**3GPP TSG-RAN WG2 Meeting #116-bis R2-2203781**

**Electronic Meeting, 21 February – 03 March 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.304** | **CR** | **draft** | **rev** | **-** | **Current version:** | **16.7.0** |  |
|  |
| *For* [*HELP*](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network | **x** | Core Network |  |

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|  |
| ***Title:***  | Running 38.304 CR for RAN slicing |
|  |  |
| ***Source to WG:*** | Ericsson |
| ***Source to TSG:*** | R2 |
|  |  |
| ***Work item code:*** | NR\_Slice-Core |  | ***Date:*** | 2022-02-27 |
|  |  |  |  |  |
| ***Category:*** | ***B*** |  | ***Release:*** | Rel-17 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
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| ***Reason for change:*** | This CR introduces the enhancements specified on support of RAN Slicing in NR. |
|  |  |
| ***Summary of change:*** | This draft CR is based on R2-2110239 “Running 38.304 CR for RAN slicing” (endorsed at RAN2#116e), uplifted to 16.7.0.Only addition is the list of relevant RAN2#116-e agreementsCapture agreements on RAN Slicing in NR.* Add slice group in definition, details FFS. The FFS will be updated based on further LSin or agreements.
* Add functional division between AS and NAS for slice based cell reselection in section 4.2.
* Add procedure description for slice based cell reselection in a new section 5.2.4.X.
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| ***Consequences if not approved:*** | Slice based cell reselection is not supported in NR. |
|  |  |
| ***Clauses affected:*** | 3.1, 4.1, 4.2, 5.2.4.1, 5.2.4.5, 5.2.4.7.0, 5.2.4.X (New) |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** | **X** |  |  Other core specifications  | TS 38.300 CR TBD...TS 38.331 CR TBD...TS 38.306 CR TBD...TS 38.321 CR TBD... |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

*Start of changes*

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**Acceptable Cell:** A cell that satisfies certain conditions as specified in 4.5.

**Allowed CAG list:** A per-PLMN list of CAG Identifiers the UE is allowed to access (see TS 23.501 [10])**.**

**Available PLMN(s):** One or more PLMN(s) for which the UE has found at least one cell and read its PLMN identity(ies).

**Available SNPN(s):** One or more SNPN(s) for which the UE has found at least one cell and read its SNPN identity(ies).

**Barred Cell**: A cell a UE is not allowed to camp on.

**CAG cell**: A cell broadcasting at least one Closed Access Group Identifier.

**Camped on a cell:** UE has completed the cell selection/reselection process and has chosen a cell. The UE monitors system information and (in most cases) paging information.

**Camped on any cell**: UE is in idle mode and has completed the cell selection/reselection process and has chosen a cell irrespective of PLMN identity.

**Closed Access Group Identifier**: Identifier of a CAG within a PLMN.

**Commercial Mobile Alert System:** Public Warning System that delivers *Warning Notifications* provided by *Warning Notification Providers* to CMAS capable UEs.

**eCall Only Mode:** A UE configuration option that allows the UE to register at 5GC and register in IMS to perform only eCall Over IMS, and a non-emergencyIMS call for test and/or terminal reconfiguration services.

**EHPLMN:** Any of the PLMN entries contained in the Equivalent HPLMN list TS 23.122 [9].

**Equivalent PLMN list:** List of PLMNs considered as equivalent by the UE for cell selection, cell reselection, and handover according to the information provided by the NAS.

**Home PLMN:** A PLMN where the Mobile Country Code (MCC) and Mobile Network Code (MNC) of the PLMN identity are the same as the MCC and MNC of the IMSI.

**Network Identifier**: Identifier of an SNPN in combination with a PLMN ID (TS 23.501 [10]).

**Non-Public Network:** A network deployed for non-public use, as defined in TS 22.261 [12].

**NR sidelink communication**: AS functionality enabling at least V2X Communication as defined in TS 23.287 [16], between two or more nearby UEs, using NR technology but not traversing any network node.

