**3GPP TSG-RAN WG2** **Meeting #118-e *R2-2206500***

**Elbonia, 09 – 20 May 2022**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.304** | **CR** | **XXXX** | **rev** | **-** | **Current version:** | **17.0.0** |  |
|  |
| *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:***  | NTN corrections to 38.304 |
|  |  |
| ***Source to WG:*** |  ZTE Corporation, Sanechips, Nokia, Nokia Shanghai Bell |
| ***Source to TSG:*** | RAN2 |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions-Core |  | ***Date:*** | 2021-05-23 |
|  |  |  |  |  |
| ***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:*** | 1. To correct and simplify some of the NTN related IDLE mode procedures.
2. To introduce cellBarredNTN.
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| ***Summary of change:*** | 1. In 5.2.4.2 the terms regarding UE location are clarified. Wording is simplified, shall is used instead of should. It is also clarified what remaining service time refers to.
2. In 5.3.1 the parameter and corresponding behavior for cellBarred-NTN is added.
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| ***Consequences if not approved:*** | cellBarredNTN is not supported |
|  |  |
| ***Clauses affected:*** | 5.2.4.2, 5.3.1 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  |  |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

Start of change

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

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

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

- If *distanceThresh* is broadcasted in SIB19, and if UE supports location-based measurement initiation and has obtained its location information:

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

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

- Otherwise, the UE may not perform intra-frequency measurements;

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

- The UE shall apply the following rules for NR 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 a NR inter-frequency or inter-RAT frequency with a reselection priority higher than the reselection priority of the current NR frequency, the UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8].

- For a NR inter-frequency with an equal or lower reselection priority than the reselection priority of the current NR frequency and for inter-RAT frequency with lower reselection priority than the reselection priority of the current NR frequency:

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

- If *distanceThresh* is broadcasted in SIB19-, and if UE supports location-based measurement initiation and has valid UE location information:

- If the distance between UE and the serving cell reference location is shorter than *distanceThresh*, the UE may choose not to perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority;

- Otherwise, the UE shall perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority according to TS 38.133 [8];

- Otherwise, the UE may choose not to perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority;

- Otherwise,the UE shall perform measurements of NR inter-frequency cells of equal or lower priority, or inter-RAT frequency cells of lower priority according to TS 38.133 [8].

- If the UE supports relaxed measurement and *relaxedMeasurement* is present in *SIB2*, the UE may further relax the needed measurements, as specified in clause 5.2.4.9.

If the *t-Service* of the serving cell is present in SIB19, UE shall perform intra-frequency, inter-frequency or inter-RAT measurements before the t-Service, regardless of the distance between UE and the serving cell reference location or whether the serving cell fulfils Srxlev > SIntraSearchP and Squal > SIntraSearchQ, or Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ and the exact time to start measurement before *t-Service* is up to UE implementation. UE shall perform measurements of higher priority NR inter-frequency or inter-RAT frequencies according to TS 38.133 [8] regardless of the remaining service time of the serving cell (i.e. time remaining until *t-Service*).

NOTE: When evaluating the distance between UE and the serving cell reference location, it's up to UE implementation to obtain UE location information.

Next change

### 5.3.1 Cell status and cell reservations

Cell status and cell reservations are indicated in the *MIB or SIB1* message as specified in TS 38.331 [3] by means of following fields:

- *cellBarred* (IE type: "barred" or "not barred")
Indicated in *MIB* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs.

- *cellBarred-NTN* (IE type: "barred" or "not barred")
Indicated in SIB1 message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs. This field is only applicable to NTN-capable UEs.

- *cellBarredRedCap1Rx* (IE type: "barred" or "not barred")
Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs. This field is only applicable to RedCap UEs.

- *cellBarredRedCap2Rx* (IE type: "barred" or "not barred")
Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs. This field is only applicable to RedCap UEs.

- *cellReservedForOperatorUse* (IE type: "reserved" or "not reserved")
Indicated in *SIB1* message*.* In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is specified per PLMN or per SNPN.

- *cellReservedForOtherUse* (IE type: "true")
Indicated in *SIB1* message. In case of multiple PLMNs indicated in *SIB1*, this field is common for all PLMNs.

*- cellReservedForFutureUse* (IE type: "true")
Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is common for all PLMNs and NPNs.

