3GPP TSG-RAN WG4 Meeting #116 R4-2511349

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **36.133** | **CR** | **7394** | **rev** | **-** | **Current version:** | **19.1.0** |  |
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| *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 |  | Core Network |  |

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| ***Title:*** | (IoT\_NTN\_TDD) Big CR 36.133 R19 UE RRM | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Iridium Satellite LLC, THALES, Qualcomm Incorporated, Nordic Semiconductor ASA, Huawei, HiSilicon, Nokia | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | IoT\_NTN\_TDD | | | | |  | ***Date:*** | | | 2025-08-29 |
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| ***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-12 (Release 12)* *Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
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| ***Reason for change:*** | | RAN4 introduced RRM requirements for the work item IoT\_NTN\_TDD | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Added new core requirements | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | NB-IoT UE might not have corresponding core requirements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 4.6B, 6.5B, 6.6B, 6.9B, 7.20B, 7.21B, 7.22B, 7.23B, 8.14B | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **x** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### <Start of Change 1>

3.6.6 Applicability of requirements for UE category NB-IoT for frame structure type 1 for NTN-TDD

When the network is configured with frame structure type 1 for NTN-TDD, as described in clause 4.4 of TS 36.211 [16], the requirements to be applicable are described in the clauses marked with suffix “B” in this specification. The frame structure consists of periodic repetition of D downlink subframes followed by a guard period and U uplink subframes. The values for D, U, the guard period and the repetition are found in clause 4.4 of TS 36.211.

### <End of Change 1>

### <Start of Change 2>

4.6B Cell Selection and Re-selection Requirements for UE category NB-IoT for frame structure type 1 for NTN-TDD

The NB-IoT applicability of the requirements in section 4.6B is defined in Section 3.6.1. The requirements in this subclause apply if UE category NB1 is in normal and enhanced coverage area of the serving cell served by a satellite access node.

4.6B.1 Cell Selection

After a UE has switched on and a PLMN has been selected, the Cell selection process takes place, as described in TS36.304. This process allows the UE to select a suitable cell where to camp on in order to access available services. In this process the UE can use stored information (*Stored information cell selection*) or not (*Initial cell selection*).

4.6B.2 Cell Re-selection for UE category NB-IoT for Satellite Access

The cell reselection procedure allows the UE to select a more suitable cell and camp on it.

When the UE is in either *Camped* *Normally* state or *Camped on Any Cell* state on a cell, the UE shall attempt to detect, synchronise, and monitor intra-frequency and inter-frequency cells indicated by the serving NB-IoT cell. For intra-frequency and inter-frequency cells the serving NB-IoT cell may not provide explicit neighbour list but carrier frequency information and bandwidth information only. UE measurement activity is also controlled by measurement rules defined in TS36.304, allowing the UE to limit its measurement activity.

If *SystemInformationBlockType32* [2] has been received and if the UE has determined that it will be out of coverage after *t-service*, the UE is not required to perform cell measurements from the last slot on the last SI modification period that ends before *t-Service* [2]. After that, if the UE has discontinuous coverage capabilities:

- when the UE is provided with *t-serviceStart-r17* the UE is not required to perform cell measurements until *t-serviceStart-r17* is reached; or

- when the UE is provided with *footprintInfo* the UE is not required to perform cell measurements until the UE is within the area provided by *footprintInfo*.

4.6B.2.1 Measurement and evaluation of serving NB-IoT cell for UE category NB1 in normal coverage

The UE shall measure the NRSRP and NRSRQ level of the serving NB-IoT cell on the anchor carrier and evaluate the cell selection criterion S defined in clause 5.2.3.2 in [1] for the serving NB-IoT cell on the anchor carrier at least every DRX cycle.

The UE shall filter the NRSRP and NRSRQ measurements of the NB-IoT serving cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by, at least DRX cycle/2.

If the UE is configured for receiving paging on the non-anchor carrier then the UE shall evaluate the cell selection criterion S defined in clause 5.2.3.2a in [1] for the serving NB-IoT cell on non-anchor carrier at least every DRX cycle.

The UE is allowed to measure NRSRP level of the serving NB-IoT cell, assuming that *nrs-NonAnchor-config* is enabled indicated by higher layer defined in clause 10.2.6 TS 36.211 [16], on non-anchor carrier provided that:

- The relaxed monitoring criteria defined in TS 36.304 clause 5.2.4.12 are met,

- Transmit power difference of the signals/channels between anchor- and non-anchor carriers is signalled to the UE, via the existing parameter *nrs-PowerOffsetNonAnchor*, and

- UE is not configured with any positioning measurements.

When all the conditions for measuring NRSRP on non-anchor carrier are satisfied, the UE shall filter the NRSRP of the serving NB-IoT cell using at least 2 measurements spaced by at least DRX cycle/2, where the measurements used for the filtering may include measurements on anchor carrier and on non-anchor carrier.

If the UE is not configured with eDRX\_IDLE cycle and has evaluated according to Table 4.6B.2.1-1 in Nserv\_NB -NC consecutive DRX cycles that the serving NB-IoT cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving NB-IoT cell, regardless of the measurement rules currently limiting UE measurement activities.

Additionally, if the UE is configured with *t-Service* [2], the UE should start measurements of the neighbour cells indicated by the serving cell before *t-Service* is reached according to the requirements provided in clause [4.6B.2.2] and [4.6B.2.5].

If *t-Service* is not provided nor applicable, and if the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency and inter-frequency information indicated in the system information during the time T, the UE shall initiate cell selection procedures for the selected PLMN as defined in [1], where T=40 s if the UE is not configured with eDRX\_IDLE cycle.

If *t-Service* is provided and applicable of the serving cell then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 36.304 when any of the following conditions is fulfilled:

- If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency and inter-frequency information indicated in the system information within 40 s since time instance T1 provided that *t-Service* > T1 or

- If the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency and inter-frequency information indicated in the system information within 40 s since the time instance *t-Service*.

- Where, T1 is the time instance in seconds when the UE has determined that the serving cell does not fulfil the cell selection criterion S.

