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**Title:****Details of Solution Direction Option 6**

**Document for:** **Discussion and Decision**

# **Introduction**

RAN2 has initiated the following long email discussion.

* [Post114-e][251][Slicing] Solution direction details for slice priorities in cell reselection (Lenovo)

      Scope: Discuss technical details for solution directions identified as part of [AT114-e][250] and identify their pros and cons. Can ask questions on how the solutions work, can discuss combined solutions etc.

      Intended outcome: Discussion report (may include also draft CRs if there is enough convergence)

      Deadline:  Long

Following are the agreements from the RAN2#114e:

|  |
| --- |
| * 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 combinationb) Option 5): Maximize slice supportc) 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 reselectiond) 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 5b) 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 mobilityd) 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) |

This email discussion will be carried in 3 phases:

Phase 1: Development of Solution directions to one well defined solution

Phase 2: Comparison among solutions out of Phase 1 and selecting the most reasonable one

Phase 3: Coming up with an acceptable draft CR for the selected solution if time and situation permits – depending on the outcome of Phase 2.

# **Phase 1**

## How does Solution Direction (Option 6) work?

### 2.1.1 Overview of Option 6

The option 6 is actually a set of solutions with below 2 key differences from other 3 options:

* Adjust frequency priority based on actually supported slice(s) in best ranked cell
* There is no need for UE to perform multiple iterations of cell reselection (which is required in option 4)

**Please note that the contents of “slice info” are still not clear at this stage.** In our understanding, it is possible to have below 4 cases for different contents of “slice info”:

* Case 1: supported slice info of neighbour cells, per-slice frequency priority and slice priority are provided to UE
* Case 2: supported slice info of neighbor cells, and per-slice frequency priority are provided to UE
* Case 3: only supported slice info of neighbor cells is provided to UE
* Case 4: only per-slice frequency priority is available to UE

Please note that we don’t discuss how UE can get these info (e.g., in SIB, RRC or NAS). **The procedure of how UE determines frequency priority in these 4 cases are different. So, we describe them one by one.**

### 2.1.2 Case 1

The contents of “slice info” are supported slice info of neighbour cells, per-slice frequency priority and slice priority. It can be illustrated as below:

* **A list of {Slice group ID, list of [frequency, frequency priority value, list of PCIs]}, where frequency priority value reuse legacy range of 0-7 and PCIs indicate neighbor cells which support the slice group**
	+ **Provided in SIB or RRC release**
* **Priority among UE’s desired slices**
	+ **Provided by NAS, RRC or UE implementation**

#### 2.1.2.1 Procedure step and Flow chart

The procedure step can be described in following sequence of operation:

* Step 1: Supported slice info of neighbor cells, per-slice frequency priority and slice priority are provided to UE
* Step 2: Each frequency gets the priority value corresponding to UE’s desired highest priority slice
* Step 3: With these priorities, legacy IDLE measurement is performed on each indicated frequency
	+ Please note whether to trigger inter-frequency IDLE measurements depend on frequency priority value according to Section 5.2.4.2 of TS 38.304 (i.e. UE may not perform measurement for low priority frequency when Srxlev > SnonIntraSearchP).
* Step 4: UE adjusts priority value for each indicated frequency:
	+ Step 4-a: If the highest priority slice supported on the best ranked cell is UE’s highest priority slice, keep the current frequency priority and go to Step 5
	+ Step 4-b: If the highest priority slice supported on the best ranked cell is NOT UE’s highest priority slice, the priority value of this frequency is changed to the priority value corresponding to the highest priority slice supported on the best ranked cell. And go to Step 5
		- As example, assume a UE’s whose desired slices are URLLC and eMBB with priority URLLC>eMBB. For F1, URLLC priority value is 8 and eMBB priority value is 2. Then, the UE first uses frequency priority value of URLLC (i.e. 8) to perform IDLE measurement for frequency F1. However, if the best ranked cell in F1 only supports eMBB, the UE changes priority of F1 to value of eMBB (i.e. 2).
	+ Step 4-c: If no suitable cell is found in one frequency, then the frequency is excluded for a maximum of 300 seconds as legacy.
* Step 5: With **updated** frequency priorities, legacy inter-frequency cell reselection is performed
	+ Please note that the **legacy inter-frequency cell reselection criteria (Section 5.2.4.5 of TS 38.304) depend on frequency priority of target frequency and serving frequency:**
		- If priority of target frequency is **higher than** serving frequency, Srxlev > ThreshX, HighP during a time interval
		- If priority of target frequency is **lower than** serving frequency, Srxlev < ThreshServing, LowP and Srxlev > ThreshX, LowP during a time interval