NOTE 0: IAB-MT ignores the *cellBarred*, *cellReservedForOperatorUse, cellReservedForFutureUse,* and *intraFreqReselection* (i.e. treats *intraFreqReselection* as if it was set to *allowed*) as defined in TS 38.331 [3]. IAB-MT also ignores *cellReservedForOtherUse* for cell barring determination (i.e. NPN capable IAB-MT considers *cellReservedForOtherUse* for determination of an NPN-only cell) as defined in TS 38.331 [3].

- *iab-Support* (IE type: "true")
Indicated in *SIB1* message. In case of multiple PLMNs or NPNs indicated in *SIB1*, this field is specified per PLMN or per SNPN.

Editor's note: Working assumption: A new bit, e.g. cellBarred-NTN, is introduced in SIB1 for NR-NTN. FFS on the expected UE behaviour upon reception of the new bit and the existing cellBarred.

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

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

When cell broadcasts any CAG-IDs or NIDs and the cell status is indicated as "not barred" and "not reserved" for operator use and "true" for other use, and not "true" for future use:

- All NPN-capable UEs shall treat this cell as candidate during the cell selection and cell reselection procedures, other UEs shall treat this cell as if cell status is "barred".

When cell status is indicated as "true" for other use, and either cell does not broadcast any CAG-IDs or NIDs or does not broadcast any CAG-IDs and the UE is not operating in SNPN Access Mode,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "true" for future use,

- The UE shall treat this cell as if cell status is "barred".

When cell status is indicated as "not barred" and "reserved" for operator use for any PLMN/SNPN and not "true" for other use and not "true" for future use,

- UEs assigned to Access Identity 11 or 15 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 Access Identity 11 or 15 shall treat this cell as candidate during the cell selection and reselection procedures if the field *cellReservedForOperatorUse* for selected/registered SNPN is set to "reserved".

- UEs assigned to an Access Identity 0, 1, 2 and 12 to 14 shall behave as if the cell status is "barred" in case the cell is "reserved for operator use" for the registered PLMN/SNPN or the selected PLMN/SNPN.

- UEs assigned to Access Identity 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 1: Access Identities 11, 15 are only valid for use in the HPLMN/ EHPLMN; Access Identities 12, 13, 14 are only valid for use in the home country as specified in TS 22.261 [12].

NOTE 1a: 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 [12].

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 select another cell 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 *MIB*:

- 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.

- else:

- If the UE is a RedCap UE, the UE shall acquire SIB1 and, in the remainder of this procedure, consider '*intraFreqReselection* in MIB' to be '*intraFreqReselectionRedCap* in SIB1', if available*.*

- If the field *intraFreqReselection* in *MIB* message is set to "allowed":

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

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

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

- else:

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

- If the field *intraFreqReselection* in *MIB* message is set to "not allowed":

- If the cell is to be treated as if the cell status is "barred" due to being unable to acquire the *SIB1*:

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

- If the cell operates in licensed spectrum:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds;

- else:

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

- else:

- If the cell operates in licensed spectrum, or if this cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or the selected PLMN of the UE, or if this cell belongs to the registered SNPN or the selected SNPN of the UE:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds;

- else:

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

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

When cell status "barred" is indicated for RedCap UEs with 1Rx/2Rx 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 select another cell according to the following rule:

- If the cell is to be treated as if the cell status is "barred" due to not supporting RedCap UEs:

- 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.

- else:

- If the field *intraFreqReselectionRedCap* in *SIB1* message is set to "allowed":

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

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

- If the field *intraFreqReselectionRedCap* in *SIB1* message is set to "not allowed":

- If the cell operates in licensed spectrum, or if this cell belongs to a PLMN which is indicated as being equivalent to the registered PLMN or the selected PLMN of the UE, or if this cell belongs to the registered SNPN or the selected SNPN of the UE:

- the UE shall not re-select to another cell on the same frequency as the barred cell and exclude such cell(s) as candidate(s) for cell selection/reselection for 300 seconds.

- else:

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

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

The cell selection of another cell may also include a change of RAT.

NOTE 2: If barring of a cell is triggered by the condition of *trackingAreaCode* and *trackingAreaList* not being provided, as specified in TS 38.331 [3], the barring only applies to this PLMN and the UE can re-evaluate the barring condition again due to selection of another PLMN.