**Table 4.6B.2.1-1: Nserv\_NB-NC**

|  |  |
| --- | --- |
| **DRX cycle length [s]** | **Nserv\_NB-IoT-NC [number of DRX cycles]** |
| 0.32 | 2 |
| 0.64 | 2 |
| 1.28 | 2 |
| 2.56 | 2 |

4.6B.2.2 Measurements of intra-frequency NB-IoT cells for UE category NB1 in normal coverage

The UE shall be able to identify new intra-frequency cells and perform NRSRP measurements of identified intra-frequency cells without an explicit intra-frequency neighbour list containing physical layer cell identities.

If Srxlev > SIntraSearchP, and *distanceThresh* and *referenceLocation* are broadcasted, and if UE supports location-based measurement initiation and has obtained its location, the UE may not perform intra-frequency measurements if the distance between UE and serving cell reference location is shorter than *distanceThresh* as defined in [1]*.*

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS36.304 within Ksatellite\*Tdetect,NB\_Intra\_NCwhen Treselection= 0. An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.4 for a corresponding Band.

The UE shall measure NRSRP at least every Ksatellite\*Tmeasure,NB\_Intra\_NC for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter NRSRP measurements of each measured intra-frequency cell using at least 2 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,NB\_Intra-NC/2

The UE shall not consider an NB-IoT neighbour cell in cell reselection if it is indicated as not allowed in the measurement control system information of the serving NB-IoT cell.

For an intra-frequency cell that has been already detected, but that has not been reselected to, the filtering shall be such that the UE shall be capable of evaluating that the intra-frequency cell has met reselection criterion defined [1] within Ksatellite\*Tevaluate,NB\_intra-NC when Treselection = 0, provided that the cell is at least XdB better ranked, where ‘X’ is specified in Table 4.6B.2.4-3. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and non-serving NB-IoT intra-frequency cells.

The parameter Ksatellite is the scaling factor for measurements correspond to multiple NGSO satellites. When the UE is performing measurements in a neighbor satellite, Ksatellite = 1 if the DL opportunities of the cells measured in the neighbor satellite are non-overlapping with the DL opportunities of the serving cell. Otherwise, Ksatellite is equal to the number of NGSO satellites to be measured.

If Treselection timer has a non zero value and the intra-frequefncy cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Intra\_NC, Tmeasure,NB\_Intra\_NC and Tevaluate, NB\_intra\_NC are specified in Table 4.6B.2.2-1

**Table 4.6B.2.2-1 : Tdetect,NB\_Intra -NC, Tmeasure,NB\_Intra -NC and Tevaluate, NB\_intra -NC**

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NB\_Intra\_NC [s] (number of DRX cycles)** | **Tmeasure,NB\_Intra\_NB\_NC [s] (number of DRX cycles)** | **Tevaluate,NB\_intra\_NB\_NC**  **[s] (number of DRX cycles)** |
| 0.32 | 5.12 (16) | 1.28 (4) | 2.56 (8) |
| 0.64 | 5.12 (8) | 1.28 | 2.56 (4) |
| 1.28 | 5.12 (4) | 1.28 (1) | 2.56 (2) |
| 2.56 | 10.24 (4) | 2.56 (1) | 5.12 (2) |

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before *t-Service* is reached, regardless of the rules currently limiting the UE measurement activities, and when to start the detection, measurement and evaluation on neighbour cells is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of *t-Service* is started to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than Ttrigger.

Ttrigger = max(Tdetect,NB\_Intra\_NC , Pcarrier \* Tdetect,NB\_Inter\_NC),

where

- Pcarrier is the number of inter-frequency carriers for which carrier frequency information was provided by the serving NB-IoT cell,

- Tdetect,NB\_Intra\_NC is defined in [4.6B.2.2], and Tdetect,NB\_Inter\_NC is defined in [4.6B.2.5].

The requirements in this clause apply provided that the valid information for the satellite serving the target cell has been provided by the serving cell.

4.6B.2.5 Measurements of inter-frequency NB cells for UE category NB1 in normal coverage

The UE shall be able to identify new inter-frequency cells and perform NRSRP measurements of identified inter-frequency cells if carrier frequency information is provided by the serving NB-IoT cell, even if no explicit neighbour list with physical layer cell identities is provided.

If Srxlev ≤ SnonIntraSearchP then the UE shall search for and measure inter-frequency layers in preparation for possible reselection.

If Srxlev > S­nonIntraSearchP, and *distanceThresh* and *referenceLocation* are broadcasted, and if UE supports location-based measurement initiation and has obtained its location, the UE may not perform inter-frequency measurements if the distance between UE and serving cell reference location is shorter than *distanceThresh* as defined in [1]*.*

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Ksatellite \*Pcarrier \* Tdetect,NB\_Inter\_NC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving NB-IoT cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least Y dB, where Pcarrier is the number of inter-frequency carriers for which carrier frequency information was provided by the serving NB-IoT cell and ‘Y’ is specified by Table 4.6B.2.6-3 (when Q1 -6 dB). An inter-frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

The UE shall filter NRSRP measurements of each measured inter-frequency cell using at least [2] measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure, Inter\_NB-IoT\_NC/2.

If an inter-frequency cell has been already detected but that has not been reselected to the filtering shall be such that the UE shall be capable of evaluating that the inter-frequency cell has met reselection criterion defined TS 36.304 within Ksatellite \* Pcarrier \* Tevaluate,NB\_Inter\_NC. When evaluating cells for reselection, the side conditions for NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot apply to both serving and inter-frequency cells.

The parameter Ksatellite is the scaling factor for measurements correspond to multiple NGSO satellites. When the UE is performing measurements in a neighbor satellite, Ksatellite = 1 if the DL opportunities of the cells measured in the neighbor satellite are non-overlapping with the DL opportunities of the serving cell. Otherwise, Ksatellite is equal to the number of NGSO satellites to be measured.

If Treselection timer has a non zero value and the inter-frequency cell is better ranked than the serving NB-IoT cell, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains better ranked within this duration, then the UE shall reselect that cell.

For UE not configured with eDRX\_IDLE cycle, Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC are specified in Table 4.6B.2.5-1.

If the UE is configured with ‘*t-Service-r17*’ [2] in the serving cell and eDRX\_IDLE, then the UE shall meet the requirements defined for DRX cycle length of [2.56] s for Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate, NB\_inter\_NC are specified in Table 4.6B.2.5-1 starting from at least [K] before ‘*t-Service-r17*’.

