**3GPP TSG-RAN WG4 Meeting #115R4-2508456**

**Malta, MT, 19 – 23 May, 2025**

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | 38.133 | **CR** |  | **rev** |  | **Current version:** | 19.0.0 |  |
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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:***  | Draft big CR for RRM requirements of NR NTN Ku Band |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_NTN\_Ku\_bands-Core |  | ***Date:*** | 2025-05-26 |
|  |  |  |  |  |
| ***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 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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | Draft big CR for RRM requirements of NR NTN Ku Band in RAN4#115 |
|  |  |
| ***Summary of change:*** | The following endorsed CRs are consolidated in this big CR.R4-2508383 DraftCR on uplink timing requirements for mobile VSAT served by NGSOR4-2506784 draftCR on applicability of requirements for Ku band NTNR4-2507201 (NR\_NTN\_Ku\_bands-Core) RRC IDLE state mobilityR4-2508387 DraftCR to TS 38.133 for including measurement procedures for VSAT UEs operating in KU band |
|  |  |
| ***Consequences if not approved:*** | RRM requirements of NR NTN Ku Band would still be missing. |
|  |  |
| ***Clauses affected:*** | 3.6.12, 4.2C, 7.1C, 9.2C, 9.3C |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS38.533 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**<<Start of change>>**

3.6.12 Applicability of requirements for Satellite Access

The requirements for Satellite Access defined in clauses with suffix ‘C’ apply provided that UE indicates *nonTerrestrialNetwork* and is accessing a cell served by a Satellite Access Node (SAN). The requirements apply provided that serving and all neighbour satellites on the same layer are of same satellite type (LEO or GEO).

Unless otherwise stated, the requirements defined for FR2-NTN apply for VSAT working in FR1-NTN.

**<<Unchanged sections omitted>>**

### 4.2C.1 Introduction

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 , inter-frequency and inter-RAT cells indicated by the serving cell. For intra-frequency ,inter-frequency and inter-RAT cells, the serving cell may provide explicit neighbour list, or only carrier frequency information and bandwidth information. UE measurement activity is also controlled by measurement rules defined in TS 38.304 [1], allowing the UE to limit its measurement activity.

For intra-frequency cell re-selection, requirements in 4.2C.2.3 apply.

For inter-frequency cell re-selection, when TN carrier is not configured, requirements specified in clause 4.2C.2.4 apply and when NTN carrier is configured, requirements specified in clause 4.2C.2.10 apply.

For inter-RAT cell re-selection, requirements in 4.2C.2.11 apply.

The requirements specified in clause 4.2C shall apply for the quasi-earth fixed cell and the earth moving cell.

The requirements specified in clause 4.2C apply to FR1-NTN and Ku band NTN supporting FR1 numerology, and FR2-NTN and Ku band NTN supporting FR2 numerology as defined in TS 38.101-5 [43].

The requirements specified in clause 4.2C apply to FR2-NTN and or Ku band NTN supporting FR2 numerology with the following assumption:

- no inter-satellite measurement is configured;

- single SAN Tx beam per radio cell in DL;

- same UE Rx beam is used for both serving and neighbouring cells which belong to the same satellite.

**<<Unchanged sections omitted>>**

#### 4.2C.2.3 Measurements of intra-frequency NR cells

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

If Srxlev > SIntraSearchP and Squal > SIntraSearchQ, and the distance between UE and serving cell reference location or serving cell moving reference location is smaller than *distanceThresh* if the *distanceThresh* is configured (see TS 38.304[1]) and UE has location information, then the UE is not required to perform measurement of intra-frequency.

The UE shall be able to evaluate whether a newly detectable intra-frequency cell meets the reselection criteria defined in TS 38.304 [1] within Kmulti\_SMTC \* Tdetect,NR\_Intrawhen that Treselection= 0 if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within Kmulti\_SMTC \* Tdetect,NR\_Intra\_enhif the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled. An intra frequency cell is considered to be detectable according to the conditions defined in annex B.1.6 for a corresponding Band.

The UE shall measure SS-RSRP and SS-RSRQ at least every Kmulti\_SMTC \* Tmeasure,NR\_Intra (see table 4.2C.2.3-1) if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or every Kmulti\_SMTC \* Tmeasure,NR\_Intra\_enh (see table 4.2C.2.3-2) if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, for intra-frequency cells that are identified and measured according to the measurement rules.

The UE shall filter SS-RSRP and SS-RSRQ 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,NR\_Intra/2.

For UE in FR1-NTN and Ku band NTN supporting FR1 numerology:

 If SMTCs do not overlap with each other,

- , if GEO satellites are measured on the carrier;

- , if LEO satellites are measured on the carrier;

- If SMTCs partially overlap with each other,

- , if only GEO satellites are measured on the carrier;

- , if only LEO satellites are measured on the carrier;

Where

-  Is the number of LEO satellites to be measured within i-th SMTC,

-  Is the number of LEO satellites that UE can measure in parallel within an SMTC,

-  Is the number of SMTCs that partially overlap with each other.

Note: for deriving Kmulti\_SMTC for Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra, two SMTCs are considered as overlapping if they overlap in one or more occasions during a single Tdetect,NR\_Intra, Tmeasure,NR\_Intra or Tevaluate,NR\_Intra.

For UE in FR2-NTN and Ku band NTN supporting FR2 numerology, Kmulti\_SMTC = 1.

