**3GPP TSG-WG4 Meeting # 111 *R4-240xxxx***

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **Draft CR** | **rev** | **1** | **Current version:** | **18.5.0** |  |
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| *For* ***[HELP](http://www.3gpp.org/3G_Specs/CRs.htm%22%20%5Cl%20%22_blank)*** *on using this form: comprehensive instructions can be found at <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 CR: Cell Re-selection for NR UE satellite access in RRC\_IDLE state |
|  |  |
| ***Source to WG:*** | ZTE Corporation |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_NTN\_enh-Core |  | ***Date:*** | 2024-05-09 |
|  |  |  |  |  |
| ***Category:*** | B |  | ***Release:*** | Rel-18 |
|  | *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:*** | To supplement the contents related to the earth-moving cell scenario. |
|  |  |
| ***Summary of change:*** | Supplement the contents related to the earth-moving cell scenario, including the time-based and location-based method. |
|  |  |
| ***Consequences if not approved:*** | The cell re-selection related requirements of earth-moving cell scenario will be vague for RAN4. |
|  |  |
| ***Clauses affected:*** |  |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ... |
| ***affected:*** |  | **x** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**<START OF CHANGE 1>**

## 4.2 Cell Re-selection

### 4.2.1 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 and inter-frequency 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.

In the requirements of clause 4.2.2, the exceptions for side conditions apply as follows:

- for the UE capable of CA, the applicable exceptions for side conditions are specified in Annex B, clause B.3.2.1, B.3.2.3, or B.3.2.5 for UE supporting CA in FR1, CA in FR2 and CA between FR1 and FR2, respectively;

- for the UE capable of SUL, the applicable exceptions for side conditions are specified in Annex B, clause B.3.4.1 for UE supporting SUL in FR1.

**<END OF CHANGE 1>**

**<START OF CHANGE 2>**

### 4.2.3 Cell Reselection with NTN carrier

This clasue applies for the inter-frequency cell reselection from TN to NTN only in FR1-NTN since the scenario where TN and NTN cells are in the same frequency is deprioritized. In the requirements of clause 4.2.3, the requirements apply provided that network provides SIB19 and UE shall be configured with TN and NTN carrier. UE is not required to ensure having a valid version of SIB19 and the exact time of reacquiring SIB19 is up to UE implementation.

#### 4.2.3.1 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, , 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, then the UE shall search for and measure inter-frequency layers of higher, equal or lower priority in preparation for possible reselection. 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 TS38.304 [1] within *Kcarrier\_TN*\* Tdetect,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$+T\_GNSS if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within *Kcarrier\_TN*\* Tdetect,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$+T\_GNSS if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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

- If SMTCs do not overlap with each other,

- $\_{\_{}}$, if GEO satellites are measured on the carrier;

- $\_{\_{}}\left⌈\frac{\_{}}{\_{}}\right⌉$, if LEO satellites are measured on the carrier;

- If SMTCs partially overlap with each other,

- $\_{\_{}}\_{}$, if only GEO satellites are measured on the carrier;

- $\_{\_{}}\sum\_{}^{\_{}}\left⌈\frac{\_{}}{\_{}}\right⌉$, 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.

The parameter Kcarrier\_TN is the number of NR TN inter-frequency carriers indicated by the serving cell.

The parameter Kcarrier\_NTN is the number of NR NTN inter-frequency carriers indicated by the serving cell.

Tdetect/measure/evaluate,NR\_Inter\_TN is the NR TN inter-frequency cell re-selection requirement defined in Table 4.2.2.4-1 in TS38.133

Tdetect/measure/evaluate,NR\_Inter\_NTN is the NR NTN inter-frequency cell re-selection requirement defined in Table 4.2C.2.4-1 in TS38.133

T\_GNSS is TTFF (Time To First Fix) of which value is left undefined in RRM spec. If UE GNSS has been switched ON, T\_GNSS can be assumed zero.

Note: the above requirement does not assume UE always performs NTN cell detection/measurement as well as TN cells.

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 *Kcarrier\_TN*\* Tmeasure,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$+T\_GNSS (see table 4.2C.2.4-1) if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or every *Kcarrier\_TN*\* Tmeasure,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$+T\_GNSS (see table 4.2C.2.4-2) if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 *Kcarrier\_TN*\* Tevaluate,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$+T\_GNSS if the UE does not support [capability for enhanced requriements] or if the [NW configuration for enhanced requirements] is not enabled, or within *Kcarrier\_TN*\* Tevaluate,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$+T\_GNSS if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 TS38.304 [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 TS38.304 [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 |
| 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 2.56s 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 |

The requriements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the [UE capability], 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.