**Table 4.6B.2.5-1 : Tdetect,NB\_Inter\_NC, Tmeasure,NB\_Inter\_NC and Tevaluate,NB\_Inter\_NC**

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NB\_Inter\_ NC [s] (number of DRX cycles)** | **Tmeasure,NB\_Inter\_ NC [s] (number of DRX cycles)** | **Tevaluate,NB\_Inter\_ NC**  **[s] (number of DRX cycles)** |
| 0.32 | 5.12 (16) | 1.28 (4) | 2.56 (8) |
| 0.64 | 5.12 (8) | 1.28 | 2.56 (4) |
| 1.28 | 5.12 (4) | 1.28 (1) | 2.56 (2) |
| 2.56 | 10.24 (4) | 2.56 (1) | 5.12 (2) |

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before *t-Service* is reached, regardless of the rules currently limiting the UE measurement activities, and when to start the detection, measurement and evaluation on neighbour cells is up to UE implementation. This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of *t-Service* is started to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than Ttrigger.

Ttrigger = max(Tdetect,NB\_Intra\_NC , Pcarrier \* Tdetect,NB\_Inter\_NC),

where

- Pcarrier is the number of inter-frequency carriers for which carrier frequency information was provided by the serving NB-IoT cell,

- Tdetect,NB\_Intra\_NC is defined in [4.6B.2.2], and Tdetect,NB\_Inter\_NC is defined in [4.6B.2.5].

The requirements in this clause apply provided that the valid information for the satellite serving the target cell has been provided by the serving cell.

4.6B.2.7 Maximum interruption in paging reception in normal coverage

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception. When the UE is configured with eDRX\_IDLE cycle, the UE shall not miss any paging in a PTW provided the paging is sent in at least 2 DRX cycles before the end of that PTW.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving NB-IoT cell for paging reception until the UE is capable to start monitoring downlink channels of the target intra-frequency and inter-frequency cell for paging reception. The interruption time shall not exceed

- TSI-NB1-EC + 100 ms, if the target cell belongs to the same satellite as the current one, and if the target cell is known.

- TSI-NB1-EC + 100 ms, If the target cell belongs to a different satellite than the current one and the target cell’s satellite is GSO , and if the target cell is known.

- TSI-NB1-EC + [250] ms, if the target cell belongs to a different satellite than the current one and the target cell’s satellite is non-GSO, and if the target cell is known.

The target cell is considered as known if it has been detectable during Tdetect,NR\_Intra\_NC or Tdetect,NR\_Inter\_NC, and the time span between SIB broadcasting cell stop time and the cell stop time is not less than Ttrigger. Otherwise, the target cell is considered as unknown, where Tdetect,NR\_Intra\_NC, Tdetect,NR\_Inter\_NC and Ttrigger are defined in [4.6B.2.2] and [4.6B.2.5]. A longer interruption can be expected if the target cell is unknown.

4.6B.2.8 UE measurement capability

For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:

- Depending on UE capability, an intra-frequency carrier.

- Depending on UE capability, at least 2 inter-frequency carriers.

In LEO deployments, the UE shall be capable of monitoring:

- for intra-frequency carrier, the number of target satellites UE needs to monitor is at least [2] including serving LEO satellite.

- for inter-frequency carrier, the number of target satellites UE needs to monitor per carrier is at least [2] if one of the target satellites include the UE serving satellite; the number of target satellites UE needs to monitor is at least [1] otherwise

- In addition to the requirements defined above, the UE which operates in LEO deployment shall be capable of monitoring a total of at least [2] satellites including the serving satellite.

### <End of Change 2>

### <Start of Change 3>

6.5B RRC Re-establishment for NB-IoT UEs for frame structure type 1 for NTN-TDD

6.5B.1 Introduction

RRC connection re-establishment is initiated when a UE in RRC connected mode loses RRC connection due to any of these reasons: radio link failure or radio link problem. The RRC re-establishment procedure is specified in clause 5.3.7 in TS 36.331 [2].

The requirements in this clause are applicable for RRC connection re-establishment to a LTE cell, which is served by satellite access node (SAN). The requirements in this clause apply provided that the ephemeris information provided by the serving cell for the target cell is valid during UE re-establishment delay as specified in 6.5B.2. For GEO, when the satellite assistance information of neighbour cells in system information is not provided, the requirements in this clause apply for intra-frequency RRC Re-establishment.

6.5B.2 Requirements

In RRC connected mode the UE shall be capable of sending *RRCConnectionReestablishmentRequest* message within Tre-establish\_delay\_NB-IoT seconds from the moment it detects a loss in RRC connection. The total RRC connection delay (Tre-establish\_delay\_NB-IoT) shall be less than:

Tre-establish\_delay\_NB-IoT = TUL\_grant + TUE\_re-establish\_delay\_NB-IoT

- TUL\_grant: It is the time required to acquire and process uplink grant from the target cell. The uplink grant is required to transmit *RRCConnectionReestablishmentRequest* message.

- The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) is specified in clause 6.5B.2.1 for a UE in normal coverage and in clause 6.5B.2.2 for a UE in enhanced coverage.

These requirements are not applicable for UEs that only support the Control Plane CIoT EPS optimisation (see TS 24.301). Connection control in NB-IoT is defined in Clause 5.3.1.4 in TS 36.331 [2].

6.5B.2.1 UE Re-establishment delay requirement in normal coverage

The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) is the time between the moments when any of the conditions requiring RRC re-establishment as defined in clause 5.3.7 in TS 36.331 [2] is detected by the UE to the time when the UE sends PRACH preamble to the target cell. The UE re-establishment delay (TUE\_re-establish\_delay\_NB-IoT) requirement shall be less than:

- Tsearch\_NB1-NC,i: It is the time required by the UE to search the target cell:

- If the target cell is *known*, then Tsearch\_NB1-NC,i = 0 ms. If the target cell is unknown Tsearch\_NB1-NC,i = Ksatellite \*2.52 s. Otherwise, Tsearch\_NB1-NC,i = Ksatellite,i \*1400 ms. Where Ksatellite,i is defined as the number NGSO satellites to be measured on i-th frequency for RRC re-establishment. When the UE is performing measurements in a neighbor satellite, Ksatellite = 1 if the DL opportunities of the cells measured in the neighbor satellite are non-overlapping with the DL opportunities of the serving cell. Otherwise, Ksatellite is equal to the number of NGSO satellites to be measured.