And the corresponding follow chart can be found in Figure.1 to help understanding:



**Figure.1 Flow chart for Case 1 of Option 6 (Orange font means spec change)**

#### 2.1.2.2 Example

One example is illustrated in Figure.2:



**Figure.2 Example scenario**

In Figure.2, the UE is camping in Cell 3, and moving in the boundary between Cell 2 and 3. Then, the UE performs below cell reselection procedure:

* Step 1: UE is provided below “slice info”:
* Cell 3’s SIB provides:
	+ List 1: {eMBB, F1, priority 2, (Cell 1, Cell2}}
	+ List 2: {eMBB, F2, priority 3, (Cell3)}
	+ List 3: {URLLC, F1, priority 8, (Cell 1)}
	+ List 4: {URLLC, F2, priority 7, (Cell 3)}
* UE’s slice priority: URLLC > eMBB
* Step 2: As URLLC>eMBB, the UE derives frequency priority value of F1 is 8 and F2 is 7 (i.e. priority of F1 is taken from List 3 and priority of F2 is taken List 4)
* Step 3: Assuming priority of F1 is 8, the UE performs IDLE measurements for cell 1 and cell 2
* Step 4: Both Cell 1 and 2 are suitable. Cell 2 is best ranked cell due to it being close to UE (-82dBm>-92dBm). Then, because only eMBB is supported in Cell 2, UE adjusts priority value of F1 from 8 to 2 in Step 4-b.
* Step 5: Because priority value of F1 (value 2) is lower than serving frequency F1 (value 7), the UE checks whether condition of reselection to Cell 2 is fulfilled, i.e. whether cell 3 fulfils Srxlev < ThreshServing, LowP and cell 2 fulfils Srxlev > ThreshX, LowP. The condition is not satisfied because RSRP of serving cell (cell 3) is larger than ThreshServing, LowP. Thus, the UE stay in Cell 3.
	+ Please Note if without priority adjustment for F1 in Step 4, the UE will regard priority value of F1 is 8 (higher than serving frequency). Then, the UE just need to check whether Srxlev > ThreshX, HighP, the condition of reselection to Cell 2 is fulfilled. So, the UE will reselect to Cell 2 supporting only eMBB, which is not intended behavior.

#### 2.1.2.3 Questions to companies

***Q1.1 Do you agree the “slice info” for case 1 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE |  | * We understand the slice priority can be provided from UE NAS layer to AS layer thus there is no need to provide such info via system information or RRCRelease message. As we also mentioned in the discussion thread for option 4, we understand the slice priority can be achieved by assigning the highest priority to the first slice in the allowed S-NSSAIs so that no additional NAS signaling is needed and this part should be discussed once we confirmed that the slice priority is really needed.
* We understand the slice info provided via system information and RRCRelease message can have the following structure:

|  |
| --- |
| Slice info |
| For the serving frequency (only in system information) |
|  | Slice id-1/Slice Group Id-1 | Slice specific Freq-x-priority (Optional) |
| Slice id-2/Slice Group Id-2 | Slice specific Freq-x-priority (Optional) |
| .... |  |
| For inter-frequency |
| Frequency 1 | Slice id-1/Slice Group Id-1 | Slice specific Freq-x-priority (Optional) |
| Slice id-2/Slice Group Id-2 | Slice specific Freq-x-priority (Optional) |
| ... | ... |
| Frequency 2 | Slice id-1/Slice Group Id-1 | Slice specific Freq-x-priority (Optional) |
| Slice id-2/Slice Group Id-2 | Slice specific Freq-x-priority (Optional) |
| ... | ... |
| ... |

 |
| OPPO | Agree | In our understanding, to cover RA border case, if the network wants, the network will/will not indicate cell level-identification in slice info. Either way seems reasonable. |
| Qualcomm  | Agree | Agree with OPPO and ZTE that either slice specific frequency priority or cell level identification can be optional provided in SIB. UE behavior may be different depending on whether they are absent.  |
|  |  |  |