**<END OF CHANGE 2>**

**<START OF CHANGE 3>**

## 4.2C Cell Re-selection for NR UE for Satellite Access

### 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 and inter-frequency cells indicated by the serving cell. For intra-frequency and inter-frequency 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.

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

The requirements in clause 4.2C apply to FR1-NTN and FR2-NTN as defined in TS 38.108 [37].

The requirements in clause 4.2C apply to FR2-NTN 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 neighboring cells which belong to the same satellite.

### 4.2C.2 Requirements

#### 4.2C.2.1 UE measurement capability

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

- Intra-frequency carrier, and

- Depending on UE capability, 7 NR inter-frequency carriers, and

#### 4.2C.2.2 Measurement and evaluation of serving cell

The UE shall measure the SS-RSRP and SS-RSRQ level of the serving cell and evaluate the cell selection criterion S defined in TS 38.304 [1] for the serving cell at least once every M1\*N1 DRX cycle; where:

- M1=2 if SMTC periodicity (TSMTC) > 20 ms and DRX cycle ≤ 0.64 second and NSMTC =1, upon one SMTC configured at the UE,

- M1=2.5 if SMTC periodicity (TSMTC) > 20 ms and DRX cycle ≤ 0.64 second and 1<NSMTC ≤ 4,

- otherwise M1=1.

Where, NSMTC is the number of SMTCs configured by SAN.

The UE shall filter the SS-RSRP and SS-RSRQ measurements of the 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 has evaluated according to Table 4.2C.2.2-1 in Nserv consecutive DRX cycles that the serving cell does not fulfil the cell selection criterion S, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell, regardless of the measurement rules currently limiting UE measurement activities.

Additionally, if the UE is configured with ‘*t-service*’ [2], the UE shall start measurements of the neighbour cells indicated by the serving cell before ‘*t-service*’ is reached according to the requirements provided in clause 4.2C.2.3 and 4.2C.2.4.

Also,

- if *distanceThresh* and *referenceLocation* are configured by the network [2] and the UE supports location-based measurement initiation and has obtained its location information, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell if the distance between UE and the serving cell reference location – *referenceLocation ­–* is larger than *distanceThresh.* The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50 m.

- if *distanceThresh* and *movingReferenceLocation* are configured by the network [2] and the UE supports location-based measurement initiation and has obtained its location information, the UE shall initiate the measurements of all neighbour cells indicated by the serving cell if the distance between UE and the serving cell moving reference location – [*movingReferenceLocation*] *­–* is larger than *distanceThresh.* The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of [80] m.

If the UE is not configured with*‘t-Service*’ [2] in the serving cell and if the UE in RRC\_IDLE has not found any new suitable cell based on searches and measurements using the intra-frequency, inter-frequency and inter-RAT information indicated in the system information for 10 s, the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 [1].

If the UE is configured with ‘*t-Service*’ in the serving cell then the UE shall initiate cell selection procedures for the selected PLMN as defined in TS 38.304 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, inter-frequency and inter-RAT information indicated in the system information within 10 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, inter-frequency and inter-RAT information indicated in the system information within 10 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 4.2C.2.2-1: Nserv

|  |  |  |
| --- | --- | --- |
| **DRX cycle length [s]** | **Scaling Factor (N1)** | **Nserv [number of DRX cycles]** |
|  | **FR1** |  |
| 0.32 | 1 | M1\*N1\*4 |
| 0.64 | M1\*N1\*4 |
| 1.28 | N1\*2 |
| 2.56 | N1\*2 |
| Note 1: The UE is not required to meet the requirements for 2.56s DRX cycle length for earth-moving LEO deployment. |

#### 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 > SnonIntraSearchP and Squal > SnonIntraSearchQ, and the distance between UE and serving cell 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 TS38.304 [1] within Kmulti\_SMTC \* Tdetect,NR\_Intrawhen that Treselection= 0 if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within Kmulti\_SMTC \* Tdetect,NR\_Intra\_enhif the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 the feature for enhanced RRM requirements defined in TS38.306 [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 the feature for enhanced RRM requirements defined in TS38.306 [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:

 If smtcs do not overlap with each other,

- $\_{}$, if GEO satellites are measured on the carrier;

- $\_{}\left⌈\frac{\_{}}{\_{}}\right⌉$, if LEO satellites are measured on the carrier;

- If smtcs partially overlap with each other,

- $\_{}\_{}$, if only GEO satellites are measured on the carrier;

- $\_{}\sum\_{}^{\_{}}\left⌈\frac{\_{}}{\_{}}\right⌉$, 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, 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 TS38.304 [1] within Kmulti\_SMTC \* Tevaluate,NR\_Intra if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within Kmulti\_SMTC \* Tevaluate,NR\_Intra\_enh if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 3dB better ranked in FR1 or 4.5dB better ranked in FR2.