- TSI\_NB1-NC: It is the time required for receiving all the relevant system information according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 36.331 [2] for the target cell for a UE in normal coverage.

- TPRACH\_NB-IoT: The additional delay caused by the random access procedure. The actual value of TPRACH\_NB-IoT shall depend upon the NPRACH configuration used in the target cell and the number of repetition used by UE for sending random access to the target cell. There might be additional delay due to ramping procedure.

- NNB-Iot-freq: It is the total number of NB-IoT frequencies to be monitored for RRC re-establishment; NNB-Iot-freq = 1 if the target cell is known.

There is no requirement if the target cell does not contain the UE context.

### <End of Change 3>

### <Start of Change 4>

6.6B Random Access for UE category NB-IoT for frame structure type 1 for NTN-TDD

6.6B.1 Introduction

The random access procedure is used when establishing the layer 1 communication between the UE and NB-IoT. The random access is specified in clause 6 of TS 36.213[3] and the control of the RACH transmission is specified in clause 5.1 of TS 36.321[17]. The UE category NB1 supports only contention-based random access transmission on anchor carrier and on non-anchor carrier.

The requirements in this section are applicable for the random access transmission by the UE category NB1 to an anchor carrier or to a non-anchor carrier under the following conditions:

- The anchor and non-anchor carrier frequencies are within 20 MHz and

- The anchor and the non-anchor carrier frequencies are operated by the same satellite access node(SAN).

6.6B.2 Requirements

The UE shall have capability to calculate NPRACH transmission power according to the NPRACH power formula defined in TS 36.213[3] and apply this power level at the first preamble or additional preambles. The absolute power applied to the first preamble shall have an accuracy as specified in TS 36.102[60]. The relative power applied to additional preambles shall have an accuracy as specified in 36.102[60].

The UE shall indicate a Random Access problem to upper layers if the maximum number of preamble transmission counter has been reached for the random access procedure on target cell as specified in clause 5.1.4 in TS 36.321 [17].

6.6B.2.1 Correct behaviour when receiving Random Access Response reception

The UE may stop monitoring for Random Access Response(s) and shall transmit the msg3 if the Random Access Response contains a Random Access Preamble identifier corresponding to the transmitted Random Access Preamble.

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires if all received Random Access Responses contain Random Access Preamble identifiers that do not match the transmitted Random Access Preamble.

6.6B.2.2 Correct behaviour when not receiving Random Access Response reception

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires if no Random Access Response is received within the RA Response window defined in clause 5.1.4 TS 36.321.

6.6B.2.3 Correct behaviour when receiving a NACK on msg3

The UE shall re-transmit the msg3 upon the reception of a NACK on msg3.

6.6B.2.4 Correct behaviour when receiving a message over Temporary C-RNTI

The UE shall send ACK if the Contention Resolution is successful.

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires unless the received message includes a UE Contention Resolution Identity MAC control element and the UE Contention Resolution Identity included in the MAC control element matches the CCCH SDU transmitted in the uplink message.

6.6B.2.5 Correct behaviour when contention Resolution timer expires

The UE shall re-select a preamble and transmit with the calculated NPRACH transmission power when the backoff time expires if the Contention Resolution Timer expires.

6.6B.2.6 MSG3-based channel quality report for UE Category NB1

The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category NB1 as defined in TS 36.331 [2] section 5.3.3.3, 5.3.3.3a, and 5.3.7.4.

The DL channel quality provides the serving eNB with information about the minimum NPDCCH repetition level to satisfy the hypothetical NPDCCH block error rate of 1% with the parameters specified in Table 6.6B.2.6-1.

**Table 6.6B.2.6-1: NPDCCH transmission parameters for downlink quality reporting**

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| DCI format | Format N1 |
| Number of information bits (excluding CRC) | 23bits |
| System bandwidth | 200kHz |
| Aggregation level | 2 |
| DRX | OFF |

For channel quality reporting in the anchor carrier, the reported NPDCCH repetition level shall be derived from the channel quality measured in the period T1 or T2 in the carrier where the random access response is transmitted, where

- T1 is the period before NPRACH transmission used for NRSRP measurement for enhanced coverage level estimation

- T2 is the period from the beginning of the random access response to the beginning of PUSCH format 1 for DL channel quality reporting.

For channel quality reporting in the non-anchor carrier, the reported NPDCCH repetition level shall be derived from the channel quality measured in the period T2 in the carrier where UE monitors Random Access Response where T2 is defined above.

The NPDCCH repetition level for CQI-NPDCCH-NB and CQI-NPDCCH-Short-NB is chosen from the supported NPDCCH repetition levels [3]. The report mapping is defined in 9.1.22.15.

The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in 9.1.22.16.

6.6B.3 Requirements for NPRACH configuration

In addition to the requirements defined in 6.6B.2, UE shall also execute the random access procedure defined in clause 5.1 in TS 36.321 [17] using the NPRACH configuration contained in *NPRACH-ConfigSIB-NB* in TS 36.331 [2].

The UE shall apply the following procedure:

- Determines the enhanced coverage level based on the NRSRP intra-frequency measurement performed on the anchor carrier, for NPRACH transmission to the anchor carrier or for NPRACH transmission to the non-anchor carrier, and the configured criterion as defined in section 5.1.1, TS 36,321 [17],

- Selects NPRACH resources [2] configured for the corresponding enhanced coverage level as determined in the previous step and;

- Transmits or re-transmits NPRACH preamble using the selected NPRACH resources and NPRACH configuration.

### <End of Change 4>

### <Start of Change 5>

6.9B RRC Connection Redirection to Non-anchor Carrier in NB-IoT for frame structure type 1 for NTN-TDD

6.9B.1 Introduction

RRC connection redirection to a non-anchor carrier is initiated by the UE upon receiving the IE, “*CarrierConfigDedicated-NB*”, from the E-UTRAN, TS 36.331 [2]. The RRC redirection to procedure is specified in clause 6.7.3.2 in TS 36.331 [2].

The requirements in this clause are applicable for UE caterory NB1 or UE caterory NB2 for operation with satellite access.