***Q1.2 Do you agree the procedure of cell reselection procedure for case 1 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Agree with step 1-3;FFS on step 4 and 5 | We are fine with step 1-3, which is a simplified solution of option 4 and UE will follow the slice specific reselection priority for the highest priority slice and will not end up in a loop.Step 4 and 5 are some further details when UE decide whether to camp the highest ranked cell or not, we would like to start with the reselection priority determination in step 1-3 and are open to discuss step 4 and 5 afterwards. |
| OPPO | See comments  | We have some concern to step 4. If the best cell does not support the most desired slice, why not exclude the cell directly? Assuming a similar scenario to Figure 2 except that the frequency priority for eMBB on F1 is higher than the frequency priority for URLLC on F2, and if the UE follows the procedure in section 2.1.2.1, the UE will select cell 2 of F1 other than cell 3 of F3, which may not be our desired intention. Thus, we prefer a variant of step 4/5 for case 1:* Step 4: With frequency priorities in step 2, legacy inter-frequency cell reselection is performed. If a suitable cell is found and it serves the UE’s highest priority slice, UE camp on the cell, otherwise UE performs legacy cell reselection (using non-slice-specific info).
 |
| Qualcomm | Yes | For OPPO’s example scenario, we think it doesn’t make sense if NW configure frequency priority for eMBB on F1 is higher than frequency priority for URLLC on F2. However, we agree that the variant suggested by OPPO is simper, and we are fine to consider it.   |
|  |  |  |

***Q1.3 Do you agree to consider case 1 of option 6 in Phase 2 discussion?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE |  | As we mentioned under Q1.2, we would like to start with the reselection priority determination mentioned in step 1-3 and are open to discuss the step 4 and 5 afterwards. |
| OPPO | See comments | We are fine with the case with/without cell level-identification in slice info, with the variant of the original solution.  |
| Qualcomm | Yes |  |
|  |  |  |

**Summary of Case 1:**

* **All companies agreed to consider Case 1 in phase 2 discussion.**
* **For the content of “Slice info”, companies converged to below table**

|  |
| --- |
| SliceInfo-List |
| Slice-Group Id-1 | Supported-on-Freq-x | Freq-x-priority (Optional) | PCI 1, PC2, ... (Optional) |
| Supported-on-Freq-y | Freq-y-priority (Optional) | PCI 1, PC2, ... (Optional) |
| Slice-Group Id-2 | Supported-on-Freq-x | Freq-x-priority (Optional) | PCI 1, PC2, ... (Optional) |
|  | Supported-on-Freq-z | Freq-z-priority (Optional) | PCI 1, PC2, ... (Optional) |
| … | … | … |  |

* **For Slice priority, rapporteur think majority view is that the UE’s AS receives it from NAS and whether to introduce NAS signalling is left for SA2/ CT1 to solve. If SA2/CT1 don’t agree to introduce new NAS signalling, it is up to UE implementation.**
* **For UE behaviour, Step 1-3 are agreed by all companies. For Step 4/5, OPPO proposed one variant that if best ranked cell doesn’t support UE’s highest priority slice, the frequency will be excluded for a maximum of 300 seconds as legacy. However, Rapporteur think this solution is actually same as converged Option 4 (removing its Step 7). Rapporteur prefer to keep original Step 4/5 as the extra step when PCI info is provided, i.e. when PCI info is provided in “Slice info”, the UE performs frequency priority adjustment in Step 4; Otherwise, it fallbacks to Option 4 (removing its Step 7).**

### 2.1.3 Case 2

The contents of “slice info” are supported slice info of neighbour cells and per-slice frequency priority. It can be illustrated as below:

* **A list of {Slice group ID, list of [frequency, frequency priority value, list of PCIs]}, where frequency priority value reuse legacy range of 0-7 and PCIs indicate neighbor cells which support the slice group**
	+ **Provided in SIB or RRC release**

#### 2.1.3.1 Procedure step and Flow chart

The procedure step can be described in following sequence of operation:

* Step 1: Supported slice info of neighbor cells, and per-slice frequency priority are provided to UE
* Step 2: Each frequency gets the priority value of the largest one across all slices
	+ For example, for frequency F1, if eMBB’s priority value is 2 and URLLC’s priority value is 7, the UE supporting both eMBB and URLLC will use priority value 7.
* Step 3: With these priorities, legacy IDLE measurement is performed on each indicated frequency
* Step 4: UE adjusts priority value for each indicated frequency:
	+ Step 4-a: If the best ranked cell supports all the UE’s desired slice(s), keep the current frequency priority and go to Step 5
	+ Step 4-b: If the best ranked cell doesn’t support all the UE’s desired slice(s), the priority value of this frequency is changed to the highest priority value across the slice(s) supported on the best ranked cell. And go to Step 5
		- For example, for a UE supporting both eMBB (priority value of F1 is 2) and URLLC (priority value of F1 is 7), if best ranked cell in F1 only supports eMBB, the UE will change priority value of F1 to 2.
	+ Step 4-c: If no suitable cell is found in one frequency, then the frequency is excluded for a maximum of 300 seconds as legacy.
* Step 5: With **updated** frequency priorities, legacy inter-frequency cell reselection is performed
	+ Same as Case 1 (in Section 2.1.2), please note that the legacy inter-frequency cell reselection criteria depend on frequency priority of target frequency and serving frequency according to Section 5.2.4.5 of TS 38.304.