**Process:** A local action in the UE invoked by an RRC procedure or an RRC\_IDLE or RRC\_INACTIVE state procedure.

**Radio Access Technology:** Type of technology used for radio access, for instance NR or E-UTRA.

**Registration Area**: (NAS) registration area is an area in which the UE may roam without a need to perform location registration, which is a NAS procedure.

**Registered PLMN:** This is the PLMN on which certain Location Registration outcomes have occurred, as specified in TS 23.122 [9].

**Registered SNPN**: This is the SNPN on which certain Location Registration outcomes have occurred, as specified in TS 23.122 [9].

**Reserved Cell**: A cell on which camping is not allowed, except for particular UEs, if so indicated in the system information.

**Selected PLMN:** This is the PLMN that has been selected by the NAS, either manually or automatically.

**Selected SNPN**: This is the SNPN that has been selected by the NAS, either manually or automatically.

**Serving cell:** The cell on which the UE is camped.

**Sidelink:** UE to UE interface for V2X sidelink communication defined in TS 23.287[16].

**Slice Group:** FFS.

**SNPN Access Mode:** Mode of operation wherein UE only selects SNPNs (as defined in TS 23.501 [10]).

**SNPN identity**: An identifier of an SNPN comprising of a PLMN ID and an NID combination.

**Strongest cell:** The cell on a particular frequency that is considered strongest according to the layer 1 cell search procedure (TS 38.213 [4], TS 38.215 [11]).

**Suitable Cell:** This is a cell on which a UE may camp. For NR cell, the criteria are defined in clause 4.5, for E-UTRA cell in TS 36.304 [7].

**V2X sidelink communication**: AS functionality enabling V2X Communication as defined in TS 23.285 [17], between nearby UEs, using E-UTRA technology but not traversing any network node.

*Next change*

## 4.1 Overview

The RRC\_IDLE state and RRC\_INACTIVE state tasks can be subdivided into three processes:

- PLMN selection (for UE not operating in SNPN access mode) or SNPN selection (for UE operating in SNPN access mode);

- Cell selection and reselection;

- Location registration and RNA update.

PLMN selection, SNPN selection, cell reselection procedures, and location registration are common for both RRC\_IDLE state and RRC\_INACTIVE state. RNA update is only applicable for RRC\_INACTIVE state. When UE selects a new PLMN or SNPN, UE transitions from RRC\_INACTIVE to RRC\_IDLE, as specified in TS 24.501 [14].

When a UE is switched on, a public land mobile network (PLMN) or a SNPN is selected by NAS. For the selected PLMN/SNPN, associated RAT(s) may be set, as specified in TS 23.122 [9]. The NAS shall provide a list of equivalent PLMNs, if available, that the AS shall use for cell selection and cell reselection.

With cell selection, the UE searches for a suitable cell of the selected PLMN or selected SNPN, chooses that cell to provide available services, and monitors its control channel. This procedure is defined as "camping on the cell".

The UE shall, if necessary, then register its presence, by means of a NAS registration procedure, in the tracking area of the chosen cell. As an outcome of a successful Location Registration, the selected PLMN/SNPN then becomes the registered PLMN/SNPN, as specified in TS 23.122 [9].

If the UE finds a more suitable cell, according to the cell reselection criteria, it reselects onto that cell and camps on it. If the new cell does not belong to at least one tracking area to which the UE is registered, location registration is performed. In RRC\_INACTIVE state, if the new cell does not belong to the configured RNA, an RNA update procedure is performed.

If necessary, the UE shall search for higher priority PLMNs at regular time intervals as described in TS 23.122 [9] and search for a suitable cell if another PLMN has been selected by NAS.

For UE not operating in SNPN access mode, search of available CAGs may be triggered by NAS to support manual CAG selection. The AS shall report available CAG-ID(s) together with their HRNN (if broadcast) and PLMN(s) to the NAS.