The requirements in this section are applicable under the following conditions:

- The anchor and non-anchor carrier frequencies are within 20 MHz and

- The anchor and the non-anchor carrier frequencies are operated by the same satellite access node (SAN).

6.9B.2 Requirements

The UE shall be capable of performing the RRC connection redirection to the non-anchor carrier within Tconnection\_redirect\_non-anchor.

The time delay (Tconnection\_redirect\_non-anchor) is the time between the end of the last subframe in the repetition period of NPDSCH containing the IE, “*CarrierConfigDedicated-NB*” received on the anchor carrier and the end of the last subframe in the repetition period of NPUSCH transmitted on the target non-anchor carrier. The time delay (Tconnection\_redirect\_non-anchor) shall be less than:

Tconnection\_redirect\_non-anchor = TRRC\_procedure\_delay + Tperiod\_DL\_bitmap + TUL\_grant + TDL-UL switch + TNPUSCH

- TRRC\_procedure\_delay: It is the RRC procedure for processing the received message “*CarrierConfigDedicated-NB*”. It shall be less than 110 ms.

- Tperiod\_DL\_bitmap: 0 ms.

- TUL\_grant: It is the time required to acquire uplink grant from the non-anchor carrier for transmitting NPUSCH on the non-anchor carrier. The value of TUL\_grant depends on Tperiod\_DL\_bitmap and th

e number of repetitions of NPDCCH used in the non-anchor carrier.

- TDL-UL switch: It is the time between the end of the last subframe in the repetition period of NPDCCH received on the non-anchor carrier and the start of the first subframe in the repetition period of the corresponding NPUSCH transmitted on the non-anchor carrier. TDL-UL switch is 50 ms.

- TNPUSCH: It is the time required to transmit NPUSCH on the non-anchor carrier. The value of TNPUSCH depends on the number of repetitions of NPUSCH used in the non-anchor carrier.

When the NPUSCH ACK transmission for the received RRC message takes longer than 110ms, the overall RRC connection redirection delay may be extended.

### <End of Change 5>

### <Start of Change 6>

7.20B UE transmit timing for NB-IoT for frame structure type 1 for NTN-TDD

7.20B.1 Introduction

The Category NB1 UE shall have capability to follow the frame timing change of the connected eNode B. The uplink frame transmission takes place before the reception of the first detected path (in time) of the corresponding downlink frame from the reference NB-IoT cell.

UE shall use the serving NB-IoT cell as the reference cell for deriving the UE transmit timing. UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are defined in the following requirements.

7.20B.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te where the timing error limit value Te is specified in Table 7.20B.2-1. This requirement applies when it is the first transmission in a DRX cycle or the first transmission in a repetition period (R>1) for NPUSCH and NPRACH, the first transmission after an uplink transmission gap in a repetition period (R>1) for NPUSCH and NPRACH transmission, or it is the transmission on PUR. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the serving NB-IoT cell minus . The downlink timing is defined as the time when the first detected path (in time) of the corresponding downlink frame is received from the serving NB-IoT cell. for NPRACH is defined as 0. (in *Ts* units) for other channels is the difference between UE transmission timing and the Downlink timing immediately after when the last timing advance in clause 7.22B was applied. *N*TA for other channels is not changed until next timing advance is received.

**Table 7.20B.2-1: Te Timing Error Limit**

|  |  |
| --- | --- |
| **Downlink Bandwidth (MHz)** | **Te\_** |
| 0.18 | 97\*TS |
| Note 1: TS is the basic timing unit defined in TS 36.211 | |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for NPUSCH the UE shall, when no repetitions are configured on the uplink or the repetition period is R=1, be capable of changing the transmission timing according to the received downlink frame of the serving NB-IoT cell except when the timing advance in clause 7.22B is applied such that the UE transmission timing error shall be less than or equal to ±Te, where the timing error limit value Te is specified in Table 7.20B.2-1.

When no repetition period is configured, or the configured repetition period is R=1, all adjustments made to the UE uplink timing shall follow these rules:

1) The maximum amount of the magnitude of the timing change, apart from a change of due to satellite position update and between the previous transmission and the current transmission, in one adjustment shall be 58.33\*TS seconds.

2) The minimum aggregate adjustment rate, apart from a change of due to satellite position update and between the previous transmission and the current transmission, shall be 7\*TS per 1second.

3) The maximum aggregate adjustment rate, apart from a change of due to satellite position update and between the previous transmission and the current transmission, shall be 58.33\*TS per 200ms.

when a repetition is configured on the uplink for which R>1, the UE shall not adjust the uplink transmission timing autonomously during an ongoing repetition period other than at initial transmission or at the start of a transmission segment boundary, as defined above.

### <End of Change 6>

### <Start of Change 7>

7.21B UE timer accuracy for NB-IoT for frame structure type 1 for NTN-TDD

7.21B.1 Introduction

UE timers are used in different protocol entities to control the UE behaviour.

7.21B.2 Requirements

For UE timers specified in TS 36.331 [2], UE shall comply with the timer accuracies according to Table 7.21B.2-1.

The requirements are only related to the actual timing measurements internally in the UE. They do not include the following:

- Inaccuracy in the start and stop conditions of a timer (e.g. UE reaction time to detect that start and stop conditions of a timer is fulfilled), or

- Inaccuracies due to restrictions in observability of start and stop conditions of a UE timer (e.g. TTI alignment when UE sends messages at timer expiry).

**Table 7.21B.2-1**

|  |  |
| --- | --- |
| **Timer value [s]** | **Accuracy** |
| timer value < 4 | ± 0.1s |
| timer value ≥ 4 | ± 2.5% |

### <End of Change 7>

### <Start of Change 8>

7.22B Timing Advance for NB-IoT for frame structure type 1 for NTN-TDD

7.22B.1 Introduction

The timing advance is initiated from E-UTRAN with MAC message that implies and adjustment of the timing advance, see TS 36.321 [17] clause 5.2.

7.22B.2 Requirements

7.22B.2.1 Timing Advance adjustment delay

UE shall adjust the timing of its uplink transmission timing at sub-frame *n*+12+ *k-Offset-r17+*1 for a timing advance command received in sub-frame *n*, where *k-Offset-r17* is specified in [2]. In case repetitions are used on the downlink, sub-frame *n* refers to the last subframe in the repetition period in which the message containing the MAC control information was received. The UE shall not apply a TA command during an uplink repetition period.