- 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 TS38.304 [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 3dB better ranked in FR1 or 4.5dB better ranked in FR2 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 TS38.304 [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** |  |  |  |
| 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 2.56s 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 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(Tdetect,NR\_Intra, 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 Table Table 4.2C.2.3-2,

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

The requirements in this clause apply provided that the number of SMTCs for any inter-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.

#### 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 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 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. 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 TS38.304 [1] within $\sum\_{}^{\_{}}\_{}\_{}$ if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or within $\sum\_{}^{\_{}}\_{}\_{}$ if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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, Kmulti\_SMTC,i = 1.

For FR1-NTN:

- If SMTCs do not overlap with each other,

- $\_{\_{}}$, if GEO satellites are measured on the carrier;

- $\_{\_{}}\left⌈\frac{\_{}}{\_{}}\right⌉$, if LEO satellites are measured on the carrier;

- If SMTCs partially overlap with each other,

- $\_{\_{}}\_{}$, if only GEO satellites are measured on the carrier;

- $\_{\_{}}\sum\_{}^{\_{}}\left⌈\frac{\_{}}{\_{}}\right⌉$, 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 $\sum\_{}^{\_{}}\_{}\_{}$ (see table 4.2C.2.4-1) if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or every $\sum\_{}^{\_{}}\_{}\_{}$ (see table 4.2C.2.4-2) if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 $\sum\_{}^{\_{}}\_{}\_{}$ if the UE does not support [capability for enhanced requriements] or if the [NW configuration for enhanced requirements] is not enabled, or within $\sum\_{}^{\_{}}\_{}\_{}$ if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 TS38.304 [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 TS38.304 [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 |
| 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 2.56s 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 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(Tdetect,NR\_Intra, Kcarrier\* Tdetect,NR\_Inter) when serving cell is below the search threshold, and Ttrigger = max(Tdetect,NR\_Intra, Nlayer\* [60s]) 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 requriements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the [UE capability], 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.

#### 4.2C.2.5 Maximum interruption in paging reception

UE shall perform the cell re-selection with minimum interruption in monitoring downlink channels for paging reception.

At intra-frequency and inter-frequency cell re-selection, the UE shall monitor the downlink of serving 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-NR + K\*Ttarget\_cell\_SMTC\_period ms.

Where,

If the target cell belongs to the same satellite as the current one, and if the target cell is known, then K = 2.

If the target cell belongs to a different satellite than the current one and the target cell’s satellite is GEO, and if the target cell is known, then K = 2.

If the target cell belongs to a different satellite than the current one and the target cell’s satellite is non-GEO, then K = 5 if the target cell is known.

Ttarget\_cell\_SMTC\_period is the periodicity of the SMTC occasions configured for the target NR cell. If the target cell is in the PCI list of *smtc2-LP*, the SMTC periodicityfollows *smtc2-LP*; otherwise, the SMTC periodicity follows *smtc*.

TSI-NR is the time required for receiving all the relevant system information data according to the reception procedure and the RRC procedure delay of system information blocks defined in TS 38.331 [2] for an NR cell.

The target cell is considered as known if it has been detectable during Tdetect,NR\_Intra or Tdetect,NR\_Inter, 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, Tdetect,NR\_Inter and Ttrigger are defined in 4.2C.2.3 and 4.2C.2.4. A longer interruption can be expected if the target cell is unknown.

These requirements assume sufficient radio conditions, so that decoding of system information can be made without errors and does not take into account cell re-selection failure.

#### 4.2C.2.6 Minimum requirement at transitions

The requirements in clause 4.2.2.8 apply provided that target cell’s satellite is GEO.

#### 4.2C.2.7 Measurements of intra-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2.2.9 apply provided that target cell’s satellite is GEO.

#### 4.2C.2.8 Measurements of inter-frequency NR cells for UE configured with relaxed measurement criterion

The requirements in clause 4.2.2.10 apply provided that target cell’s satellite is GEO.

#### 4.2C.2.9 General requirements

The UE shall search every layer of higher priority at least every Thigher\_priority\_search = (60 \* Nlayers) seconds, where Nlayers is the total number of higher priority NR carrier frequencies broadcasted in system information.

