**3GPP TSG-RAN WG2 Meeting #131 R2-250XXXX**

**Bengaluru, India, Aug. 25–29 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.304** | **CR** | **0882** | **rev** | **0** | **Current version:** | **18.4.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](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 CR for TS36.304 for IoT-NTN | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia, Nokia Shanghai Bell | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | IoT\_NTN\_Ph3-Core | | | | |  | ***Date:*** | | | 2025-02-09 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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 can be 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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19) Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To introduce Rel-19 IoT NTN enhancements to TS 36.304. This version of RRC running CR is based on the RAN2 agreements up to RAN2#129related to store and forward operation | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. Introduce changes related to cell status and access barring for cell operating in store and forward mode. 2. Introduce acceptable cell camping for NB-IoT 3. Cell reselection priority handling for neighbour cells operating in SF mode | | | | | | | | |
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| ***Consequences if not approved:*** | | Rel-19 IoT NTN enhancements are not supported. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.4, 5.2.2, 5.2.4.4, 5.2.8a, 5.3.1 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **X** |  | Other core specifications | | | | TS36.331CR 5137. | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS36.300CR 1425 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | R2-2501979 – First version of running CR  R2-2504149 – Updated running CR after post-email discussion after RAN3-129bis.  R2-2505249 - Updated version over R2-2504149 for RAN2-130 agreements related to SF operation changes for idle mode operation. EN in section 5.3.1 is removed.  R2-250XXX -Latest agreements of RAN2-131 are incorporated. | | | | | | | | |

## 4.4 NB-IoT functionality in Idle Mode

This specification is applicable to NB-IoT, except for the following functionality which is not applicable to NB-IoT:

- Accessibility measurements

- Access Control based on ACDC categories

- Camped on Any cell state

- CSG, including support for manual CSG selection and CSG or Hybrid cell related functionality in PLMN selection, or HNB name (SIB9), Cell selection and Cell reselection.

- Emergency call

- E-UTRAN Inter-frequency Redistribution procedure

- Inter-RAT Cell Selection and Reselection including measurements in other RATs

- Logged measurements

- Mobility History Information

- Mobility states of a UE

- Priority based reselection

- RAN-assisted WLAN interworking

- RRC\_INACTIVE state

- Sidelink operation

## 5.2 Cell selection and reselection

### 5.2.1 Introduction

UE shall perform measurements for cell selection and reselection purposes as specified in TS 36.133 [10].

The NAS can control the RAT(s) in which the cell selection should be performed, for instance by indicating RAT(s) associated with the selected PLMN, and by maintaining a list of forbidden registration area(s) and a list of equivalent PLMNs. The UE shall select a suitable cell based on idle mode measurements and cell selection criteria.

In order to speed up the cell selection process, stored information for several RATs may be available in the UE.

When camped on a cell, the UE shall regularly search for a better cell according to the cell reselection criteria. If a better cell is found, that cell is selected. The change of cell may imply a change of RAT, or if the current and selected cell are both E-UTRA cells, a change of the CN type. Details on performance requirements for cell reselection can be found in TS 36.133 [10].

The NAS is informed if the cell selection and reselection results in changes in the received system information relevant for NAS.

For normal service, the UE shall camp on a suitable cell, tune to that cell's control channel(s) so that the UE can:

- Receive system information from the PLMN; and

- receive registration area information from the PLMN, e.g., tracking area information; and

- receive other AS and NAS Information; and

- if registered:

- receive paging and notification messages from the PLMN; and

- initiate transfer to connected mode.

### 5.2.2 States and state transitions in Idle Mode

Except for NB-IoT, figure 5.2.2-1 shows the states and state transitions and procedures in RRC\_IDLE. Whenever a new PLMN selection is performed, it causes an exit to number 1.

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Figure 5.2.2-1: RRC\_IDLE Cell Selection and Reselection

For NB-IoT, figure 5.2.2-2 shows the states and state transitions and procedures in RRC\_IDLE. Whenever a new PLMN selection is performed, it causes an exit to number 1.

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Figure 5.2.2-2: RRC\_IDLE Cell Selection and Reselection for NB-IoT

