, the UE will continue to check the next frequency and may find a suitable cell on F2 supporting slice1. |
| Intel | See comments | We should differentiate two cases.  1)Under normal scenario (except in TA borders with different slice availability in neighbouring cells), it is sufficient to sort the frequency once based on the highest priority slice supported on that frequency.  2)For the TA border scenario, it should be done multiple times if cell level slice information is available and the expected highest priority slice on the highest priority frequency in the ordered list is not available in the highest ranked cell of that frequency, rearrange the frequency in the ordered list according to the frequency priority order for highest priority slice actually available on the cell if cell level slice availability is different to the highest priority slice on that frequency in that location. |
| BT | Multiple times |  |
| Xiaomi | See comments | Share the same view with Samsung, and anyway if the highest ranked cell of a frequency supports multiple slices, it needs to be checked more than one time. |
| OPPO | See comments | We understand that normally a frequency needs to be checked only once, according to its highest priority slice.  There is one exceptional case, i.e. the best cell in the frequency doesn’t support the highest priority slice(e.g. slice1). For this case, we think that the UE can follow solution A or B. Solution A is to recalculate priority according to the highest priority slice supported by the best cell(e.g. slice 2, slice1> slice 2), and solution B is to reset the priority according to the legacy frequency priority. If that is the case, in a certain cell reselection procedure, such frequency can be rechecked one more time by using slice 2 priority(if solution A is used and if there is no other frequency supporting slice1) or legacy priority if solution B is used and if there is no other frequency supporting any slice). |
| CATT | Multiple times | When perform recalculation, we think UE should also consider slice1 but only F1 will not be considered for slice1. Then both methods will have the same result if a frequency is sorted only one time using recalculation. As the method that a frequency can be sorted multiple times seems simpler, we slightly prefer this method. |
| Spreadtrum | Multiple times | We can agree that a frequency can be sorted multiple times. And the frequency priority should not be changed again during cell reselection for simplicity.  What’s more, the selected slice should be confirmed before checking whether the highest ranked cell supports the selected slice. As mentioned by HW, the frequency priority order may be:  {F1(6), F2(3), F2(6), F3(5), F1(2), F4(4)}  UE should regard slice 1 as selected slice and checks the highest ranked cell in F1(6) and F2(3) and should regard slice 2 as selected slice when checks the highest ranked cell in F2(6), F3(5), F1(2).  There is no need for UE to check whether slice 1 is supported by the highest ranked cells in F3(5). |
| NEC | Probably only once | As an example, if the serving frequency appears two times, how should UE executes measurement rule (i.e., which frequencies are considered lower priority than serving frequencies and hence UE can choose not to measure them?  To Qualcomm: for the last part of alternative 1, frequency priority will be recalculated based on another slice, it sounds the same iteration as in solution B, do I misunderstand anything? Same for the alternative 2, there seems a hidden iteration once you check with another slice |
| Nokia | Once, but see comments | Our interpretation of checking/listed "once" has an exception: a frequency can be checked/listed twice if it has a priority based on a slice group and a legacy (non-slice specific) priority.  Checking/Listing once is not perfect, but much simpler. Problems of listing/checking a frequency multiple times are the following:  1) It is unclear whether multiple measurements are needed or not  2) Which priority is considered for the current frequency (this is essential for measurement rules)  We agree with the comments that it should be left to UE implementation whether the frequency is listed twice or listed once, but the priority is changed when necessary. |
| Ericsson | UE implementation | Using legacy cell re-selection principle means that each frequency can only have one reselect priority. However, UE may implement this a list where each frequency may appear multiple times. In that case, the priority that corresponds to the later entries can be used as temporary reselection priority if the best cell does not support a slice. |
| ZTE | UE implementation |  |
| MediaTek | Up to UE implementation |  |
|  |  |  |

**Q1.4: For bullet b), how to handle the frequency priority among the frequencies supporting the same slice/slice group with same frequency priority, which option do you prefer?**

