3GPP TSG-RAN WG4 Meeting # 111 R4-2410263

Fukuoka , JP, 20 May – 24 May 2024

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
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|  | 36.133 | **CR** | 7317 | **rev** | 1 | **Current version:** | 18.5.0 |  |
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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 |  | Radio Access Network | **X** | Core Network |  |

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|  |
| ***Title:***  | Big CR to TS 36.133 on core requirement maintenance for IoT NTN enhancements |
|  |  |
| ***Source to WG:*** | MediaTek inc. |
| ***Source to TSG:*** |  |
|  |  |
| ***Work item code:*** | IoT\_NTN\_enh-Core |  | ***Date:*** | 20 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** |  |
|  | *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)* |
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| ***Reason for change:*** | * Formal CR for the draft big CRs R4-2406521 endorsed at RAN4 #110bis
* Capture the following CRs endorsed at RAN4 #111

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| --- | --- | --- |
| T-doc number | Title | note |
| [R4-2408517](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408517.zip) | CR on 36.133 on applicability of requirements upon GNSS-MG duration | 8.13A.1, 8.14A.1 |
| [R4-2408575](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2408575.zip) | Draft CR on core requirements maintenance for R18 IoT NTN enh | 4.6A.2.2, 4.6A.2.4, 4.6A.2.5, 4.6A.2.6, 4.7A.2.1.3, 4.7A.2.2.3 |

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| ***Summary of change:*** | Changes of R4-2408575 (Change 1 ~ Change 6)* Remove Ksatellites in the requirements for the spacing between measurement for filtering.

Changes of R4-2405603 (Change 7)* Add requirements for time and location based measurement triggering are supported for eMTC over NTN in RRC\_CONNECTED.

Changes of R4-2408517 (Change 7, Change 8)* Clarify the measurement gap applies if it starts after the early termination of the GNSS measurement gap.
* The RAN4 #110-bis agreement is implemented in 8.13A and 8.14A

Changes of R4-2404993 (Change 9)* The margin for location-triggered measurement is defined as 50 m and 80m for qualsi-earth fixed cell and earth moving cell respectively, as agreed in NR NTN.
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| ***Consequences if not approved:*** | Incorrect RRM requirement.  |
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| ***Clauses affected:*** | 4.6A.2.2, 4.6A.2.4, 4.6A.2.5, 4.6A.2.6, 4.7A.2.1.3, 4.7A.2.2.3, 8.13A.1, 8.14A.1, 8.14A.6 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 36.521-3 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

### <Start of Change 1>

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

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

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

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

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

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

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

### < End of Change 1>

### <Start of Change 2>

4.6A.2.4 Measurements of intra-frequency NB-IoT cells for UE category NB1 in enhanced coverage

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

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

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

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

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

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

### < End of Change 2>

### <Start of Change 3>

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

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

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

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Ksatellite \*Pcarrier \* Tdetect,NB\_Inter\_NC, if at least carrier frequency information is provided for inter-frequency neighbour cells by the serving NB-IoT cells when Treselection = 0 provided that the reselection criteria is met by a margin of at least Y dB, where Pcarrier is the number of inter-frequency carriers for which carrier frequency information was provided by the serving NB-IoT cell and ‘Y’ is specified by Table 4.6A.2.6-3 (when Q1³ -6 dB). An inter-frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

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

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

### < End of Change 3>

### < Start of Change 4>

4.6A.2.6 Measurements of inter-frequency NB-IoT cells for UE category NB1 in enhanced coverage

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

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

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Ksatellite \*Pcarrier \* Tdetect,NB\_Inter\_EC. An inter-frequency cell is considered to be detectable according to NRSRP, NRSRP Ês/Iot, NSCH\_RP and NSCH Ês/Iot defined in Annex B.1.5 for a corresponding Band.

The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

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

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

### < End of Change 4>

### < Start of Change 5>

4.7A.2.1.3 Measurements of inter-frequency cells for UE category M1 in normal coverage

The requirements in this subclause apply if UE is in the normal coverage area of the serving cell served by satellite access node. The UE is considered to be in normal coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new inter-frequency cells and perform RSRP or 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. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

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 4.2.2.

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.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Ksatellite \* Kcarrier\*Tdetect,EUTRAN\_Inter\_NC, 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 8 dB for reselections based on ranking or 8 dB for RSRP reselections based on absolute priorities or 5.5 dB for RSRQ reselections based on absolute priorities. Kcarrier is the number of inter-frequency carriers in the neighbour cell list. An inter frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.8 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter\_NC . 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 E-UTRA 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 RSRP or RSRQ at least every Ksatellite \* Kcarrier\*Tmeasure,EUTRAN\_Inter\_NC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA 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 RSRP or 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,EUTRAN\_Inter\_NC/2.