### 5.2.4 Cell Reselection evaluation process

#### 5.2.4.1 Reselection priorities handling

Absolute priorities of different E-UTRAN frequencies or inter-RAT frequencies may be provided to the UE in the system information, in the *RRCConnectionRelease* or *RRCEarlyDataComplete* message, or by inheriting from another RAT at inter-RAT cell (re)selection. In the case of system information, an E-UTRAN frequency or inter-RAT frequency may be listed without providing a priority (i.e. the field *cellReselectionPriority* is absent for that frequency). If priorities are provided in dedicated signalling, the UE shall ignore all the priorities provided in system information. If UE is in *camped on any cell* state, UE shall only apply the priorities (i.e. *cellReselectionPriority* and/or *cellReselectionSubPriority*) provided by system information from current cell, and the UE preserves priorities provided by dedicated signalling, *deprioritisationReq* received in *RRCConnectionReject* and *altFreqPriorities* provided by dedicated signalling 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). While the UE is camped on a suitable CSG cell in normal coverage, the UE shall always consider the current frequency to be the highest priority frequency (i.e. higher than any of the network configured values), irrespective of any other priority value allocated to this frequency. When the HSDN capable UE is in High-mobility state, the UE shall always consider the HSDN cells to be the highest priority (i.e. higher than any other network configured priorities). When the HSDN capable UE is not in High-mobility state, the UE shall always consider HSDN cells to be the lowest priority (i.e. lower than network configured priorities). If the UE capable of sidelink communication is configured to perform sidelink communication and can only perform the sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only perform the V2X sidelink communication while camping on a frequency, the UE may consider that frequency to be the highest priority. If the UE capable of V2X sidelink communication is configured to perform V2X sidelink communication and can only use pre-configuration while not camping on a frequency, the UE may consider the frequency providing inter-carrier V2X sidelink configuration to be the highest priority. If the UE is configured to perform both V2X sidelink communication and NR sidelink communication, the UE may consider the frequency providing both V2X sidelink communication and 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. If the UE is configured to perform NR sidelink communication and not perform V2X sidelink communication, the UE may consider the frequency providing NR sidelink communication configuration to be the highest priority. If the UE capable of sidelink discovery is configured to perform Public Safety related sidelink discovery and can only perform the Public Safety related sidelink discovery while camping on a frequency, the UE may consider that frequency to be the highest priority. A UE on a vehicle with an NR mobile-IAB cell detected may consider the inter-RAT frequency for which an NR mobile-IAB cell is the best cell to be the highest priority. The UE identifies an NR mobile-IAB cell by *mobileIAB-Cell* in SIB1 (see TS 38.331 [37]). The UE may narrow its search scope for NR mobile-IAB cell(s) by *mobileIAB-CellList* if broadcasted in *SystemInformationBlockType24* (see TS 36.331 [3]). A non-mobile-IAB cell may be excluded from this mobile IAB frequency prioritization for up to 300 seconds.

NOTE 1: The prioritization among the frequencies which UE considers to be the highest priority frequency is left to UE implementation.

NOTE 1a: The frequency only providing the anchor frequency configuration should not be prioritized for V2X service during cell reselection as specified in TS 36.331[3].

NOTE 1b: 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 1c: 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 1d: 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.

NOTE 1e: How the UE determines itself to be on a vehicle with an NR mobile-IAB cell is left to UE implementation.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service and can only receive this MBMS service while camping on a frequency on which it is provided, the UE may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the two following conditions are fulfilled:

1) Either:

- the UE is capable of MBMS service continuity and the reselected cell is broadcasting SIB13; or

- the UE is capable of SC-PTM reception and the reselected cell is broadcasting SIB20;

2) Either:

- SIB15 of the serving cell indicates for that frequency one or more MBMS SAIs included and associated with that frequency in the MBMS User Service Description (USD) TS 26.346 [22] of this service; or

- SIB15 is not broadcast in the serving cell and that frequency is included in the USD of this service.

If the UE is capable either of MBMS Service Continuity or of SC-PTM reception and is receiving or interested to receive an MBMS service provided on a downlink only MBMS frequency, on a frequency used by dedicated MBMS cells, on a frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2], or on a frequency belonging to PLMN different from its registered PLMN, the UE may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2], as long as the above mentioned condition 1) is fulfilled for the cell on the MBMS frequency which the UE monitors or this cell broadcasts SIB1-MBMS and as long as the above mentioned condition 2) is fulfilled for the serving cell.

NOTE 2: Example scenarios in which the previous down-prioritisation may be needed concerns the cases where camping is not possible, while the UE can only receive this MBMS frequency when camping on a subset of cell reselection candidate frequencies, e.g. the MBMS frequency is a downlink only carrier, the MBMS frequency is used by dedicated MBMS cells, the MBMS frequency is used by FeMBMS/Unicast-mixed cells TS 36.300 [2], or the MBMS frequency belongs to a PLMN different from UE's registered PLMN.

If the UE is not capable of MBMS Service Continuity but has knowledge on which frequency an MBMS service of interest is provided, it may consider that frequency to be the highest priority during the MBMS session TS 36.300 [2] as long as the reselected cell is broadcasting SIB13.

If the UE is not capable of MBMS Service Continuity but has knowledge on which downlink only frequency, on which frequency used by dedicated MBMS cells, on which frequency used by FeMBMS/Unicast-mixed cells as defined in TS 36.300 [2] or on which frequency belonging to PLMN different from its registered PLMN an MBMS service of interest is provided, it may consider cell reselection candidate frequencies at which it can not receive the MBMS service to be of the lowest priority during the MBMS session TS 36.300 [2] as long as the cell on the MBMS frequency which the UE monitors is broadcasting SIB13 or SIB1-MBMS.