The parameter Kmulti\_SMTC is the scaling factor for measurements of multiple SMTCs which correspond to different satellites.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving 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 in TS 38.304 [1] within Kmulti\_SMTC \* Tevaluate,NR\_Intra if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within Kmulti\_SMTC \* Tevaluate,NR\_Intra\_enh if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, when Treselection = 0as specified in table 4.2C.2.3-1 or table 4.2C.2.3-2 provided that:

- when *rangeToBestCell* is not configured:

- the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2 and Ku band.

- when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

- if there are multiple such cells, the cell has the highest rank among them.

- the cell is at least 3 dB better ranked in FR1 or 4.5 dB better ranked in FR2 and Ku band if the current serving cell is among them.

When evaluating cells for reselection, the SSB side conditions apply to both serving and non-serving intra-frequency cells.

If Treselection timer has a nonzero value and the intra-frequency cell is satisfied with the reselection criteria which are defined in TS 38.304 [1], the UE shall evaluate this intra-frequency cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

**Table 4.2C.2.3-1: Tdetect,NR\_Intra, Tmeasure,NR\_Intra and Tevaluate,NR\_Intra**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | **Tdetect,NR\_Intra [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra****[s] (number of DRX cycles)** |
|  | **FR1, FR2-NTN and Ku band NTN** |  |  |  |
| 0.32 | 1 | 11.52 x N1 x M2 (36 x N1 x M2) | 1.28 x N1 x M2 (4 x N1 x M2) | 5.12 x N1 x M2 (16 x N1 x M2) |
| 0.64 | 17.92 x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| NOTE 1: M2 = 2 if SMTC periodicity of measured intra-frequency cell > 20 ms and 1<NSMTC ≤ 4 upon more than 1 SMTC configured at the UE; M2 = 1.5 if SMTC periodicity of measured intra-frequency cell > 20 ms and NSMTC=1 upon 1 SMTC configured at the UE; otherwise M2=1. Where, NSMTC is the number of SMTCs configured by SAN If different SMTC periodicities are configured for different cells, the SMTC periodicity in this note is the one used by the cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed, and if the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected.NOTE 2: The UE is not required to meet the requirements for 2.56 s DRX cycle length for earth-moving LEO deployment. |

**Table 4.2C.2.3-2: Tdetect,NR\_Intra\_enh, Tmeasure,NR\_Intra\_enh and Tevaluate,NR\_Intra\_enh**

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NR\_Intra\_enh [s] (number of DRX cycles)** | **Tmeasure,NR\_Intra\_enh [s] (number of DRX cycles)** | **Tevaluate,NR\_Intra\_enh [s] (number of DRX cycles)** |
|
| 0.32 |  2.56 x M2 (8 x M2)Note 1 | 0.32 x M3 (1 x M3) Note 1 | 0.96 x M4 (3 x M4) Note 1 |
| 0.64 | 5.12 (8) | 0.64 (1) | 1.92 (3) |
| 1.28 | 8.96 (7) | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 2, M3 = M4 = 2.5 |

If ‘*t-Service*’ is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location is met or the legacy Srxlev/Squal condition are met, 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 the last updated value for t-Service is acquired by the UE for the first time 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(Kmulti\_SMTC\*Tdetect,NR\_Intra, Kmulti\_SMTC\*Kcarrier\* Tdetect,NR\_Inter),

where

- Kcarrier is the number of NR inter-frequency carriers indicated by the serving cell,

- Tdetect,NR\_Intra refers to intra-frequency cell detection delay in IDLE/INACTIVE mode defined in table 4.2C.2.3-2,

- Tdetect,NR\_Inter refers to inter-frequency cell detection delay in IDLE/INACTIVE mode defined in table 4.2C.2.4-2.

The requirements in this clause apply provided that the number of SMTCs for intra-frequency carrier does not exceed the *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially for performing the measurements until all of the SMTCs can be measured. The selection of SMTCs to be used is up to UE implementation, and in this case, measurement period longer than the corresponding measurement period specified in table 4.2C.2.3-1 and table 4.2C.2.3-2 is expected.

**<<Unchanged sections omitted>>**

#### 4.2C.2.4 Measurements of inter-frequency NR cells

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

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, and the distance between UE and serving cell reference location or serving cell moving reference location is smaller than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for inter-frequency layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2C.2.9.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, or the distance between UE and serving cell reference location or serving cell moving reference location is larger than *distanceThresh* if *distanceThresh* is configured and UE has location information, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m when *referenceLocation* is configured by the network or 80 m when *movingReferenceLocation* is configured by the network. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority layers shall be the same as that defined below in this clause.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS 38.304 [1] within  if the UE does not support t *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within  if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least [5]dB in FR1 for reselections based on ranking or [6]dB in FR1 for SS-RSRP reselections based on absolute priorities or [4]dB in FR1 for SS-RSRQ reselections based on absolute priorities. The parameter Kcarrier is the number of NR inter-frequency carriers indicated by the serving cell.

The parameter Kmulti\_SMTC,i is the scaling factor for measurement of multiple SMTCs or multiple satellites.

For FR2-NTN and Ku band NTN supporting FR2 numerology, Kmulti\_SMTC,i = 1.

For UE in FR1-NTN and Ku band NTN supporting FR1 numerology:

- If SMTCs do not overlap with each other,

- , if GEO satellites are measured on the carrier;

- , if LEO satellites are measured on the carrier;

- If SMTCs partially overlap with each other,

- , if only GEO satellites are measured on the carrier;

- , if only LEO satellites are measured on the carrier;

where

 is the number of LEO satellites to be measured within i-th SMTC,

 is the number of LEO satellites that UE can measure in parallel within an SMTC, is the number of SMTCs that partially overlap with each other.