4.2C.3 Requirements with TN carrier

UE is allowed to skip TN neighbour cells measurement in an area where there is no coverage of the frequency based on the provided TN cell coverage information and UE GNSS position information. Otherwise, UE shall perform TN measurement if its estimated distance to tn-ReferenceLocation is smaller than tn-DistanceRadius. The requirements apply provided that the actual distance between UE to tn-ReferenceLocation is smaller than tn-DistanceRadius – 50m.This clasue considers the inter-frequency cell reselection from NTN to TN in FR1-NTN to TN since the scenario where TN and NTN cells are in the same frequency is deprioritized.

#### 4.2C.3.1 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 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 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. 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 TS38.304 [1] within Kcarrier\_TN \* Tdetect,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$ if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or withinKcarrier\_TN \* Tdetect,NR\_Inter\_TN + $\sum\_{}^{\_{}}\_{}\_{}$ if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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

- If SMTCs do not overlap with each other,

- $\_{\_{}}$, if GEO satellites are measured on the carrier;

- $\_{\_{}}\left⌈\frac{\_{}}{\_{}}\right⌉$, if LEO satellites are measured on the carrier;

- If SMTCs partially overlap with each other,

- $\_{\_{}}\_{}$, if only GEO satellites are measured on the carrier;

- $\_{\_{}}\sum\_{}^{\_{}}\left⌈\frac{\_{}}{\_{}}\right⌉$, 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.

The parameter Kcarrier\_TN is the number of NR TN inter-frequency carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.

The parameter Kcarrier\_NTN is the number of NR NTN inter-frequency carriers indicated by the serving cell.

Tdetect/measure/evaluate,NR\_Inter\_TN is the NR TN inter-frequency cell re-selection requirement defined in Table 4.2.2.4-1 in TS38.133

Tdetect/measure/evaluate,NR\_Inter\_NTN is the NR NTN inter-frequency cell re-selection requirement defined in Table 4.2C.2.4-1 in TS38.133.

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 Kcarrier\_TN \* Tmeasure,NR\_Inter\_TN + $\sum\_{}^{}\_{\_{}}\_{}$ (see table 4.2C.2.4-1) if the UE does not support the feature for enhanced RRM requirements defined in TS38.306 [14] or if the *enhancedMeasurementLEO-r17* is not enabled, or every Kcarrier\_TN \* Tmeasure,NR\_Inter\_TN + $\sum\_{}^{}\_{\_{}}\_{}$ (see table 4.2C.2.4-2) if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 Kcarrier\_TN \* Tevaluate,NR\_Inter\_TN + $\sum\_{}^{}\_{\_{}}\_{}$ if the UE does not support [capability for enhanced requriements] or if the [NW configuration for enhanced requirements] is not enabled, or within Kcarrier\_TN \* Tevaluate,NR\_Inter\_TN + $\sum\_{}^{}\_{\_{}}\_{}$ if the UE supports the feature for enhanced RRM requirements defined in TS38.306 [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 TS38.304 [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 TS38.304 [1].

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 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(Tdetect,NR\_Intra, Kcarrier\* Tdetect,NR\_Inter) when serving cell is below the search threshold, and Ttrigger = max(Tdetect,NR\_Intra, Nlayer\* [60s]) 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 requriements in this clause apply provided that the number of SMTCs for any inter-frequency carrier does not exceed the [UE capability], 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.

**<END OF CHANGE 3>**

**<START OF CHANGE 4>**

#### 4.2C.3.2 Measurements of inter-RAT E-UTRAN cells

If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then the UE shall search for inter-RAT E-UTRAN layers of higher priority at least every Thigher\_priority\_search where Thigher\_priority\_search is described in clause 4.2.2.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ then the UE shall search for and measure inter-RAT E-UTRAN layers of higher, lower priority in preparation for possible reselection. In this scenario, the minimum rate at which the UE is required to search for and measure higher priority inter-RAT E-UTRAN layers shall be the same as that defined below for lower priority RATs.

The requirements in this clause apply to inter-RAT E-UTRAN FDD measurements and E-UTRA TDD measurements. When the measurement rules indicate that inter-RAT E-UTRAN cells are to be measured, the UE shall measure RSRP and RSRQ of detected E-UTRA cells in the neighbour frequency list at the minimum measurement rate specified in this clause.

The parameter NEUTRA\_carrier is the number of EUTRA TN carriers indicated by the serving cell, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.

The parameter NEUTRA\_carrier\_HST is the total number of configured E-UTRA carriers indicated to meet high speed requirements in the neighbour frequency list, except for the frequency carrier where there is no coverage of that frequency based on the provide TN cell coverage information and UE GNSS position information.

If Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ, an inter-RAT E-UTRAN layer is indicated to meet high speed requirements if *highSpeedMeasFlag-r16* is configured and the carrier to be measured is configured with *highSpeedEUTRACarrier-r16* and UE supports the enhanced inter-RAT E-UTRAN measurement requirements. If Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ, UE is required to meet non high-speed requirements no matter whether *highSpeedMeasFlag-r16* or *highSpeedEUTRACarrier-r16* is configured or not.

The parameter NEUTRA\_carrier for a UE configured with idle mode DC measurements (while T331 is running), is the combined number of configured E-UTRA carriers in the neighbour frequency list and E-UTRA carriers configured for idle mode DC measurements, excluding the configured E-UTRA carriers indicated to meet high speed requirements in the neighbour frequency list.

Note: combined total number means that if a carrier is an E-UTRA carrier indicated by the serving cell for mobility and additionally a carrier configured for idle mode CA/DC measurements, it only counts as one carrier.

The UE shall filter RSRP and RSRQ measurements of each measured E-UTRA 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 half the minimum specified measurement period.

An inter-RAT E-UTRA cell is considered to be detectable provided the following conditions are fulfilled:

- the same conditions as for inter-frequency RSRP measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band, and

- the same conditions as for inter-frequency RSRQ measurements specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band.

- SCH conditions specified in TS 36.133 [15, Annex B.1.2] are fulfilled for a corresponding Band

The UE shall be able to evaluate whether a newly detectable inter-RAT E-UTRAN cell meets the reselection criteria defined in TS38.304 [1] within NEUTRA\_carrier \* Tdetect,EUTRAN when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ when Treselection = 0 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

Cells which have been detected shall be measured at least every NEUTRA\_carrier \* Tmeasure,EUTRAN when Srxlev ≤ SnonIntraSearchP or Squal ≤ SnonIntraSearchQ.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,EUTRAN. 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 an inter-RAT E-UTRAN 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 not consider an inter-RAT E-UTRA cell in cell reselection, if it is indicated as not allowed in the measurement control system information of the serving cell.

For a cell that has been already detected, but has not been reselected to, the filtering shall be such that a UE not configured with eDRX\_IDLE cycle shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within NEUTRA\_carrier \* Tevaluate,EUTRAN when Treselection = 0as speficied in table 4.2.2.5-1 and 4.2.2.5-2 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

For a cell that has been already detected, but that has not been reselected to, the filtering shall be such that a UE configured with eDRX\_IDLE cycle shall be capable of evaluating that an already identified inter-RAT E-UTRA cell has met reselection criterion defined in TS 38.304 [1] within NEUTRA\_carrier \* T evaluate,EUTRAN when Treselection = 0as speficied in table 4.2.2.5-3 provided that the reselection criteria is met by a margin of at least 6dB for RSRP reselections based on absolute priorities or 4dB for RSRQ reselections based on absolute priorities.

If the Treselection timer has a non-zero value and an inter-RAT E-UTRA cell satisfies the reselection criteria defined in TS 38.304 [1], the UE shall evaluate this E-UTRA cell for the Treselection time. If this cell remains satisfied with the reselection criteria within this duration, then the UE shall reselect to this cell.

When the distance between the UE and tn-ReferenceLocation is larger than tn-DistanceRadius +50m, the UE is allowed to not perform measurements on the TN frequency in the corresponding area.

For UE not configured with eDRX\_IDLE cycle, Tdetect,EUTRAN, Tmeasure,EUTRAN and Tevaluate, E-UTRAN are specified in Table 4.2.2.5-1 and . 4.2.2.5-2

For UE configured with eDRX\_IDLE cycle, Tdetect,EUTRAN, Tmeasure,EUTRAN and Tevaluate, E-UTRAN are specified in Table 4.2.2.5-3, where the requirements apply provided that the serving cell is configured with eDRX\_IDLE and the DRX cycle length is the same in all PTWs during any of Tdetect,EUTRAN, Tmeasure,EUTRAN and Tevaluate, E-UTRAN when multiple PTWs are used.

The requirements in Table 4.2.2.5-2 apply only when the UE supports *measurementEnhancement-r16* or *interRAT-MeasurementEnhancement-r16*. For UE not supporting either *measurementEnhancement-r16* or *interRAT-MeasurementEnhancement-r16*, the UE is not required to meet the requirements specified in Table 4.2.2.5-2.

For any requirement in this section, when the UE transitions between any two states when being configured with eDRX\_IDLE, changing eDRX\_IDLE cycle length, or changing PTW configuration, the UE shall meet the transition requirement, which is the less stringent requirement of the two requirements corresponding to the first state and the second state, during the transition time interval which is the time corresponding to the transition requirement. After the transition time interval, the UE shall meet the requirement corresponding to the second state.

**<END OF CHANGE 4>**