NOTE 3: The UE considers that the MBMS session is ongoing using the session start and end times as provided by upper layers in the USD i.e. the UE does not verify if the session is indicated on MCCH.

In case UE receives *RRCConnectionReject* with *deprioritisationReq*, UE shall consider current carrier frequency and stored frequencies due to the previously received *RRCConnectionReject* with *deprioritisationReq* or all the frequencies of EUTRA 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 is performed on request by NAS TS 23.122 [5].

NOTE 4: Connecting to CDMA2000 does not imply PLMN selection.

NOTE 5: 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 36.133 [10] are still applicable.

The UE shall delete priorities or *altFreqPriorities* provided by dedicated signalling when:

- the UE enters a different RRC state; or

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

- the optional validity time of *altFreqPriorities* (T323) expires; or

- a PLMN selection is performed on request by NAS TS 23.122 [5].

NOTE 6: Equal priorities between RATs are not supported.

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

In case the UE received *RRCConnectionRelease* with *altFreqPriorities*, for E-UTRAN frequencies, the UE shall apply the alternative cell reselection priorities broadcast via *altCellReselectionPriority* and *altCellReselectionSubPriority* in the system information instead of priorities broadcast via *cellReselectionPriority* and *cellReselectionSubPriority.* If the UE received *RRCConnectionRelease* with *altFreqPriorities* and the alternative cell reselection priorities are not broadcast via *altCellReselectionPriority* and *altCellReselectionSubPriority* in the system information, for E-UTRAN frequencies, the UE shall apply the cell reselection priority information broadcast in the system information via *cellReselectionPriority* and *cellReselectionSubPriority.* When *altFreqPriorities* is discarded or deleted, the UE shall apply the cell reselection priority information broadcast in the system information via *cellReselectionPriority* and *cellReselectionSubPriority*.

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

For cell reselection to NR operating with shared spectrum channel access, the UE shall consider only the allow-listed cells, if configured in SIB24, as candidates for cell reselection.

The UE shall inherit the priorities provided by dedicated signalling and the remaining validity time (i.e., T320 in E-UTRA and NR, T322 in UTRA and T3230 in GERAN), if configured, at inter-RAT cell (re)selection. The UE shall delete *altFreqPriorities* provided by dedicated signalling, if configured, at inter-RAT cell (re)selection.

NOTE 7: The network may assign dedicated cell reselection priorities for frequencies not configured by system information.

While T360 is running, redistribution target is considered to be the highest priority (i.e. higher than any of the network configured values). UE shall continue to consider the serving frequency as the highest priority until completion of E-UTRAN Inter-frequency Redistribution procedure specified in 5.2.4.10 if triggered on T360 expiry/ stop.

#### 5.2.4.2 Measurement rules for cell re-selection

For NB-IoT measurement rules for cell re-selection is defined in clause 5.2.4.2.a.

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the measurements are performed using RSS as specified in [10] and the serving cell fulfils Srxlev> SIntraSearchP:

- If *distanceThresh* and *referenceLocation* are broadcast in *SystemInformationBlockType31*, and if the UE has obtained its location information:

- If *referenceLocation* is set to *fixedReferenceLocation* and if the UE supports location-based measurement initiation (quasi-)Earth for fixed cell, *referenceLocation* is used as serving cell reference location.

- If the distance between the UE and the serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform intra-frequency measurements.

- Else, the UE shall perform intra-frequency measurements.

- If *referenceLocation* is set to *movingReferenceLocation* and if the UE supports location-based measurement initiation for Earth moving cell, the UE derives the serving cell reference location based on ephemeris, *epochTime* and *referenceLocation.*

- If the distance between the UE and the serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform intra-frequency measurements.

- Else, the UE shall perform intra-frequency measurements.

- Else, the UE may choose not to perform intra-frequency measurements.

- Else, the UE may choose not to perform intra-frequency measurements.

- Else if the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ:

- If *distanceThresh* and *referenceLocation* are broadcast in *SystemInformationBlockType31*, and if the UE has obtained its location information:

- If *referenceLocation* is set to *fixedReferenceLocation* and if the UE supports location-based measurement initiation for (quasi-)Earth fixed cell, the *referenceLocation* is used as serving cell reference location.

- If the distance between the UE and the serving cell reference location, the UE may choose not to perform intra-frequency measurements.

- Else, the UE shall perform intra-frequency measurements.

- If *referenceLocation* is set to *movingReferenceLocation* and if the UE supports location-based measurement initiation for Earth moving cell, the UE derives the serving cell reference location based on ephemeris, *epochTime* and *referenceLocation*.