NAS may also provide slice information including slice or slice group priorities to be considered by the UE during cell reselection.

Editor’s note: FFS: The format of the slice information, and if it is given per slice or slice group.

If the UE loses coverage of the registered PLMN/SNPN, either a new PLMN/SNPN is selected automatically (automatic mode), or an indication of available PLMNs/SNPNs is given to the user so that a manual selection can be performed (manual mode). As part of manual SNPN selection, the AS shall report available SNPN identifiers together with their HRNN (if broadcast) to the NAS.

Registration is not performed by UEs only capable of services that need no registration.

The UE may perform NR sidelink communication and/or V2X sidelink communication while in-coverage or out-of-coverage for sidelink, as specified in clause 8.

The purpose of camping on a cell in RRC\_IDLE state and RRC\_INACTIVE state is fourfold:

a) It enables the UE to receive system information from the PLMN or the SNPN.

b) When registered and if the UE wishes to establish an RRC connection or resume a suspended RRC connection, it can do this by initially accessing the network on the control channel of the cell on which it is camped.

c) If the network needs to send a message or deliver data to the registered UE, it knows (in most cases) the set of tracking areas (in RRC\_IDLE state) or RNA (in RRC\_INACTIVE state) in which the UE is camped. It can then send a "paging" message for the UE on the control channels of all the cells in the corresponding set of areas. The UE will then receive the paging message and can respond.

d) It enables the UE to receive ETWS and CMAS notifications.

When the UE is in RRC\_IDLE state, upper layers may deactivate AS layer when MICO mode is activated as specified in TS 24.501 [14]. When MICO mode is activated, the AS configuration (e.g. priorities provided by dedicated signalling) is kept and all running timers continue to run but the UE need not perform any idle mode tasks. If a timer expires while MICO mode is activated it is up to the UE implementation whether it performs the corresponding action immediately or the latest when MICO mode is deactivated. When MICO mode is deactivated, the UE shall perform all idle mode tasks.

4.2 Functional division between AS and NAS in RRC\_IDLE state and RRC\_INACTIVE state

Table 4.2-1 presents the functional division between UE non-access stratum (NAS) and UE access stratum (AS) in RRC\_IDLE state and RRC\_INACTIVE states. The NAS part is specified in TS 23.122 [9] and the AS part in the present document.