**Option 1: the frequency supporting maximum intended slices may be prioritized;**

**Option 2: they are considered as equal priority;**

**Option 3: up to UE implementation;**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1/2/3** | **Comments** |
| **Qualcomm** | **Option 2 and option 3 (they are not mutual exclusive)** | **We think Option 2 and option 3 are aligned with legacy behaviour in 38.304. Please note below copy of NOTE3 from section 5.2.4.1 of TS 38.304:**  *NOTE 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.* |
| Lenovo, MotM | 3 | No need to specify this. |
| Huawei, HiSilicon | Option 2 and option 3 | Share the similar views as Qualcomm. |
| **Samsung** | **Option 2** | **Option 2: they are considered as equal priority.** |
| Apple | Option 1 | We added one note to the TP, to make it soft enough. |
| LGE | Option 1 | In a cell associated with the frequency supporting more intended slices, the probability to move to another cell supporting intended service is low. |
| CMCC | Prefer option 1, acceptable for option2/3 | If the frequency supporting maximum intended slices is prioritized, more slices are available for the UE. |
| Intel | Option 2 |  |
| BT | Prefer Option 1, acceptable option 2 | From an operator point of view, a predictable behaviour is preferred and that is option 1 or option 2.  Option 3 will provide an unpredictable behaviour so it is not desired once we need to engineer the network. |
| Xiaomi | Option 3 |  |
| OPPO | Option 2 or 3 | Either is fine to us. |
| CATT | Prefer option 1, acceptable for option2/3 |  |
| Spreadtrum | Option 2 and option 3 | For the option 1, it still cannot solve the bullet b) totally and only covers part of issues.  Things will be more complex, if more than one frequencies support the same number of slices. In this case, should we prioritize the frequencies supporting higher priority slices?  For example: slice priority (Slice 1>Slice 2>Slice 3)  Slice1 Slice 2 Slice 3  F1: ✓ x ✓  F2: ✓ ✓ x  F3: ✓ ✓ ✓  According to the option1，F3 should have higher frequency priority than F1 and F2. But the frequency priority of F1 and F2 still hard to determine.  To keep it simple, option 2 and option 3 is OK. |
| NEC | Option2 or option 3 if It is easy to implement option3 in the end | Option2 is simpler,  Option 3 can be considered if it is easy to implement, but should be discussed with lower priority |
| Nokia | Option 2 | This is the legacy behaviour when there are frequencies with the same priority |
| Ericsson | Option 1 and 2. | Option 1 will optimize slice access. For frequencies supporting same number of slices, we prefer the legacy behaviour of Option 2 is used. |
| ZTE | Option 1 |  |
| MediaTek | Option 3 |  |
| KDDI | Option2 |  |

### OI 3.5: If the UE is configured with slice based dedicated priority, but the UE cannot find a suitable cell, whether and how to fallback to legacy cell reselection

***Summary from R2-2203509:***

From the above proposals, QC and CMCC suggest to reuse the legacy procedure (i.e., UE first enters any cell selection state and performs cell selection) when the UE cannot find a suitable cell if the UE is configured with slice based dedicated priority, and in legacy procedure, if priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. Samsung and Huawei’s view are similar. But Ericsson proposes that the UE shall use broadcasted legacy priorities if slice specific frequency priorities are sent in RRC release, but no legacy priorities are included.

Hence, rapporteur suggests to confirm the following understanding firstly:

**Cat-a-Proposal 8.1: RAN2 confirm that if the UE is configured with slice specific frequency priority via RRCRelease message, the UE shall ignore all the slice specific priorities provided in system information.**

**Q2.1: Do you agree cat-a-proposal 8.1?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| **Qualcomm** | **Yes** | **It is aligned with legacy principle when both dedicated signalling and common signalling are provided to the UE.**  **Please note that legacy (cell specific) frequency priority in SIB are still needed to be applied by the UE because some frequencies may not support any slice, i.e., rule e) in Q1.2.** |
| Lenovo, MotM | Yes | This is in line with *CellReselectionPriority*. |
| Huawei, HiSilicon | Yes | We think that if the UE receives dedicated slice reselection info via dedicated ignalling and legacy reselection info via SIB, the UE should combine both information.  For example, based on Qualcomm’s scenario in Q1.3 (as below), If slice1 and slice2 info is received from dedicated ignalling and legacy info is received from SIB, the UE should try F1, F2, F3 and F4.        Slice1  slice2    Legacy (slice 1>slice 2 in NAS)          F1：6               2          1 (value is frequency priority value)          F2：3               6            2          F3：\*               5            3          F4:   \*               \*            4 |
| **Samsung** | **Yes** |  |
| Apple | Yes |  |
| LGE | Yes |  |
| CMCC | Yes |  |
| Intel | Yes |  |
| BT | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes | We would like to clarify whether this proposal means:  if the UE is configured with slice specific frequency priority via RRCRelease message, the UE shall ignore all the slice specific priorities provided in system information**, even if the slice frequency priorities in RRCRelease and SIB are for different slices and/or different frequencies.** => please confirm. |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| NEC | yes | As general principle, dedicated configuration should take precedence than common configuration. |
| Nokia | Yes |  |
| Ericsson | Yes | Agree with Huawei and Qualcomm that UE should use both slice specific and legacy priorities for cell re-selection. However, it must be possible to include both legacy priorities and slice specific priorities in dedicated signalling. If not included, UE should read legacy priorities from SIB. |
| ZTE | Yes |  |
| MediaTek | Yes |  |
| KDDI | Yes |  |