The flow chat of Case 2 is shown in Figure. 3.



**Figure.3 Flow chart for Case 2 of Option 6 (Orange font means spec change)**

#### 2.1.3.2 Example

We still use the example shown in Figure.2 to help understand.

* Step 1: UE is provided below “slice info”:
* Cell 3’s SIB provides:
	+ List 1: {eMBB, F1, priority 2, (Cell 1, Cell2}}
	+ List 2: {eMBB, F2, priority 3, (Cell3)}
	+ List 3: {URLLC, F1, priority 8, (Cell 1)}
	+ List 4: {URLLC, F2, priority 7, (Cell 3)}
* Step 2: The UE derives frequency priority value of F1 is 8 and F2 is 7 (i.e., max between 2 and 8 for F1; max between 3 and 7 for F2)
* Step 3: Assuming priority of F1 is 8, the UE performs IDLE measurements for cell 1 and cell 2
* Step 4: Both Cell 1/2 are suitable. Cell 2 is best ranked cell due to it being close to UE. Then, because only eMBB is supported in Cell 2, UE adjusts priority of F1 from 8 to 2 in Step 4-b.
* Step 5: Because priority value of F1 (value 2) is lower than serving frequency F1 (value 7), the UE checks whether condition of reselection to Cell 2 is fulfilled, i.e. whether cell 3 fulfils Srxlev < ThreshServing, LowP and cell 2 fulfils Srxlev > ThreshX, LowP. The condition is not satisfied because RSRP of serving cell (cell 3) is larger than ThreshServing, LowP. Thus, the UE stay in Cell 3.
	+ Similar to Case 1, if without priority adjustment for F1 in Step 4, the UE will reselect to Cell 2 supporting only eMBB, which is not intended behavior.

#### 2.1.3.3 Questions to companies

***Q2.1 Do you agree the “slice info” for case 2 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Agree | In this case, there is no slice priority while NW provides the supported slice info and the slice specific reselection priority. We understand it is a valid case and should be considered.  |
| OPPO | See comments  | We are not sure it is a proper case. In our understanding, with such slice info but without UE slice priority, many UE which supports e.g. eMBB + URLLC, will camp on the same frequency, e.g. URLLC preferred frequency, which may introduce the overload issue to such frequency and will not be what we want. |
| Qualcomm | See comments | It seems not a popular case. Majority companies seem to think UE’s AS can receive a highest priority slice from NAS (no matter whether to introduce NAS signaling or up to UE implementation). Thus, we are fine to preclude this case. |
|  |  |  |

***Q2.2 Do you agree the procedure of cell reselection procedure for case 2 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | We have another alternative for step 1-3,FFS on step 4 and 5. | * We understand the step 1-3 for slice priority determination is similar as option 7 moderated by Intel and is applied for the case when there is no slice priority available. As we mentioned above, another alternative is to treat the first slice in the allowed S-NSSAI to be the highest priority and follow the slice specific priority provided.
* We would like to start with the reselection priority determination mentioned in step 1-3 and are open to discuss the step 4 and 5 afterwards.
 |
| OPPO | See comments | Similar comments to ***Q2.1*** and step 4 for ***Q1.2****.* |
| Qualcomm | See comments | It seems not a popular case. Majority companies seem to think UE’s AS can receive a highest priority slice from NAS (no matter whether to introduce NAS signaling or up to UE implementation). Thus, we are fine to preclude this case. |
|  |  |  |

***Q2.3 Do you agree to consider case 2 of option 6 in Phase 2 discussion?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Agree | We understand case 2 is a valid case and should be taken into consideration in option comparison. |
| OPPO | See comments | We suggest to prioritize other cases.  |
| Qualcomm | See comments | It seems not a popular case. Majority companies seem to think UE’s AS can receive a highest priority slice from NAS (no matter whether to introduce NAS signaling or up to UE implementation). Thus, we are fine to preclude this case. |
|  |  |  |