- If the distance between the UE and the serving cell reference location is shorter than distanceThresh, the UE may choose not to perform intra-frequency measurements.

- Else, the UE shall perform intra-frequency measurements.

- Else, the UE may choose not to perform intra-frequency measurements.

- Else, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for E-UTRAN inter-frequencies and inter-RAT frequencies which are indicated in system information and for which the UE has priority provided as defined in 5.2.4.1:

- For an E-UTRAN inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current E-UTRA frequency the UE shall perform measurements of higher priority E-UTRAN inter-frequency or inter-RAT frequencies according to TS 36.133 [10].

- For an E-UTRAN inter-frequency with an equal or lower reselection priority than the reselection priority of the current E-UTRA frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current E-UTRAN frequency:

- If the measurements are performed using RSS as specified in [10] and the serving cell fulfils Srxlev > SnonIntraSearchP:

- If *distanceThresh* and *referenceLocation* are broadcast in *SystemInformationBlockType31*, and if the UE has obtained its location:

- If *referenceLocation* is set to *fixedReferenceLocation* and if the UE supports location-based measurement initiation for (quasi-)Earth fixed cell, the *referenceLocation* is used as serving cell reference location. The *referenceLocation* is used as serving cell reference location.

- If the distance between the UE and serving cell reference location is shorter than *distanceThresh* the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo.*

- Else, the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If *referenceLocation* is set to *movingReferenceLocation* and if the UE supports location-based measurement initiation for Earth moving cell, the UE derives the serving cell reference location based on ephemeris, *epochTime* and *referenceLocation*.

- If the distance between the UE and serving cell reference location is shorter than *distanceThresh* the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo.*

- Else, the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- Else, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo.*

- Else, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo.*

- Else if the serving cell fulfils Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ:

- If *distanceThresh* and *referenceLocation* are broadcast in *SystemInformationBlockType31*, and if the UE supports location-based measurement initiation and has obtained its location:

- If *referenceLocation* is set to *fixedReferenceLocation* and UE supports location-based measurement initiation for (quasi-)Earth fixed cell, the *referenceLocation* is used as serving cell reference location.

- If the distance between the UE and serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo*.

- Else, the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If *referenceLocation* is set to *movingReferenceLocation* and UE supports location-based measurement initiation for Earth moving cell, the UE derives the serving cell reference location based on ephemeris, *epochTime* and *referenceLocation*.

- If the distance between the UE and serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo*.

- Else, the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- Else, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo.*

- Else, the UE may choose not to perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority unless the UE is triggered to measure an E-UTRAN inter-frequency which is configured with *redistributionInterFreqInfo.*

- Otherwise,the UE shall perform measurements of E-UTRAN inter-frequencies or inter-RAT frequency cells of equal or lower priority according to TS 36.133 [10].

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3*, the UE may further limit the needed measurements, as specified in clause 5.2.4.12.

If *t-Service* is present in *SystemInformationBlockType3* of the serving cell, UE shall perform intra-frequency, inter-frequency or inter-RAT measurements, before the time *t-Service* regardless of the distance between the UE and serving cell reference location, and regardless whether the serving cell fulfils Srxlev> SIntraSearchP and Squal > SIntraSearchQ, or Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ. The exact time to start measurements before *t-Service* is up to UE implementation and *t-ServiceStartNeigh* if present in *SystemInformationBlockType33* may be used to decide on when to start measurements. UE shall perform measurements of higher priority inter-frequencies or inter-RAT frequencies regardless of the remaining service time of the serving cell.

#### 5.2.4.2a Measurement rules for cell re-selection for NB-IoT

When evaluating Srxlev and Squal of non-serving cells for reselection purposes, the UE shall use parameters provided by the serving cell.

Following rules are used by the UE to limit needed measurements:

- If the serving cell fulfils Srxlev> SIntraSearchP:

- If *distanceThresh* and *referenceLocation* are broadcast in *SystemInformationBlock31-NB*, and if the UE has obtained its location:

- If *referenceLocation* is set to *fixedReferenceLocation* and the UE supports location-based measurement initiation for (quasi-)Earth fixed cell, the *referenceLocation* is used as serving cell reference location.

- If the distance between UE and serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform intra-frequency measurements.

- Else, the UE shall perform intra-frequency measurements.

- If *referenceLocation* is set to *movingReferenceLocation* and the UE supports location-based measurement initiation for Earth moving cell the UE derives the serving cell reference location based on ephemeris, *epochTime* and *referenceLocation*.

- If the distance between UE and serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform intra-frequency measurements.

- Else, the UE shall perform intra-frequency measurements.

- Else, the UE may choose not to perform intra-frequency measurements.

- Else, the UE may choose not to perform intra-frequency measurements.

- Otherwise, the UE shall perform intra-frequency measurements.