If the proposal 8.1 is agreed, for OI 3.5, rapporteur suggests to follow majority view to reuse the legacy procedure.

**Cat-a-Proposal 8.2: The legacy procedure (i.e., UE first enters any cell selection state and performs cell selection) should be reused when the UE cannot find a suitable cell if the UE is configured with slice based dedicated priority.**

**Q2.2: Do you agree cat-a-proposal 8.2?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| **Qualcomm** | **Yes** | **It is legacy behaviour of TS 38.304** |
| Lenovo, MotM | Yes |  |
| Huawei, HiSilicon | Yes |  |
| **Samsung** | **Yes** |  |
| Apple | Yes |  |
| LGE | See comment | Yes, but different barring alleviation conditions can be applied. E.g., when the UE moves to other area, or the UE receives the updated slice information. |
| CMCC | Yes |  |
| Intel | Yes | After the frequencies using the legacy cell reselection priorities are also scanned. |
| BT | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| NEC | Yes | Share the same understanding as Intel |
| Nokia | Yes, but | Not supporting a slice group shall not mean that the cell is not suitable |
| Ericsson | Yes | Share same understanding as Intel |
| ZTE | Yes |  |
| MediaTek | Yes |  |
| KDDI | Yes |  |

### OI 3.6: Whether the inter-RAT frequency should be considered in slice-based cell reselection

***Summary from R2-2203509:***

From the above proposals, QC and CMCC propose that slice specific frequency priority values are not assigned to inter-RAT frequencies, 3 companies (Intel, Samsung, Ericsson) propose to consider the inter-RAT frequency at the bottom of list with legacy priority, and Spreadtrum proposes inter-RAT frequency should not be considered in slice-based cell reselection.

This issue is also related to OI 3.1, rapporteur suggests the following proposal:

**Cat-a-Proposal 9: Inter-RAT frequencies are not configured with slice specific frequency priority, but inter-RAT frequencies can be considered in slice based cell reselection based on legacy frequency priority** **after all frequencies that support any slice/slice group.**

**Q3: Do you agree cat-a-proposal 9?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| **Qualcomm** | **Yes** | **We think it is the most reasonable way forward: LTE frequencies can still be considered (for coverage) with lowest priority** |
| Lenovo, MotM | No | inter-RAT frequencies can’t be considered in slice based cell reselection. If the UE does not reselect to an NR cell on a higher priority and needs to find an Inter-RAT cell, like in legacy, the reselection to Inter-RAT frequency can be attempted. |
| Huawei, HiSilicon | Yes | Agree with Qualcomm |
| **Samsung** | **Yes** |  |
| Apple | Yes |  |
| LGE | No | The target of this WI is NR only. |
| CMCC | Yes |  |
| Intel | Yes | LTE frequencies will still be considered using legacy cell reselection priorities after the NR frequencies with slice based priority are considered. |
| Xiaomi | Yes |  |
| OPPO | Yes | Inter-RAT frequencies can be considered with lower priority, i.e. using legacy cell reselection priorities after the NR frequencies supporting slice are considered. |
| CATT | Yes |  |
| Spreadtrum | Yes | In our original understanding, inter-RAT frequency should not be considered in slice-based cell reselection because it doesn’t have slice specific frequency priority. The legacy cell reselection will be performed if UE cannot find a suitable cell using slice-specific frequency priority.  Now that, legacy frequency priority is considered together with slice specific frequency priority. We can also accept the above proposal considering coverage purpose. |
| NEC | Yes | Without iteration, we understand that slice based frequency priority will be integrated with legacy NR frequency priority to create a frequency list with order, then intra-RAT frequency should be in the list as well as the NR frequency which does not support any slice group. |
| Nokia | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |
| MediaTek | Yes |  |
| KDDI | Yes | Share the similar views as Intel. |

### OI 3.10: The slice info is slice or slice group specific

***Whether the slice specific cell reselection information provided by the network in SIB or RRCRelease message is slice or slice group specific***

***Summary from R2-2203509:***

For slice info provided in SIB, all companies (9/9) agree that it should be slice group specific.