7.22B.2.2 Timing Advance adjustment accuracy

The UE shall adjust the timing of its transmissions with a relative accuracy better than or equal to ±13.33\* TS seconds to the signalled timing advance value compared to the timing of preceding uplink transmission. The timing advance command is expressed in multiples of 16\* TS and is relative to the current uplink timing.

### <End of Change 8>

### <Start of Change 9>

7.23B Radio Link Monitoring for Category NB-IoT UE for frame structure type 1 for NTN-TDD

7.23B.1 Introduction

The applicability of the requirements for performing radio link monitoring for Category NB1 UE in subclause 7.23B is defined in Section 3.6.1.

The UE shall monitor the downlink link quality based on the narrowband reference signal in order to detect the downlink radio link quality of the NB-IoT cell served by satellite access node (SAN) as specified in [3]. The measurement delay could be longer if GNSS re-acquisition happens during the measurement period defined in 7.23B, and UE shall restart the cell measurement when the interval between two samples are larger than 5000 ms.

7.23B.2 Requirements for Category NB1 UE

The requirements defined in this subclause 7.23B.2 for performing radio link monitoring are applicable for Category NB1 UE defined in Section 3.1.

The UE shall meet all applicable requirements specified in clause 7.23B.2 under the following condition:

- at least 1 DL subframe per radio frame of serving NB-IoT cell is available at the UE during Qout\_NB-IoT and Qin\_NB-IoT evaluation periods.

The UE shall estimate the downlink radio link quality and compare it to the thresholds Qout\_NB-IoT and Qin\_NB-IoT for the purpose of monitoring downlink radio link quality of the NB-IoT cell.

The threshold Qout\_NB-IoT is defined as the level at which the downlink radio link cannot be reliably received and shall correspond to 10% block error rate of a hypothetical NPDCCH transmission with transmission parameters specified in Table 7.23B.2-1.

The threshold Qin\_NB-IoT is defined as the level at which the downlink radio link quality can be significantly more reliably received than at Qout\_NB-IoT and shall correspond to 2% block error rate of a hypothetical NPDCCH transmission with transmission parameters specified in Table 7.23B.2-1.

**Table 7.23B.2-1 NPDCCH transmission parameters for out-of-sync and in-sync for Category NB1 UE**

|  |  |  |
| --- | --- | --- |
| **Attribute** | **Out-of-sync** | **In-sync** |
| DCI format | Format N1 | Format N1 |
| Number of information bits | 23 bits | 23 bits |
| System Bandwidth | 200kHz | 200kHz |
| Antenna configuration | 1x1 | 1x1 |
| Maximum NPDCCH Repetition level | RmaxNote1 | Rmax/2 Note1 |
| Aggregation level | 2 | 2 |
| DRX | OFF | OFF |
| Note 1: Rmax is a configurable parameter defined in TS 36.331[2]. The RLM requirements in terms of RLF evaluation period are applicable only when the configured Rmax is equal to 2. | | |

7.23B.2.1 Minimum requirement when no DRX is used

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qout\_NB-IoT period becomes worse than the threshold Qout\_NB-IoT, Layer 1 of the UE shall send an out-of-sync indication for the NB-IoT cell to the higher layers within TEvaluate\_Qout\_NB-IoT evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qin\_NB-IoT period becomes better than the threshold Qin\_NB-IoT, Layer 1 of the UE shall send an in-sync indication for the NB-IoT cell to the higher layers within TEvaluate\_Qin\_NB-IoT evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the NB-IoT cell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least 10ms.

The transmitter power of the UE shall be turned off within 40ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2]. The following table 7.23B.2.1-1 defines the TEvaluate\_Qout\_NB-IoT and TEvaluate\_Qin\_NB-IoT.

**Table 7.23B.2.1-1 Qout and Qin Evaluation Period in non-DRX for Category NB1 UE**

|  |  |  |
| --- | --- | --- |
| **Configured NPDCCH Rmax** | **TEvaluate\_Qout\_NB-IoT** | **TEvaluate\_Qin\_NB-IoT** |
| Rmax ≤ 64 | 800ms | 200ms |

7.23B.2.2 Minimum requirement when DRX is used

When DRX is used for Category NB1 UE UEs, the Qout\_NB-IoT evaluation period (TEvaluate\_Qout\_DRX\_NB-IoT) and the Qin\_NB-IoT evaluation period (TEvaluate\_Qin\_DRX\_NB-IoT) is specified in Table 7.23B.2.2-1 will be used.

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qout\_DRX\_NB-IoT [s] period becomes worse than the threshold Qout\_NB-IoT, Layer 1 of the UE shall send out-of-sync indication for the NB-IoT cell to the higher layers within TEvaluate\_Qout\_DRX\_NB-IoT [s] evaluation period. A Layer 3 filter shall be applied to the out-of-sync indications as specified in TS 36.331 [2].

When the downlink radio link quality of the NB-IoT cell estimated over the last TEvaluate\_Qin\_DRX\_NB-IoT [s] period becomes better than the threshold Qin\_NB-IoT, Layer 1 of the UE shall send in-sync indications for the NB-IoT cell to the higher layers within TEvaluate\_Qin\_DRX\_NB-IoT [s] evaluation period. A L3 filter shall be applied to the in-sync indications as specified in TS 36.331 [2].

The out-of-sync and in-sync evaluations of the NB-IoT cell shall be performed as specified in clause 4.2.1 in [3]. Two successive indications from Layer 1 shall be separated by at least max(10ms, DRX\_cycle\_length).

Upon start of T310 timer as specified in clause 5.3.11 in TS 36.331 [2], the UE shall monitor the link for recovery, except when T310 timer is suspended during GNSS acquisition, using the evaluation period and Layer 1 indication interval corresponding to the non-DRX mode until the expiry or stop of T310 timer.

The transmitter power of the UE shall be turned off within 40 ms after expiry of T310 timer as specified in clause 5.3.11 in TS 36.331 [2].