- The UE shall apply the following rules for NB-IoT inter-frequencies which are indicated in system information:

- If the serving cell fulfils Srxlev > SnonIntraSearchP:

- If *distanceThresh* and *referenceLocation* are broadcast in *SystemInformationBlock31-NB*, and if the UE supports location-based measurement initiation and has obtained its location:

- If *referenceLocation* is set to *fixedReferenceLocation* and the UE supports location-based measurement initiation for (quasi-)Earth fixed cell, the *referenceLocation* is used as serving cell reference location.

- If the distance between UE and serving cell location is shorter than *distanceThresh*, the UE may choose not to perform inter-frequency measurements.

- Else, the UE shall perform inter-frequency measurements.

- If *referenceLocation* is set to *movingReferenceLocation* and the UE supports location-based measurement initiation for Earth moving cell the UE derives the serving cell reference location based on ephemeris, *epochTime* and *referenceLocation*.

- If the distance between the UE and serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform inter-frequency measurements.

- Else, the UE shall perform inter-frequency measurements.

- Else, the UE may choose not to perform inter-frequency measurements.

- Else, the UE may choose not to perform inter-frequency measurements.

- Otherwise,the UE shall perform inter-frequency measurements.

- If the UE supports relaxed monitoring and *s-SearchDeltaP* is present in *SystemInformationBlockType3-NB*, the UE may further limit the needed measurements, as specified in clause 5.2.4.12.

If *t-Service* is present in *SystemInformationBlockType3-NB* of the serving cell, UE shall perform intra-frequency or inter-frequency measurements before the time *t-Service* regardless of the distance between UE and serving cell reference location, and regardless whether the serving cell fulfils Srxlev> SIntraSearchP or Srxlev > SnonIntraSearchP. The exact time to start measurements before *t-Service* is up to UE implementation and *t-ServiceStartNeigh* if present in *SystemInformationBlockType33-NB* may be used to decide on when to start measurements.

#### 5.2.4.3 Mobility states of a UE

Besides Normal-mobility state a High-mobility and a Medium-mobility state are applicable if the parameters (TCRmax, NCR\_H, NCR\_M, TCRmaxHyst and *cellEquivalentSize*) are sent in the system information broadcast of the serving cell.

**State detection criteria:**

Medium-mobility state criteria:

- If number of cell reselections during time period TCRmax exceeds NCR\_M and not exceeds NCR\_H

High-mobility state criteria:

- If number of cell reselections during time period TCRmax exceeds NCR\_H

The UE shall not count consecutive reselections between same two cells into mobility state detection criteria if same cell is reselected just after one other reselection. If the UE is capable of HSDN and the *cellEquivalentSize* is configured, the UE counts the number of cell reselections for this cell as *cellEquivalentSize* configured for this cell.

**State transitions:**

The UE shall:

- if the criteria for High-mobility state is detected:

- enter High-mobility state.

- else if the criteria for Medium-mobility state is detected:

- enter Medium-mobility state.

- else if criteria for either Medium- or High-mobility state is not detected during time period TCRmaxHys**t**:

- enter Normal-mobility state.

If the UE is in High- or Medium-mobility state, the UE shall apply the speed dependent scaling rules as defined in clause 5.2.4.3.1.

##### 5.2.4.3.1 Scaling rules

UE shall apply the following scaling rules:

- If neither Medium- nor Highmobility state is detected:

- no scaling is applied.

- If High-mobility state is detected:

- Add the *sf-High* of "Speed dependent ScalingFactor for Qhyst" to Qhyst if sent on system information

- For E-UTRAN cells multiply TreselectionEUTRA by the *sf-High* of "Speed dependent ScalingFactor for TreselectionEUTRA" if sent on system information

- For UTRAN cells multiply TreselectionUTRA by the *sf-High* of "Speed dependent ScalingFactor for TreselectionUTRA" if sent on system information

- For GERAN cells multiply TreselectionGERA by the *sf-High* of "Speed dependent ScalingFactor for TreselectionGERA state" if sent on system information

- For CDMA2000 HRPD cells Multiply TreselectionCDMA\_HRPD by the *sf-High* of "Speed dependent ScalingFactor for TreselectionCDMA\_HRPD" if sent on system information

- For CDMA2000 1xRTT cells Multiply TreselectionCDMA\_1xRTT by the *sf-High* of "Speed dependent ScalingFactor for TreselectionCDMA\_1xRTT" if sent on system information

- For NR cells multiply TreselectionNR by the *sf-High* of "Speed dependent ScalingFactor for TreselectionNR" if sent on system information

- If Medium-mobility state is detected:

- Add the *sf-Medium* of "Speed dependent ScalingFactor for Qhyst" to Qhyst if sent on system information

- For E-UTRAN cells multiply TreselectionEUTRA by the *sf-Medium* of "Speed dependent ScalingFactor for TreselectionEUTRA" if sent on system information