NOTE: For deriving Kmulti\_SMTC,i for Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter of frequency layer *i*, two SMTCs are considered as overlapping if they overlap in one or more occasions during a single Tdetect,NR\_Inter, Tmeasure,NR\_Inter or Tevaluate,NR\_Inter.

An inter-frequency cell is considered to be detectable according to the conditions defined in Annex B.1.7 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,NR\_Inter. If, after detecting a cell in a higher priority search, it is determined that reselection has not occurred then the UE is not required to continuously measure the detected cell to evaluate the ongoing possibility of reselection. However, the minimum measurement filtering requirements specified later in this clause shall still be met by the UE before it makes any determination that it may stop measuring the cell. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall measure SS-RSRP or SS-RSRQ at least every  (see table 4.2C.2.4-1) if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or every  (see table 4.2C.2.4-2) if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementLEO-r17*is enabled, for identified lower or equal priority inter-frequency cells. If the UE detects on a NR carrier a cell whose physical identity is indicated as not allowed for that carrier in the measurement control system information of the serving cell, the UE is not required to perform measurements on that cell.

The UE shall filter SS-RSRP or SS-RSRQ measurements of each measured higher, lower and equal priority 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,NR\_Inter/2.

The UE shall not consider a NR neighbour cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For an inter-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 inter-frequency cell has met reselection criterion defined TS 38.304 [1] within  if the UE does not support *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within  if the UE supports *Enhanced RRM requirements for measurements in IDLE and INACTIVE modes* defined in TS 38.306 [14] and the *enhancedMeasurementLEO-r17* is enabled, when Treselection = 0as specified in table 4.2C.2.4-1 provided that the reselection criteria is met by

- the condition when performing equal priority reselection and

 when *rangeToBestCell* is not configured:

- the cell is at least [5]dB better ranked in FR1 or.

when *rangeToBestCell* is configured:

- the cell has the highest number of beams above the threshold *absThreshSS-BlocksConsolidation* among all detected cells whose cell-ranking criterion R value in TS 38.304 [1] is within *rangeToBestCell* of the cell-ranking criterion R value of the highest ranked cell.

- if there are multiple such cells, the cell has the highest rank among them

- the cell is at least [5]dB better ranked in FR1 if the current serving cell is among them. or

- [6]dB in FR1 for SS-RSRP reselections based on absolute priorities or

- [4]dB in FR1 for SS-RSRQ reselections based on absolute priorities.

When evaluating cells for reselection, the SSB side conditions apply to both serving and inter-frequency cells.

If Treselection timer has a non-zero value and the inter-frequency cell is satisfied with the reselection criteria, the UE shall evaluate this inter-frequency cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect that cell.

The UE is not expected to meet the measurement requirements for an inter-frequency carrier under DRX cycle=320 ms defined in table 4.2C.2.4-1 under the following conditions:

- TSMTC\_intra = TSMTC\_inter = 160 ms; where

- TSMTC\_intra is the periodicity of the SMTC configured for the intra-frequency carrier if no identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier; TSMTC\_intra is the periodicity of the *smtc2-LP* configured for the intra-frequency carrier if at least one identified intra-frequency cell is in the PCI list of *smtc2-LP* on this intra-frequency carrier. During PSS/SSS detection, the periodicity of the SMTC configured for the intra-frequency carrier is assumed for TSMTC\_intra. If the actual SSB transmission periodicity is greater than the SMTC configured for the intra-frequency carrier, longer Tdetect, NR\_intra is expected.

- TSMTC\_inter is the actual SMTC periodicity used by the inter-frequency cell being identified. During PSS/SSS detection, the periodicity of the SMTC configured for the inter-frequency carrier is assumed for TSMTC\_inter. If the actual SSB transmission periodicity is greater than the SMTC configured for the inter-frequency carrier, longer Tdetect, NR\_inter is expected.

- SMTC occasions configured for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the SMTC occasions configured for the intra-frequency carrier, and

- SMTC occasions configured for the intra-frequency carrier and for the inter-frequency carrier occur up to 1 ms before the start or up to 1 ms after the end of the paging occasion in TS 38.304 [1].

**Table 4.2C.2.4-1: Tdetect,NR\_Inter, Tmeasure,NR\_Inter and Tevaluate,NR\_Inter**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | **Tdetect,NR\_Inter [s] (number of DRX cycles)** | **Tmeasure,NR\_Inter [s] (number of DRX cycles)** | **Tevaluate,NR\_Inter [s] (number of DRX cycles)** |
| **FR1, FR2-NTN and Ku band NTN** |
| 0.32 | 1 | 11.52 x N1 x 1.5 (36 x N1 x 1.5) | 1.28 x N1 x 1.5 (4 x N1 x 1.5) | 5.12 x N1 x 1.5 (16 x N1 x 1.5) |
| 0.64 | 17.92x N1 (28 x N1) | 1.28 x N1 (2 x N1) | 5.12 x N1 (8 x N1) |
| 1.28 | 32 x N1 (25 x N1) | 1.28 x N1 (1 x N1) | 6.4 x N1 (5 x N1) |
| 2.56 | 58.88 x N1 (23 x N1) | 2.56 x N1 (1 x N1) | 7.68 x N1 (3 x N1) |
| NOTE 1: UE is not required to fulfil the requirements for 2.56 s DRX cycle length for earth-moving LEO deployment. |