**Table 7.23B.2.2-1: Qout and Qin Evaluation Period in DRX for Category NB1 UE**

|  |  |  |
| --- | --- | --- |
| **DRX cycle length (s)** | **TEvaluate\_Qout\_DRX\_NB-IoT and TEvaluate\_Qin\_DRX\_NB-IoT (s)** | |
| **DRX cycles for Rmax ≤ 64** |
| 0.256 ≤ DRX cycle ≤ 1.024 | Note 1 (8) | |
| 1.024 < DRX cycle ≤ 3.072 | Note 1 (4) | |
| 4.096 < DRX cycle ≤ 10.24 | Note 1 (3) | |
| Note 1: Evaluation period length in time depends on the length of the DRX cycle in use | | |

7.23B.2.3 Minimum requirement at transitions

When the UE transitions between DRX and non-DRX or when DRX cycle periodicity changes, for a duration of time equal to the evaluation period corresponding to the second mode after the transition occurs, the UE shall use an evaluation period that is no less than the minimum of evaluation periods corresponding to the first mode and the second mode. Subsequent to this duration, the UE shall use an evaluation period corresponding to the second mode. This requirement shall be applied to both out-of-sync evaluation and in-sync evaluation of the NB-IoT cell.

### <End of Change 9>

### <Start of Change 10>

8.14B Measurements for UE category NB-IoT for frame structure type 1 for NTN-TDD

8.14B.1 Introduction

The requirements in clause 8.14B apply for intra-frequency measurements on an SAN carrier frequency.

This clause contains requirements on the UE category NB1 regarding measurement in RRC\_CONNECTED state. The requirements are specified for NB-IoT intra frequency measurements for serving NB-IoT cell. These measurements may be used by the NB-IoT for uplink power control. The measurement quantities are defined in [4], the measurement model is defined in [22] and measurement accuracies are specified in clause 9.1.22A.1. During the RRC\_CONNECTED state the UE shall continuously measure serving NB-IoT cell.

The UE shall meet all applicable requirements specified in clause 8.14B under the following conditions:

- at least 1 DL subframe per radio frame of serving NB-IoT cell is available at the UE during measurement period.

- Valid information for the serving satellite has been provided

If DRX is used and the UE is configured with GNSS measurement gap, the requirements in 8.14B on time to detect, measure and evaluate apply if the GNSS measurement gap length is shorter than the DRX cycle and the GNSS measurement gap does not overlap with the On Duration of the DRX cycle. Otherwise, the measurement delay could be longer if GNSS re-acquisition happens during the measurement period defined in 8.14B. UE shall restart the cell measurement when the interval between two samples are larger than 5000 ms.

8.14B.2 NB-IoT intra frequency measurements under normal coverage

8.14B.2.1 NB-IoT intra frequency measurements when no DRX is used

In the RRC\_CONNECTED state the measurement period for intra frequency measurements is 800ms, unless the UE is capable of NSSS-based RRM measurements and *nsss-NumOccDiffPrecoders* value *n1* [2] is indicated by higher layers, by which the measurement period is [1600] ms. The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22A.1.

8.14B.2.2 NB-IoT intra frequency measurements when DRX is used

When DRX is used in the RRC\_CONNECTED state the measurement period for intra frequency measurements is Tmeasure\_intra as shown in table 8.14B.2.2-1.

**Table 8.14B.2.2-1: Requirement for intrafrequency measurement**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra (s) (DRX cycles)** |
| 0.256<DRX-cycle<5.12 | Note 1 (5) |
| Note 1: Time depends upon the DRX cycle in use | |

The NRSRP measurement accuracy shall be as specified in the sub-clauses 9.1.22A.1

8.14B.4 Connected mode channel quality report for UE Category NB1

The requirements in this clause shall apply for UE supporting DL channel quality reporting for UE Category NB1 as defined in TS 36.331 [2] when triggered by the MAC-CE command as specified in TS 36.321 [17].

The DL channel quality provides the serving eNB with information about the minimum NPDCCH repetition level to satisfy the hypothetical NPDCCH block error rate of 1% with the parameters specified in Table 8.14B.4-1.

**Table 8.14B.4-1: NPDCCH transmission parameters for downlink quality reporting**

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| DCI format | Format N1 |
| Number of information bits (excluding CRC) | 23bits |
| System bandwidth | 200kHz |
| Aggregation level | 2 |
| DRX | OFF |

The reported NPDCCH repetition level shall be derived from the channel quality measured over the NPDCCH period which carries the uplink grant of channel quality report for measurement of DL channel quality of the configured carrier.

The NPDCCH repetition level for QualityReport specified in TS 36.321 [17] is chosen from the supported NPDCCH repetition levels [3]. The report mapping is defined in 9.1.22.15.

The UE shall satisfy the downlink channel quality measurement accuracy requirements as specified in 9.1.22A.8.

8.14B.6 NB-IoT neighbour cell measurements

8.14B.6.1 Introduction

This clause contains requirements for the neighbour cell measurements performed by the UE category NB1 in RRC\_CONNECTED state. The requirements in this clause are applicable when:

* the UE is in normal coverage or in enhanced coverage on the serving cell and
* the target cell fulfils the criteria for normal coverage.

8.14B.6.2 Requirements

The UE supporting connected mode measurements, as indicated by the capabilities *connModeMeasIntraFreq-r17* and *connModeMeasInterFreq-r17* [31] shall measure neighbour cells when:

* the criterion for triggering the neighbour cell measurements defined in [1] is fulfilled; or
* before t-service if the UE supports time-based measurement initiation and t-service is configured by the serving cell [2] , but the exact instant to start the measurements is left by UE implementation; or
* the UE supports location-based measurement initiation and the distance between the UE and the serving cell reference location is larger than distanceThresh [2]. The requirements apply provided that the distance exceeds the distanceThresh by a margin of 50 m for qualsi-earth fixed Cell and 80 m for earth moving cell as defined in [2].

The measurement quantities are defined in [4], the measurement model is defined in [22].

The requirements for intra-frequency neighbour cell measurement when the target carrier is same as serving carrier is defined in clause 8.14B.6.3, and are applicable for UEs supporting *connModeMeasIntraFreq-r17* .

The requirements for inter-frequency neighbour cell measurement when the target carrier is different from serving carrier is defined in clause 8.14B.6.4, and are applicable for UEs supporting *connModeMeasInterFreq-r17*.

If *t-serviceStartNeigh* is configured for the neighbor cells in a given frequency layer, the UE is not required to initiate measurements in this frequency layer in neighbor cells associated to this satellite until *t-serviceStartNeigh* is reached.