**Table 4.2-1: Functional division between AS and NAS in RRC\_IDLE state and RRC\_INACTIVE state**

| **RRC\_IDLE and RRC\_INACTIVE state Process** | **UE Non-Access Stratum** | **UE Access Stratum** |
| --- | --- | --- |
| PLMN Selection  | **For a UE not operating in SNPN access mode, perform the following:**Maintain a list of PLMNs in priority order according to TS 23.122 [9]. Select a PLMN using automatic or manual mode as specified in TS 23.122 [9] and request AS to select a cell belonging to this PLMN. For each PLMN, associated RAT(s) may be set.Evaluate reports of available PLMNs and any associated CAG-IDs from AS for PLMN selection.Maintain a list of equivalent PLMN identities.To support manual CAG selection, provide request to search for available CAGs and evaluate reports of available CAGs from AS for CAG selection.**For a UE operating in SNPN access mode, perform the following:**Maintain a list of SNPNs according to TS 23.122 [9]. Select a SNPN using automatic or manual mode as specified in TS 23.122 [9] and request AS to select a cell belonging to this SNPN.Evaluate reports of available SNPNs from AS for SNPN selection. | For a UE not operating in SNPN access mode, search for available PLMNs.If associated RAT(s) is (are) set for the PLMN, search in this (these) RAT(s) and other RAT(s) for that PLMN as specified in TS 23.122 [9].For a UE operating in SNPN access mode, search for available SNPNs only consider NR cells.Perform measurements to support PLMN/SNPN selection.Synchronise to a broadcast channel to identify found PLMNs/SNPNs.Report available PLMNs and any associated CAG-IDs with associated RAT(s) to NAS on request from NAS or autonomously.For a UE operating in SNPN access mode, report available SNPNs to NAS autonomously.**To support manual CAG selection, perform the following:**Search for cells broadcasting a CAG-ID.Read the HRNN (if broadcast) for each CAG-ID if a cell broadcasting a CAG-ID is found.Report CAG-ID(s) of found cell(s) broadcasting a CAG-ID together with the associated manual CAG selection allowed indicator, HRNN and PLMNto NAS.On selection of a CAG by NAS, select any acceptable or suitable cell belonging to the selected CAG and give an indication to NAS that access is possible (for the registration procedure)To support manual SNPN selection, report available SNPNs together with associated HRNNs (if available) to NAS on request from NAS. |
| Cell Selection | Control cell selection for example by indicating RAT(s) associated with the selected PLMN to be used initially in the search of a cell in the cell selection.Maintain a list of "Forbidden Tracking Areas" and provide the list to AS.For a UE not operating in SNPN access mode: Maintain Allowed CAG list and optional CAG-only indication along with associated PLMN ID(s) on which the UE is allowed access and provide these lists to AS. To support manual CAG selection, select a CAG and request AS to select a cell belonging to this CAG. | Perform measurements needed to support cell selection.Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.Search for a suitable cell. The cells broadcast one or more 'PLMN identity' or 'SNPN identity' (for a UE operating in SNPN access mode) in the system information. Respond to NAS whether such cell is found or not.If associated RATs is (are) set for the PLMN, perform the search in this (these) RAT(s) and other RATs for that PLMN as specified in TS 23.122 [9].If a cell is found which satisfies cell selection criteria, camp on that cell. |
| Cell Reselection | For a UE not operating in SNPN access mode,maintain a list of equivalent PLMN identities and provide the list to AS.Maintain a list of "Forbidden Tracking Areas" and provide the list to AS.For a UE not operating in SNPN access mode, maintain Allowed CAG list and optional CAG-only indication along with associated PLMN ID(s) on which the UE is allowed access and provide these lists to AS.Maintain slice information including slice/slice group priorities and provide this information to AS. | Perform measurements needed to support cell reselection.Detect and synchronise to a broadcast channel. Receive and handle broadcast information. Forward NAS system information to NAS.Change cell if a more suitable cell is found.Determine cell reselection priorities for slice-based cell reselection |
| Location registration | Register the UE as active after power on.Register the UE's presence in a registration area, for instance regularly or when entering a new tracking area.Deregister UE when shutting down.Maintain a list of "Forbidden Tracking Areas".Control and restrict location registration for a UE in eCall Only Mode. | Report registration area information to NAS. |
| RAN Notification Area Update | Not applicable. | Register the UE's presence in a RAN-based notification area (RNA), periodically or when entering a new RNA. |

*Next change*

### 5.2.4 Cell Reselection evaluation process

#### 5.2.4.1 Reselection priorities handling

Absolute priorities of different NR frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCRelease* message, or by inheriting from another RAT at inter-RAT cell (re)selection. 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). If any fields with *cellReselectionPriority* are provided in dedicated signalling, the UE shall ignore any fields with *cellReselectionPriority* and any slice reselection information provided in system information. If slice reselection information is provided in dedicated signaling, the UE shall ignore slice reselection information provided in system information.

Editor’s note: #117e: “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. FFS if we still apply the legacy cell reselection frequency priorities in SIB.”
UE behavior if only legacy priorities are included in dedicated signalling. Assumes slice specific info from system information is not used by UE.

If UE supports slice-based cell reselection, UE shall derive re-selection priorities according to clause 5.2.4.x.