### < End of Change 5>

### < Start of Change 6>

4.7A.2.2.3 Measurements of inter-frequency cells for UE category M1 in enhanced coverage

The requirements in this subclause apply if UE is in the enhanced coverage area of the serving cell. The UE is considered to be in enhanced coverage area of serving cell according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot of the serving cell defined in Annex B.1.3 for a corresponding Band.

The UE shall be able to identify new inter-frequency cells and perform RSRP or 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. The UE shall not cause any interruption to the paging reception and acquisition of SI while performing measurement on serving or any neighbor cells.

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 4.2.2.

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.

The UE shall be able to evaluate whether a newly detectable inter-frequency cell meets the reselection criteria defined in TS36.304 within Ksatellite \* Kcarrier\*Tdetect,EUTRAN\_Inter\_EC, 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 8 dB for reselections based on ranking. Kcarrier is the number of inter-frequency carriers in the neighbour cell list. An inter frequency cell is considered to be detectable according to RSRP, RSRP Ês/Iot, SCH\_RP and SCH Ês/Iot defined in Annex B.1.8 for a corresponding Band.

When higher priority cells are found by the higher priority search, they shall be measured at least every Tmeasure,E-UTRAN\_Inter\_EC . If, after detecting a ce ll 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 E-UTRA 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 RSRP or RSRQ at least every Ksatellite \* Kcarrier\*Tmeasure,EUTRAN\_Inter\_EC for identified lower or equal priority inter-frequency cells. If the UE detects on a E-UTRA 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 RSRP or RSRQ measurements of each measured higher, lower and equal priority inter-frequency cell using at least 4 measurements. Within the set of measurements used for the filtering, at least two measurements shall be spaced by at least Tmeasure,EUTRAN\_Inter\_EC/2.

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

### < End of Change 6>

### < Start of Change 7>

### 8.13A.1 Introduction

The UE category M1 applicability of the requirements in subclause 8.13A is defined in Section 3.6.

This clause contains requirements on the UE regarding measurement reporting in RRC\_CONNECTED state for UE Category M1 for Satellite Access. The requirements are specified for E-UTRA intra- and inter-frequency measurements. These measurements may be used by the E-UTRAN, e.g. for handover decisions. The measurement quantities are defined in TS 36.214 [4], the measurement model is defined in TS 36.302 [22] and measurement accuracies are specified in clause 9. Control of measurement reporting is specified in TS 36.331 [2].

The UE shall meet the requirements in Section 8.13A, provided:

- the UE does not require measurement gaps for the corresponding measurements, or

- the UE requires measurement gaps for the corresponding measurements and is configured with the measurement gap pattern Id 0 or 1 and is not configured with any measurement gap pattern from Table 8.1.2.1-3.

UE shall measure neighbor cell on intra-frequency layer and configured inter-frequency layers, regardless of *s-Measure* configured in *MeasConfig*,

­- before *t-Service* if the UE supports time-based measurement initiation and *t-Service* is configured by the serving cell [2], while the exact instant to start the measurements is left by UE implementation; or

­- when the distance between the UE and the serving cell reference location is larger than *distanceThresh* [2], if UE supports location-based measurement initiation. The requirements apply provided that the distance exceeds the *distanceThresh* by a margin of 50m for quasi-earth fixed Cell and 80m for earth moving cell as defined in [2].

If the UE is configured with any of the GNSS measurement gap patterns specified in [REF to RAN1 GNSS gaps] for the GNSS signal reception and also configured with measurement gap pattern ID#0 or ID#1 defined in Table 8.1.2.1-1 for performing measurements defined in subclause 8.13A, then the UE shall suspend the configured measurement gap pattern ID#0 or ID#1 during at least the time period over which the two measurement gap patterns overlap with each other in time. When measurement gap overlaps with GNSS measurement gap, measurement gap applies if GNSS measurement is terminated earlier than measurement gap starts and after the UE has performed RACH procedure to indicate the early termination of the GNSS measurement.

If DRX is used and the UE is configured with GNSS measurement gap, the requirements in 8.13A on time to detect, measure and evaluate apply if the GNSS measurement gap length is shorter than the DRX cycle and the GNSS measurement gap does not overlap with the On Duration of the DRX cycle.

When the UE is provided with IDC solution, the UE shall also perform RRM measurements and meet the corresponding requirements in clause 8.

### < End of Change 7>

### < Start of Change 8>

## 8.14A Measurements for UE category NB-IoT for Satellite Access

### 8.14A.1 Introduction

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

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

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

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

- Valid information for the serving satellite has been provided

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

### < End of Change 8>

### < Start of Change 9>

8.14A.6 NB-IoT neighbour cell measurements

8.14A.6.1 Introduction

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

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

8.14A.6.2 Requirements

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

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

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

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

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

*[FFS on the following: When the UE is configured with multiple layers to be measured it is up to UE implementation which frequencies to be measured/prioritized in RRC\_CONNECTED The minimum number of layers to be measured is up to UE implementation.]*

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

### < End of Change 9>