**Table 4.2C.2.4-2: Tdetect,NR\_Inter\_enh, Tmeasure,NR\_Inter\_enh and Tevaluate,NR\_Inter\_enh**

|  |  |  |  |
| --- | --- | --- | --- |
| **DRX cycle length [s]** | **Tdetect,NR\_Inter\_enh [s] (number of DRX cycles)** | **Tmeasure,NR\_Inter\_enh [s] (number of DRX cycles)** | **Tevaluate,NR\_Inter\_enh [s] (number of DRX cycles)** |
|
| 0.32 | [3.2 x M2 (10 x M2)] Note 1 | [0.32 x M3 ([1] x M3)] Note 1 | 0.96 x M4 (3 x M4) Note 1 |
| 0.64 | [6.4 (10)] | [0.64 (1)] | 1.92 (3) |
| 1.28 | [10.24 (8)] | 1.28 (1) | 3.84 (3) |
| 2.56 | 58.88 (23) | 2.56 (1) | 7.68 (3) |
| NOTE 1: When SMTC < = 40 ms, M2 = M3 = M4 = 1; and when SMTC > 40 ms, M2 = 1.5, M3 = M4 = 2 |

If *t-Service* is broadcasted and applicable, UE shall be able to detect, measure, and evaluate neighbour cells before the serving cell stops serving the area regardless of whether the distance condition based on serving cell reference location or serving cell moving reference location or the legacy Srxlev/Squal condition are met, and when to start detection, measurement, and evaluation 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 the last updated value for t-Service is acquired by the UE for the first time to the first slot when the cell is scheduled to stop serving the area according to the broadcasted information is less than Ttrigger, and Ttrigger = max(Kmulti\_SMTC\*Tdetect,NR\_Intra, Kmulti\_SMTC\*Kcarrier\* Tdetect,NR\_Inter) when serving cell is below the search threshold, and Ttrigger = max(Kmulti\_SMTC\*Tdetect,NR\_Intra, Nlayer\* [60 s]) when serving cell is above the search threshold, where

- Kcarrier is the number of NR inter-frequency carriers indicated by the serving cell,

- Nlayer is the total number of higher priority NR carrier frequencies broadcasted in system information,

- Tdetect,NR\_Intra refers to HST intra-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.3-2,

- Tdetect,NR\_Inter refers to HST inter-frequency cell detection delay in IDLE/INACTIVE mode defined table 4.2.2.4-2.

The requirements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the values indicated by *parallelSMTC-r17*, otherwise UE may select one or subset of all the configured SMTCs sequentially until all of the SMTCs can be measured, the selection of SMTCs to be used is up to UE implementation, and longer measurement delay than the corresponding measurement period specified in table 4.2C.2.4-1 and table 4.2C.2.4-2 is expected.

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.

The requirements in this clause apply provided that SSB of neighbour cells are within the time shifted SMTC.

**<<Unchanged sections omitted>>**

7.1C UE transmit timing for Satellite Access

7.1C.1 Introduction

The UE shall have capability to follow the frame timing change of the reference cell in RRC\_CONNECTED state. The uplink frame transmission takes place $\left(N\_{TA}+N\_{TA offset}+N\_{TA,adj}^{common}+N\_{TA,adj}^{UE}\right)×T\_{c}$ before the reception of the first detected path (in time) of the corresponding downlink frame from the reference cell. UE initial transmit timing accuracy and gradual timing adjustment requirements are defined in the following requirements.

7.1C.2 Requirements

The UE initial transmission timing error shall be less than or equal to ±Te\_NTN where the timing error limit value Te\_NTN:

- is specified in table 7.1C.2-1 for FR1-NTN.

- is specified in table 7.1C.2-2 and table 7.1C.2-3 for VSAT UE in FR2-NTN.

This requirement applies:

- when it is the first transmission in a DRX cycle for PUCCH, PUSCH and SRS, or it is the PRACH transmission, or it is the msgA transmission.

The UE shall meet the Te\_NTN requirement for an initial transmission provided that at least one SSB is available at the UE during the last 160 ms. The reference point for the UE initial transmit timing control requirement shall be the downlink timing of the reference cell minus $\left(N\_{TA}+N\_{TA-offset}+N\_{TA,adj}^{common}+N\_{TA,adj}^{UE}\right)×T\_{c}$.

The downlink timing is defined as the time when the first path (in time) of the corresponding downlink frame used by the UE to determine downlink timing is received from the reference cell at the UE antenna.

$N\_{TA}$ for PRACH is defined as 0. $\left(N\_{TA}+N\_{TA offset}+N\_{TA,adj}^{common}+N\_{TA,adj}^{UE}\right)×T\_{c}$ (in *T*c units) for other channels is the difference between UE transmission timing and the downlink timing immediately after when the last timing advance in clause 7.3C was applied. or after the last update in $N\_{TA,adj}^{common}$ or $N\_{TA,adj}^{UE}$.

The value of $N\_{TA offset}$ depends on the duplex mode of the cell in which the uplink transmission takes place and the frequency range (FR). $N\_{TA offset}$is defined in table 7.1.2-2 for FR1-NTN.

$N\_{TA offset}$ is defined in table 7.1C.2-4 for VSAT UE in FR2-NTN.

$N\_{TA,adj}^{common}$ and $N\_{TA,adj}^{UE}$ are defined in TS 38.211 [6].