If UE is in *camped on any cell* state, UE shall only apply the priorities provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling and *deprioritisationReq* received in *RRCRelease,* or derived for slice-based cell reselection, unless specified otherwise. When the UE in camped normally state, has only dedicated priorities other than for the current frequency, the UE shall consider the current frequency to be the lowest priority frequency (i.e. lower than any of the network configured values). If the UE is configured to perform both NR sidelink communication and V2X sidelink communication, the UE may consider the frequency providing both NR sidelink communication configuration and V2X sidelink communication configuration to be the highest priority. If the UE is configured to perform NR sidelink communication and not perform V2X communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE is configured to perform V2X sidelink communication and not perform NR sidelink communication, the UE may consider the frequency providing V2X sidelink communication configuration to be the highest priority.

NOTE 1: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection, as specified in TS 38.331[3].

NOTE 2: When UE is configured to perform NR sidelink communication or V2X sidelink communication performs cell reselection, it may consider the frequencies providing the intra-carrier and inter-carrier configuration have equal priority in cell reselection.

NOTE 3: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 4: The UE is configured to perform V2X sidelink communication or NR sidelink communication, if it has the capability and is authorized for the corresponding sidelink operation.

NOTE 5: When UE is configured to perform both NR sidelink communication and V2X sidelink communication, but cannot find a frequency which can provide both NR sidelink communication configuration and V2X sidelink communication configuration, UE may consider the frequency providing either NR sidelink communication configuration or V2X sidelink communication configuration to be the highest priority.

Editor’s note: FFS if it is allowed to signal both the legacy field *cellReselectionPriority* and slice-specific *cellReselectionPriority* in the RRCRelease message.

The UE shall only perform cell reselection evaluation for NR frequencies and inter-RAT frequencies that are given in system information and for which the UE has a priority provided.

In case UE receives *RRCRelease* with *deprioritisationReq*, UE shall consider current frequency and stored frequencies due to the previously received *RRCRelease* with *deprioritisationReq* or all the frequencies of NR to be the lowest priority frequency (i.e. lower than any of the network configured values) while T325 is running irrespective of camped RAT. The UE shall delete the stored deprioritisation request(s) when a PLMN selection or SNPN selection is performed on request by NAS (TS 23.122 [9]).

NOTE: UE should search for a higher priority layer for cell reselection as soon as possible after the change of priority. The minimum related performance requirements specified in TS 38.133 [8] are still applicable.

The UE shall delete priorities provided by dedicated signalling when:

- the UE enters a different RRC state; or

- the optional validity time of dedicated priorities (T320) expires; or

- the UE receives an *RRCRelease* message with the field *cellReselectionPriorities* absent; or

- a PLMN selection or SNPN selection is performed on request by NAS (TS 23.122 [9]).

NOTE 2: Equal priorities between RATs are not supported.

The UE shall not consider any black listed cells as candidate for cell reselection.

The UE shall consider only the white listed cells, if configured, as candidates for cell reselection.

The UE in RRC\_IDLE state shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e. T320 in NR and E-UTRA), if configured, at inter-RAT cell (re)selection.

NOTE 3: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

*Next change*

5.2.4.5 NR Inter-frequency and inter-RAT Cell Reselection criteria

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority NR or EUTRAN RAT/frequency fulfils Squal > ThreshX, HighQ during a time interval TreselectionRAT

Otherwise, cell reselection to a cell on a higher priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- A cell of a higher priority RAT/ frequency fulfils Srxlev > ThreshX, HighP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

Cell reselection to a cell on an equal priority NR frequency shall be based on ranking for intra-frequency cell reselection as defined in clause 5.2.4.6.

If *threshServingLowQ* is broadcast in system information and more than 1 second has elapsed since the UE camped on the current serving cell, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Squal < ThreshServing, LowQ and a cell of a lower priority NR or E-UTRAN RAT/ frequency fulfils Squal > ThreshX, LowQ during a time interval TreselectionRAT.