End of change

# Annex – Agreements for idle/inactive mode in NTN

## RAN2#111e

Agreements:

1. Cell selection / reselection in NR is the baseline in NTN idle mode procedure.
2. Satellite/HAPS ephemeris based cell selection and reselection should be defined for NTN (FFS what the term satellite/HAPS ephemeris actually means). FFS when this ephemeris based cell selection / reselection can be used. FFS whether UE location (and/or other information) based cell selection and reselection should be introduced for NTN
3. The satellite ephemeris should be provided to UE, at least for Satellite/HAPS ephemeris based cell selection and reselection (FFS what the term satellite/HAPS ephemeris actually means).
4. The network type (i.e. TN or NTN) should be known to UE. FFS whether to achieve this in an implicit or explicit way.
5. The existing cell reselection priority configuration can be taken as a baseline in NTN. FFS on any further enhancement.
6. Postpone the discussion on whether to introduce a new SIB until we have more progress on the content of NTN specific system information.

## RAN2#112e

Agreements:

1. Existing cell reselection principles are considered as baseline and that information about when a cell is going to stop serving the area and information about new upcoming cell can be further considered. In which form and how this is exactly implemented in the cell reselection principles is FFS.

## RAN2#113e

Agreements:

1. In NTN, the UE determines the TA based on the broadcast information (the use of other information is not excluded). In any case RAN2 will not go in a different direction than other groups
2. In NTN, the network may broadcast more than one TACs per PLMN in a cell, which is to up to network implementation.
3. The NTN ephemeris is divided into serving cell’s ephemeris and neighbour’s ephemeris. FFS how would they differ regarding e.g. the required accuracy or signalling impact.
4. Consider pre-configuration in uSIM, NAS, SIB and RRC signalling for providing the NTN ephemeris. Further discussion depends on the agreed ephemeris contents.
5. RAN2 thinks that a UE needs to know whether the network is a TN or NTN no later than SIB1 reception
6. The information on when a cell is going to stop serving the area and/or the timing information (e.g. timer or absolute time) about new upcoming cell is supported at least in Earth-fixed NTN scenario. FFS if both types of information are needed. FFS if this is known from system information and/or the ephemeris.

## RAN2#114e

Agreements:

1. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is needed to assist cell reselection in NTN for earth fixed scenario.
2. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area is used to decide when to perform measurement on neighbor cells.
3. At least in the quasi-earth fixed case (FFS for moving case), the timing information on when a cell is going to stop serving the area for earth fixed scenario is broadcast to UE via system information.

## RAN2#115e

Agreements via email - from offline 108:

1. Broadcast of cell stop time in SIB is only applicable to quasi earth fixed cell (not to moving cell). No further work in this release to address any moving cell specific details on using the cell stop time to assist measurements or cell reselection
2. For quasi-earth fixed cell, the reference location of the cell (serving cell or the neighbor cells) is broadcast in system information
3. For quasi-earth fixed cell, UE should start measurements on neighbour cells before the serving cell stops covering the current area.
4. For quasi-earth fixed cell, the broadcast “timing information on when a cell is going to stop serving the area” refers to the time when a cell stops covering the current area.
5. For quasi-earth fixed cell, specify that UE should start measurements on neighbour cells before the broadcast stop time of the serving cell, i.e. the time when the serving cell stops covering the current area, and the exact time to start measurements is up to UE implementation.

Working Assumption:

Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell, if UE has valid location information, which means location acquisition will not be triggered at UE side only for location assisted cell reselection. FFS on the details.

## RAN2#116e

Agreements:

Location assisted cell reselection, with the distance between UE and the reference location of the cell (serving cell and/or neighbor cell) taken into account, is supported for quasi-earth fixed cell. FFS on how UE performs location acquisition.

Agreements via email - from offline 102:

1. When UE uses location based cell reselection enhancements, it's up to UE implementation to guarantee that a valid location information is available

2. For quasi-earth fixed cell, same as legacy, UE shall perform neighbour cell measurements of “higher priority NR inter-frequency or inter-RAT frequencies” regardless of the distance between UE and serving cell reference location.

Agreements via email - from offline 102 - second round:

For quasi-earth fixed cell, UE should start measurements on neighbour cells before the serving cell stops covering the current area, regardless of (the distance between UE and serving cell reference location) or (if legacy Srxlev/Squal condition is met, i.e., serving cell’s Srxlev/Squal is better than a threshold).