**Summary of Case 2:**

* **It seems not a popular case. Majority companies think UE’s AS can receive a highest priority slice from NAS (no matter whether to introduce NAS signalling or up to UE implementation). Thus, we are fine to preclude this case.**

### 2.1.4 Case 3

The contents of “slice info” are supported slice info of neighbour cells. It can be illustrated as below:

* **A list of {Slice group ID, list of [frequency, list of PCIs]} where PCIs indicate neighbor cells which support the slice group**
	+ **Provided in SIB or RRC release**

#### 2.1.4.1 Procedure step and Flow chart

The procedure step can be described in following sequence of operation:

* Step 1: Supported slice info of neighbor cells is provided to UE
* Step 2: Each frequency gets the priority value of legacy frequency priority
* Step 3: With these priorities, legacy IDLE measurement is performed on each indicated frequency
* Step 4: UE adjusts priority value for each indicated frequency:
	+ Step 4-a: If the best ranked cell supports all the UE’s desired slice(s), adjust frequency priority to highest and go to Step 5
		- For example, assume a UE’s whose desired slices are URLLC and eMBB. If the best ranked cell in F1 supports both URLLC and eMBB, the UE may regard priority value of F1 as 8 (i.e. highest value).
	+ Step 4-b: If the best ranked cell doesn’t support all the UE’s desired slice(s), keep the current frequency priority and go to Step 5
	+ Step 4-c: If no suitable cell is found in one frequency, then the frequency is excluded for a maximum of 300 seconds as legacy.
* Step 5: With **updated** frequency priorities, legacy inter-frequency cell reselection is performed
	+ Same as Case 1 (in Section 2.1.2), please note that the legacy inter-frequency cell reselection criteria depend on frequency priority of target frequency and serving frequency, according to Section 5.2.4.5 of TS 38.304.

The flow chat of Case 3 is shown in Figure. 4. **Please note that this case is similar to existing service-based cell reselection (LTE SC-PTM/V2X and NR V2X), i.e. UE may regard frequency supporting its V2X/eMBMS service as highest priority and then follow existing cell reselection procedure.**



**Figure.4 Flow chart for Case 3 of Option 6 (Orange font means spec change)**

#### 2.1.4.2 Example

We still use the example shown in Figure.2 to help understand:

* Step 1: UE is provided below “slice info”:
* Cell 3’s SIB provides:
	+ List 1: {eMBB, F1, (Cell 1, Cell2}}
	+ List 2: {eMBB, F2, (Cell3)}
	+ List 3: {URLLC, F1, (Cell 1)}
	+ List 4: {URLLC, F2, (Cell 3)}
	+ Legacy frequency priority: F1 is 3 and F2 is 7
* Step 2: The UE uses legacy frequency priority: F1 is 3 and F2 is 7
* Step 3: Regarding priority of F1 is 3, the UE performs IDLE measurements for cell 1 and cell 2
* Step 4: Both Cell 1 and 2 are suitable. Cell 2 is best ranked cell due to it being close to UE. Then, because only eMBB is supported in Cell 2, UE keeps priority of F1 as 3.
* Step 5: Because priority value of F1 (value 3) is lower than serving frequency F1 (value 7), the UE checks whether condition of reselection to Cell 2 is fulfilled, i.e. whether cell 3 fulfils Srxlev < ThreshServing, LowP and cell 2 fulfils Srxlev > ThreshX, LowP. The condition is not satisfied because RSRP of serving cell (cell 3) is larger than ThreshServing, LowP. Thus, the UE stay in Cell 3.

#### 2.1.4.3 Questions to companies

***Q3.1 Do you the “slice info” for case 3 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Yes | We understand case 3 is valid case as it is possible that NW only provide the supported slice info of neighbour cells or frequencies without assigning slice specific reselection priority. |
| OPPO | Agree | In our understanding, it is possible that slice-specific frequency priority is an optional configuration. Regarding PCI, to cover RA border case, if the network wants, the network will/will not indicate cell level-identification in slice info. Either way seems reasonable. |
|  |  |  |
|  |  |  |