**Table 7.1C.2-1: Te\_NTN Timing Error Limit**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of SSB signals (kHz)** | **SCS of uplink signals (kHz)** | **Te\_NTN** |
| FR1-NTN | 15 | 15 | 29\*64\*Tc |
|  |  | 30 | 24\*64\*Tc |
|  |  | 60 | N/A |
|  | 30 | 15 | 24\*64\*Tc |
|  |  | 30 | 22\*64\*Tc |
|  |  | 60 | N/A |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6] |

**Table 7.1C.2-2: Te\_NTN Timing Error Limit for fixed VSAT served by GSO and fixed VSAT is served by NGSO**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of SSB signals (kHz)** | **SCS of uplink signals (kHz)** | **Te\_NTN** |
| FR2-NTN | 120 | 60 | 13\*64\*Tc |
| 120 | 7.5\*64\*Tc |
| 240 | 60 | 13\*64\*Tc |
| 120 | 7.5\*64\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6] |

**Table 7.1C.2-3: Te\_NTN Timing Error Limit for mobile VSAT served by GSO and NGSO**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency Range** | **SCS of SSB signals (kHz)** | **SCS of uplink signals (kHz)** | **Te\_NTN** |
| FR2-NTN | 120 | 60 | 13\*64\*Tc |
| 120 | 7.5\*64\*Tc |
| 240 | 60 | 13\*64\*Tc |
| 120 | 7.5\*64\*Tc |
| NOTE 1: Tc is the basic timing unit defined in TS 38.211 [6]NOTE 2: Te\_NTN for 120 kHz UL SCS applies under all the following conditions:- LOS channel between UE and each GNSS satellite - The GNSS signal power level greater than or equal to the applicable value specified in Table 6.2-1 of TS 38.171- The GNSS satellite allocation is no less than the applicable value speicifed in Table 6.2-2 of TS 38.171- The velocity change within one second does not result in the position difference with respect to the projected position, based on the position and velocity obtained one second before, exceeding 10 meters.NOTE 3: The requirement for mobile VAST served by NGSO applies only to band n509 and n508. The requirement applies when the interval between adjacent epoch times does not exceed 5.12 sec. |

Fixed VSAT and mobile VSAT are defined in TS 38.101-5 [43].

**Table 7.1C.2-4: The Value of** $N\_{TA offset} $**for VSAT in FR2-NTN**

|  |  |
| --- | --- |
| **Frequency range and band of cell used for uplink transmission** | $N\_{TA offset}$**(Unit: TC)** |
| FR2-NTN | 0 |
| Note 1: The UE identifies $N\_{TA offset}$ based on the information n-TimingAdvanceOffset as specified in TS 38.331 [2]. If UE is not provided with the information n-TimingAdvanceOffset, the default value of $N\_{TA offset}$ is set as 0 for FR2-NTN band. |

When it is not the first transmission in a DRX cycle or there is no DRX cycle, and when it is the transmission for PUCCH, PUSCH including PUSCH transmissions in Time Domain Window when *pusch-DMRS-Bundling* is enabled, and SRS transmission, the UE shall be capable of changing the transmission timing according to the received downlink frame of the reference cell, the updating of $N\_{TA,adj}^{common}$ and the updating of $N\_{TA,adj}^{UE}$, except when the timing advance in clause 7.3C is applied.

**<<Unchanged sections omitted>>**

9.2C.7 Intra-frequency measurements without measurement gaps for NTN band above 10 GHz

The requirements in this clause are applicable for mobile VSAT UEs operating in FR2-NTN or in Ku bands [cite band numbers] regardless of whether operating with FR1 or FR2 numerology.

9.2C.7.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra\_without\_index if the UE is not indicated to report SSB based RRM measurement result with the associated SSB index(*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE is indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within Tidentify\_intra\_without\_index.

 Tidentify\_intra\_without\_index = (TPSS/SSS\_sync\_intra + TSSB\_measurement\_period\_intra) ms

 Tidentify\_intra\_with\_index = (TPSS/SSS\_sync\_intra + TSSB\_measurement\_period\_intra + TSSB\_time\_index\_intra) ms

Where:

 TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2C.7.1-1

 TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.7.1-2

 TSSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2C.7.2-1

 CSSFintra: it is a carrier specific scaling factor and is determined

 according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when intra-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps, or according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when intra-frequency SMTC is fully overlapping with measurement gaps.

 if the high layer in TS 38.331 [2] signalling of *smtc2* is configured, the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc2*; Otherwise the assumed periodicity of intra-frequency SMTC occasions corresponds to the value of higher layer parameter *smtc1*.

Kp is the scaling factor for an SSB frequency layer to be measured without measurement gaps. Kp = Ntotal\_SAN / Navailable\_SAN, where Navailable\_SAN and Ntotal\_SAN are calculated as follows:

- For a window W of duration max(SMTC period, MGRP\_max), where

- If UE is configured with concurrent measurement gaps, MGRP max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP max is the MGRP of configured measurement gap.

- Ntotal\_SAN is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and

- Navailable\_SAN is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

Kp = [1] when Navailable\_SAN = 0 and measurement gap sharing in clause 9.1.2.1a shall apply.

Kp = 1 when intra-frequency SMTC is fully non overlapping with measurement gaps.

 For calculation of Kp, if the high layer signalling (TS 38.331 [2]) of *smtc2* is configured, for cells indicated in the *pci-List* parameter in *smtc2*, the SMTC periodicity corresponds to the value of higher layer parameter *smtc2*; for the other cells, the SMTC periodicity corresponds to the value of higher layer parameter *smtc1.*

Klayer1\_measurement: it is scaling factor for sharing between L3 and L1 measurement, and Klayer1\_measurement =1

 If the above-mentioned reference signal configured for L1-RSRP measurement is aperiodic CSI-RS resource, longer cell identification delay would be expected.