- For UTRAN cells multiply TreselectionUTRA by the *sf-Medium* of "Speed dependent ScalingFactor for TreselectionUTRA" if sent on system information

- For GERAN cells multiply TreselectionGERA by the *sf-Medium* of "Speed dependent ScalingFactor for TreselectionGERA" if sent on system information

- For CDMA2000 HRPD cells Multiply TreselectionCDMA\_HRPD by the *sf-Medium* of "Speed dependent ScalingFactor for TreselectionCDMA\_HRPD" if sent on system information

- For CDMA2000 1xRTT cells Multiply TreselectionCDMA\_1xRTT by the *sf-Medium* of "Speed dependent ScalingFactor for TreselectionCDMA\_1xRTT" if sent on system information

- For NR cells multiply TreselectionNR by the *sf-Medium* of "Speed dependent ScalingFactor for TreselectionNR" if sent on system information

In case scaling is applied to any TreselectionRAT parameter the UE shall round up the result after all scalings to the nearest second.

#### 5.2.4.4 Cells with cell reservations, access restrictions or unsuitable for normal camping

For the highest ranked cell (including serving cell) according to cell reselection criteria specified in clause 5.2.4.6, for the best cell according to absolute priority reselection criteria specified in clause 5.2.4.5, the UE shall check if the access is restricted according to the rules in clause 5.3.1.

If that cell and other cells have to be excluded from the candidate list, as stated in clause 5.3.1, the UE shall not consider these as candidates for cell reselection. This limitation shall be removed when the highest ranked cell changes.

If the highest ranked cell or best cell according to absolute priority reselection rules is an intra-frequency or inter-frequency cell which is not suitable for a CN type due to being part of the "list of forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell and other cells on the same frequency, as candidates for reselection for the CN type for a maximum of 300s. If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under E-UTRAN control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

If the highest ranked cell or best cell according to absolute priority reselection rules is an inter-RAT cell which is not suitable due to being part of the "list of forbidden TAs for roaming" or belonging to a PLMN which is not indicated as being equivalent to the registered PLMN, the UE shall not consider this cell and other cells on the same frequency as candidates for reselection for a maximum of 300s. In case of UTRA further requirements are defined in the TS 25.304 [8]. In case of NR further requirements are defined in the TS 38.304 [38]. If the UE enters into state *any cell selection*, any limitation shall be removed. If the UE is redirected under E-UTRAN control to a frequency for which the timer is running, any limitation on that frequency shall be removed.

If the highest ranked cell or best cell according to absolute priority reselection rules is a CSG cell which is not suitable due to not being a CSG member cell, the UE shall not consider this cell as candidate for cell reselection but shall continue considering other cells on the same frequency for cell reselection.

NOTE: If the highest ranked cell or best cell according to absolute priority reselection rules is cell operating in store and forward mode the UE may not consider this cell as candidate cell for cell reselection and continue considering other cells not operating in store and forward mode for cell reselection.

### 5.2.8 Any Cell Selection state

For NB-IoT Any Cell Selection state is defined in clause 5.2.8a.

This state is applicable for RRC\_IDLE and RRC\_INACTIVE state. In this state, the UE shall perform cell selection process to find a suitable cell. If the cell selection process fails to find a suitable cell after a complete scan of all RATs and all frequency bands supported by the UE, the UE shall attempt to find an acceptable cell of any PLMN to camp on, trying all RATs that are supported by the UE and searching first for a high quality cell, as defined in clause 5.1.2.2.

The UE, which is not camped on any cell, shall stay in this state.

### 5.2.8a Any Cell Selection state for NB-IoT

In this state, the UE shall attempt to find a suitable cell of any PLMN to camp on and searching first for a high quality cell, as defined in clause 5.1.2.2. If the cell selection process fails to find a suitable cell cell after a complete scan of all RATs and all frequency bands supported by the UE, if the UE is capable of PWS reception the UE shall attempt to find an acceptable cell of any PLMN to camp on in current RAT and searching first for a high quality cell, as defined in clause 5.1.2.2.

The UE, which is not camped on any cell, shall stay in this state until a suitable cell is found.

### 5.2.9 Camped on Any Cell state

In this state, the UE shall perform the following tasks:

- monitor the paging channel of the cell as specified in clause 7 according to information sent in system information;

- monitor relevant System Information as specified in TS 36.331 [3];

- perform necessary measurements for the cell reselection evaluation procedure;

- execute the cell reselection evaluation process on the following occasions/triggers:

1) UE internal triggers, so as to meet performance as specified in TS 36.133 [10];

2) When information on the BCCH or BR-BCCH used for the cell reselection evaluation procedure has been modified;

- regularly attempt to find a suitable cell trying all frequencies of all RATs that are supported by the UE. If a suitable cell is found, UE shall move to *camped normally* state;

- if the UE supports voice services and the current cell does not support emergency call as indicated in System information specified in TS 36.331 [3], the UE should perform cell selection/ reselection to an acceptable cell of any supported RAT regardless of priorities provided in system information from current cell, if no suitable cell is found.