***Q3.2 Do you agree the procedure of cell reselection procedure for case 3 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Disagree | * On the reselection priority determination mentioned in step 1-3 the case when NW only provide the supported slice info of neighbour cells or frequencies without assigning slice specific reselection priority, we would prefer NW to treat the frequency supporting maximum number of allowed S-NSSAIs to be the highest priority.
* We would like to start with the reselection priority determination mentioned in step 1-3 and are open to discuss the step 4 and 5 afterwards.
 |
| OPPO | See comments  | In NR V2X, the measurement and reselection are preformed based on the updated frequency priority, which seems a bit different from the above solution for case 3. To minimize spec impact, we suggest a variant of the solution, which is more similar to legacy NR V2X. Specifically, the legacy frequency priority is used as baseline for each frequency. Above that, the frequency that supports all slices among UE’s intended slices or the most desired slice among UE’s intended slices or supports the maximum number of UE’s intended slices has the highest frequency priority. The measurement and reselection are preformed based on the updated frequency priority. On the other hand, we are also fine with another variant of the above solution, which seems simple. Specifically, the legacy frequency priority is used for each frequency. The UE performs cell reselection based on legacy inter-frequency cell reselection criteria. If the suitable cell does not serve any of the UE’s intended slices, the cell will be ignored, and the UE will continue the procedure of cell reselection.  |
|  |  |  |
|  |  |  |

***Q3.3 Do you agree to consider case 3 of option 6 in Phase 2 discussion?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Yes | We understand case 3 is a valid case and should be taken into consideration in option comparison. |
| OPPO | See comments | We are fine with the case with/without cell level-identification in slice info, with the variant of the original solution. |
|  |  |  |
|  |  |  |

**Summary of Case 3:**

* **All companies agreed to consider Case 3 in phase 2 discussion.**
* **For the content of “Slice info”, companies converged to below table**

|  |
| --- |
| SliceInfo-List |
| Slice-Group Id-1 | Supported-on-Freq-x | Freq-x-priority (Optional) | PCI 1, PC2, ... (Optional) |
| Supported-on-Freq-y | Freq-y-priority (Optional) | PCI 1, PC2, ... (Optional) |
| Slice-Group Id-2 | Supported-on-Freq-x | Freq-x-priority (Optional) | PCI 1, PC2, ... (Optional) |
|  | Supported-on-Freq-z | Freq-z-priority (Optional) | PCI 1, PC2, ... (Optional) |
| … | … | … |  |

 **Case 3 works when Per slice frequency priority is absent.**

* **For Slice priority, no need for UE to decide it**
* **For UE behaviour, Rapporteur agree OPPO’s suggestion to simplify the procedure. Then, Rapporteur think it is same as option 5**

### 2.1.5 Case 4

The contents of “slice info” are only per-slice frequency priority. It can be illustrated as below:

* **A list of {Slice group ID, list of [frequency, frequency priority value]}, where frequency priority value reuse legacy range of 0-7**
	+ **Provided in SIB or RRC release**

#### 2.1.5.1 Procedure step and Flow chart

The procedure step can be described in following sequence of operation:

* Step 1: Only per slice frequency priority is provided to UE
* Step 2: Each frequency gets the priority value of the largest one across all slices
	+ For example, for frequency F1, if eMBB’s priority value is 2 and URLLC’s priority value is 7, the UE supporting both eMBB and URLLC will use priority value 7.
* Step 3: With these priorities, legacy IDLE measurement is performed on each indicated frequency
* Step 4: Based on priorities decided in Step 3, legacy inter-frequency cell reselection is performed
	+ Priority adjustment based on best ranked cell can’t be performed because supported slice info is not available to UE
	+ Same as Case 1 (in Section 2.1.2), please note that the legacy inter-frequency cell reselection criteria depend on frequency priority of target frequency and serving frequency, according to Section 5.2.4.5 of TS 38.304.

The flow chat of Case 3 is shown in Figure. 5.



**Figure.5 Flow chart for Case 4 of Option 6 (Orange font means spec change)**

#### 2.1.5.2 Example

We still use the example shown in Figure.2 to help understand. The UE is camping in Cell 3, and moving in the boundary of Cell 3 and 2. Then, the UE performs below cell reselection procedure:

* Step 1: UE is provided below “slice info”:
* Cell 3’s SIB provides:
	+ List 1: {eMBB, F1, priority 2}
	+ List 2: {eMBB, F2, priority 3}
	+ List 3: {URLLC, F1, priority 8}
	+ List 4: {URLLC, F2, priority 7}
* Step 2: The UE derives frequency priority value of F1 is 8 and F2 is 7 (i.e., max between 2 and 8 for F1; max between 3 and 7 for F2)
* Step 3: Assuming priority of F1 is 8, the UE performs IDLE measurements for cell 1 and cell 2
* Step 4: Both Cell 1 and 2 are suitable. Cell 2 is best ranked cell due to it being close to UE. Then, because priority value of F1 (value 8) is higher than serving frequency F1 (value 7), the UE checks whether condition of reselection to Cell 2 is fulfilled, i.e. whether cell 2 fulfils Srxlev > ThreshX, HighP. As the condition is satisfied, the UE will reselect to Cell 2 supporting only eMBB, which is not intended behavior.