 If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and smtc2 is partially overlapping with measurement gaps, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index

**Table 9.2C.7.1-1: Time period for PSS/SSS detection**

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_intra** |
| No DRX | max( 600 ms, ceil( 5 x Kp x Klayer1\_measurement) x SMTC period )Note 1 x CSSFintra |
| DRX cycle≤ 320 ms | max( 600 ms, ceil(1.5x 5 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | ceil(5 x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified |

**Table 9.2C.7.1-2: Time period for time index detection**

|  |  |
| --- | --- |
| **DRX cycle** | **TSSB\_time\_index\_intra** |
| No DRX | max(120 ms, ceil( 3 x Kp x Klayer1\_measurement)x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320 ms | max(120 ms, ceil (1.5 x 3 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | Ceil(3 x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified |

9.2C.7.2 Measurement period

The measurement period for intra-frequency measurements without gaps is as shown in table 9.2C.7.2-1.

If the higher layer signaling in TS 38.331 [2] signalling of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for *TSSB\_measurement\_period\_intra*

**Table 9.2C.7.2-1: Measurement period for intra-frequency measurements without gaps**

|  |  |
| --- | --- |
| **DRX cycle** | **T SSB\_measurement\_period\_intra**  |
| No DRX | max(200 ms, ceil( 5 x Kp x Klayer1\_measurement) x SMTC period)Note 1 x CSSFintra |
| DRX cycle≤ 320 ms | max(200 ms, ceil(1.5x 5 x Kp x Klayer1\_measurement) x max(SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | ceil( 5 x Kp x Klayer1\_measurement) x DRX cycle x CSSFintra |
| NOTE 1: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified |

9.2C.7.3 Scheduling availability of UE during intra-frequency measurements

When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols indicated by the union set of *SSB-ToMeasure* from all the configured measurement objects on the same serving carrier which can be merged[2], if it is configured; otherwise, all *L* SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.2C.7.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on NTN bands above 10 GHz

For UE which do not support *simultaneousRxDataSSB-DiffNumerology* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If *deriveSSB\_IndexFromCell* is enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured within SMTC window duration. If the high layer signalling of *smtc2*is configured(in TS 38.331 [2]), the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

- If *deriveSSB\_IndexFromCell* is not enabled the UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration. If the high layer signalling of *smtc2*is configured in TS 38.331 [2], the SMTC periodicityfollows *smtc2*; Otherwise the SMTC periodicity follows *smtc1.*

**<<Unchanged sections omitted>>**

9.2C.8 Intra-frequency measurements with measurement gaps for NTN band above 10 GHz

The requirements in this clause are applicable for mobile VSAT UEs operating in FR2-NTN or in Ku bands [cite band numbers] regardless of whether operating with FR1 or FR2 numerology.

9.2C.8.1 Intra-frequency cell identification

The UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured), or the UE has been indicated that the neighbour cell is synchronous with the serving cell (*deriveSSB-IndexFromCell* is enabled). Otherwise UE shall be able to identify a new detectable intra-frequency cell within Tidentify\_intra\_with\_index. The UE shall be able to identify a new detectable intra frequency SS block of an already detected cell within Tidentify\_intra\_without\_index.

 Tidentify\_intra\_without\_index = TPSS/SSS\_sync\_intra + TSSB\_measurement\_period\_intra ms

 Tidentify\_intra\_with\_index = TPSS/SSS\_sync\_ntra + TSSB\_measurement\_period\_intra + TSSB\_time\_index\_intra ms

Where:

 TPSS/SSS\_sync\_intra: it is the time period used in PSS/SSS detection given in table 9.2C.8.2-1.

 TSSB\_time\_index\_intra: it is the time period used to acquire the index of the SSB being measured given in table 9.2C.8.2-2.

 TSSB\_measurement\_period\_intra: equal to a measurement period of SSB based measurement given in table 9.2C.8.3-1.

 Kgap is the scaling factor for a SSB frequency layer to be measured within an associated a measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps. When the UE is configured with concurrent measurement gaps and the two measurement gaps are fully overlapping with MGRP=160ms, Kgap = 2. Otherwise, Kgap = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

- For a window W of duration max(SMTC period, MGRP\_max), where

- If UE is configured with concurrent measurement gaps, MGRP max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP max is the MGRP of configured measurement gap.

- Ntotal is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and

- Navailable is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

 CSSFintra: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

If the higher layer signaling in TS 38.331 [2] of *smtc2* is present and *smtc1* is fully overlapping with measurement gaps and *smtc2* is partially overlapping with measurement gaps, requirements are not specified for Tidentify\_intra\_without\_index or Tidentify\_intra\_with\_index.

**Table 9.2C.8.2-1: Time period for PSS/SSS detection**

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_intra** |
| No DRX | max(600 ms, 5 x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320 ms | max(600 ms, ceil(1.5x 5) x Kgap x max(MGRP, SMTC period,DRX cycle)) x CSSFintra |
| DRX cycle>320 ms | 5 x Kgap x max(MGRP, DRX cycle) x CSSFintra |

**Table 9.2C.8.2-2: Time period for time index detection**

|  |  |
| --- | --- |
| **DRX cycle** | **TSSB\_time\_index\_intra** |
| No DRX | max(120 ms, 3 x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320 ms | max(120 ms, ceil(1.5 x 3) x Kgap x max(MGRP, SMTC period,DRX cycle) x CSSFintra) |
| DRX cycle>320 ms | 3 x Kgap x max(MGRP, DRX cycle) x CSSFintra |

9.2C.8.3 Intra-frequency Measurement Period

The measurement period for intra-frequency measurements with gaps is as shown in table 9.2C.8.3-1.