NOTE: The UE is allowed to not perform reselection to an inter-frequency E-UTRAN cell in order to prevent camping on a cell on which it cannot initiate an IMS emergency call.

## 5.3 Cell Reservations and Access Restrictions

There are two mechanisms which allow an operator to impose cell reservations or access restrictions. The first mechanism uses indication of cell status and special reservations for control of cell selection and reselection procedures. The second mechanism, referred to as Access Control, shall allow preventing selected classes of users or ACDC categories from sending initial access messages for load control reasons. For Access Control based on Access Classes, at subscription, one or more Access Classes are allocated to the subscriber and stored in the USIM TS 22.011 [4]. For Access Control based on ACDC categories, at subscription at least four ACDC categories are allocated to the subscriber and stored in the ACDC MO TS 24.105 [31] or USIM TS 31.102 [32].

IAB-MT does not apply the access control.

### 5.3.1 Cell status and cell reservations

Cell status and cell reservations are indicated in the *SystemInformationBlockType1* message (or *SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB* message) TS 36.331 [3] by means of the following fields:

- *cellBarred* (IE type: "barred" or "not barred")   
This field indicates if the cell is barred for connectivity to EPC.  
This field is ignored by the UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1.   
This field is ignored by the BL UEs or UEs in CE supporting *ce-CRS-IntfMitig* while *crs-IntfMigitNumPRBs* is included in SIB1-BR.  
This field is ignored by UEs supporting NTN while *cellBarred-NTN* is included in SIB1-BR or SIB1-NB.  
In case of multiple EPC PLMNs indicated in SIB1/SIB1-BR, this field is common for all EPC PLMNs

NOTE 1: IAB-MT ignores the *cellBarred*, *cellReservedForOperatorUse,* *intraFreqReselection* and *csg-Indication* (i.e. treats *intraFreqReselection* as if it was set to *allowed* and the *csg-Indication* as if it was set to *FALSE*) as defined in TS 36.331 [3].

- *cellBarred-5GC* (IE type: "barred" or "not barred")  
This field indicates if the cell is barred for connectivity to 5GC.  
This field is ignored if the UE does not support E-UTRA connected to 5GC or if the UE supports network-based CRS interference mitigation and *nw-BasedCRS-InterferenceMitigation* is included in *SystemInformationBlockType1*.  
In case of multiple 5GC PLMNs indicated in SIB1, this field is common for all 5GC PLMNs.

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")  
This field indicates if the cell is reserved for operator use.  
This field is ignored by the UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1.   
This field is ignored by the BL UEs or UEs in CE supporting *ce-CRS-IntfMitig* while *crs-IntfMigitNumPRBs* is included in SIB1-BR.   
In case of multiple EPC or 5GC PLMNs indicated in SIB1/SIB1-BR, this field is specified per EPC or 5GC PLMN.

- *cellBarred-CRS* (IE type: "barred" or "not barred")  
This field indicates if the cell is barred for connectivity to EPC for UEs supporting network-based CRS interference mitigation.  
*barred* means the cell is barred for UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1. For BL UEs or UEs in CE capable of *ce-CRS-IntfMitig*, *barred* means the cell is barred while *crs-IntfMitigNumPRBs* is included in SIB1-BR.  
This field is ignored by the UE if the UE does not support CRS interference mitigation or while *crs-IntfMitigConfig* is not included in SIB1 (SIB1-BR for BL UEs or UEs in CE).  
In case of multiple PLMNs indicated in SIB1/SIB1-BR, this field is common for all PLMNs.

- *cellBarred-5GC-CRS* (IE type: "barred" or "not barred")  
This field indicates if the cell is barred for connectivity to 5GC for UEs supporting network-based CRS interference mitigation.  
This field is ignored if the UE does not support E-UTRA connected to 5GC or network-based CRS interference mitigation.  
In case of multiple 5GC PLMNs indicated in SIB1, this field is common for all 5GC PLMNs.

- *cellReservedForOperatorUse-CRS* (IE type: "reserved" or "not reserved")  
This field indicates if the cell is reserved for operator use for UEs supporting network-based CRS interference mitigation.  
*reserved* means the cell is "reserved" for operator use for UEs supporting *crs-IntfMitig* while *crs-IntfMitigEnabled* is included in SIB1.   
For BL UEs or UEs in CE capable of *ce-CRS-IntfMitig*, *reserved* means the cell is "reserved" for operator use while *crs-IntfMitigNumPRBs* is included in SIB1-BR.  
This field is ignored if the UE does not support CRS interference mitigation or while *crs-IntfMitigConfig* is not included in SIB1 (SIB1-BR for BL UEs or UEs in CE).  
In case of multiple PLMNs indicated in SIB1/SIB1-BR, this field is specified per PLMN.