8.14B.6.3 Intra-frequency neighbour cell measurements

The UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra\_NB1-NC ­­­when the criteria for intra-frequency measurements is fulfilled [1]. An intra frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.2.24 for a corresponding Band.

Tidentify\_intra\_NB1-NC = Tdetect\_intra\_NB1-NC + Tmeasure \_intra\_NB1-NC

If only intra-satellite measurements are configured by the serving cell in this frequency layer, or if the UE is configured to measure GSO satellites:

When DRX is not used, Tdetect\_intra\_NB1-NC is 1,89 s, and Tmeasure \_intra\_NB1-NC is 800 ms.

When DRX is used, Tdetect\_intra\_NB1-NC and Tmeasure \_intra\_NB1-NC are defined in table 8.14B.6.3-1 and 8.14B.6.3-2.

**Table 8.14B.6.3-1: Requirement for intra-frequency detection**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tdetect\_intra\_NB1-NC (s) (DRX cycles)** |
| 0.256<DRX-cycle<5.12 | (10)Note 1 |
| Note1: Time depends upon the DRX cycle in use | |

**Table 8.14B.6.3-2: Requirement for intra-frequency measurement**

|  |  |
| --- | --- |
| **DRX cycle length (s)** | **Tmeasure\_intra\_NB1-NC (s) (DRX cycles)** |
| 0.256<DRX-cycle<5.12 | (2)Note 1 |
| Note1: Time depends upon the DRX cycle in use | |

If the UE is configured to measure a neighbor NGSO satellite, then Tdetect\_intra\_NB1-NC = Tdetect\_inter\_NB1-NC,m and Tmeasure\_intra\_NB1-NC = Tmeasure\_inter\_NB1-NC,m, where Tmeasure\_inter\_NB1-NC,m and Tdetect\_inter\_NB1-NC,m are defined in clause 8.14B.6.4. If the UE is configured for measurements across 3 or more cells with non-overlapping consecutive DL subframes, the Tdetect\_intra\_NB1-NCand Tmeasure \_intra\_NB1-NC are relaxed by a factor of 2. If the UE is configured for measurements across 3 or more cells with non-overlapping consecutive DL subframes, the Tdetect\_intra\_NB1-NCand Tmeasure \_intra\_NB1-NC are relaxed by a factor of 2.

When UE is monitoring multiple carriers, Tidentify\_intra\_NB1-NC = Tdetect\_NB1-NC + Tmeasure\_NB1-NC, where Tdetect\_NB1-NC = Tdetect \_intra\_NB1-NC + and Tmeasure = Tmeasure \_intra\_NB1-NC +.

8.14B.6.4 Inter-frequency neighbour cell measurements

The UE shall be able to identify a new detectable inter-frequency cell in the within Tidentify\_inter\_NB1-NC,m ­­­when the criteria for inter-frequency measurement is fulfilled [1]. An inter frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.2.25 for a corresponding Band.

Tidentify \_inter\_NB1-NC = Tdetect\_inter\_NB1-NC,m + Tmeasure \_inter\_NB1-NC,m

Where

ms

- ,

- Ta,i is the interval between available measurement samples in measurement occasions (MOdetect\_inter\_NB1-NC) for inter-frequency detection, where

40 ms ≤ Ta,i ≤ 5000 ms

- The UE shall restart the cell detection when the interval between two samples are larger than 5000 ms.

- The UE is not required to monitor NPSS/NSSS more frequent than once per 40ms.

- MOdetect\_inter\_NB1-NC are time occasions containing NPSS/NSSS and fulfil the following conditions:

- Resources on which the UE is not scheduled for data transmission or reception,

- Resources on which the UE is not required to do NPDCCH monitoring,

- Resources occurring during the DRX inactive period

- Length of MOdetect\_inter\_NB1-NC  is at least 200 ms.

- The inter-frequency detection requirements apply when ≤ 60 seconds per inter-frequency carrier.

- *Ksatellite,m*is the number of satellites to be measured in this frequency layer and whose value is equal to:

* 1, if measurements are performed on GSO cells in this frequency layer; or if there is only one NGSO satellite associated to cells the UE is required to measure in this frequency layer;
* 2, if there are two or more NGSO satellites associated to the cells the UE is required to measure;

Tmeasure\_inter\_NB1-NC is the physical layer measurement period of NRSRP on the detected inter-frequency cell as defined below:

ms

- M = 60 for NRS-based RRM measurement and M = 40 for NSSS based RRM measurement,

- Tb,i is the interval between available measurement samples in measurement occasions (MOmeasure\_inter\_NB1-NC) for inter-frequency measurement, where

20 ms ≤ Tb,i ≤ 5000 ms for NRS based measurement or

40 ms ≤ Tb,i ≤ 5000 ms for NSSS-based measurement

- The UE shall restart the measurement when the interval between two samples are larger than 5000 ms.

- The UE is not required to monitor NRS more frequent than once per 20ms for NRS-based measurement and NSSS more frequent than 40 ms for NSSS-based measurement.

- MOmeasure\_inter\_NB1-NC are time occasion containing at least NRS or NSSS that fulfil the following conditions:

- Resources on which the UE is not scheduled for data transmission or reception,

- Resources on which the UE is not required to do NPDCCH monitoring,

- Resources occurring during the DRX inactive period,

- Length of MOmeasure\_inter\_NB1-NC  is at least 50 ms.

- The inter-frequency measurement requirements apply when ≤ 50 seconds per inter-frequency carrier.

When UE is monitoring multiple carriers, Tidentify\_inter\_NB1-NC = Tdetect\_NB1-NC + Tmeasure\_NB1-NC, where Tdetect\_NB1-NC = Tdetect \_intra\_NB1-NC + and Tmeasure = Tmeasure\_intra\_NB1-NC +. Nfreq is number of inter-frequency carriers to be measured according to the measurement capability, where Tmeasure\_intra\_NB1-NC andTdetect \_intra\_NB1-NC are defined in clause 8.14B.6.2.

8.14B.6.5 Requirements for monitoring multiple carriers

For RRC\_CONNECTED state, the UE shall be capable of monitoring at least:

- Depending on UE capability, an intra-frequency carrier.

- Depending on UE capability, at least 2 inter-frequency carriers.

### <End of Change 10>