**Table 9.2C.8.3-1: Measurement period for intra-frequency measurements with gaps**

|  |  |
| --- | --- |
| **DRX cycle** | **TSSB\_measurement\_period\_intra** |
| No DRX | max(200 ms, 5 x Kgap x max(MGRP, SMTC period)) x CSSFintra |
| DRX cycle≤ 320 ms | max(200 ms, ceil(1.5x 5) x Kgap x max(MGRP, SMTC period,DRX cycle))x CSSFintra |
| DRX cycle>320 ms | 5 x Kgap x max(MGRP, DRX cycle) x CSSFintra |

**<<Unchanged sections omitted>>**

9.3C.8 Inter-frequency measurement with measurement gaps for NTN band above 10 GHz

The requirements in this clause are applicable for mobile VSAT UEs operating in FR2-NTN or in Ku bands [cite band numbers] regardless of whether operating with FR1 or FR2 numerology.

When measurement gaps are provided, or the UE supports capability of conducting such measurements without gaps, the UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_with\_index. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within Tidentify\_inter\_without\_index.

 Tidentify\_inter\_without\_index = (TPSS/SSS\_sync\_inter + TSSB\_measurement\_period\_inter) ms

 Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + TSSB\_measurement\_period\_inter + TSSB\_time\_index\_inter) ms

Where:

 TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3C.8-1.

 TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.8-2.

 TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3C.9-1.

 CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps.

 Kgap is the scaling factor for a SSB frequency layer to be measured within an associated measurement gap pattern. Kgap = 1 when the UE is not configured with concurrent measurement gaps. When the UE is configured with concurrent measurement gaps and the two measurement gaps are fully overlapping with MGRP=160 ms, Kgap = 2. Otherwise, Kgap = Ntotal / Navailable, where Navailable and Ntotal are calculated as follows:

 For a window W of duration max(SMTC period, MGRP\_max), where MGRP max is the maximum MGRP across all configured per-UE measurement gap, and starting from the beginning of any SMTC occasion:

- Ntotal is the total number of SMTC occasions that are covered by instances of the associated measurement gap within the window W, including those overlapped with other measurement gap occasions within the window, and

- Navailable is the number of SMTC occasions that are covered by instances of the non-dropped associated measurement gap within the window W after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1.8.3.

 Kgap is only applicable for UE supporting *parallelMeasurementGap-r17*. When concurrent measurement gaps are configured, requirements in this clause do not apply if Navailable =0, or if one SMTC overlaps more than one MGs associated to the frequency layer.

**Table 9.3C.8-1: Time period for PSS/SSS detection**

|  |  |
| --- | --- |
| **Condition NOTE1** | **TPSS/SSS\_sync\_inter** |
| No DRX |  Max(600 ms, Ceil(8 x Kgap) × Max(MGRP, SMTC period **NOTE2**)) × CSSFinter |
| DRX cycle ≤ 320 ms | Max(600 ms, Ceil(8\*1.5 x Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320 ms | Ceil(8 x Kgap) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. |

**Table 9.3C.8-2: Time period for time index detection**

|  |  |
| --- | --- |
| **Condition NOTE1** | **TSSB\_time\_index\_inter** |
| No DRX | Max(120 ms, Ceil(3 x Kgap) × Max(MGRP, SMTC period **NOTE2**)) × CSSFinter |
| DRX cycle ≤ 320 ms | Max(120 ms, Ceil(3 × 1.5 x Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320 ms | Ceil(3 x Kgap) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. |

**<<Unchanged sections omitted>>**

9.3C.9 Inter-frequency measurements for NTN band above 10 GHz

The requirements in this clause are applicable for mobile VSAT UEs operating in FR2-NTN or in Ku bands [cite band numbers] regardless of whether operating with FR1 or FR2 numerology.

When measurement gaps are provided for inter-frequency measurements, or the UE supports capability of conducting such measurements without gaps, the UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.5C, 10.1.10C and 10.1.15C, respectively, as shown in table 9.3C.5-1.

**Table 9.3C.9-1: Measurement period for inter-frequency measurements with gaps**

|  |  |
| --- | --- |
| **Condition NOTE1** | **TSSB\_measurement\_period\_inter** |
| No DRX | Max(200 ms, Ceil(8 x Kgap) × Max(MGRP, SMTC period **NOTE2**)) × CSSFinter |
| DRX cycle ≤ 320 ms | Max(200 ms, Ceil(8 × 1.5 x Kgap) × Max(MGRP, SMTC period, DRX cycle)) × CSSFinter |
| DRX cycle > 320 ms | Ceil(8 x Kgap) × DRX cycle × CSSFinter |
| NOTE 1: DRX or non DRX requirements apply according to the conditions described in clause 3.6.1NOTE 2: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. |

**<<Unchanged sections omitted>>**

9.3C.10 Inter-frequency measurements without measurement gaps for NTN band above 10 GHz

The requirements in this clause are applicable for mobile VSAT UEs operating in FR2-NTN or in Ku bands [cite band numbers] regardless of whether operating with FR1 or FR2 numerology.

9.3C.10.1 Inter-frequency Cell identification

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_without\_index if UE is not indicated to report SSB based RRM measurement result with the associated SSB index (*reportQuantityRsIndexes* or *maxNrofRSIndexesToReport* is not configured). Otherwise UE shall be able to identify a new detectable inter-frequency cell within Tidentify\_inter\_with\_index. The UE shall be able to identify a new detectable inter frequency SS block of an already detected cell within Tidentify\_inter\_without\_index.

Tidentify\_inter\_without\_index = (TPSS/SSS\_sync\_inter + TSSB\_measurement\_period\_inter) ms

Tidentify\_inter\_with\_index = (TPSS/SSS\_sync\_inter + TSSB\_measurement\_period\_inter + TSSB\_time\_index\_inter) ms

Where:

 TPSS/SSS\_sync\_inter: it is the time period used in PSS/SSS detection given in table 9.3C.10.1-1.