Agreements online:

Distance based cell reselection criteria for quasi-earth fixed cell is supported

For quasi-earth fixed cell, the cell stop time of neighbour cell(s) is NOT broadcast

## RAN2#116bis-e

Agreements:

1. A new NTN-specific SIB is introduced (SIBx), scheduled by SIB1

2. Introduce the following serving cell information to the corresponding SIBx (scheduled by SIB1):

 - Ephemeris;

 - common TA parameters;

 - validity duration for UL sync information;

 - t-Service;

 - cell reference location;

 - Epoch time.

 Also send a LS to RAN1 asking whether some parameters might be sent more frequently.

1. For quasi-earth fixed cell, same as legacy, UE shall perform neighbour cell measurements of “higher priority NR inter-frequency or inter-RAT frequencies” regardless of the remaining serving time.

5. RRC\_INACTIVE mode is supported for NTN.

Agreements via email - from offline 102 - second round:

1. Regarding UE-based solution for SMTC adjustments, UE autonomously adjust the SMTCs based on location and ephemeris. FFS whether NW assistance information is provided.

2. UE can know the NW type implicitly no later than SIB1 reception, there is no explicit NW type indication in SIB1.

3. No LS is sent to RAN3 on the support of RRC\_INACTIVE.

Agreements via email - from offline 103 - third round

1. Update of ephemeris and common TA information does not affect the value tag and does not trigger SI modification procedure.

2. The ntnUlSyncValidityDuration applies to the whole SIBX. UE acquires the updated SIBX when the timer expires. FFS whether to also include it in the LS to RAN1. FFS if this applies only to Connected mode or to idle mode UE as well

3. Location information can be used to determine when to start measurement.

4. UE may choose not to perform neighbour cell measurements of “NR intra-freq or inter-freq with equal or lower priority, or inter-RAT freq with lower priority”, if (the distance between UE and serving cell reference location is shorter than a threshold) and (legacy Srxlev/Squal condition is met, i.e., serving cell’s Srxlev/Squal is better than a threshold).

5. Location-based measurement initiation is only applied if the cell broadcasts location-related parameters (e.g. a threshold) and by implementation the UE has location information.

6. Before the stop-time based measurements are triggered, the UE measurements follow Legacy behaviour (i.e., based on Srxlev/Squal) and there is no measurement relaxation.

7. Cell stop time is not applied to cell ranking in determining the target cell for reselection.

## RAN2#117-e

Agreements:

1. Satellite ephemeris based cell reselection is represented by time and location based cell reselection. No further enhancement in this release for ephemeris based cell reselection.
2. No further enhancement on cell reselection priority in NTN. Remove the corresponding FFS from 38.304 CR.
3. No need to provide the timing information about the new upcoming cell for either earth fixed scenario or earth moving scenario in Rel-17.
4. No further enhancement on cell reselection procedure to support TN prioritization over NTN in Rel-17.
5. RAN2 assumes that in addition to the ephemeris information, assistance information is needed for UE-based SMTC adjustment in idle and inactive mode. (FFS on the option to enable this)
6. Adopt the text proposal in R2-2203725 to capture the location based cell reselection agreements in 38.304.

Working Assumption:

1. To prevent non-NTN capable UE from accessing an NTN cell in Rel-17, for NR-NTN RAN2 follows a similar solution as in IoT-NTN (FFS on the details and whether this is always needed or not).

Agreements via email - from offline 102 - second round:

1. The introduction of a distance threshold for cell reselection would not impact the cell reselection priority determination in inter-frequency and inter-RAT cell reselection criteria.

Agreements via email - from offline 102 - third round:

1. The validity timer information for neighbour cell’s ephemeris information should be introduced in system information and it can be the same as or different from the validity timer of the serving cell.

Agreements online:

1. SMTC offset and change rate is needed to assist UE-based SMTC adjustment in idle and inactive mode (FFS on the signalling details, e.g. whether to broadcast feeder link delay difference or something different)
2. There is no need to indicate to UE in idle/inactive mode whether a cell (serving cell and/or neighbour cell) is earth moving or quasi-earth fixed.

## RAN2#118-e

Agreements via email – from offline 110:

1. The working assumption that new bit, e.g. cellBarred-NTN, is introduced for NR-NTN in SIB1 is confirmed

2. NTN UE consider the cell to be barred for NTN access if cellBarredNTN is set to “barred”.

3. NTN UE consider the cell to be allowed for NTN access if cellBarredNTN is set to “not barred”.

4. NTN UE follows the legacy cellBarred for TN access and consider the cell is not allowed for NTN access if cellBarredNTN is not present.