Otherwise, cell reselection to a cell on a lower priority NR frequency or inter-RAT frequency than the serving frequency shall be performed if:

- The serving cell fulfils Srxlev < ThreshServing, LowP and a cell of a lower priority RAT/ frequency fulfils Srxlev > ThreshX, LowP during a time interval TreselectionRAT; and

- More than 1 second has elapsed since the UE camped on the current serving cell.

For a UE performing slice-based cell reselection if a cell fulfils the above criteria for cell reselection based on re-selection priority for the frequency and slice group derived according to 5.2.4.x, but this cell does not support the slice group (see 5.2.4.x), the UE shall re-derive a re-selection priority for the frequency by considering the slice group(s) supported by this cell (rather than those of the corresponding NR frequency) according to 5.2.4.x. This reselection priority shall be used until the highest ranked cell changes on the frequency, or new slice priorities are received from NAS.

Editor’s note: FFS a frequency can be sorted multiple times (7/18) or only once (2/18) or it is up to UE implementation (5/18). Can discuss this further offline (244) (Lenovo) based on the consequences of each decision (including TPs).

Cell reselection to a higher priority RAT/frequency shall take precedence over a lower priority RAT/frequency if multiple cells of different priorities fulfil the cell reselection criteria.

If more than one cell meets the above criteria, the UE shall reselect a cell as follows:

- If the highest-priority frequency is an NR frequency, the highest ranked cell among the cells on the highest priority frequency(ies) meeting the criteria according to clause 5.2.4.6;

- If the highest-priority frequency is from another RAT, the strongest cell among the cells on the highest priority frequency(ies) meeting the criteria of that RAT.

*Next change*

##### 5.2.4.7.0 General reselection parameters

Editor's Note: Slice specific cell reselection parameters to be added here after they are agreed

Cell reselection parameters are broadcast in system information and are read from the serving cell as follows:

**absThreshSS-BlocksConsolidation**

This specifies the minimum threshold for beams which can be used for selection of the highest ranked cells, if *rangeToBestCell* is configured, and for beams used for derivation of cell measurement quantity. The parameter in *SIB2* applies to the current serving frequency and the parameter in *SIB4* applies to the corresponding inter-frequency.

**cellReselectionPriority**

This specifies the absolute priority for NR frequency or E-UTRAN frequency.

**cellReselectionSubPriority**

This specifies the fractional priority value added to cellReselectionPriority for NR frequency or E-UTRAN frequency.

**combineRelaxedMeasCondition**

This indicates when the UE needs to fulfil both low mobility criterion and not-at-cell-edge criterion to determine whether to relax measurement requirements.

**highPriorityMeasRelax**

This indicates whether measurement on higher priority frequency is allowed to be relaxed as specified in clause 5.2.4.9.0.

**nrofSS-BlocksToAverage**

This specifies the number of beams which can be used for selection of the highest ranked cell, if *rangeToBestCell* is configured, and the number of beams used for derivation of cell measurement quantity. The parameter in *SIB2* applies to the current serving frequency and the parameter in *SIB4* applies to the corresponding inter-frequency.

**Qoffsets,n**

This specifies the offsetbetween the two cells.

**Qoffsetfrequency**

Frequency specific offset for equal priority NR frequencies.

**Qhyst**

This specifies the hysteresis value for ranking criteria.

**Qoffsettemp**

This specifies the additional offset to be used for cell selection and re-selection. It is temporarily used in case the RRC Connection Establishment fails on the cell as specified in TS 38.331 [3].

**Qqualmin**

This specifies the minimum required quality level in the cell in dB.

**Qrxlevmin**

This specifies the minimum required Rx level in the cell in dBm.

**Qrxlevminoffsetcell**

This specifies the cell specific Rx level offset in dB to Qrxlevmin.

**Qqualminoffsetcell**

This specifies the cell specific quality level offset in dB to Qqualmin.