 TSSB\_time\_index\_inter: it is the time period used to acquire the index of the SSB being measured given in table 9.3C.10.1-2.

 TSSB\_measurement\_period\_inter: equal to a measurement period of SSB based measurement given in table 9.3C.10.2-1.

 CSSFinter: it is a carrier specific scaling factor and is determined according to CSSFoutside\_gap,i in clause 9.1.5.1 for measurement conducted outside measurement gaps, i.e. when inter-frequency SMTC is fully non overlapping or partially overlapping with measurement gaps or according to CSSFwithin\_gap,i in clause 9.1.5.2 for measurement conducted within measurement gaps, i.e. when inter-frequency SMTC is fully overlapping with measurement gaps.

Kp is the scaling factor for a SSB frequency layer to be measured without measurement gaps. Kp = Ntotal\_SAN / Navailable\_SAN, where Navailable\_SAN and Ntotal\_SAN are calculated as follows:

- For a window W of duration max(SMTC period, MGRP\_max), where

- If UE is configured with concurrent measurement gaps, MGRP\_max is the maximum MGRP across all configured per-UE measurement gap. Otherwise, MGRP\_max is the MGRP of configured measurement gap.

- Ntotal\_SAN is the total number of SMTC occasions within the window, including those overlapped and non-overlapped with measurement gap occasions within the window, and

- Navailable\_SAN is the number of SMTC occasions within the window W that do not collide with any non-dropped MG occasion within or outside the window W, after accounting for measurement gap collisions by applying the measurement gap collision rule in clause 9.1C.8.3. The collision rule between SMTC occasion and measurement gap occasion is defined in clause 9.1C.9.1

Kp = 1 when Navailable\_SAN = 0 and measurement gap sharing in clause 9.1.2.1a shall apply.

Kp = 1 when inter-frequency SMTC is fully non overlapping with measurement gaps.

**Table 9.3C.10.1-1: Time period for PSS/SSS detection**

|  |  |
| --- | --- |
| **DRX cycle** | **TPSS/SSS\_sync\_inter** |
| No DRX | max( 600 ms, ceil( 5 x Kp) x SMTC period )Note 1 x CSSFinter |
| DRX cycle≤ 320 ms | max( 600 ms, ceil(1.5x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320 ms | ceil(5 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. |

**Table 9.3C.10.1-2: Time period for time index detection**

|  |  |
| --- | --- |
| **DRX cycle** | **TSSB\_time\_index\_inter** |
| No DRX | max(120 ms, ceil( 3 x Kp )x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320 ms | max(120 ms, ceil (1.5 x 3 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320 ms | Ceil(3 x Kp) x DRX cycle x CSSFinter |
| NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. |

9.3C.10.2 Measurement period

The UE physical layer shall be capable of reporting SS-RSRP, SS-RSRQ and SS-SINR measurements to higher layers with measurement accuracy as specified in clauses 10.1.5C, 10.1.10C and 10.1.15C, respectively, as shown in table 9.3C.7.2-1, if UE supports inter-frequency measurement without measurement gaps:

**Table 9.3C.10.2-1: Measurement period for inter-frequency measurements without gaps**

|  |  |
| --- | --- |
| **DRX cycle** | **TSSB\_measurement\_period\_inter** |
| No DRX | max(200 ms, ceil( 5 x Kp) x SMTC period)Note 1 x CSSFinter |
| DRX cycle≤ 320 ms | max(200 ms, ceil(1.5x 5 x Kp) x max(SMTC period,DRX cycle)) x CSSFinter |
| DRX cycle>320 ms | ceil( 5 x Kp ) x DRX cycle x CSSFinter |
| NOTE 1: SMTC period is the SMTC period in SMTC configuration which is associated with the target cell to be measured configured in *SSB-MTC4List-r17*. |

9.3C.10.3 Scheduling availability of UE during inter-frequency measurements

If UE supports *interFrequencyMeas-NoGap-r16* and the flag *interFrequencyConfig-NoGap-r16* is configured by the Network, UE is required to be capable of measuring without measurement gaps when the SSB is completely contained in the active bandwidth part of the UE. When any of the conditions in the following clauses is met, there are restrictions on the scheduling availability; otherwise, there is no scheduling restriction. Note that the SSB symbols to be measured in the following clauses are the SSB symbols indicated by *SSB-ToMeasure* [2], if it is configured; otherwise, all L SSB symbols within the SMTC window duration defined in clause 4.1 of TS 38.213 [3] are included. For UL, the scheduling restriction applies to UL symbols that fully or partially overlap with the restricted symbols as defined below.

9.3C.10.3.1 Scheduling availability of UE performing measurements with a different subcarrier spacing than PDSCH/PDCCH on NTN bands above 10 GHz

For UE which do not support *simultaneousRxDataSSB-DiffNumerology-Inter-r16* [14] the following restrictions apply due to SS-RSRP/RSRQ/SINR measurement

- If UE performs inter-frequency measurements without measurement gaps in a TDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on SSB symbols to be measured, and on 1 data symbol before each consecutive SSB symbols to be measured and 1 data symbol after each consecutive SSB symbols to be measured within SMTC window duration.

- If UE performs inter-frequency measurements without measurement gaps in a FDD band, UE is not expected to transmit PUCCH/PUSCH/SRS or receive PDCCH/PDSCH/TRS/CSI-RS for CQI on all symbols within SMTC window duration.

When intra-band carrier aggregation is performed, the scheduling restrictions due to a given serving cell also apply to all other serving cells in the same band on the symbols that fully or partially overlap with aforementioned restricted symbols.

**<<End of change>>**