For slice info provided in RRCRelease, 6/9 companies (Qualcomm, CATT, Huawei, Nokia, NEC, Ericsson) propose that it should be slice group specific, but 3/9 companies (Xiaomi, Spreadtrum, CMCC) propose that it can be either slice or slice group specific.

Hence, the following proposals are suggested to reach:

**(9/9) Cat-a-Proposal 12: The slice specific cell reselection information provided by the network in SIB is slice group specific.**

**Q4.1: Do you agree cat-a-proposal 12?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| **Qualcomm** | **Yes** |  |
| Lenovo, MotM | Yes |  |
| Huawei, HiSilicon | Yes |  |
| **Samsung** | **Yes** |  |
| Apple | Yes |  |
| LGE | Yes |  |
| CMCC | Yes |  |
| Intel | Yes |  |
| BT | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| NEC | Yes |  |
| Nokia | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |
| MediaTek | Yes |  |
| KDDI | Yes |  |

**Cat-b-Proposal 13: The slice specific cell reselection information provided by the network in RRCRelease is slice group specific (6/9) or it can be either slice specific or slice group specific (3/9).**

**Q4.2: which option do you prefer for slice specific cell reselection information provided by the network in RRCRelease?**

**Option 1: slice group specific.**

**Option 2: it can be either slice specific or slice group specific.**

|  |  |  |
| --- | --- | --- |
| **Company** | **Option 1 or 2** | **Comments** |
| **Qualcomm** | **Option 1** | **Otherwise, do we need to specify how the UE performs the mapping from slice level (in RRC release) to slice group level in AS layer?** |
| Lenovo, MotM | Option 2 | This allows flexibility |
| Huawei, HiSilicon | Option 1 |  |
| **Samsung** | **Option 1** | **The slice specific cell reselection information provided by the network in RRCRelease is slice group specific.** |
| Apple | Option 1 |  |
| LGE | Option 1 |  |
| CMCC | Option 2 | RRC signalling is protected by security mechanisms, and payload size is larger than system message, so option 2 is more flexible for network and this can provide UE-specific slice based cell reselection priority to help the UE reselect to a suitable cell.  We understand that the UE doesn’t need to perform mapping from slice level (in RRCRelease) to slice group level in AS layer. |
| Intel | Option 1 |  |
| BT | Option 2 | Same view as CMCC |
| Xiaomi | Option 2 | Per slice configuration in RRCRelease should be allowed to provide more precise control than per slice group. And to make UE aware of slice specific cell reselection info provided by RRCRelease, the slice/slice mapping as well as slice group which are all maintained in NAS layer needs to be provided to AS layer, no extra network ignalling overhead.  For the payload size many companies concerned about, in our understanding, gNB can only provide the configuration of the UE intended slices in RRCRelease which is at most 8 slices, thus the payload size is acceptable. |
| OPPO | Option 1 | We have similar concern as Qualcomm mentioned. |
| CATT | Option 2 | This method is more flexible. |
| Spreadtrum | Option 2 | Share similar view with CMCC. |
| NEC | Option1 | Consider we do not have time, option1 is simpler |
| Nokia | Option 1 | We have the same concern as Qualcomm on AS complexity.  Earlier agreement was that the same type of information can be provided in RRCRelease as in SIB messages. |
| Ericsson | Option 1 |  |
| ZTE | Option 2 | Share same understanding with CMCC that slice specific can be considered in RRCRelease message. |
| MediaTek | Option 2 |  |
| KDDI | Option1 |  |

## List of RRC open issues

### OI 1.3: Whether to introduce a T320-like timer

***Whether to introduce a T320-like timer for slice-based cell reselection priorities in dedicated signalling, and if needed, there are two options:***

***Option 1: introduce a new T320-like timer which is independent from the current T320 timer.***

***Option 2: re-use the current T320 timer.***

Previous agreements in RAN2#113bis-e

Agreements

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

***Summary from R2-2203509:***

From the above proposals, all companies (6/6) support to reuse the legacy T320 timer for slice specific frequency priority in RRCRelease.