**rangeToBestCell**

This specifies the R value range which the cells whose R value is within the range can be a candidate for the highest ranked cell. It is configured in SIB2 and used for intra-frequency and equal priority inter-frequency cell reselection and among the cells on the highest priority frequency(ies) for inter-frequency cell reselection within NR.

**SIntraSearchP**

This specifies the Srxlev threshold (in dB) for intra-frequency measurements.

**SIntraSearchQ**

This specifies the Squal threshold (in dB) for intra-frequency measurements.

**SnonIntraSearchP**

This specifies the Srxlev threshold (in dB) for NR inter-frequency and inter-RAT measurements.

**SnonIntraSearchQ**

This specifies the Squal threshold (in dB) for NR inter-frequency and inter-RAT measurements.

**SSearchDeltaP**

This specifies the threshold (in dB) on Srxlev variation for relaxed measurement.

**SSearchThresholdP**

This specifies the Srxlev threshold (in dB) for relaxed measurement.

**SSearchThresholdQ**

This specifies the Squal threshold (in dB) for relaxed measurement.

**TreselectionRAT**

This specifies the cell reselection timer value. For each target NR frequency and for each RAT other than NR, a specific value for the cell reselection timer is defined, which is applicable when evaluating reselection within NR or towards other RAT (i.e. TreselectionRAT for NR is TreselectionNR, for E-UTRAN TreselectionEUTRA).

NOTE: TreselectionRAT is not broadcast in system information but used in reselection rules by the UE for each RAT.

**TreselectionNR**

This specifies the cell reselection timer value TreselectionRAT for NR. The parameter can be set per NR frequency as specified in TS 38.331 [3].

**TreselectionEUTRA**

This specifies the cell reselection timer value TreselectionRAT for E-UTRAN.

**ThreshX, HighP**

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, HighQ**

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a higher priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, LowP**

This specifies the Srxlev threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshX, LowQ**

This specifies the Squal threshold (in dB) used by the UE when reselecting towards a lower priority RAT/ frequency than the current serving frequency. Each frequency of NR and E-UTRAN might have a specific threshold.

**ThreshServing, LowP**

This specifies the Srxlev threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

**ThreshServing, LowQ**

This specifies the Squal threshold (in dB) used by the UE on the serving cell when reselecting towards a lower priority RAT/ frequency.

**TSearchDeltaP**

This specifies the time period over which the Srxlev variation is evaluated forrelaxed measurement.

*New Clause*

#### 5.2.4.X Re-selection priorities for slice-based cell reselection

The UE derives re-selection priorities for slice-based cell re-selection by using:

* a list of prioritized slice groups provided by NAS in priority order,

Editor’s note: Details to be confirmed with SA2/CT1.

* *sliceInformation* per frequency with *cellReselectionPriority* per slice group provided system information and/or dedicated signalling,
* *cellReselectionPriority* per frequency provided system information and/or dedicated signalling.

The UE considers an NR frequency to support a slice group if

* the *NR frequency* is included in *sliceInformation* and indicates support for the slice group.

The UE considers a cell on an NR frequency to support a slice group if

*-* the *NR frequency* is included in *sliceInformation* and supports the said *slice group*; and

- the cell is either listed in the *includedCellList* (if provided in system information of the serving cell and/or dedicated signalling); or

- the cell is not listed in the *excludedCellList* (if provided in system information of the serving cell and/or dedicated signalling).