- *iab-Support* (IE type: "true")  
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is specified per PLMN. This field indicates if the cell is barred for IAB node or the cell does not support IAB node, or both. When this field is absent, the IAB node shall treat this cell as if cell status is barred.

- *cellBarred-NTN* (IE type: "barred" or "not barred")  
This field indicates if the cell is barred for connectivity to EPC via NTN.  
This field is ignored if the UE does not support NTN connectivity.This field is ignored by the UE supporting store and forward operation for NTN while *sf-OperationMode* is included in SIB1-BR or SIB1-NB.

*- sf-OperationMode* (IE type: “barred” or “not barred”)  
Presence of this field indicates that the cell is operating in store and forward mode. This field indicates if the cell is barred for connectivity to EPC via NTN for the UE capable of store and forward operation. This field is ignored if the UE does not support store and forward operation.

The following description for handling of barred and reserved cells is per CN type. If the UE supports more than one CN type, the UE shall only exclude a cell as candidate for selection/reselection if it is excluded for both CN types.

NOTE 2: Fields *cellBarred-CRS* and *cellReservedForOperatorUse-CRS* are not indicated in *SystemInformationBlockType1-NB*

When cell status is indicated as "not barred" and "not reserved" for operator use,

- All UEs shall treat this cell as candidate during the cell selection and cell reselection procedures.

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN,

- UEs assigned to Access Class 11 or 15 (or corresponding Access Identity) operating in their HPLMN/EHPLMN shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for that PLMN set to "reserved".

- UEs assigned to an Access Class in the range of 0 to 9 (or corresponding Access Identity 0), 12 to 14 (or corresponding Access Identity) or to Access Identity 1, 2 or 3 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN or the selected PLMN.

NOTE 3: ACs 11, 15 (or corresponding Access Identity) are only valid for use in the HPLMN/ EHPLMN; ACs 12, 13, 14 (or corresponding Access Identity) are only valid for use in the home country TS 22.011 [4].

NOTE 4: Access Identities 1, 2 are valid in the PLMNs as specified in TS 22.261 [41].

NOTE 5: Access Identity 3 is only valid for PLMNs that indicate to potential Disaster Inbound Roamers that the UEs can access the PLMN as specified in TS 22.261 [41].

When cell status "barred" is indicated or to be treated as if the cell status is "barred",

- The UE is not permitted to select/reselect this cell, not even for emergency calls.

- The UE shall consider other cells for cell selection/reselection according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *MasterInformationBlock (*or *MasterInformationBlock-NB),* the *SystemInformationBlockType1 (*or *SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB),* the *SystemInformationBlockType2 (*or *SystemInformationBlockType2-NB)* or *SystemInformationBlockType31 (*or *SystemInformationBlockType31-NB)* if broadcasted for UEs supporting NTN:

- the UE may exclude the barred cell as a candidate for cell selection/reselection for up to 300 seconds.

- the UE may select another cell on the same frequency if the selection criteria are fulfilled.

- the UE may select the same cell in normal coverage if the UE was barred in the cell due to being unable to acquire *MasterInformationBlock*, *SystemInformationBlockType1-BR*, or *SystemInformationBlockType2* in enhanced coverage, but was able to acquire *MasterInformationBlock*, *SystemInformationBlockType1*, and *SystemInformationBlockType2* in normal coverage, if the selection criteria are fulfilled.

- the UE may select the same cell in enhanced coverage if the UE was barred in the cell due to being unable to acquire *MasterInformationBlock*, *SystemInformationBlockType1*, or *SystemInformationBlockType2* in normal coverage, but was able to acquire *MasterInformationBlock*, *SystemInformationBlockType1-BR*, and *SystemInformationBlockType2*, if the selection criteria are fulfilled.

- else

- If the cell is a CSG cell:

- the UE may select another cell on the same frequency if the selection/reselection criteria are fulfilled.

- else

- If the field *intraFreqReselection* in field *cellAccessRelatedInfo* in *SystemInformationBlockType1 (*or *SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB)* message is set to "allowed", the UE may select another cell on the same frequency if re-selection criteria are fulfilled.

- The UE shall exclude the barred cell as a candidate for cell selection/reselection for 300 seconds.

- If the field *intraFreqReselection* in field *cellAccessRelatedInfo* in *SystemInformationBlockType1* (or *SystemInformationBlockType1-BR* message or *SystemInformationBlockType1-NB*) message is set to "not allowed" the UE shall not re-select a cell on the same frequency as the barred cell;

- The UE shall exclude the barred cell and the cells on the same frequency as a candidate for cell selection/reselection for 300 seconds.

The cell selection of another cell may also include a change of RAT or, if the previous and selected cell are both E-UTRA cells, a change of the CN type.