#### 2.1.5.3 Questions to companies

***Q4.1 Do you agree the “slice info” for case 4 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Yes | This a valid case that only the slice specific reselection priority per frequency is provided while the supported slice info of specific neighbour cells and the slice priority are not provided. |
| OPPO | See comments | Similar comments to ***Q2.1*** |
|  |  |  |
|  |  |  |

***Q4.2 Do you agree the procedure of cell reselection procedure for case 4 of option 6?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | We have another alternative for step 1-3 | * We understand the reselection priority determination for case 4 would be similar to that for case 2.
* As we mentioned above for case 2, another alternative is to treat the first slice in the allowed S-NSSAI to be the highest priority and follow the slice specific priority provided.
 |
| OPPO | See comments | Similar comments to ***Q2.1*** |
|  |  |  |
|  |  |  |

***Q4.3 Do you agree to consider case 4 of option 6 in Phase 2 discussion?***

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Yes | We understand case 4 is a valid case and should be taken into consideration in option comparison. |
| OPPO | See comments | We suggest to prioritize other cases.  |
|  |  |  |
|  |  |  |

**Summary of Case 4:**

* **It seems not a popular case. Majority companies think UE’s AS can receive a highest priority slice from NAS (no matter whether to introduce NAS signalling or up to UE implementation). Thus, we are fine to preclude this case.**

## What is the content of “Slice Info” when provided using Broadcast and dedicated signaling?

See Question in Section 2.1

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

**Q5: If used, who provides the “Slice priority” (NAS/ AS, UE/ Network)**

|  |  |  |
| --- | --- | --- |
| **Companies** | **NAS, AS, UE, Network** | **Comments**  |
| Qualcomm | Up to UE implementation, or not introduced in this release | Please note that SA2 has discussed whether to introduce NAS signaling for slice priority in eNS-phase 2, but it was NOT agreed. Thus, to avoid misalignment between RAN2 and SA2, we think the only option in this release is left to UE implementation (if it needs to be introduced). In addition, we don’t think “slice priority” is essential to be introduced to support slice specific cell reselection in Rel-17. In Case 2/3/4 of Option 6, it is not required to be used. Thus, we are fine if it is not introduced in this release.  |
| ZTE | Following the order of the allowed S-NSSAI | We understand the slice priority can be handled by following the order of the allowed S-NSSAI, the first to be the highest priority one. And the allowed S-NSSAI will be provided from NAS to AS to help decide the slice priority.No additional NAS signaling is needed if we go this way and we can keep the intended slice definition as we had in TR38.832. |
| OPPO | From NAS signaling or NAS itself | In our understanding, the slice priority is provided to the UE AS from the UE NAS. The UE NAS can obtain such information via NAS signaling or NAS itself (i.e. UE implementation). |
|  |  |  |

**Summary:**

* **Majority companies think UE’s AS can receive a highest priority slice from NAS (no matter whether to introduce NAS signalling or up to UE implementation).**

## Can “intended” slice as defined in TR38.832 be used “as is” for in this Solution Direction?

**Q6: Can “intended” slice as defined in TR38.832 be used “as is” for in this Solution Direction?**

|  |  |  |
| --- | --- | --- |
| **Companies** | **Agree or Disagree** | **Comments**  |
| ZTE | Yes | We understand the slice priority can be handled by following the order of the allowed S-NSSAI, the first to be the highest priority one. And the allowed S-NSSAI will be provided from NAS to AS to help decide the slice priority.No additional NAS signaling is needed if we go this way and we can keep the intended slice definition as we had in TR38.832. |
| OPPO | See comments | It is better to leave to SA2/CT1 to decide which kind of slices info is provided to the UE AS for cell reselection. From this perspective, there may be no need to use “intended slice” in RAN2 spec.However, we should note that sometimes cell reselection is not triggered by NAS procedure, but by UE mobility. For this case, the UE AS should decide which slices are the intended slices. As one possible consideration, the UE AS may need to store the obtained intended slice from the UE NAS, and use the stored intended slice for cell reselection for mobility case. |
|  |  |  |
|  |  |  |

**Summary:**

* **Majority companies think “intended slice” is signalled by NAS. The signalling details can be discussed further (e.g. left to SA2/CT1 to decide).**

## Any comments on Rapporteur’s answers in Annex?

We provide our answers on 5 questions list in Annex. Companies are welcome to provide comments to our answer.