The UE shall derive re-selection priorities for slice-based cell re-selection according to the following rules:

* Frequencies that support at least one prioritized slice group received from NAS have higher re-selection priority than frequencies that support no prioritized slice groups.
* Frequencies that support a higher prioritized slice group have higher re-selection priority than frequencies that support lower prioritized slice groups.
* Frequencies that support the same prioritized slice group are prioritized according to the per slice group *cellReselectionPriority*.
* Frequencies that support a prioritized slice group and that indicate per slice group *cellReselectionPriority* have higher re-selection priority than frequencies that support this prioritized slice group without indicating per slice group *cellReselectionPriority*.
* Frequencies that support no prioritized slice group are prioritized according to the per frequency *cellReselectionPriority*;

*End of changes*

Annex - RAN2 agreements for NR Slicing WI

Green highlight – agreements captured in this specification

No highlight – agreements with no clear impact on TS 38.304 or agreements are not mature to be captured in the specification

**RAN2#113bis-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**

**RAN2#114-e agreements**

Slice based cell reselection

**Can consider documenting SMBR enforcement in Stage-2 as conclusion of the slicing WI.**

**Email [250] (Lenovo): Attempt to formulate how the slice priorities could work (i.e. the entire approach, can have multiple options). We will not try to consider Stage-3 details yet or e.g. where priorities come from. Stick to basic principles of slice prioritization.**

**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)**

**RAN2#115-e agreements**

Slice based cell reselection

**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.**

**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)”.

**RAN2#116-e agreements**

Slice based cell reselection

* 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

**RAN2#116bis-e agreements**

Slice based cell reselection

* 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.
* No change to previous agreement that there can be different slice groups for RACH and reselection. Align with SA2 (if they tell us differently).
* 2.1: Among multiple TAs in the same RA, RAN2’s understanding is that the configuration on slice grouping should be homogeneous.
* 2.2: RAN2 assumes that for purpose of UE checking supported slices on the highest ranked cell at TA/RA boundary, gNB can provide in SIB the slice group that supported by these neighbour cells. If this conflicts with SA2, RAN2 will align with SA2.

FFS if the slice group is mapped by the mapping relationship in current RA or not.

FFS PCI list and/or TAC per slice group are provided.

FFS what is the UE behaviour if gNB doesn’t provide supported slice group info on the best ranked cell.

**RAN2#117s-e agreements – TO BE COMPLETED AFTER #117e ENDS**

Slice based cell reselection

* 1: RAN2 confirm the working assumption on option A without formula.
* 2: The UE should determine the frequency priority order according to the following rules:

a) 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;

b) 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);

c) Among the frequencies supporting the same slice/slice group, the frequency not configured with slice specific reselection priority should be considered as lower priority than other frequencies configured with slice specific reselection priority;

d) The frequencies that support any slice/slice group have higher slice based frequency priority than the frequencies that support none of slice/slice group;

e) For the frequencies that do not support any slice/slice group, the UE should follow the legacy cell reselection priority received in SIB, FFS when only legacy priority received in RRCRelease;

* 5: 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. FFS if we still apply the legacy cell reselection frequency priorities in SIB.
* 6: 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 using any cell reselection priorities (including slice-based and legacy (non-slice based) priorities) if the UE is configured with slice based dedicated priority.
* 7: Inter-RAT frequencies are not configured with slice specific frequency priority, but inter-RAT frequencies can be considered using legacy cell reselection frequency priority after all NR frequencies that support any slice/slice group.
* 8: The slice specific cell reselection information provided by the network in SIB is slice group specific.
* 10: Reuse the legacy T320 timer for slice specific frequency priority in RRCRelease.
* 11: RAN sharing can be supported for slice based cell reselection and RACH by network implementation (e.g. dedicated priorities in RRCRelease). We don't define PLMN-specific reselection priorities or RACH configuration. FFS if we need something extra in RACH (may not be critical to WI completion).
* 3: FFS a frequency can be sorted multiple times (7/18) or only once (2/18) or it is up to UE implementation (5/18). Can discuss this further offline (244) (Lenovo) based on the consequences of each decision (including TPs).
* 9: The slice group specific cell reselection information can be provided by the network in RRCRelease.
* 15: PCI list per slice group per frequency can be provided in system information.
* 15.1: Network can indicate whether the PCI list is block-list (“cells not supporting the corresponding slice group”) or allow-list (“cells supporting the corresponding slice group”).