There is a consensus to agree the following proposal:

**(6/6) Cat-a-Proposal 16: Reuse the legacy T320 timer for slice specific frequency priority in RRCRelease.**

**Q5: Do you agree cat-a-proposal 16?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| **Qualcomm** | **Yes** | **The IE in RRC release is UE dedicated. So, reusing legacy T320 is sufficient.** |
| Lenovo, MotM | Yes |  |
| Huawei, HiSIicon | Yes | For this meeting, we re-submit the report (as below) because it was not treated in the last RAN2 meeting.  R2-2203021 Report of [Post116-e][243][Slicing] Running NR RRC CR for RAN slicing (Huawei) Huawei discussion Rel-17 NR\_slice-Core  In the report, P1 is supported by most of companies, and it is aligned with cat-a-proposal 16.  **Proposal 1: legacy T320 timer is applied to slice specific frequency priority.** |
| **Samsung** | **Yes** |  |
| Apple | Yes |  |
| LGE | Yes |  |
| CMCC | Yes |  |
| Intel | Yes |  |
| Xiaomi | Yes |  |
| OPPO | Yes |  |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| NEC | Yes |  |
| Nokia | Yes |  |
| Ericsson | Yes |  |
| ZTE | Yes |  |
| MediaTek | Yes |  |
| KDDI | Yes |  |

### OI 1.9: Whether to support RAN sharing

***FFS RAN sharing for slice-based cell re-selection and slice-based RACH.***

***Summary from R2-2203509:***

# Companies commented on OI 1.9.

# companies support RAN sharing in R17. 1 company worry about the complexity and propose to limit that the different TAs in one cell should share the same slice group mapping relationship.

**(3/4) Cat-b-Proposal 18: RAN sharing can be supported for slice based cell reselection and RACH, but the complexity should be kept low. Details are FFS.**

**Q6: Do you agree cat-b-proposal 18?**

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| **Qualcomm** | **Yes, but** | **We prefer to make it clear that RAN sharing can be supported via NW implementation. Specifically:**   * **Slice specific frequency priorities are still RAN specific as legacy (i.e., not PLMN specific). And as legacy, operators sharing the same RAN should coordinate the values of frequency priorities broadcast in SIB.** * **cell ID, TAC and ranac are PLMN specific as legacy.** |
| Lenovo, MotM | Yes |  |
| Huawei, HiSIicon | Yes |  |
| **Samsung** | **Yes** |  |
| Apple | Yes |  |
| LGE | Yes | Same view with Qualcomm |
| CMCC | Yes |  |
| Intel | Yes with comments | It seems possible to support network sharing at as implementation option with some coordination at RAN level.  We are open to provide more flexibility at RAN level if the only complexity is in terms of providing the slice information in SIB per PLMN. If any additional complexity is identified, we propose not to consider this. |
| Xiaomi | See comments | We are fine if the only enhancement is to provide the PLMN ID with slice info in SIB, otherwise, we’d like not to consider it. |
| OPPO | Yes, but | We also prefer to support RAN sharing by NW implementation. |
| CATT | Yes |  |
| Spreadtrum | Yes |  |
| NEC | No strong opinion | We need to focus on basic function, so it is ok to delay this to later release or keep it simple, this release RAN sharing can be achieved by NW implementation |
| Nokia | Yes | Same view as Qualcomm |
| Ericsson | Yes | We do not understand the comment by Qualcomm. In R2-2203411, we presented our views on RAN sharing. The solution should allow that each sharing PLMN have its own slice grouping and inter-frequencies. This can be implemented in SIB signalling or (as in current spec) by re-selection info (inter-frequency list for the PLMN, incl re-selection priorities) provided in RRCRelease. |
| ZTE | Yes | Same view as QC. |
| MediaTek | Yes |  |
| KDDI | Yes |  |

# Summary

# References

1. R2-2202616 (is revised of R2-2201730) List of open issues for RAN slicing WI, CMCC
2. R2-2203509 Report for [Pre117-e][240][Slicing] Summary of slice-specific cell reselection (CMCC)