**Q7: Any comments on Rapporteur’s answers in Annex?**

|  |  |
| --- | --- |
| **Companies** | **Comments**  |
|  |  |
|  |  |
|  |  |

# **Annex**

*Somewhat* in line with the TR 38.832 following geographies are depicted – only as a checkpoint to see how your solution works here. Only “slice” is mentioned but it can also mean “slice group”. A general term of “desired slice” is used to intentionally avoid using the term “intended slice”. A “desired slice” for one solution may mean higher priority slice (if a slice priority exists) or, for another solution may just point to the slice corresponding to the highest absolute priority for a supporting frequency.



Q1: Best Cell (Cell 1) on a high priority frequency (F1) does not support the-most-desired Slice (Slice 2). Where should the UE camp (or reselect)? Only one of TA1 or TA2 is part of UE’s RA.

Answer to Q1: UE can only camp/reselect to Cell 1. The best cell concept should be adhered to for intra-frequency cell reselection. Any proposal beyond it can’t be agreed in RAN2, which has RAN4 and RAN5 impacts. If RAN2 agree to change the principle due to slice, RAN2 has to send LS to RAN4 and RAN5 for evaluation of its impacts.



Q2: Best Cell (Cell 4) on a high priority frequency (F1) does not support UE’s only desired Slice (Slice 1). Where should the UE camp (or reselect)? Only TA1 is part of UE’s RA.

Answer to Q2: It is not clear where the UE is currently in. If it is in Cell 3, the best cell concept should be adhered to for intra-frequency cell reselection. If TA1 is in UE’s RA and the best cell is cell 4, then it implies to us that the UE has moved from cell3/5 to cell 4. In this particular figure (which is not entirely clear to us what it is trying to say), UE will camp on cell 4 based on best cell principle and perform registration update.



Q3: Only TA1 is part of UEs Registration area. All Slices (1, 2, 3 and 4) are part of UEs Slice list. From radio quality Cell 6 is the best cell on F1. Where should the UE camp (or reselect) if

1. Slice 1 is most desired
2. Slice 4 is most desired

Answer to Q3: From the best cell concept, the UE should be in Cell 6 regardless of the desired slice



Q4: F1 has the highest absolute frequency priority according to the *cellReselectionPriorities* provided to the UE but none of the UE desired slices prefer F1 (as configured in the Slice-Info) and cell 8 does not broadcast any Slice support indication. Slice 1 is the only desired slice for the UE and UE’s RA consist of:

1. Both TA1 and TA2 (assuming this is not violating “homogeneous principle in the UE’s RA since cell 11 - TA1 does not prohibit use of any particular slice)
2. Only TA1
3. Only TA2

Answer to Q4:

For a), we think it violates the homogeneous deployment principle that requires all the cells of an RA to support the same slices.

No difference for b) and c), cell 8 has no slice info and hence this feature does not apply.



Q5: F1 has the highest absolute frequency priority according to the *cellReselectionPriorities* provided to the UE but none of the UE desired slices prefer F1 (as configured in the Slice-Info). Cell 10 supports only Slice 2 but Slice 1 is the only desired slice for the UE. UE’s RA consist of:

1. Only TA1
2. Only TA2.

Answer to Q5:

The question is not very clear to us. Is the cellReselectionPriorities referring to the legacy field? If this feature is deployed, the legacy priority is not used by the UE supporting this feature anymore, as agreed in RAN2#113b-e:

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.

We don’t think it is good idea to revert previous agreement.

From solution direction Option#6, since the only desired slice is Slice 1, UE will finally stay in Cell 11 or move to Cell 11.

# **Annex-2**

List of companies contributing to this option

|  |  |  |
| --- | --- | --- |
| Company Name | Delegate Name | Email Address |
| Qualcomm | Peng Cheng | chengp@qti.qualcomm.com |
| OPPO | Zhe Fu | fuzhe@OPPO.com |
|  |  |  |